



Tillandsia uiraretama (Bromeliaceae), another new species from Alcatrazes Island, southeastern Brazil

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Abstract

A new species of bromeliad, *Tillandsia uiraretama*, is here described and illustrated. *Tillandsia uiraretama* was discovered during fieldwork on an insular granitic outcrop in southeast Brazil. The proposed taxon belongs to *T.* subgenus *Anoplophytum* and is compared to the morphological related *T. araujei*, *T. aeranthos*, *T. iassuensis*, and *T. tenuifolia*. It differs from them by the unique combination of fertile portion of the inflorescence with 4–7.5 cm long, 8 to 16 flowers per inflorescence, flower length of 3–3.4 cm, floral bract length of 1.7–3.8 cm, petal lilac with 2.7–3.4 cm long and 0.8–0.9 cm wide, stamen length of 1.5–1.9 cm and style length of 1.8 cm. A preliminary conservation assessment classifies *T. uiraretama* as vulnerable (VU).

Key words: Atlantic Forest, Bromeliad, conservation, Poales, saxicole

Introduction

With 792 species, *Tillandsia* Linnaeus (1753: 286) is the most species-rich genus within Bromeliaceae Jussieu (1789: 49) (Gouda *et al.* [continuously updated]). The genus exhibits notable morphological diversity and a broad geographical range (Smith & Downs 1977). It is classified within the subfamily Tillandsioideae and includes seven currently recognized subgenera: *Aerobia* Mez (1896: 812), *Anoplophytum* (Beer 1854: 346) Baker (1887: 212), *Diaphoranthema* (Beer 1854: 349) Baker (1878: 236), *Phytarrhiza* (Visiani 1855: 340) Baker (1887: 212), *Pseudovriesea* Barfuss & W.Till (Barfuss *et al.* 2016: 46), *Tillandsia*, and *Viridantha* (Espejo-Serna 2002: 27) W.Till & Barfuss (Barfuss *et al.* 2016: 47).

In Brazil, more than one hundred *Tillandsia* species are known, of which one-quarter are endemic to the Atlantic Forest (Flora e Funga do Brasil 2024), an important Neotropical biodiversity hotspot for Bromeliaceae (Martinelli *et al.* 2008), from where several new *Tillandsia* species have been described in recent years, such as *T. itatiensis* E.H. Souza & Leodegario (Leodegario *et al.* 2020: 187), *T. iassuensis* L. Hrom. & H. Hrom. (Hromadnik 2021: 76), *T. mantiqueirae* Paixão-Souza, N.G. Silva & R.J.V. Alves (Paixão-Souza *et al.* 2021: 198), *T. nathanii* E.H. Souza & Leme (Souza *et al.* 2022: 99), and *T. alcatrazensis* Sabino & Leodegario (Sabino *et al.* 2023: 215). The last one was discovered by us from the Alcatrazes Island, which is the same place where we found the new species described here.

In continuing botanical survey of vascular flora on the Alcatrazes Island carried out by the first author, we

collected the *Tillandsia* that is here being described as a new species. Although this population was already noted to be very different from the mainland populations (Paixão-Souza 2016), it was never described. The specimens collected on the island were referred to by distinct names, according to its general morphological resemblance, which is here discussed. We present a description, color photographs, illustration, a morphological comparison with related species, and provide the preliminary conservation status of the new species.

Material and Methods

The samples of the new species were found growing on vertical granitic walls and on rocky shores of the Alcatrazes Island (166 hectares), located in the municipality of São Sebastião, 35 km far from the shore, in the state of São Paulo, southeastern Brazil (Fig. 1). The specimens were collected and pressed according to Fidalgo & Bononi (1984) and the herborized material was deposited in UEC, RB, and R herbaria (acronyms according to Thiers [continuously updated]). Some of the individuals collected were kept in cultivation in the living collection of the Universidade Estadual de Campinas (UNICAMP, Campinas, São Paulo state) and were used for the color photographs, illustrations, and description. The photographs were taken from plants in natural habitats as well as in cultivation. The description was obtained from material collected *in situ* and under cultivation, using a stereomicroscope.

Information about related taxa was sourced from the original descriptions and the Flora e Funga do Brasil (2023). The terminology is based on Smith & Downs (1977), with modifications by Scharf & Gouda (2008), and includes the new terminology suggested by Barfuss *et al.* (2016).

The preliminary evaluation of the conservation status adhered to the IUCN Red List criteria (IUCN 2022) and the guidelines outlined in version 15.1 of the IUCN Red List (IUCN Standards and Petitions Committee 2022), considering the geographic distribution of the species. GeoCAT software (Bachman *et al.* 2011) was utilized to assess the estimated area of occupancy (AOO) and extent of occurrence (EOO) using standard values (2×2 km grid cells).

Taxonomic treatment

Tillandsia uiraretama Sabino & Leodegario, *sp. nov.* (Figs. 1–3)

Type:—BRAZIL. São Paulo: São Sebastião, Refúgio de Vida Silvestre do Arquipélago de Alcatrazes, Ilha dos Alcatrazes, em paredão granítico, na base do Pico Alto (Pico da Boa Vista), 24°6'16.32"S, 45°41'47.65"W, 270 m, 24 July 2023, G.P. Sabino, G. Marcusso & M. Tavares 897 (holotype UEC, isotype RB).

Diagnosis:—*Tillandsia uiraretama* is similar to *T. aeranthos*, *T. araujei*, *T. iassuensis*, and *T. tenuifolia*, but is distinguished of them by the unique combination of fertile portion of the inflorescence with 4–7.5 cm long, 8 to 16 flowers per inflorescence, flower length of 3–3.4 cm, floral bract length of 1.7–3.9 cm, petal lilac with 2.7–3.4 cm long and 0.9 cm wide, stamen length of 1.5–1.9 cm and style length of 1.8 cm.

Description:—**Plant** rupicolous or rarely epiphytic, heliophytic, caulescent, forming clumps, flowering 21–64 cm long, rosette 9–11 cm in diameter. **Roots** present. **Leaves** 5.7–8.5 cm long, numerous, densely spirally arranged, recurved, lepidote on both sides, greenish or vinaceous; **sheath** 0.5–1 × 1.5–1.6 cm, ovate-triangular, membranaceous; **blade** 5.2–7.6 × 0.8–1 cm, triangular, coriaceous, apex acute. **Peduncle** 6–8 cm long, 1–2 mm in diameter, recurved, green; **peduncle bracts** 1.8–6 × 0.7–1 cm, numerous, foliaceous, imbricate, almost completely covering the peduncle, whitish to greenish. **Inflorescence** (fertile part) 4–7.5 × 2–2.5 cm, arcuate, simple spike, fusiform, with 8–16 flowers; **floral bracts** 1.7–3.9 × 0.6–1.5 cm, gradually decreasing in size toward the distal part of the inflorescence, elliptic, apiculate, pinkish, lepidote. **Flowers** sessile, polystichous, *ca.* 3–3.4 cm long × 1.2 cm wide; **sepals** 14–17 × 4–5 mm, symmetrical, lanceolate, apex attenuate to acute, the abaxial one free, the adaxial ones connate, sparsely lepidote, green at the base, pink from middle to apex; **petals** spatulate, 2.7–3.4 × 0.8–0.9 cm, free, the blades spreading to reflexed, apex obtuse, entire or, sometimes, asymmetrical with margin irregularly bilobed in the apex, lilac; **Stamens** included, *ca.* 15 mm long; **filament** *ca.* 12–15 × 0.5–1 mm, plicate, flattened, flaccid, sublinear, whitish, slightly translucent, free; **anther** *ca.* 2–4 × 0.5–1 mm, basifixed at the base, base and apex acute, yellowish. **Pistil** exceeding the stamens; **ovary** *ca.* 3.5–5 × 2–3 mm, greenish to yellowish, ovoid; **style** *ca.* 18 mm long, *ca.* 0.5–0.6 mm in diameter, erect, whitish; **stigma** simple-patent, white, 0.1 cm long; **Fruits** and **seeds** not seen.

Etymology:—The Alcatrazes Island was called by the Tupinambás, the indigenous people that occupied the shores of São Paulo state, as “Uraritan” according to Knivet ([1625] 2015). But, in terms of linguistics, in Tupi language, it is composed by the prefix “wyrá” (bird) and the suffix “r-etám-a” (place) (Cabral, pers. comm.). The name is in reference to the large colonies of seabirds that inhabit the island. Therefore, the correct spelling should be wyrá r-etám-a. In this way, we choose “*uiraretama*” to be the most suitable epithet.

Phenology:—The blooming season is from May to September, during the winter and dry period in southeast Brazil. However, some individuals were also found blooming in October and February. Fruits not seen.

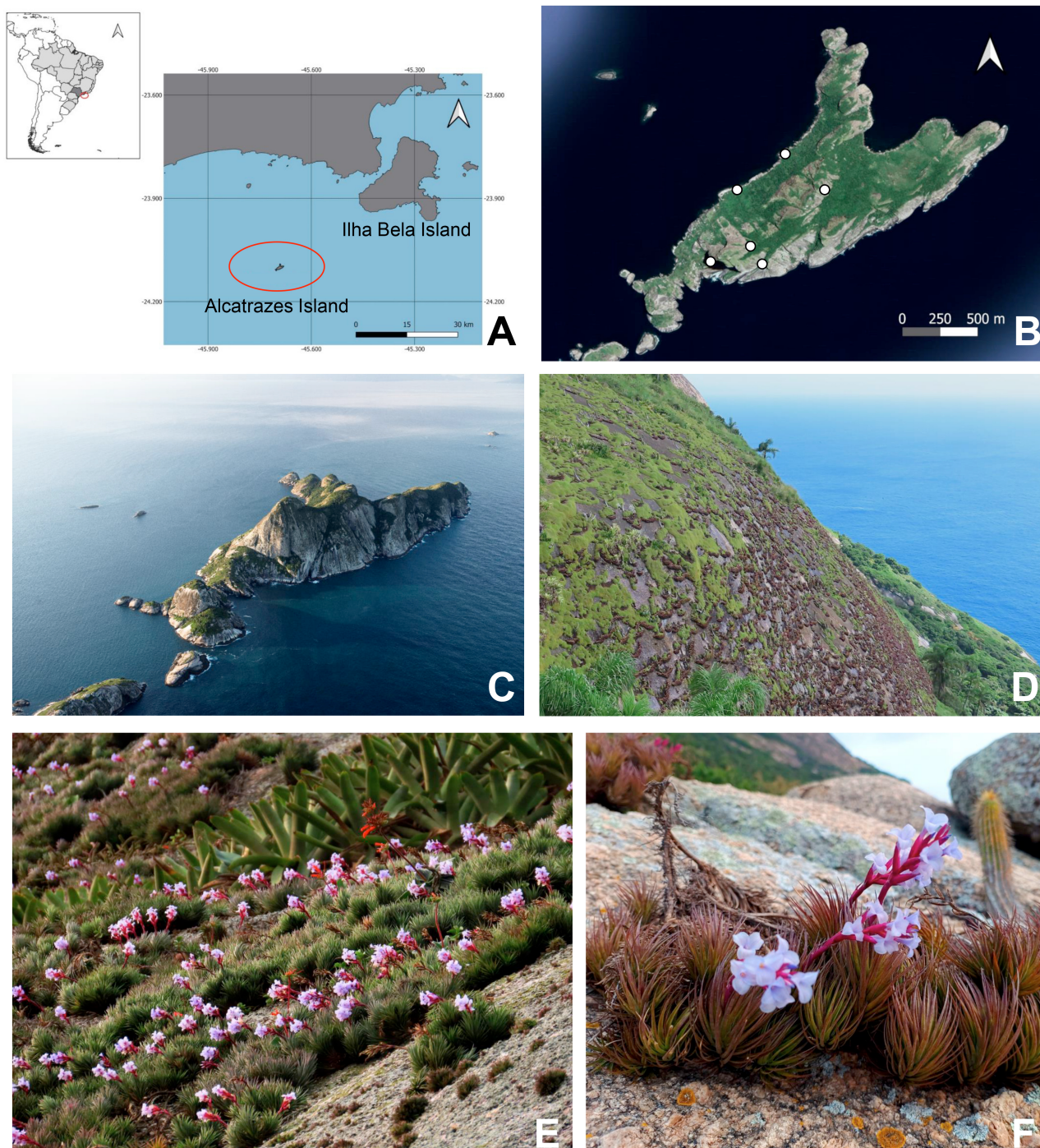


FIGURE 1. Geographical location and habitat of *Tillandsia uiraretama* in the Alcatrazes Island, state of São Paulo, southeastern Brazil. A. South America and Alcatrazes Island location. B. White dots indicating the collection points of *T. uiraretama* on the island (adapted from Google Earth Pro). C. Overview of Alcatrazes Island (photo by Luciano Candisani). D. Overview of a vertical granitic wall, the habitat of *T. uiraretama* (photo by Gabriel Mendes Marcusso). E. *Tillandsia uiraretama* grows together with *T. alcatrazensis* and *Vriesea sp. nov.* (photo by Gabriel Mendes Marcusso) F. Close up of the flowers (photo by Gabriel Pavan Sabino).

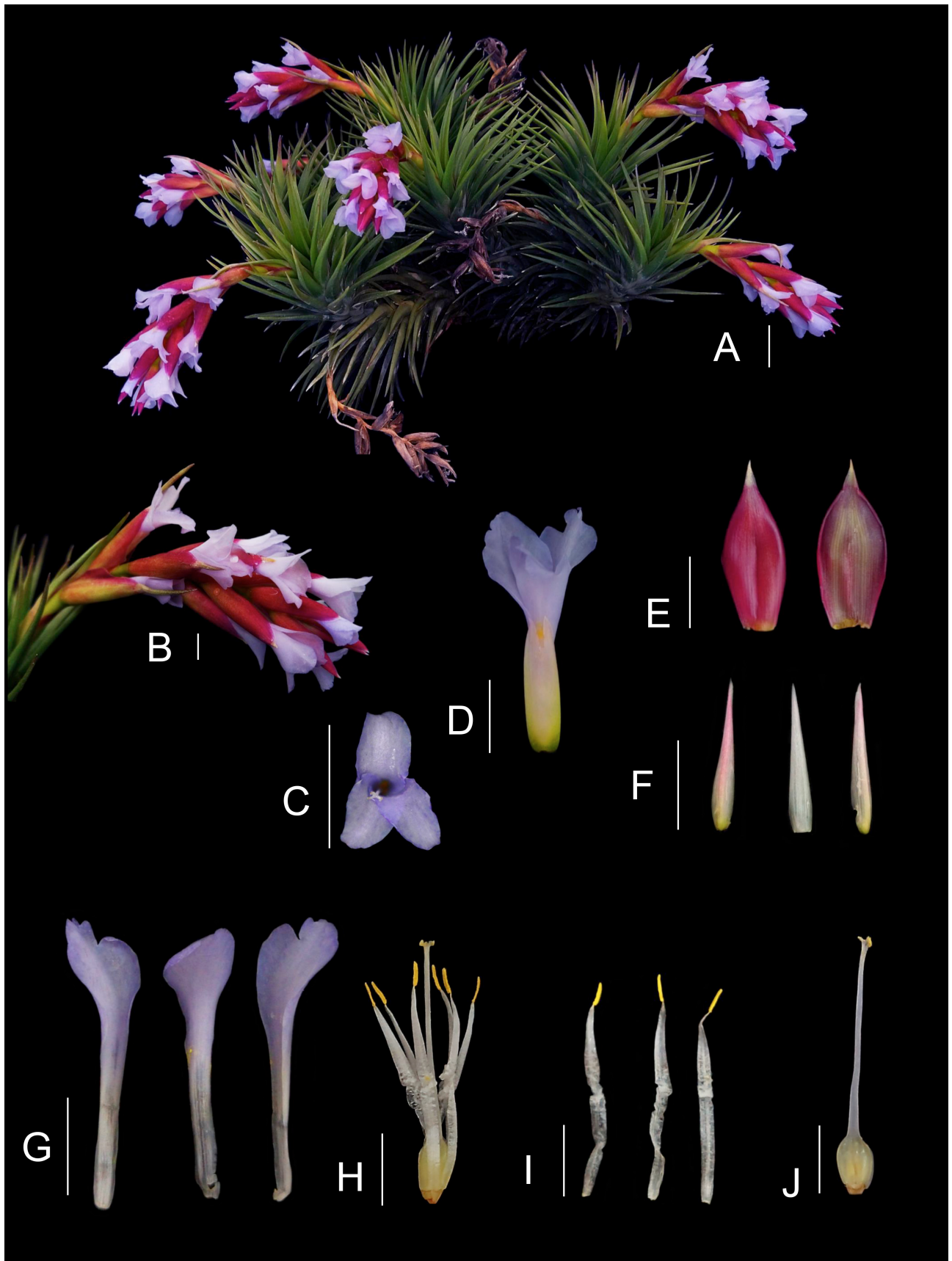


FIGURE 2. *Tillandsia uiraretama*. A. Habit. B. Inflorescence. C–D. Flower. E. Floral bracts F. Sepals. G. Petals. H. Androecium and Gynoecium. I. Stamens. J. Gynoecium. Bars: A = 2 cm; B–G = 1 cm; H–J = 0.5 cm. (Photos by G.P. Sabino based on G.P. Sabino 897).

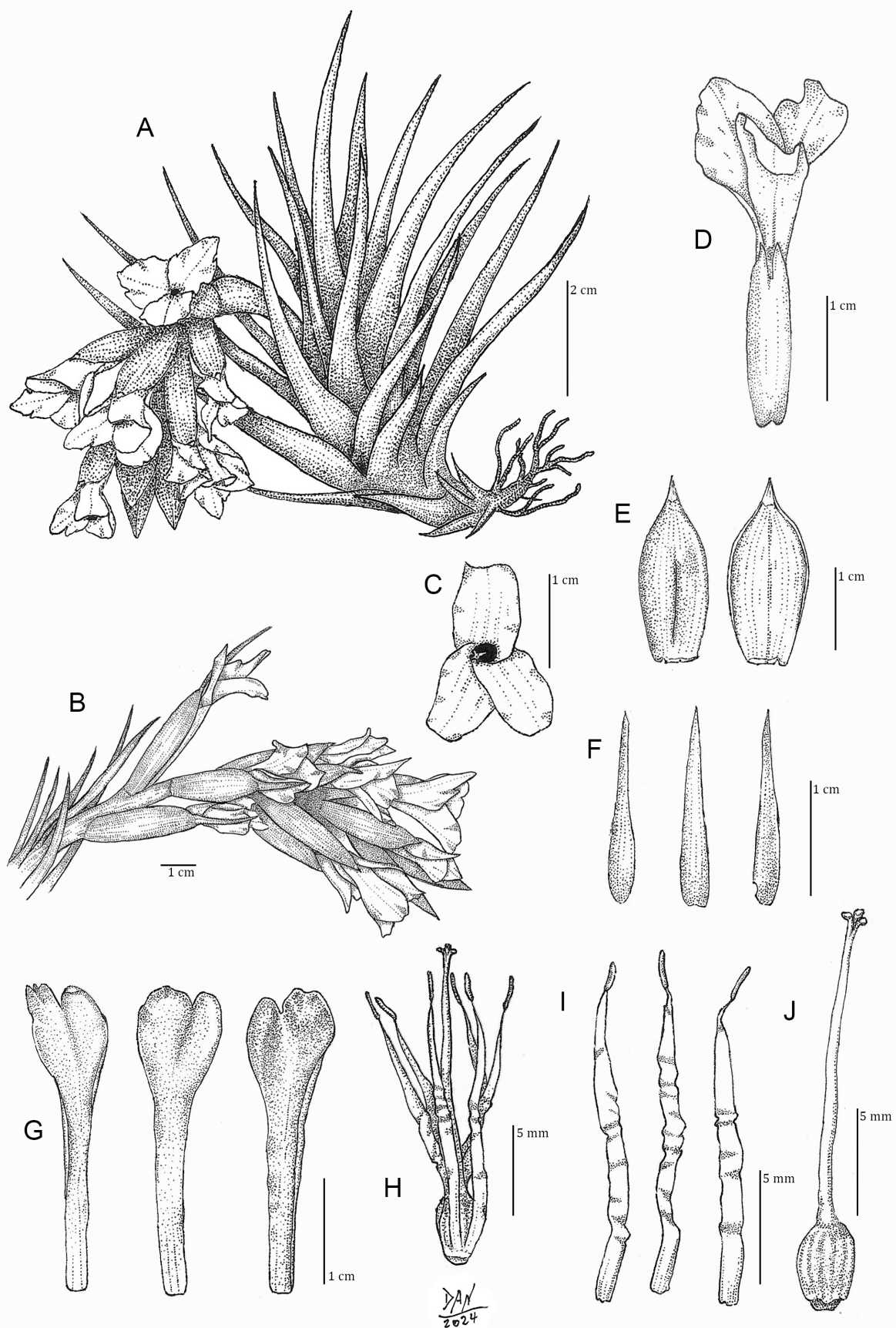


FIGURE 3. A–J *Tillandsia uiraretama* (G.P. Sabino 897). A. Habit. B. Inflorescence branch. C–D. Flower. E. Floral bracts. F. Sepals. G. Petals. H. Androecium and Gynoecium. I. Stamens. J. Gynoecium. Illustration: D.U. Tavares.

Distribution and habit:—Known only from the granitic walls of the Alcatrazes Island, a maritime rock massif 35 km far from the continent, within the municipality of São Sebastião, state of São Paulo, southeastern Brazil. *Tillandsia uiraretama* grows under full sunlight, mainly on rocky surfaces, particularly on vertical walls of the island, as hyperepilithic (Couto *et al.* 2023). It stands as the most abundant bromeliad species on Alcatrazes Island, the main island of an archipelago with the same name. Individuals of *Tillandsia uiraretama* were also found growing on rocky shores, near the sea level, and very rarely as epiphytes in the forest patches. The species frequently forms densely aggregated specimens and often grows together with *Tillandsia alcatrazensis*, as well as *Trilepis lhotzkiana* Nees (Arnott 1834: 267), *Anthurium alcatrazense* Coelho & Catharino (2008: 830), *Neoregelia insulana* Leme (Leme & Kollmann 2013: 28), *Coleocephalocereus fluminensis* (Miquel 1838: 48) Backeberg (1942: 53), and *Rhipsalis grandiflora* Haworth (1819: 83).

The isolation of the Alcatrazes Island is reinforced by the considerable distance from the mainland and its inselberg-like feature (Sabino *et al.*, 2023), factors that may restrict the gene flow, thereby increasing genetic differentiation and reproductive isolation among insular species (Pinheiro *et al.* 2021). The island's landscape comprises rocky outcrops interspersed with rocky vegetation and forest patches influenced by the coastal Atlantic Forest. The terrain is predominantly steep, with areas of forest vegetation where soil has accumulated. On rocky outcrops where soil is scarce or absent, the forest transitions to shrubby or herbaceous vegetation providing the habitat for the described species.

The island is home to several endemic plant, such as *Anthurium alcatrazense*, *Begonia venosa* Skan ex Hooker (1899: pl. 7657), *Begonia larorum* Smith & Wasshausen (1983: 446), *Neoregelia insulana*, and *Tillandsia alcatrazensis*, and animal species, as *Oloolygon alcatraz* Lutz (1973: 2), and *Bothrops alcatraz* Marques, Martins & Sazima (2002: 304). Both the different climate and the strong isolation from the continent are potential elements contributing to the differentiation of island populations, and the contribution of neutral (drift) and adaptive forces (selection) in shaping the island endemic species (Losos & Ricklefs, 2009; Burns, 2009) should be investigated in the future

Additional specimens examined (paratypes):—BRAZIL. São Paulo: São Sebastião, Refúgio de Vida Silvestre do Arquipélago de Alcatrazes, Ilha dos Alcatrazes, próximo ao tablado de madeira, 3 October 2022, 24° 5'55.01"S, 45°41'39.60"W, 15 m, G.P. Sabino, I.M. Cunha, M.M. Tavares, & P. Oliveira 638 (UEC). *Ibidem*, afloramento próximo à base da Marinha, floresceu em cultivo nas estufas da UNICAMP, 24 July 2023, 24°6'3.09"S, 45°41'30.11"W, 210 m, G.P. Sabino, F. Pinheiro, B.L. Arida & W.L.S. Júnior 896 (UEC). *Ibidem*, Próximo a costão rochoso, no ninhal, 10 May 2022, 24°6'3.17"S, 45°41'50.36"W, 17 m, G.P. Sabino, V. Kamimura & R.A. Pereira 505 (UEC). *Ibidem*, face sudeste da ilha, em vale voltado para o mar aberto, 19 February 2024, 24°6'20.84"S, 45°41'45.47"W, 115 m, G.P. Sabino, V. Kamimura & L. Oliveira 982 (UEC). *Ibidem*, próximo ao tablado de madeira, face oeste da ilha., 20 February 2024, 24°5'55.22"S, 45°41'39.04"W, 20 m, G.P. Sabino, V. Kamimura & L. Oliveira 988 (UEC). *Ibidem*, próximo ao tablado de madeira, face oeste da ilha., 22 February 2024, 24° 5'53.32"S, 45°41'36.71"W, 20 m, G.P. Sabino, V. Kamimura & L. Oliveira 999 (UEC). *Ibidem*, na base do pico alto, face sul da ilha. 2 September 2024, 24° 6'18.29"S, 45°41'57.39"W, 72m, G.P. Sabino, V. Kamimura & G.M. Marcusso 1021 (UEC). *Ibidem*, October 1920. H. Luederwaldt & Fonseca s.n. (SP 12374 [image]); *Ibidem*, nas rochas nuas, 20 August 1895, A. Löfgren CGG3187 (SP 12372 [image]); *Ibidem*, no topo do pico ao N. do heliponto, 7 June 2006, R.J.V. Alves, R. Fernandes, D. Canabarro & Flávio do IEAPM 7789 (R 225969 [image]); *Ibidem*, encosta voltada para o Saco do Funil, 1 September 1988, L. Rossi *et al.* 437 (SP 248265 [image]).

Conservation status:—*Tillandsia uiraretama* exclusively inhabits the Alcatrazes Island, which, besides being a fragile environment within a protected area (ICMBio 2020), has a history of anthropogenic disturbances. A significant fire, caused by a Brazilian navy training course, destroyed 20 hectares of vegetation on the northeast side of the island, leading to the proliferation of exotic plants such as *Melinis minutiflora* Palisot de Beauvois (1812: 54) (ICMBio 2020).

The GeoCAT (Bachman *et al.*, 2011) found that the estimated area of occupancy (AOO) and extent of occurrence (EOO) for *T. uiraretama* are 4 km² and 0.252 km², respectively. Although it is very abundant in the Alcatrazes Island (e.g. Fig. 1), it is restricted to this island, which qualifies it for the D2 category due to the limited number of locations where it occurs (endemic to the island) and the potential future threats that may lead the taxon to extinction. One such threat is the invasion of *Melinis minutiflora*, which increases flammable biomass, posing a risk of potential fires. Furthermore, rising sea levels could directly affect several individuals that grow near the sea water. Thus, we have preliminarily classified the new species as vulnerable (VU).

Taxonomic notes:—We have found specimens collected in previous expeditions identified as *Tillandsia araujei* Mez (1894: 600): H. Luederwaldt 12374 (GH), A. Löfgren 12372 (GH), R. Alves 7789 (R), A. Löfgren s.n. (SP); and as *Tillandsia aeranthos* (Loiseleur-Deslongchamps 1821: t. 304) Smith (1943: 200): H. Luederwaldt s.n. (SP), and L.

Rossi 437 (SP). After a carefully evaluating through digitized photographs, we concluded that all these specimens correspond to the new species.

Tillandsia uiraretama belongs to subgenus *Anoplophytum* by the included stamens, strongly plicate filaments, and a slender style considerably longer than the ovary (Smith & Downs 1977). According to the phylogenetic analysis, *T. uiraretama* (sample JB1934) was also confirmed as part of the subgenus *Anoplophytum* (Paixão-Souza 2016). Indeed, it is morphologically related to *Tillandsia araujei*, *T. aeranthos*, *T. iassuensis*, and *T. tenuifolia*. A morphological comparison with these putative similar species is presented on Table 1.

TABLE 1. Morphological comparison between *Tillandsia uiraretama* and the most morphologically similar species, *T. araujei*, *T. aeranthos*, *T. iassuensis*, and *T. tenuifolia*. Morphological traits, measures and lifestyles were obtained from literature. The main diagnostic features of *T. uiraretama* are in bold.

Traits	<i>T. uiraretama</i>	<i>T. araujei</i>	<i>T. aeranthos</i>	<i>T. iassuensis</i>	<i>T. tenuifolia</i>
Lifestyle	rupicolous	rupicolous	rupicolous / epiphytic	rupicolous	rupicolous / epiphytic
Plant height	21–64 cm	15–60 cm	9–32 cm	up to 40 cm	8–55 cm
Leaf length	5.7–8.5 cm	3–7 cm	4–14 cm	20 cm	5–8 cm
Leaf color	green/vinaceous	green	green	green	green
Peduncle length	6–8 cm	8–9 cm	4.5–9.5 cm	7–11 cm	7–7.5 cm
Inflorescence length of fertile part	4–7.5 cm	5 cm	3–4.2 cm	4–5 cm	3 cm
Flower length	3–3.4 cm	2–2.5 cm	2–3 cm	2 cm	1.8–2 cm
Flowers per inflorescence	8 to 16	8 to 10	5 to 20	6 to 12	6 to 8
Floral bract length	1.7–3.9 cm	1.5–2.3 cm	1.4 cm	1–1.4 cm	1.8–2 cm
Sepal length	1.4–1.7 cm	1.6 cm	1.2–1.9 cm	0.6–1.2 cm	1.4 cm
Sepal color	pink	pink-greenish	pink	pink	pink
Petal color	lilac	white	dark blue	white	white, pinkish, blue or lilac
Petal length	2.7–3.4 cm	2.4 cm	1.7–2.7 cm	2 cm	1.8 cm
Petal width	0.8–0.9 cm	0.5 cm	0.5 cm	0.2–0.4 cm	0.4 cm
Stamen length	1.5 cm	1.4 cm	1.1–1.2 cm	1.4 cm	1.2 cm
Style length	1.8 cm	1.3 cm	0.9 cm	1.2 cm	0.7 cm
Ovary length	0.35–0.5 cm	0.3 cm	0.3–0.6 cm	0.3 cm	0.3 cm

Tillandsia uiraretama differs from *T. araujei* by the longer floral bract (1.7–3.9 cm vs. 1.5–2.3 cm), longer flower (ca. 3–3.4 cm vs. ca. 2–2.5 cm), longer petal (2.7–3.4 cm vs. 2.4 cm), wider petal (ca. 8–9 mm vs. ca. 5 mm), lilac petal (vs. white), longer style (ca. 1.8 cm vs. 1.3 cm), and longer ovary (ca. 3.5–5 mm vs. ca. 3 mm); from *T. aeranthos* by the longer fertile part of the inflorescence (4–7.5 cm vs. 3–4.2 cm), floral bract longer (1.7–3.9 cm vs. 1.4 cm), petal lilac (vs. dark blue), longer petal (2.7–3.4 cm vs. 1.7–2.7 cm), wider petal (ca. 8–9 mm vs. ca. 5 mm), and longer style (18 mm vs. 9 mm); from *T. iassuensis* by the shorter leaves (5.7–8.5 cm vs. 20 cm), peduncle shorter (6–8 cm vs. 7–11 cm), fertile part of the inflorescence longer (4–7.5 cm vs. 4–5 cm), longer flower (3–3.4 cm vs. 2 cm), longer floral bract (1.7–3.9 cm vs. 1.4 cm), longer sepal (1.4–1.7 cm vs. 0.6–1.2 cm), longer petal (2.7–3.4 cm vs. 2 cm), wider petal (ca. 8–9 mm vs. ca. 2–4 mm), petal color (lilac vs. white); and from *T. tenuifolia* by its longer fertile portion of the inflorescence (4–7.5 cm vs. 3 cm), longer flower (3–3.4 cm vs. 1.8–2 cm), higher number of flower per inflorescence (8–16 vs. 6–8), longer floral bracts (1.7–3.9 cm vs. 1.8–2 cm), longer petal (2.7–3.4 cm vs. 1.8 cm), wider petal (ca. 8–9 mm vs. ca. 4 mm), and longer style (1.8 cm vs. 0.7 cm).

Tillandsia uiraretama occurs sympatrically with *T. gardneri* Lindley (1842: sub t. 63) and *T. alcatrazensis* of subg. *Anoplophytum*, and *Tillandsia usneoides* (Linnaeus) Linnaeus (1762: 411) of subg. *Diaphoranthema*.

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