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Original Paper

Bromeliaceae from a forest fragment in the Atlantic Forest Central Corridor, southern Bahia state, Northeastern Brazil

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Abstract

The Atlantic Forest Central Corridor is the center of Bromeliaceae diversity in the Atlantic Forest domain, comprising most of the endemic and threatened species. The extreme south of Bahia state, Northeastern Brazil, is included within the corridor, with few taxonomic flora studies carried out in this area. Herein, we present a taxonomic study of the Bromeliaceae family from an important fragment in the extreme south of Bahia, based on field collections, herbarium material and specialized literature. Twelve species of Bromeliaceae were recorded, belonging to *Aechmea* (2 spp.), *Araeococcus* (1 sp.), *Billbergia* (1 sp.), *Catopsis* (1 sp.), *Guzmania* (1 sp.), *Hohenbergia* (1 sp.), *Tillandsia* (1 sp.), and *Vriesea* (4 spp.). Eight species are endemic to the Atlantic Forest domain. Identification keys, descriptions, and comments on their phenology, geographical distribution and habitat are provided, as well as an illustration of *Hohenbergia sandrae*, which was described for the first time in the Atlantic Forest domain.

Key words: Estação Veracel Private Natural Heritage Reserve, muçununga, Pau-Brasil Ecological Station, Tabuleiro forest, taxonomy.

Resumo

O Corredor Central da Mata Atlântica é o centro da diversidade de Bromeliaceae no Domínio da Mata Atlântica, compreendendo a maioria das espécies endêmicas e ameaçadas. O extremo sul da Bahia, nordeste do Brasil, faz parte do corredor e é escasso em termos de pesquisas taxonômicas da flora. Apresenta-se um estudo florístico-taxonômico da família Bromeliaceae em um importante fragmento no extremo sul da Bahia, com base em coleta de campo, material de herbário e literatura especializada. Foram registradas doze espécies de Bromeliaceae, pertencentes à *Aechmea* (2 spp.), *Araeococcus* (1 sp.), *Billbergia* (1 sp.), *Catopsis* (1 sp.), *Guzmania* (1 sp.), *Hohenbergia* (1 sp.), *Tillandsia* (1 sp.) e *Vriesea* (4 spp.). Oito espécies são endêmicas do domínio da Mata Atlântica. No presente artigo, são fornecidas chaves de identificação, descrições e comentários sobre a fenologia, distribuição geográfica e habitat, além de uma ilustração de *Hohenbergia sandrae*, que foi descrita pela primeira vez no Domínio da Mata Atlântica.

Palavras-chave: RPPN Estação Veracel, muçununga, Estação Ecológica do Pau-Brasil, floresta de Tabuleiro, taxonomia.

Introduction

Bromeliaceae was the last family in the order Poales (Bouchenak-Khelladi *et al*. 2014) to diversify, likely originating in the Guayana Shields around 100 million years ago and beginning to radiate and diversify ca. 20 million years ago in parallel with the uplift of the northern Andes, the Serra do Mar, and nearby ranges in southeastern Brazil (Givnish *et al*. 2011, 2014). The diversification and adaptation of Bromeliaceae

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across a wide range of environmental conditions are likely related to its epiphytic habit, its coevolution with hummingbird pollinators, its invasion of fertile, geographically extensive, and topographically diverse montane regions, and its association with the repeated evolution of physiologically (*e.g.* CAM photosynthesis) and morphologically (*e.g.* tank habit, absorbing trichomes, and entangling seeds) key innovations (Givinish *et al*. 2014). The tank habit has also provided Bromeliaceae with one of the most important ecological roles: the creation of microhabitats and microecosystems for several animal species (Rocha *et al*. 2004; Givinish *et al*. 2011; Zizka *et al*. 2019). With the advancement of the phylogenetic approach, the family is considered monophyletic (Bouchenak-Khelladi *et al*. 2014; APG IV 2016) and is divided into eight subfamilies: Brocchinioideae, Bromelioideae, Lindmanioideae, Hechtioideae, Navioideae, Pitcairnioideae, Puyoideae and Tillandsioideae (Givinish *et al*. 2007, 2011).

Bromeliaceae comprises 3,658 species and 78 genera (Gouda & Butcher, continuously updated) almost exclusively distributed throughout the Neotropical region, except for a long-distance dispersal species, *Pitcairnia feliciana* (A.Chev.) Harms & Mildbr., located in West Africa (Smith & Downs 1974, 1977, 1979; Givnish *et al*. 2007, 2011, 2014; Zizka *et al*. 2019). At least 72% of all species of Bromeliaceae (2,638 spp.) are possibly threatened, with most of them (77%, 1,928 spp.) occurring in Tropical and Subtropical Moist Broadleaf Forests, especially the Atlantic Forest and Central Andes (Zizka *et al*. 2019). About 1,379 species of Bromeliaceae occur in Brazil, with ca. 85% (1,178 spp.) representing endemic species (BFG 2015; Flora do Brasil 2020). The Brazilian Atlantic Forest is recognized as a center of species richness and endemism of Bromeliaceae (Martinelli *et al*. 2008; Zanella *et al*. 2012; Zizka *et al*. 2019), comprising 26% of the total species (934 spp.) (BFG 2015; Flora do Brasil 2020), with at least 70% (653 spp.) of this number representing endemic species and at least 36% (338 spp.) representing threatened species (Martinelli *et al*. 2008; BFG 2015). The Atlantic Forest Central Corridor, which extends all the way through the state of Espírito Santo to southern Bahia, is the richest (42.4%, 396 spp.) corridor in the Atlantic Forest, with 85% being endemic species (336 ssp.) and 43% being threatened species (166 spp.) (Martinelli *et al*. 2008). Ostroski *et al*. (2018) found 108 endemic Bromeliaceae taxa in the Bahia Coastal Forests, an area that partially overlaps with the Central Corridor.

Despite many specialists and a plethora of information about Bromeliaceae, there are still large gaps in knowledge about its distribution throughout the Atlantic Forest (Martinelli *et al.* 2008; Zizka *et al*. 2019). This lack of knowledge is especially problematic in the Atlantic Forest of southern Bahia, as it is under several anthropic pressures, such as illegal logging, fires, agriculture, pasture, and land occupation. This region also contains a rare and vulnerable endemic ecosystem that occurs in the midst of the Atlantic Forest landscape, known as mussununga or muçununga, which is under constant human pressure due to similarities with the impacted areas of the Atlantic Forest, making it difficult to legally protect (Saporetti Junior 2009; Gastauer *et al*. 2017). Given this scenario, the present study sought to describe the Bromeliaceae diversity of one of the most important conservation areas remaining of the Tabuleiro Forests and mussununga in southern Bahia, emphasizing their taxonomic aspects.

Material and Methods

The fragment is located inside the Estação Veracel Private Natural Heritage Reserve (RPPN EVC) and Pau-Brasil Ecological Station (ESPAB/CEPLAC), Porto Seguro - Santa Cruz Cabrália, Bahia (16°21'23.7"S, 39°8'00.6"W) and occupies an area of approximately 7,220 ha of primary vegetation and secondary vegetation at a high successional stage (Fig. 1). The area is located on coastal plains covered by pliopleistocene shelves from the Barreiras Group (Dantas *et al*. 2002; IBGE 2012), from which its name, Tabuleiro Forest, was derived (Figs. 1; 2a; see discussion in Pinto *et al.* 2019). In the midst of the Tabuleiro Forest landscape a vegetation endemic to southern Bahia and northern Espírito Santo, known as mussununga, can be found. It is characterized as an oligotrophic savanna-type formation occurring on Spodsol with orstein comprising three main physiognomies: shrubland (Figs. 1; 2b), grassland (Figs. 1; 2c), and woodland (Figs. 1; 2c-d; Saporetti Junior 2009; Gastauer *et al*. 2017). The first two are mostly covered with an herbaceous stratum, however, shrubland also contains some scattered shrubs, whereas the woodland varies between dense tree stratum and sparse tree stratum (Saporetti Junior 2009; Gastauer *et al*. 2017). The predominant climate in the region is Af: rainy, hot and moist, with no defined dry season, according to the

Köppen-Geiger classification (Peel *et al*. 2007). The average temperature is 24.2 ºC and average precipitation varies between 1100+ mm to 2000+ mm per year, distributed regularly throughout the year (RPPN Estação Veracel 2016).

Collections were carried out between July 2018 and March 2019, during which all the RPPN EVC environments were explored by walking on (Filgueiras *et al*. 1994) pre-existing trails (Fig. 1). The collections obtained during fieldwork were deposited into the Herbarium Geraldo C. P. Pinto (GCPP) of the Federal University of Southern Bahia (Universidade Federal do Sul da Bahia - UFSB). Genera and species names were assigned based on national and regional flora identification keys, classic works and by consulting specialists. The classification followed APG IV (2016). The taxonomic study was based on 26 examined material from GCPP and 59 digitalized specimens in the herbariums ALCB, CEN, CEPEC, HURB, K, MBM, NY, RB and US (acronyms according to Thiers, continuously updated), in addition to collections and field observations.

Morphological terminology follows the specialized bibliography of Smith & Downs (1977, 1979), Radford (1986) and Scharf & Gouda (2008). The structures were measured at the widest and/or longest parts. Inflorescences were only measured from fertile branches (flowering or fruited), excluding the peduncle. Geographic distribution data was taken from Smith & Downs (1977, 1979), Martinelli *et al*. (2008), Zizka *et al*. (2019), and the Flora do Brasil species list (Flora do Brasil 2020). The physiognomy classification follows IBGE (2012), except for mussunungas, which follows the modified classification of Saporetti Junior (2009). The conservation status for *Hohenbergia sandrae* follows the IUCN Red List criterion B ("geographic range", IUCN 2012, 2019) and was determined

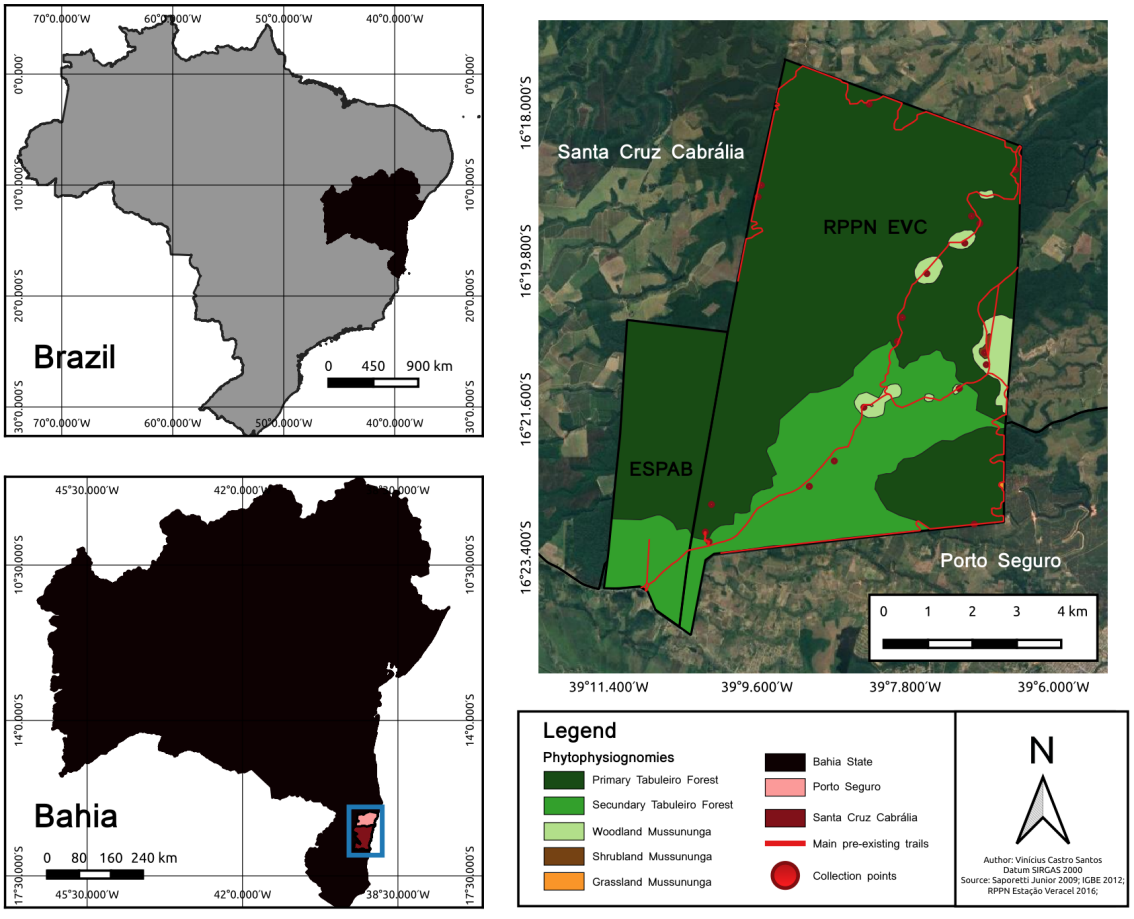

Figure 1 – Map of phytophysiognomies, trails and collection points at the Estação Veracel Private Natural Heritage Reserve (RPPN EVC) and Pau-Brasil Ecological Station (ESPAB), Porto Seguro-Santa Cruz Cabrália, Bahia state, Brazil.

using the Geospatial Conservation Assessment Tool (GeoCAT, Bachman & Moat 2012), which calculates the extent of occurrence (EOO), the area of occupancy (AOO), and the number of locations based on its occurrence records. The conservation status for other species was based on the Brazilian Red List (CNCFlora 2012).

Results and Discussion

Twelve species and eight genera of Bromeliaceae were recorded in the fragment, belonging to two subfamilies: Bromelioideae and Tillandsioideae. Bromelioideae comprises the genera *Aechmea* Ruiz & Pav. (2 spp.), *Araeococcus* Brongn (1 sp.), *Billbergia* Thunb (1 sp.) and *Hohenbergia* Schult.f. (1 sp.), while Tillandsioideae includes *Catopsis* Griseb. (1 spp.), *Guzmania* Ruiz & Pav. (1 sp.), *Tillandsia* L. (1 sp.) and *Vriesea* Lindl. (4 spp.). Eight endemic species were recorded from the Atlantic Forest domain, one from the Bahia state (*Vriesea duvaliana* É.Morren) (Flora do Brasil 2020), and two from the Bahia Coastal Forest (*Hohenbergia sandrae* Leme and *Vriesea minuta* Leme) (Ostroski *et al.*

Figure 2 – a. Ombrophilous Lowland Forest or Tabuleiro Forest. b. shrubland mussununga. c. grassland mussununga in front and woodland mussununga in the background. d. woodland mussununga.

2018). The conservation status for nine species were categorized as Not Evaluated (NE) because potential risks had not yet been studied or published (CNCFlora 2012), except for *Hohenbergia sandrae*, *Vriesea duvaliana*, and *Vriesea procera* var. *procera* Wittm, whose conservation status will be discussed later.

The representativeness of Bromeliaceae in the fragment (12 spp.) is relatively low compared to other fragments of the Atlantic Forest Central Corridor, *e.g.*, the Serra das Lontras National Park (64 spp.) (Leitman *et al*. 2014), the Una Biological Reserve (40 spp.) (Fontoura & Santos 2010) and the Vale Natural Reserve (31 spp.) (Rolim *et al*. 2016; Tab. 1). The smaller size of the area and the floristic dissimilarity of the extreme south region of Bahia in relation to the other areas of the Central Corridor (*e.g.*, Pinto *et al.* 2019), seem to explain the number of species found in the fragment studied in the RPPN EVC and ESPAB. The diversity of species found in the studied area is more similar to other remnants of the Atlantic Forest that are outside the Central Corridor, such as those found by Krahl *et al*. (2012), who registered 10 spp. In Cachoeira do Itapemirim / ES, and Dias *et al*. (2020), who found 23 species in 12 fragments analyzed in Juiz de Fora / MG.

Regarding shared species, the fragment analyzed in this study shares six species with Una Biological Reserve (Fontoura & Santos 2010), five species with the Lontras National Park (Leitman *et al*. 2014) and one to three species with the other areas of the Central Corridor (Tab. 1), with only one species shared with each of the areas outside the Central Corridor (Krahl *et al*. 2012; Dias *et al*. 2020). In general terms, only widely distributed species, such as *Vriesea ensiformis* (Vell.) Beer and *Vriesea procera* Wittm, are common to most of the areas. *Vriesea duvaliana* É.Morren is the only exception, which is an endemic species in the Atlantic Forest domain of Bahia state. The high number species shared between the Una Biological Reserve and the study area (6 spp.) may be related to the geographical proximity (ca. 135 km) and climatic and vegetational similarities (Tab. 1).

It is worth mentioning that the study fragment is the only Atlantic Forest Central Corridor area with *Hohenbergia sandrae* Leme, a species that is endemic to the Bahia Coastal Forest (Ostroski *et al.* 2018) and has never been described for the Atlantic Forest. This data shows the importance of regional and local taxonomic studies for the conservation of Brazilian flora.

Table 1 – Comparison of Bromeliaceae flora found in the present study with surveys conducted in the Atlantic Forest Central Corridor, Brazil. Nt = total number of species; Ns = number of species shared with the study area; * = areas outside the Atlantic Forest Central Corridor, Brazil.

Area	Area (ha)	Climate (Köppen)	Vegetation	Nt	Ns
Serra das Lontras National Park (Leitman *et al*. 2014)	11,000	Af	Submontane Forest	64	5
Una Biological Reserve (Fontoura & Santos 2010)	18,500	Af	Ombrophilous Dense Lowland Forest	40	6
Serra do Corcovado (Coelho & Amorim 2014)	2,500	Af	Montane Forest	33	3
Vale Natural Reserve (Rolim *et al*. 2016)	22,777	Awi	Seasonal Evergreen Forest	31	3
Serra da Pedra Lascada Reserve (Amorim *et al*. 2009)	300	Af	Montane Forest	28	2
Serra Bonita Private Natural Heritage Reserve (Amorim *et al*. 2009)	7,500	Af	Montane Forest	25	3
Juiz de Fora / MG (Dias *et al*. 2020) *	9 - 370	Cwa	Seasonal Semideciduous Forest	23	1
Present study area	7,220	Af	Ombrophilous Dense Lowland Forest	12	-
Cachoeira do Itapemirim / ES (Krahl *et al*. 2012) *	-	-	Seasonal Semideciduous Forest	10	1
FLORAS Botanical Garden (Pinto *et al*. 2019)	23.2	Af	Ombrophilous Dense Lowland Forest	4	1

Identification key for Bromeliaceae species at the Estação Veracel Private Natural Heritage Reserve and Pau-Brasil Ecological Station

1. Leaf blade with margin aculeate.
   2. Rosette tubular; flowers pedicellate; stamens exserted..... 4. *Billbergia saundersii*
   2'. Rosette infundibuliform; flowers sessile; stamens included.
      3. Inflorescence simple..... 1. *Aechmea alba*
      3'. Inflorescence compound.
         4. Leaf blade with prickles < 0.1 cm long; inflorescence with first order branches; floral bracts deltoid.....2. *Aechmea fulgens*
         4'. Leaf blade with prickles 0.1–0.4 cm long; inflorescence with third order branches; floral bracts sub-orbicular..... 7. *Hohenbergia sandrae*
1'. Leaf blade with margin entire.
   5. Rosette tank absent; leaf sheath sub-orbicular, forming a bulbose rosette ... 8. *Tillandsia bulbosa*
   5'. Rosette tank present; leaf sheath without these characteristics.
      6. Inflorescence compound.
         7. Inflorescence with second order branches; floral bracts < 0.4 cm long, very widely ovate; fruits berry.....3. *Araeococcus parviflorus*
         7'. Inflorescence with first order branches; floral bracts > 0.4 cm long, sub-orbicular or elliptic-ovate; fruits capsule.
            8. Leaf blade covered with white powder wax; floral bracts 0.5–1 cm long, sub-orbicular, green.....5. *Catopsis berteroriana*
            8'. Leaf blade glabrous; floral bracts 2.7–3.7 long, elliptic-ovate, red..... ..... 12. *Vriesea procera* var. *procera*
      6'. Inflorescence simple.
         9. Inflorescence corymb .....6. *Guzmania lingulata* var. *minor*
         9'. Inflorescence raceme.
            10. Leaf blade green-purple, white sericeous; floral bracts sub-orbicular, shorter than the sepals ..... 11. *Vriesea minuta*
            10'. Leaf blade green or reddish, glabrous; floral bracts ovate, exceeding the sepals.
               11. Flowering plant 18–35 cm tall; leaf blade 8.2–19 cm long; inflorescence congested..... 9. *Vriesea duvaliana*
               11'. Flowering plant 46,5–70 cm tall.; leaf blade 21–48.5 cm long, congested towards the apex in the beginning of anthesis and sub-congested to lax towards the base after anthesis.....10. *Vriesea ensiformis* var. *ensiformis*

1. ***Aechmea alba*** Mez, *Fl. Bras.* (Martius) 3(3): 375 (1892). Fig. 3a

Flowering plant 27–60 cm tall, epiphytic or terricolous herb. Leaves coriaceous, arranged in infundibuliform rosettes, tank present; sheath 8–14.5 × 2.5–8 cm, obovate or elliptical, vinaceous adaxially, green abaxially; blade 10–62 × 1–7 cm, linear or linear-lanceolate, green or yellowish-green, white-sericeous adaxially, margin aculeate, prickles ca. 0.1 cm long, apex acute, apiculate. Inflorescence 2–6 cm long, simple, spike, congested; peduncle 14–28.5 cm long, erect, green, white-floccose; peduncle bracts 3.5–11 × 1.1–2.4 cm, lanceolate, red or reddish-pink, glabrous, exceeding the internodes, apex acuminate; floral bracts 0.7–1.1 × 1–1.7 cm, depressed ovate, brown, ecarinate, white-floccose, margin entire, shorter than the sepals, apex truncated and apiculate. Flowers 1.4–2.4 cm long, sessile; sepals 0.7–1.2 × 0.3–0.5 cm, asymmetric, ovate, brown, conate at the base, ecarinate, white-lepidote, apex apiculate; petals 1.3–1.6 × 0.3–0.4 cm, white, apex acute; petal appendages fimbriate; stamens included; stigma conduplicate-spiral. Ovary inferior. Fruit berry.

Examined material: Santa Cruz Cabrália-Porto Seguro, Estação Ecológica do Pau-Brasil (= Reserva Biológica do Pau-Brasil), 17.IX.1971, fl., *T.S. dos Santos 1953* (CEPEC); 4.VIII.1973, fl., *J.L. Hage 69* (CEPEC); 19.IV.1982, fr., *A.M. de Carvalho et al. 1187* (CEPEC); 12.II.1974, fl., *C.M. Erskine 54* (K); 28.VIII.2018, fl., *V.C. Santos et al. 323* (GCPP); RPPN Estação Veracel,

Figure 3 – a. *Aechmea alba* – habit. b. *A. fulgens* – habit. c. *Araeococcus parviflorus* – inflorescence. d. *Billbergia saundersii* – habit. e. *Catopsis berteroriana* – inflorescence. f. *Guzmania lingulata* var. *minor* – habit. g. *Hohenbergia sandrae* – habit. h. *Vriesea ensiformis* – inflorescence. i. *V. minuta* – habit. j. *V. procera* var. *procera* – detail of the flower.

10.IV.1994, fr., *M.L. Guedes et al. 3205* (ALCB); 17.VI.2006, fl., *M.M.M. Lopes et al.* 914 (CEPEC); 1.III.2010, fl., *G.M. Carvalho & M.C. Gouvêa 198* (CEPEC); 10.III.2010, fl., *L. Daneu et al. 269* (CEPEC); 24.III.2017, fl., *V.C. Santos et al. 41* (GCPP); 29.V.2017, fl., *J.R. Maciel et al. 1944* (RB); 28.IV.2018, fl., *V.C. Santos 200* (GCPP); 28.IV.2018, fl. and fr., *V.C. Santos 201* (GCPP); 7.VI.2018, fl., *V.C. Santos 237* (GCPP).

Aechmea alba is endemic to the Atlantic Forest domain of Bahia and Minas Gerais states in the Ombrophilous Forest and Restinga (Martinelli *et al*. 2008; Flora do Brasil 2020). In the fragment, the species is found as terrestrial or as an epiphyte at the base of tree trunks inside and at the edge of the Ombrophilous Lowland Forest or the Tabuleiro Forest (see discussion in Pinto *et al.* 2019), forming large populations. The taxon is characterized by its bright, red peduncle bracts, white-floccose inflorescence, depressed-ovate floral bracts and white petals. Flowering between January and August and fruiting in April.

2. *Aechmea fulgens* Brongn., Ann. Sci. Nat., Bot. sér. 2, 15: 371 (1841). Fig. 3b

Flowering plant 27–50 cm tall, epiphytic or terricolous herb. Leaves coriaceous, arranged in infundibuliform rosettes, tank present; sheath 9–11.5 × 5–7 cm, elliptical, brown-lepitode; blade 17.5–49.3 × 3–5.2 cm, linear, green, margin aculeate, prickles less than 0.1 cm long, apex apiculate. Inflorescence 6.9–14.9 cm long, compound, paniculate, with first order branches, gradually becoming simple towards the apex, slightly congested; peduncle 13–21.6 cm long, erect, reddish-green, glabrous; peduncle bracts 3.4–12 × 0.3–0.9 cm, lanceolate, stramineous, glabrous, exceeding the internodes, apex acute; primary bracts 0.1–3.3 × 0.1–0.3 cm, deltoid or linear, glabrous, apex acuminate; primary branches 1–3.5 cm long, stipitate, glabrous; floral bracts 0.1 × 0.1 cm, deltoid, stramineous, ecarinate, glabrous, margin entire, shorter than the sepals, apex acuminate. Flowers 0.8–1.7 cm long, sessile; sepals 0.2–0.4 cm long, asymmetric, apex red with purple; petals reddish to pinkish; petal appendages crenulate; stamens included; stigma conduplicate-spiral. Ovary inferior. Fruit berry.

Examined material: Santa Cruz Cabrália-Porto Seguro, Estação Ecológica do Pau-Brasil, 9.IV.2002, fr., *L. de P. Almeida et al. 82* (CEN). RPPN Estação Veracel, 3.III.2010, fl., G.*M. Carvalho & M.C. Gouvêa 226* (CEPEC); 19.V.2017, fr., *V.C. Santos 77* (GCPP).

Additional examined material: BRASIL. BAHIA: Porto Seguro, Extremo Sul, 10.II.2003, fl., *M.L. Guedes et al. 10016* (ALCB); Fonte dos Protomartires, Costal rain forest with small river and clearings with disturbed ground, fl., 21.III.1974, *R.M. Harley 17249* (K).

Aechmea fulgens is endemic to the Atlantic Forest domain of Alagoas, Sergipe, and Pernambuco states in the Seasonal Semideciduous Forest and Ombrophilous Forest (Martinelli *et al*. 2008; Flora do Brasil 2020). However, its distribution is outdated becauseother studies have recorded *A. fulgens* in Bahia state (*e.g*., Carvalho-Sobrinho & Queiroz 2005), with voucher in virtual herbariums. In the fragment, the species occurs as terrestrial or an epiphytic at the base of tree trunks at the edge of the Tabuleiro Forests, forming small populations. The taxon is characterized by its red and purple inflorescences, with first order branches at the base, and inconspicuous and deltoid floral bracts (0.1 × 0.1 cm). Flowering in February and April and fruiting in April and May.

3. *Araeococcus parviflorus* (Mart. *ex* Schult. & Schult.f.) Lindm., Kongl. Svenska Vetensk. Acad. Handl. n.s., 24(8): 12 (1891). Fig. 3c

Flowering plant 20–48.5 cm tall, epiphytic herb. Leaves arranged in utriculous rosettes, tank present; sheath 5–14 × 3–5.5 cm, elliptical, brown-lepitode, ; blade 8–36 × 1.1–2.2 cm, linear to linear-lanceolate, green or reddish-green, glabrescent, margin entire, apex acute to acuminate. Inflorescence 3.5–19.5 cm long, compound, paniculate, with second order branches, gradually narrowing towards the apex, lax; peduncle 13–24.5 cm long, erect, vinaceous, inconspicuous and sparsely white-lanuginose to glabrescent; peduncle bracts 1.7–5 × 0.6–0.7 cm, linear-lanceolate, stramineous, glabrous, exceeding the internodes, apex acuminate; primary bracts 0.2–3 × 0.1–0.3 cm, linear-triangular and triangular, glabrous, apex acute; primary branches 1–10 cm long, stipitate, glabrous to glabrescent; secondary bracts 0.1–0.2 × 0.1 cm, triangular, glabrous, apex acute; secondary branches 1.5–5 cm long., stipitate, glabrous to glabrescent; floral bracts 0.1–0.2 × 0.1–0.2 cm, very widely ovate, ecarinate, glabrescent, margin entire, shorter than the sepals, apex acuminate. Flowers 0.6–0.8 cm long, pedicellate; sepals 0.1–0.2 × 0.1–0.2 cm, sub-symmetric, pale yellowish-white or pale green, conate at the base, ecarinate, glabrescent, apex acuminate; petals 0.3–0.4 × 0.1–0.2 cm, sub-spatulate, white, apex retuse or rounded; petal appendages absent; stamens included; stigma conduplicate-spiral. Ovary inferior. Fruit berry.

Examined material: Porto Seguro-Santa Cruz Cabrália, Estação Ecológica do Pau-Brasil (=Reserva Biológica do Pau-Brasil), 15.IX.1971, fl., *T.S. Santos 1932* (CEPEC); 11.XII.1971, fl., *A. Eupunino 66* (US, RB); 19.III.1974, fr., *R.M. Harley 17199* (CEPEC); 21.III.1978, fr., *S.A. Mori et al. 9771* (CEPEC, NY); 9.II.1984, *F.S. Santos 240* (CEPEC, RB); 25.XI.1987, fl., *P.J.M. Maas et al. 6988* (CEPEC, RB); RPPN Estação Veracel, 10.IV.1994, fr., *M.L. Guedes et al. 3185* (ALCB); 10.V.1997, fr., *M.L. Guedes 4178* (ALCB); 5.II.2000, fl. and fr., *J.G. Jardim & M. Alves 2689* (CEPEC, NY, RB); 29.V.2014, fr., *J.R. Maciel et al. 1943* (RB); 5.VII.2018, fl. and fr., *V.C. Santos 250* (GCPP); 8.IX.2018, fl., *V.C. Santos & D. Albuquerque 319* (GCPP).

Araeococcus parviflorus is endemic to Ombrophilous Forest and Restinga in the Atlantic Forest domain of Bahia state (Martinelli *et al*. 2008; Flora do Brasil 2020). In the fragment, the species occurs as an epiphytic at the base of tree trunks in primary vegetation within the Tabuleiro Forests, forming relatively large populations. Small populations also occur at the edge of secondary vegetation. The species is characterized by its small flowers (0.6–0.8 cm long), short pedicel (0.1–0.3 cm long) and very widely ovate floral bracts. In the study area, *A*. *parviflorus* is the only species in the subfamily Bromelioideae that presents leaf blades with an entire margin (*vs*. aculeate margin). According to Leme & Siqueira Filho (2006), the species *Araeococcus nigropurpureus* Leme & J.A. Siqueira is easily confused with this plant. The same authors separated it from *A*. *parviflorus* mainly because of the obtuse base (*vs.* rounded) and dark-purple color of the ovary (*vs.* pale green), but also by its floral bract morphology and flower and pedicel sizes. However, in the fragment analyzed, *A*. *parviflorus* was also found with a dark-purple ovary, which makes ovary color an unreliable characteristic for differentiating these species. Flowering between September and February and in July and fruiting between February and July and in September.

4. *Billbergia saundersii* Hort.Bull, Fl. Mag. (London) N. S. t. 106 (1874). Fig. 3d

Flowering plant 40–50 cm tall, epiphytic or terricolous herb. Leaves sub-coriaceous, arranged in tubular rosettes, tank present; sheath 11–16.5 × 3–6.8 cm, elliptical, vinaceous; blade 20–65.5 × 2.3–5.2 cm, linear, green with yellow stains or green-vinaceous with silvery-white stains, margin aculeate, prickles ca. 0.1 cm long., apex acuminate or acute. Inflorescence 5.1–13.6 cm long, simple, raceme, lax; peduncle 21–40.2 cm long, erect, pink, red or orange, white-lepidote or glabrescent; peduncle bracts exceeding the internodes, apex acute; floral bracts 0.1–0.2 × 0.1–0.2 cm, inconspicuous, red, shorter than the petiole and sepals. Flowers 3.8–6.6 cm long, long-pedicellate, pedicel 0.4–1.7 cm long; sepals 1.2–2 × 0.3–0.5 cm, symmetric, narrowly elliptical, red and green with blue margin or green with blue margin, free, ecarinate, white-lepidote, margin entire, apex acuminate or apiculate; petals 1.9–3.6 × 0.3–0.5 cm, spatulate, green with blue or purple apex, reflexes at anthesis, apex obtuse; petal appendages present; stamens exserted; stigma conduplicate-spiral. Ovary inferior. Fruit not seen.

Examined material: Porto Seguro-Santa Cruz Cabrália, Estação Ecológica do Pau-Brasil (=Reserva Biológica do Pau-Brasil), 22.IV.1932, fl., *A.M. de Carvalho et al. 1347* (CEPEC); 21.V.1975, fl., *T.S. Santos 3007* (CEPEC); 7.V.1976, fl., *J.L. Hage 150* (CEPEC, RB); 17.V.1999, fl., *G. Martinelli & T. Barbará 15468* (RB); 18.V.2002, fl., *S.C. Sant'Ana et al. 1051* (NY).

Billbergia saundersii is endemic to Ombrophilous Forest in the Atlantic Forest domain of Bahia, Minas Gerais, and Rio de Janeiro states (Martinelli *et al*. 2008; Flora do Brasil 2020). In the fragment, *B*. *saundersii* is terrestrial at the edge of the Tabuleiro Forest. Despite the large sampling effort, this taxon was not collected again, indicating that it is a rare species in the fragment. The species is easily identified when sterile by its tubular rosette and yellow or silvery-white stains. The taxon is also characterized by its pedicellate flowers (0.4–1.7 cm long) and exserted stamens. Flowering between April and May.

5. *Catopsis berteroniana* (Schult. & Schult.f.) Mez, Monogr. Phan. [A.DC. & C.DC.] 9: 621 (1896).

Fig. 3e

Flowering plant 71–110 cm tall, epiphytic herb. Leaves sub-cartaceous, arranged in infundibuliform rosettes, tank present; sheath 7–12 × 3–5.5 cm, narrowly elliptical, slightly different from the blade, brown, densely covered with white powder wax; blade 9.6–24.6 × 2.8–5.5 cm, narrowly triangular, green or yellowish-green, densely covered with white powder wax, margin entire, apex cuspidate deflex or acuminate. Inflorescence 15.8–26 cm long, compound, paniculate, with first order branches,lax; peduncle 50–70 cm long, sub-erect, green, glabrous; peduncle bracts 2.8–19 × 0.5–3.5 cm, foliaceous to ovate-lanceolate, green to yellowish-green, brown-

lepidote, densely covered with white powder wax, exceeding the internodes, apex cuspidate; primary bracts 1–5 × 1–1.5 cm, ovate-lanceolate to very widely ovate, glabrous, apex cuspidate; primary branches 5.1–14.5 cm long, green, stipitate, glabrous; floral bracts 0.5–1 × 0.5–0.9 cm, sub-orbicular, green, ecarinate, glabrous adaxially, inconspicuous brown-lepidote abaxially, margin entire, shorter than the sepals, apex acuminate to obtuse and short-apiculate. Flowers not seen. Fruit capsule.

Examined material: Porto Seguro-Santa Cruz Cabrália, RPPN Estação Veracel, 17.VI.2006, fr., *M.M.M. Lopes et al. 880* (CEPEC, RB); 22.VI.2017, fr., *V.C. Santos et al. 95* (GCPP); 7.VI.2018, fr., *V.C. Santos 238* (GCPP); 7.VI.2018, fr., *V.C. Santos 239* (GCPP).

Catopsis berteroriana has a wide geographic distribution, from southern Florida (United States) to Santa Catarina in southern Brazil, through Central America, including the Antilles, and Venezuela (Smith & Downs 1977; Zikza *et al*. 2019). In Brazil, it is restricted to Semideciduous Seasonal Forest, Ombrophilous Forest, and Restinga in the Atlantic Forest domain and occurs between Santa Catarina and São Paulo states and between Bahia and Pernambuco states (Martinelli *et al*. 2008; Flora do Brasil 2020). In the fragment, the taxon occurs as epiphytic, forming relatively large populations in the shrubland mussununga (Fig. 2b). The taxon is easily identified by the leaf blades covered with white powder wax. Fruiting in June.

6. *Guzmania lingulata* var. ***minor*** (Mez) L.B.Sm. & Pittendr., Phytologia 7: 105 (1960). Fig. 3f

Flowering plant 19–50 cm tall, epiphytic herb. Leaves papyraceous, arranged in infundibuliform rosettes, tank present; sheath 5–7.7 × 3.3–4.5 cm, elliptical, brown-lepitode; blade 15.9–29.5 × 1.6–2.2 cm, linear, green or green-vinaceous, inconspicuous to sparsely brown-lepidote abaxially, margin entire, apex acute. Inflorescence 3–6.2 cm long, simple, corymb, congested; peduncle 8.5–15.3 cm long, erect, glabrous; peduncle bracts 5–8 × 1.2–2.8 cm, lanceolate, orange, pink, red or reddish-green, glabrous, exceeding the internodes, apex acute, apiculate; floral bracts 0.7–1.5 × 3.5–5 cm, linear-lanceolate to narrowly elliptical-lanceolate, reddish-cream, ecarinate, glabrous adaxially, margin entire, apex slightly cuculate. Flowers ca. 0.4 cm long, sessile; sepals 1.4–1.6 × 0.2–0.3 cm, sub-symmetric, linear-lanceolate, pale yellow, conate to the base, carinate, apex obtuse; petals pale yellow; petal appendages absent; stamens included; stigma conduplicate. Ovary semi-inferior. Fruit capsule.

Examined material: Porto Seguro-Santa Cruz Cabrália, Estação Ecológica do Pau-Brasil (=Reserva Biológica do Pau-Brasil), 20.I.1977, fl., *R.M. Harley 18139* (CEPEC); 21.III.1978, fl., *S.A. Mori et al. 9803* (CEPEC). RPPN Estação Veracel, 22.IV.1994, fl., *M.L. Guedes et al. 3014* (ALCB); 17.VI.2006, fl., *M.M.M. Lopes et al. 915* (CEPEC); 2.III.2010, fl., *G.M. Carvalho & M.C. Gouvêa 202* (CEPEC); 9.IV.2018, fl., *V.C. Santos 181* (GCPP); 4.VII.2018, fr., *V.C. Santos 256* (GCPP).

Guzmania lingulata var. *minor* only occurs in Brazil, with a disjunct distribution between the Atlantic Forest domain of Bahia state and the Amazon Forest of Amazonas, Amapá, and Pará states (Flora do Brasil 2020). It differs from *G. lingulata* var *lingulata* Mez and *G. lingulata* var *splendens* Mez in its leaf blades shorter than 25 mm wide, small in size, slightly cucullate floral bracts, and small number of flowers (Flora do Brasil 2020). In the fragment, the taxon is an epiphyte at the base of tree trunks inside and at the edge of the Tabuleiro Forests, forming relatively large populations. The taxon is characterized by its corymb inflorescence with densely rosulated red peduncle bracts. Flowering between January and June and fruiting in July.

7. *Hohenbergia sandrae* Leme, J. Bromeliad Soc. 53(4): 174 (-177; figs. 32-33) (2003). Figs. 3g; 4

Flowering plant ca. 150–160 cm tall, epiphytic herb. Leaves coriaceous, arranged in infundibuliform rosettes, tank present; sheath 20–27 × 7–13 cm, elliptical; dark brown, blade 41–115 × 4–8 cm, linear-lanceolate, yellowish-green or green, glabrous, margin aculeate, prickles 0.1–0.4 cm long, apex acuminate, mucronate. Inflorescence 63–95.5 cm long, compound, paniculate, with third order branches, gradually narrowing towards the apex, bearing long stipitate to sessile and dense fascicles of spikes, lax; peduncle 40–48 cm long, erect, red or green, white-lanuginose; bracts of peduncle 5–9 × 1.5–3.5 cm, elliptic-lanceolate, stramineous, sparsely white-lanuginose adaxially, glabrous or glabrescent abaxially, exceeding the internodes, apex acute, mucronate; primary bracts 2–6.5 × 0.5–3.5 cm, triangular-lanceolate to narrow triangular-lanceolate, sparsely white-lanuginose adaxially, glabrous or glabrescent abaxially, apex acute, mucronate; primary branches 7.3–45

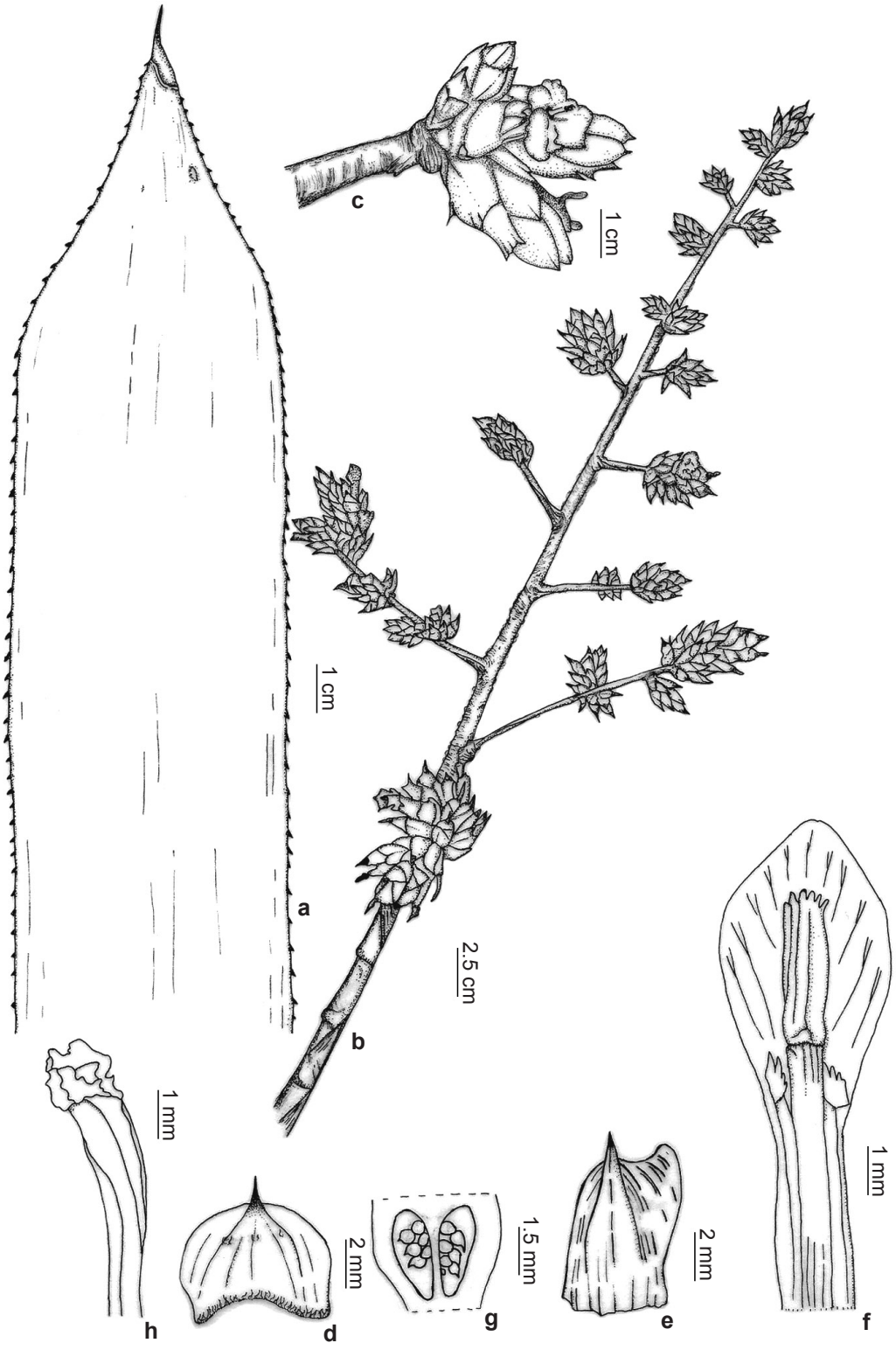

Figure 4 – a-h. *Hohenbergia sandrae* – a. leaf blade; b. inflorescence; c. secondary branch of the inflorescence; d. floral bract; e. sepal; f. petal with stamen; g. ovary; h. stigma. (a-h. J.A.S. Costa *et al.* 2181).

cm long, stipitate, sparsely white-lanuginose; secondary bracts 0.6–1.6 × 0.4–4 cm, narrowly triangular-lanceolate to very widely ovate, sparsely white-lanuginose or sub-densely white-lanuginose adaxially, glabrescent or glabrous abaxially, apex acute, mucronate; secondary branches 1.5–4.5 cm long, stipitate, sparsely white-lanuginose; tertiary bracts 0.7–0.9 × 0.9–1 cm, very widely ovate, sparsely white-lanuginose to glabrous, apex mucronate; tertiary branches 1–3.5 × 1–1.5 cm, strobilate spikes, sub-globose or sub-cylindrical, sub-sessile to sessile, sparsely white-lanuginose or glabrous; floral bracts 0.6–0.7 × 0.9–1 cm, pink or green, sub-orbicular, ecarinate, sparse white-lanuginose to glabrescent, margin entire, shorter than the sepals, apex mucronate. Flowers 0.8–1.1 cm long, sessile; sepals 0.5–0.6 × 0.3–0.5 cm, asymmetric, pink or rarely green, free, strongly carinate, glabrous, auriculate, apex mucronate; petals 0.8–1 × 0.3–0.4 cm, sub-spatulate, purple with white base, apex not cuculate or slightly cuculate, obtuse; petal appendages present, irregularly dentate to lacerate; stamens included; stigma conduplicate-spiral. Ovary inferior. Fruit berry.

Examined material: Porto Seguro-Santa Cruz Cabrália, RPPN Estação Veracel, 18.V.2002, fl. and fr., *S.C. de Sant'Ana et al. 1050* (CEPEC, NY); 12.V.2017, fl. and fr., *J.A.S. Costa et al. 2181* (GCPP); 7.VI.2018, fl. and fr., *V.C. Santos 235* (GCPP); 7.VI.2018, fl. and fr., *V.C. Santos 236* (GCPP).

Additional examined material: BRASIL. BAHIA: Itiruçu, Fazenda Gameleiras, 1.VII.2018, fl., *B.P. Cavalcante & E.H Souza 12* (HURB). Jiquiriçá, Fazenda Riacho Novo, 3.IX.2018, fr., *T.T. Silva 254* (HURB). Brejões, Distrito de Serrana, Fazenda Camacari, 10.I.2019, fl., *E.H. Souza & S. Oliveira 1013* (HURB). Fazenda Lagoa do Morro, 20.II.2019, fl., *E.H. Souza et al. 188* (HURB).

Hohenbergia sandrae was collected and described for the first time as terrestrial in the Caatinga vegetation in Maracás, Bahia state (Leme 2003). Other occurrences were recorded to the Atlantic Forest in Bahia state (Flora do Brasil 2020; Ostroski *et al.* 2018), but with no species descriptions. In the fragment, the taxon is exclusively epiphytic and forms large populations in the understory and canopy of the edge and interior of the Tabuleiro Forest. It is easily identified by its large size (150–160 cm tall) and showy pink inflorescences, with white-lanuginose third order branches. Inflorescences are rarely green. It is essential that this taxon be described in the Atlantic Forest domain since the morphological characteristics of the species can vary between domains. For example, *Hohenbergia ridley* (Baker) Mez is a species from the Atlantic Forest that is easily confused with *Hohenbergia cantingae* Üle when present in Restinga due to its reddish leaves and inflorescence, as well as mucronate sepals and floral bracts (Baracho 2004). The same is true for *H. sandrae*, which has unarmed or remotely apiculate sepals in the Caatinga (Leme 2003) and mucronate sepals in the Atlantic Forest (present study). Pinto *et al.* (2019) found a species of *Hohenbergia* in a forest fragment located about 5 km from the study area, but observations of the material show that it is not *H. sandrae*. For this species, a Near Threatened (NT) category is suggested according to IUCN criteria (IUCN 2012, 2019) due to its restricted extent of occurrence (approximately 22,500 km^2) and its records in only five severely fragmented areas, including unprotected/anthropized areas. Although the species was also collected in a large protected area, this fragment is surrounded by pasture and agricultural areas and suffers from illegal logging which could potentially affect *H. sandrae* population. Flowering between January and June and fruiting between May and September.

8. *Tillandsia bulbosa* Hook., Exot. Fl. 3(26): t. 173 (1825).

Flowering plant 11–18 cm tall, epiphytic herb. Leaves coriaceous, forming a bulbose rosette 3–4.9 cm long, tank absent; sheath 1.9–3 × 1.8–3 cm, sub-orbicular, white-lepidote; blade 8–15 × 0.2–0.3 cm, linear-filiform, green, glabrous abaxially, white-lepidote adaxially, indumentum exceeding the margin, margin entire, apex attenuate. Inflorescence 3.5–8.5 cm long, compound or simple, with first order branches when compound; peduncle 6–9 cm long, erect, inconspicuous and densely white-lepidote; peduncle bracts 3.1–7 × 0.4–0.9 cm, foliaceous, green, densely white-lepidote, exceeding the internodes apex attenuate; primary bracts 2.3–4.8 × 0.6–0.7 cm, linear-lanceolate to ovate-lanceolate, densely white-lepidote, apex attenuate; primary branches 6–7.5 cm long, stipitate, densely white-lepidote; floral bracts 1.4–1.9 × 0.4–0.6 cm, narrowly ovate, red, carinate, white-lepidote, margin entire, exceeding the sepals, apex acute, slightly curved. Flowers not seen. Fruit capsule.

Examined material: Porto Seguro, RPPN Estação Veracel, 28.III.1999, fr., *P.A. de Pereira et al. 8* (ALCB, CEPEC, MBM); 14.X.2004, fr., *M.S. Nery & L.S. Leoni 6042* (RB); 22.VI.2017, fr., *T.J. Antunes 47* (GCPP).

Tillandsia bulbosa has a wide geographic distribution, from Mexico to northern South America, including Central America and the Caribbean (Smith & Downs 1977; Zizka *et al*. 2019). In Brazil, it occurs in the Amazon region (Amazonas, Amapá and Pará states), Northeastern region (Paraíba, Pernambuco, Alagoas, Sergipe and Bahia states), and in Espírito Santo state (Martinelli *et al*. 2008; Flora do Brasil 2020). In the fragment, the species occurs as epiphytic at the base of tree trunks in the Tabuleiro Forest, forming small populations. Some individuals are also found in the transition between Tabuleiro Forest and woodland mussununga. The taxon is easily recognized, even when sterile, due to its false ovate or sub-globose and inflated pseudobulb formed by the sub-orbicular leaf sheaths. Fruiting in March, June and October.

9. *Vriesea duvaliana* É.Morren, Belgique Hort. xxxiv. (1884) 105. tt. 7, 8.

Flowering plant 18–35 cm tall, epiphytic herb. Leaves coriaceous, arranged in infundibuliform rosettes, tank present; sheath 3.7–8.5 × 2.8–4.5 cm, brown-lepidote; blade 8.2–19 × 1.1–1.6 cm, linear, green or reddish, glabrous, margin entire, apex acuminate. Inflorescence 6–16 cm long, simple, raceme, congested; peduncle 9–19 cm long, erect, glabrous; peduncle bracts 2–3.6 cm long, ovate, orange, reddish-pink or red, glabrous, exceeding the internodes, apex acuminate; floral bracts 2.8–5 × 1.2–1.8 cm, ovate, orange, reddish-pink or red and yellow, glabrous, exceeding the sepals, apex acuminate. Flowers not seen. Fruit capsule.

Examined material: Porto Seguro, RPPN Estação Veracel, 8.VII.2010, fl., *G.M. Carvalho et al. 384* (CEPEC); 31.VIII.2010, fr., *L. Daneu et al. 378* (CEPEC).

Additional examined material: BRASIL. BAHIA: Una, Estrada Una-Olivença, 10.IX.1974, fl., *T.S. Santos 2791* (RB); 19.X.1983, fl., *G. Martinelli e T. Soderstrom 9690* (CEPEC). Itacaré, ca. 5 km SW de Itacaré, on side road south from the main Itacaré-Ubaitava road, south of the mouth of the Rio da Contas, 30.III.1974, *R.M. Harley 17525* (K).

Vriesea duvaliana is endemic to the Atlantic Forest domain, currently occurring only in state of Bahia (Flora do Brasil 2020). In the fragment, it occurs in the Tabuleiro Forest. The taxon looks similar to *Vriesea ensiformis* Beer, but can be differentiated by its small size (18–35 cm tall *vs.* 46.5–70 cm tall) and congested inflorescence (*vs.* congested towards the apex at the beginning of anthesis and sub-congested to lax towards the base after anthesis). This species is also commonly misidentified as *Vriesea carinata* Wawra in herbaria collections, especially in Bahia, but it can be differentiated by its lanceolate or elliptical inflorescence (vs. oblong inflorescence in *V. carinata*) (Morren 1884). CNCFlora (2012) suggested a Near Threatened (NT) category for *V. duvaliana* due to the overexploitation risks for its populations. Flowering in July and fruiting in August.

10. *Vriesea ensiformis* var. *ensiformis* Beer, Fam. Brom. 92 (1856). Fig. 3h

Flowering plant 46.5–70 cm tall, epiphytic or terricolous herb. Leaves coriaceous, arranged in infundibuliform rosettes, tank present; sheath 6–14 × 6.5 cm, elliptical, brown, glabrous; blade 21–48.5 × 2.3–4 cm, linear, green or reddish, glabrous, margin entire, apex acuminate. Inflorescence 16.5–34 cm long, simple, raceme, congested towards the apex at the beginning of anthesis and sub-congested to lax towards the base after anthesis; peduncle 23.5–27 cm long, erect, red, glabrous; peduncle bracts 3–4.7 × 1.6–2.7 cm, ovate, red, glabrous, exceeding the internodes, apex obtuse, mucronate; floral bracts 3.6–4.2 × 2–2.5 cm, ovate, red, ecarinate, glabrous, margin entire, exceeding the sepals, apex occasionally yellow, obtuse. Flowers 5–6 cm long, pedicellate, 0.6–0.7 cm long; sepals 3.4–3.7 × 0.8–0.9 cm, symmetric, narrowly elliptical, yellow, free, ecarinate, glabrous, apex obtuse, apiculate; petals not seen; petal appendages not seen, stamens not seen, sitgma not seen. Ovary superior. Fruit capsule.

Examined material: Porto Seguro-Santa Cruz de Cabrália, Estação Ecológica do Pau-Brasil, 8.X.1994, fl., *F.S. Santos et al. 440* (CEPEC); RPPN Estação Veracel, 21.III.2018, fr., *V.C. Santos 158* (GCCP).

Vriesea ensiformis var. *ensiformis* is endemic to the Atlantic Forest domain of Bahia, Pernambuco, Paraná, and Santa Catarina states (Martinelli *et al*. 2008; Flora do Brasil 2020). In the fragment, the taxon occurs as epiphytic at the base of tree trunks at the edge of the Tabuleiro Forest. It is characterized by its inflorescence in the shape of a "sword", being congested towards the apex at the beginning of anthesis and sub-congested to lax towards the base after anthesis. Flowering in October and fruiting in March.

11. *Vriesea minuta* Leme, Bromélia 2: 24, fig (1995). Fig. 3i

Flowering plant ca. 50 cm tall, epiphytic herb. Leaves coriaceous, arranged in infundibuliform rosettes, tank present; sheath 4.3–10 × 2.9–6.9

cm, elliptical, brown-lepidote; blade 4.3–10 × 2.9–6.9 cm, linear-lanceolate, dark-green adaxially, green-purple abaxially, white-sericeous, margin entire, apex purple, acute. Inflorescence 12.5–20 cm long, simple, raceme, sub-congest, glabrous to glabrescent; peduncle 8.7–44 cm long, erect-patent or sub-erect, green, glabrous; peduncle bracts 2.1–16 × 1.9–2 cm, sub-foliaceous to very widely ovate, green or green and brown, glabrous, eventually exceeding the internodes, apex purple, acute, apiculate; floral bracts 1.2–2.7 × 1.4–2.9 cm, sub-orbicular, green and brown, ecarinate, glabrous, , margin entire, shorter than the sepals, apex obtuse, short-apiculate. Flowers 3.5–4.9 cm long, pedicellate, 0.6–1 cm long; sepals 2.1–2.7 × 1.1–1.5 cm, symmetric, elliptical, green-brown, free, ecarinate, brown-lepidote, apex obtuse; petals 3–3.5 × 1.5–1.7 cm, obovate, yellow, apex brown; petal appendages obovate; stamens included; stigma laminar-convolute. Ovary superior. Fruit capsule.
Examined material: Santa Cruz Cabrália-Porto Seguro, Estação Ecológica do Pau-Brasil, 15.V.1999, fl., *G. Matinelli 15465* (RB); 17.V.1999, fl., *G. Martinelli e T. Barbará 15465* (RB). RPPN Estação Veracel, 5.VII.2018, fr., *V.C. Santos 251* (GCPP); 5.VII.2018, fr., *V.C. Santos 253* (GCPP); 5.VII.2018, fr., *V.C. Santos 254* (GCPP).

Vriesea minuta is endemic to the Atlantic Forest domain of Bahia state (Martinelli *et al*. 2008; Flora do Brasil 2020). In the fragment, the taxon is exclusively an epiphyte in the undergrowth and canopy of the primary vegetation in the Tabuleiro Forest, forming large populations. The taxon is easily recognized, even when sterile, by its leaf blades green-purple, white-sericeous, with purple apex. It is also characterized by sub-orbicular floral bracts, shorter than sepals. Flowering in May and fruiting in May and July.

12. *Vriesea procera* var. ***procera*** Wittm., Bot. Jahrb. Syst. 13(3-4, Beibl. 29): 21 (1891). Fig. 3j

Flowering plant 100–180 cm tall, epiphytic or terricolous herb. Leaves coriaceous, arranged in infundibuliform rosettes, tank present; sheath 6–9 × 10–18.5 cm, elliptical, dark-brown with purple stains adaxially, glabrous; blade 21.5–45 × 3.5–4.5 cm, linear-lanceolate, green or green with purple stains, glabrous, margin entire, apex acuminate. Inflorescence 38–110.5 cm long, compound, paniculate, with first order branches, gradually narrowing towards the apex, lax; peduncle 25–70 cm long, erect, reddish-green, glabrous; peduncle bracts 3–20 × 1.5–3 cm, lanceolate to ovate, reddish-green to red, glabrous, exceeding the internodes, apex acuminate, mucronate; primary bracts 2.4–7 × 1–2.2 cm, lanceolate to ovate, red, glabrous, apex acute, apiculate; primary branches 19.5–46 cm long, long-stipitate, glabrous; floral bracts 2.7–3.7 × 1.1–1.7 cm, elliptic-ovate, red, ecarinate, glabrous, shorter than the sepals, apex acute, apiculate. Flowers 5–5.3 cm long, pedicellate, 0.8–0.9; sepals 2.5–3.5 × 0.8–1 cm, symmetric, narrowly elliptical, greenish-yellow, free, ecarinate, glabrous, apex obtuse, apiculate; petals 3.4–4 × 0.5–0.6 cm, sub-spatulate or spatulate, greenish-yellow, apex retuse or obtuse; petal appendages irregularly dentate; stamens included; stigma laminar-convolute. Ovary semi-inferior. Fruit capsule.
Examined material: Santa Cruz Cabrália-Porto Seguro, RPPN Estação Veracel, 22.VI.2017, fl., *C.B.N. Costa et al. 542* (GCPP); 7.VI.2018, fl., *V.C. Santos 231* (GCPP); 7.VI.2018, fl., *V.C. Santos 232* (GCPP); 7.VI.2018, fl., *V.C. Santos 233* (GCPP); 7.VI.2018, fl., *V.C. Santos 240* (GCPP); 10.X.2018, fr., *V.C. Santos et al. 326* (GCPP).

Vriesea procera var. *procera* has a wide geographical distribution, occurring in Venezuela and in the Atlantic Forest and Cerrado domains of Brazil, between Piauí and Santa Catarina states (Martinelli *et al*. 2008; Zizka *et al*. 2019; Flora do Brasil 2020). In the fragment, the taxon is an epiphyte or terrestrial in the woodland mussununga (Fig. 2c-d), forming large populations. The species also presents isolated individuals in the mussununga shrubland (Fig. 2b). *V. procera* var. *procera* is characterized by its showy red inflorescences, with first order branches; red and ovate floral bracts; and stamens included. CNCFlora (2012) suggested a Least Concern (LC) category for *Vriesea procera* due to its wide distribution. Flowering in February and June and fruiting in September and October.

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