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RESEARCH ARTICLE

To print in red ink: two new species of *Hippeastrum* (Amaryllidaceae) from the Brazilian Atlantic Forest

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Abstract

Background and aims – The Atlantic Forest is among the five most important biodiversity hotspots in the world, harbouring one of the highest levels of endemism and species richness in the tropics. The region has been suggested as a centre of diversity for the genus *Hippeastrum*, which comprises about one hundred species distributed throughout the Neotropics. Due to its large and showy flowers, the genus is highly sought after by collectors and horticulturists around the world, with hundreds of hybrids produced and traded for centuries. However, most of its species are still known from only one or a few populations, and several are officially recognized as endangered. Monographic studies on the genus *Hippeastrum* in Brazil have revealed two likely microendemic new species from the Atlantic Forest.
Material and methods – The morphological descriptions of the new species are based on herbarium specimens and cultivated plants, as well as in situ observations. Descriptions and measures were taken following standard procedures. Preliminary conservation assessments followed IUCN guidelines and criteria.
Key results – Both species show typical morphology of the subgenus *Hippeastrum*, in which they should be placed. They can be distinguished from similar taxa, including some of the most widely distributed and known species of the genus, by several floral characters. Data on ecology, conservation, and photographs and illustrations are provided, as well as comparisons with related species. An identification key to the Brazilian Atlantic Forest species of *Hippeastrum* is provided, accompanied by photographs of these species in their natural habitats.
Conclusion – The new species are considered critically endangered due to their single known location and small population size. The findings reinforce the need for continued sampling across different regions of the Atlantic Forest, as well as the importance of systematic studies conducted by specialist taxonomists.

Keywords

Bahia, endemism, Hippeastreae, Santa Catarina, systematics, taxonomy, threatened species

INTRODUCTION

Brazil has the most diverse flora in the world, harbouring approximately a quarter of all plant species in the Neotropics, about half of which are endemic (Ulloa Ulloa et al. 2017; Antonelli et al. 2020; Raven et al. 2020). Much of this diversity is in the Atlantic Forest (Stehmann et al. 2009; Brasilian Flora Group 2018), which is also where the majority of the species on the Brazilian red list occur (Martinelli and Moraes 2013). The domain comprises a mosaic of vegetation types occurring along the coast, which includes forest and open formations, and a great diversity of associated ecosystems, such as mangroves, restingas (Stehmann et al. 2009; Marques et al. 2021),

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and inselbergs (De Paula et al. 2020). The Atlantic Forest has experienced a series of agricultural commodity cycles from the coast inward since Brazil was colonized by Europeans (Dean 1997). Originally, it covered approximately 15% of the national territory, equivalent to almost 1.5 million km^2 (Ribeiro et al. 2009). Currently, the Atlantic Forest is reduced to about 10% of its original area, mostly represented by small and isolated fragments, generally smaller than 50 hectares, of which only 1% is protected in conservation units (Myers et al. 2000; Ribeiro et al. 2009).

Hippeastrum Herb. is one of the most popular ornamental plants in the world, and is widely cultivated due to its large and showy flowers, supporting large export markets in countries such as South Africa and the Netherlands (Meerow 2009; Wang et al. 2018). The genus is composed of about 100 species (García et al. 2019), although little of this genetic diversity is represented in modern commercial hybrids selected from a small number of species (Meerow 2009). *Hippeastrum* is distributed from central Argentina to Colombia, but the highest diversity is found in eastern Brazil and the Andes of Bolivia and Peru (Meerow and Snijman 1998; García et al. 2019). Brazil currently has about 35 recognized species, most of which are known to occur in the Atlantic Forest, 15 of which are endemic (Dutilh et al. 2020; Campos-Rocha et al. 2022a). With our ongoing studies for the genus in Brazil, dozens of field activities for the collection and observation of *Hippeastrum* species in different areas of the country have been carried out.

In this paper, we describe two new species found by us during our field trips to the Atlantic Forest. A review of their distribution, habitat, and phenology is provided, as well as a preliminary assessment of their conservation status, and both are tentatively considered critically endangered. Additionally, an identification key for the *Hippeastrum* species occurring in the Brazilian Atlantic Forest is presented, accompanied by photographs of these species in their natural habitat. Combined with the key provided by Campos-Rocha et al. (2018a) for the species from the Brazilian Cerrado, the identification keys cover virtually all Brazilian species of *Hippeastrum*.

MATERIAL AND METHODS

The descriptions and morphological comparisons are based on the literature (Oliveira 2012; Oliveira et al. 2013, 2017; Campos-Rocha et al. 2018a, 2022a, 2022b; Dutilh et al. 2020), examination of herbarium specimens or plants collected in the field and brought into cultivation. The following herbaria with important collections of Amaryllidaceae from the Brazilian Atlantic Forest were consulted: ALCB, BHCB, BM, CEPEC, CVRD, ESA, FTG, HRCB, HUEFS, IAC, K, MBM, MBML, MO, RB, SP, SPF, SPSF, UEC, UESC, and VIES (acronyms follow Thiers 2023). Online databases were also checked for additional records of the new species (http://plants.jstor.org/; http://reflora.jbrj.gov.br/; and http://www.splink.org.br/). The morphological terminology adopted follows Radford et al. (1974) and Meerow and Snijman (1998) with adaptations. The conservation status assessments were based on the guidelines for using the IUCN Red List categories and criteria v.15.1 (IUCN 2012, 2022). Brazilian vegetation types were classified according to IBGE (2012); Barbosa and Thomas (2008) and Leite (2002) provided a more detailed classification for the states of Bahia and Santa Catarina, respectively. The distribution map was generated with ArcGIS software, using layers available from IBGE (2022).

TAXONOMIC TREATMENT

Hippeastrum curupira Campos-Rocha & M.Peixoto, **sp. nov.**

urn:lsid:ipni.org:names:77322619-1

Figs 1, 2, 3C

Type. BRAZIL • Bahia, Ilhéus, distrito de Castelo Novo, no sub-bosque da mata, florescimento em cultivo no município de Mogi das Cruzes-SP; 29 Aug. 2018; fl.; *A. Campos-Rocha 1989*; holotype: UEC.

Diagnosis. *Hippeastrum curupira* may be related to *H. puniceum* (Lam.) Voss or *H. reginae* (L.) Herb., from which it is distinguished by the absence of a paraperigone and having a trifid stigma (vs paraperigone of fimbriae and stigma capitate to trilobed in *H. puniceum* and *H. reginae*).

Description. Geophytic perennial herb up to 70 cm tall at flowering. Bulb subterranean, oval to spheroid; neck formed by sheathing leaf bases up to 7 cm long. Leaves 1–6, 22–72 × 2.2–5 cm, lorate, flat, slightly canaliculate proximally adaxially, erect to reclinate, apex acute, frequently asymmetric, margins flat to slightly revolute, midrib inconspicuous, dark green adaxially, pale green abaxially, occasionally with vinaceous pigmentation near the base. Inflorescence 2–3 flowered; scape 28–56 cm long × 1.6–2 cm diameter, erect, subcylindrical, laterally compressed, hollow, greenish, often with vinaceous pigmentation, glaucous; spathe bracts 2, 4.4–5 × 1.2–1.6 cm, free, lanceolate to obovate, apex acute to obtuse, reddish, marcescent; bracteoles 2–4, 2.2–3 cm long, subulate. Pedicels 3–5.6 cm long × 5–6 mm diameter at anthesis, greenish to vinaceous. Perigone 9–12.2 cm long, infundibuliform; hypanthium tube 1.4–1.8 cm long, greenish or reddish to vinaceous; paraperigone absent. Tepals in free portion bright scarlet red, internally with greenish to whitish, central stripe up to half of their length, usually absent on the lower petal; sepals (outer whorl) wider than petals (inner whorl), elliptic, apex acute with apicule subapical 1.5–4 mm long; upper 7.4–10.4 × 4.7–5.2 cm, symmetric, slightly recurvated; lateral 7.2–10.2 × 4.5–5 cm, slightly asymmetric; petals (inner tepals) slightly smaller than the sepals, lower petal narrower than the laterals, apex acute with apicule inconspicuous

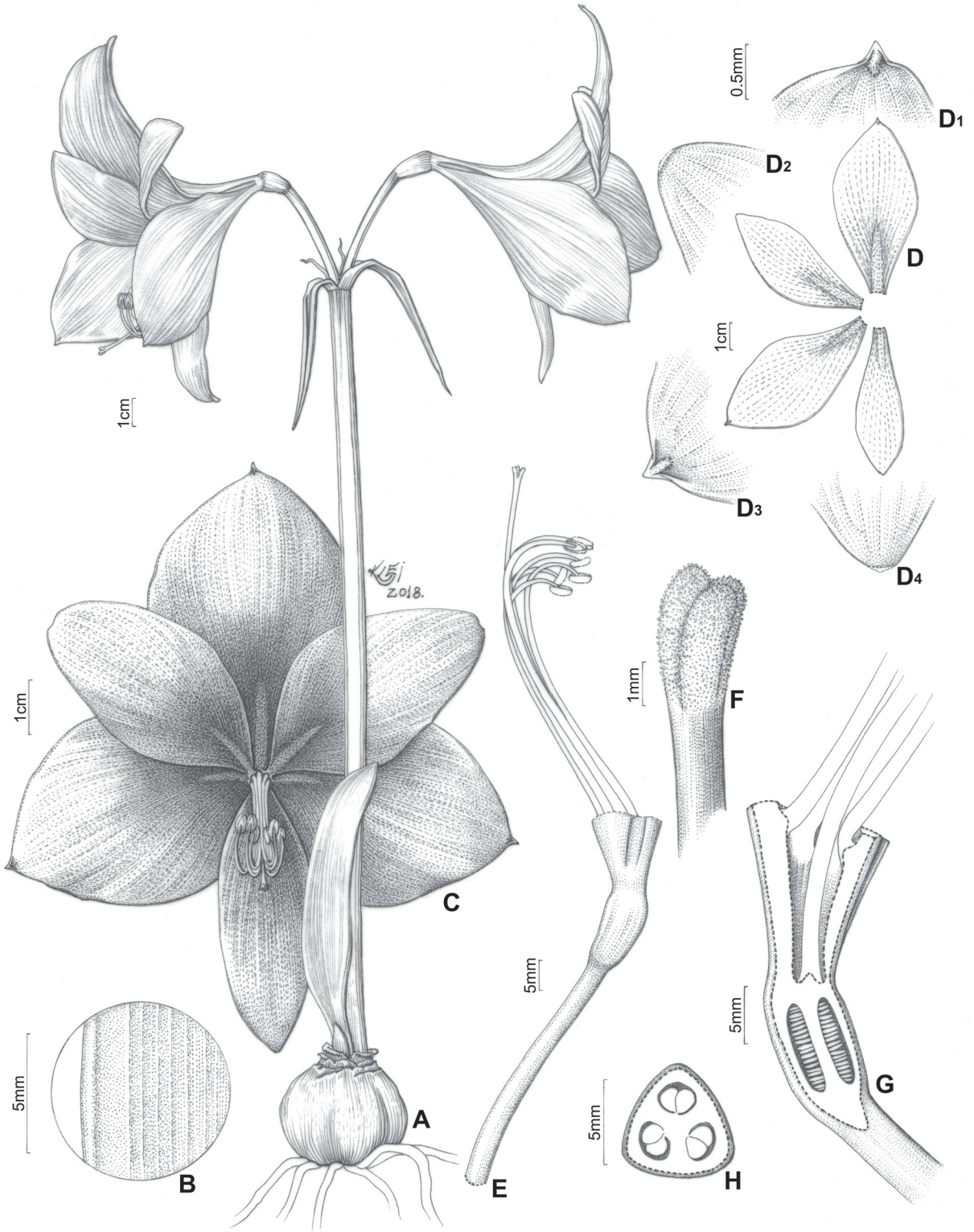

Figure 1. *Hippeastrum curupira*. **A**. Habit. **B**. Detail of leaf venation, abaxial surface. **C**. Flower, frontal view. **D**. Sepals and petals: shape and apices. **D1**. Upper sepal. **D2**. Lateral petal. **D3**. Lateral sepal. **D4**. Lower petal. **E**. Flower with removed perigone, showing stamens and style. **F**. Stigma. **G**. Longitudinal section of ovary and hypanthium tube. **H**. Cross section of the ovary. Drawn by Klei Sousa from the holotype.

or absent; lateral 6.8–9.4 × 3.8–48 cm, elliptic, slightly recurvated; lower 7.4–9.6 × 2.1–3 cm, narrowly elliptic to oblanceolate. Stamens 6, of four different lengths, inserted at the mouth of the hypanthium tube, shorter than limb segments; filaments fasciculate, declinate-ascending, free portion greenish proximally, reddish distally, upper episepalous 4.8–5.2 cm long, lateral episepalous 4.8–5.4 cm long, lateral epipetalous 5.5–6 cm long, lower epipetalous 5.6–6.2 cm long; anthers 4.4–5.7 mm long after anthesis, oblong, vinaceous, pollen yellow. Ovary 1.1–1.8 cm long × 7–9.6 mm diameter, oblong to obovoid, greenish to vinaceous; ovules 30–36. Style 5.4–6 mm long, shorter than limb segments, filiform, declinate to slightly ascending, greenish proximally, reddish distally; stigma trifid, lobes 4–5 mm long, recurved, whitish. Fruit capsule globose-compressed, greenish; seeds half-discoid, flattened.

Distribution and habitat. *Hippeastrum curupira* is known only from the type locality, north of the city of Ilhéus, in the coastal region of southern Bahia State (Fig. 3A). It grows in the shade of the Ombrophilous Dense Forest, about 140 meters above sea level, among species of grasses, Marantaceae, ferns, and climbing aroids (*Philodendron* spp.). In the same area, we found understory shrubs and small trees such as *Heisteria* sp. (Olacaceae), *Miconia* spp. (Melastomataceae), a palm species of the genus *Geonoma* Willd., and many species of Rubiaceae (e.g. *Palicourea deflexa* (DC.) Borhidi, *Palicourea dichotoma* (Rudge) Delprete & J.H.Kirkbr., and *Psychotria bahiensis* DC.). Other co-occurring species include trees such as *Eschweilera ovata* (Cambess.) Miers (Lecythidaceae), *Pseudobombax grandiflorum* (Cav.) A.Robyns. (Malvaceae), *Guatteria* spp. (Annonaceae), *Inga* spp. (Fabaceae), *Ocotea* spp. (Lauraceae), and

Figure 2. *Hippeastrum curupira*. **A**. Sepals and petals. **B**. Flower with removed perigone, showing stamens and style. **C**. Detail of anthers and stigma. **D**. Stigma. **E**. Anthers starting to dehisce. **F**. Detail of spathe bracts and floral buds. **G**. Leaf apex. **H**. Point of insertion of the staminal filaments. **I**. Longitudinal section of the ovary. **J**. Detail of spathe bracts and pedicels. **K**. Detail of leaf venation, adaxial surface. **L**. Fully developed leaves. **M**. Habit. **N**. Apex of the lower petal. **O**. Inflorescences, frontal view. A–C, E–I, K–L by Antonio Campos-Rocha; D, J, M–O by Mauro Peixoto.

members of Sapotaceae (*Chrysophyllum* spp., *Pouteria* spp.), as well as arborescent species of palms (*Attalea* sp. and *Syagrus botryophora* (Mart.) Mart., Arecaceae). The local climate is classified as Af type (Tropical rainforest climate) under the Köppen climate classification, characterized as hot and humid without a dry season. The annual average temperature is 23.2°C, and the minimum average temperature is registered in July (21°C), whereas February is the hottest month, with a monthly value of 24.8°C; the annual average precipitation is 1722 mm, with less than 100 mm of rainfall only in the month of August; and the annual average relative humidity is about 85% (Mendonça et al. 1996). Three species of *Hippeastrum* are known to occur in the Atlantic Forest of southern Bahia: *H. puniceum*, *H. reticulatum* Herb., and *H. striatum* (Lam.) H.E.Moore. *Hippeastrum puniceum* is the most generalist species of the genus and is widely distributed throughout Central and South America (Oliveira 2012). On the south coast of Bahia, *H. puniceum* was collected in the understory of Ombrophilous Dense Forest, and in different physiognomies of restinga and mussunungas (a very specialized vegetation established on hydromorphic, dystrophic and white sandy soils, with physiognomies ranging from grasslands to forest formations; for more detailed definitions, see Meira Neto et al. 2005 and Saporetti-Junior et al. 2012). *Hippeastrum reticulatum* and *H. striatum* are species distributed mainly in the south and southeast regions of Brazil, occurring in both evergreen and seasonal forests, also reaching Argentina and Paraguay. *Hippeastrum striatum* can occasionally be found in open formations such as rocky outcrops. Southern Bahia represents the northernmost extent of known distribution for *H. reticulatum*. The region is considered one of the richest areas in the Atlantic Forest for biodiversity and is home to numerous endemic species of plants (Thomas et al. 1998; Martini et al. 2007; Murray-

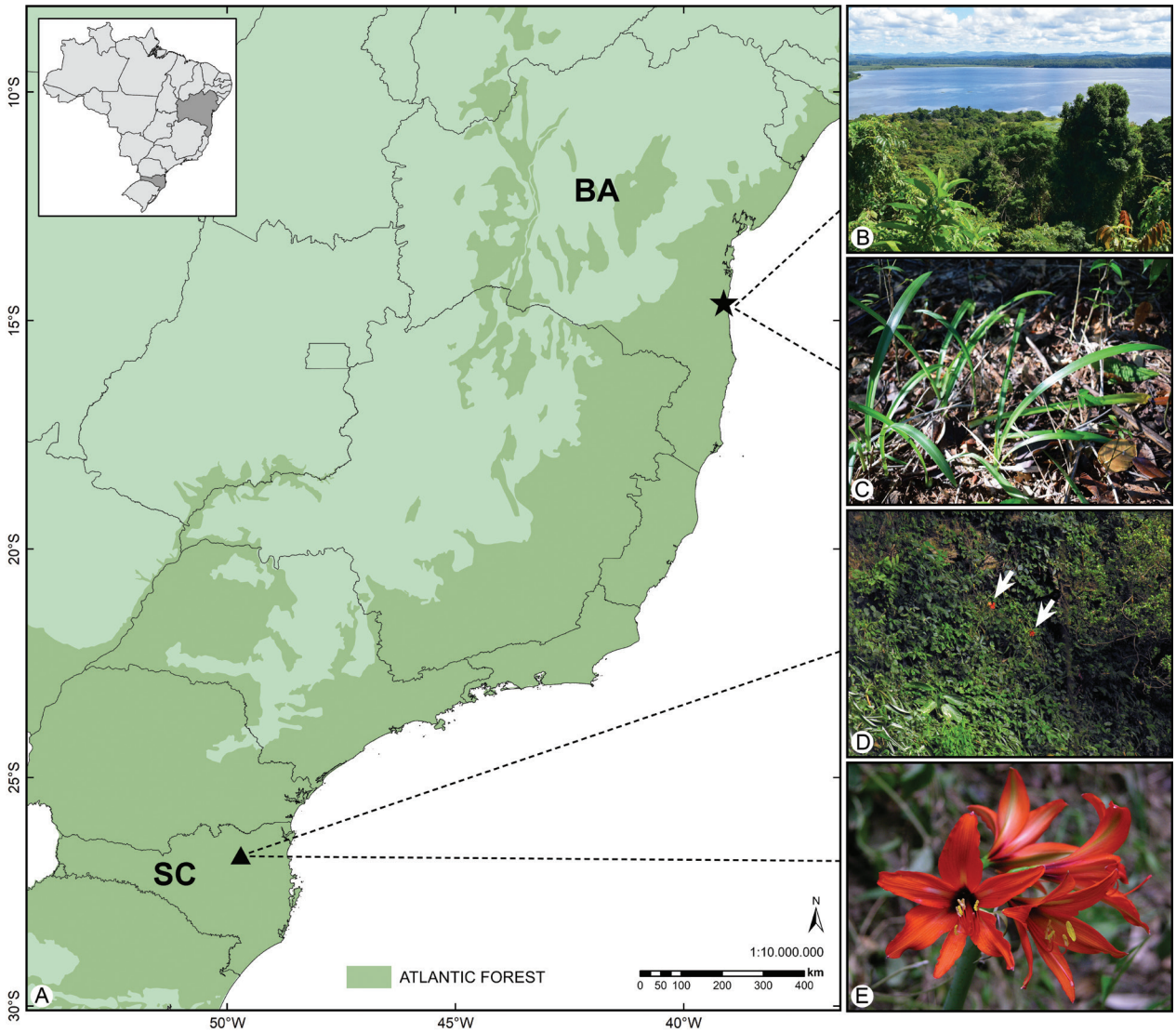

Figure 3. A. Distribution map showing collections of *Hippeastrum curupira* (star) and *H. laklano* (triangle). Habitat and new species in the wild: **B**. Lagoa Encantada seen from a nearby viewpoint. **C**. *Hippeastrum curupira* at the type locality. **D–E**. *Hippeastrum laklano* at the type locality. **D**. Flowering plants indicated by arrows. **E**. Detail of inflorescence. B, C by Antonio Campos-Rocha; D by Alain Chautems; E by Mauro Peixoto.

Smith et al. 2009; Ostroski et al. 2018), although it still represents one of the lesser known and poorly collected regions of the domain (Goldenberg et al. 2016).

Phenology. In cultivation, *Hippeastrum curupira* flowers between August and early October. We do not have any data on the reproduction of the species in its natural habitat, which was collected in vegetative condition.

Etymology. The specific epithet honours one of the most traditional and popular mythical characters of Brazilian folklore, the Curupira. Of indigenous origin, it is usually represented as a dwarf, with red hair and inverted feet. Curupira inhabits the interior of the most remote forests, avoiding getting close to highly disturbed or inhabited places (Cascudo 1998, 2002). The epithet is a reference to the bright scarlet red flower of the new species, unique among Brazilian species of *Hippeastrum*. It is also a reference to its forest habitat, as well as to its rarity. It even represents a call to protect the forest in Brazil, in a scenario of dismantling anti-deforestation policies (Menezes and Barbosa 2021; Vale et al. 2021; Agapito et al. 2022). Interestingly, the type locality is believed to be a magical place, inhabited by several characters of Brazilian mythology (Santos 2004; Sousa 2010). The specific epithet is treated as a noun in apposition, in line with Article 23.1 of the International Code of Nomenclature (Turland et al. 2018).

Preliminary IUCN conservation assessment. Critically Endangered CR B1ab(iii)+B2ab(iii); D. *Hippeastrum curupira* should be categorized as Critically Endangered (CR), based on the subcriteria B1ab(iii)+B2ab(iii), because of the number of known localities (1), and declining habitat quality, as well as criterion D, because of its small population size. About ten adult individuals were found in a small forest fragment, with several signs of recent disturbance, including cutting some trees. The forest fragment is located on private property and is surrounded by larger fragments in different successional stages. This area is located within a federal conservation unit, named EPA (Environmental Protection Area) of the Lagoa Encantada and Rio Almada, covering over 150,000 hectares of protected land (State of Bahia 2003). The southern coast of Bahia, despite having a long history of logging activity, started with the extraction of brazilwood in the precolonial period, remained one of the most preserved areas of the Brazilian Atlantic Forest until the beginning of the 1970s, when an intense deforestation cycle began (Thomas et al. 1998; Landau et al. 2008). Current research shows that the extent of native forest cover in the south coast of Bahia may be as low as 5% of its original area, with about 2% of the remaining fragments larger than 400 hectares (Landau et al. 2008).

Additional specimens examined. BRAZIL – **Bahia** • Ilhéus, distrito de Castelo Novo, no sub-bosque de remanescente de Floresta Ombrófila Densa; 140 m; 3 Aug. 2019; st.; *A. Campos-Rocha et al. 2607*; UEC • Ilhéus, distrito de Castelo Novo, no sub-bosque de remanescente de Floresta Ombrófila Densa; 145 m; 3 Aug. 2019; st.; *A. Campos-Rocha et al. 2608*; UEC.

Taxonomic notes. *Hippeastrum curupira* has a unique flower among the Brazilian species of *Hippeastrum*, mainly because of its colour and shape. It appears related to *H. reginae*, being distinguished by the absence of paraperigone and trifid stigma (vs fimbriate paraperigone and capitate to lobate stigma in *H. reginae*). The new species also shares some affinities with *H. puniceum*, from which it can be readily distinguished by having bright scarlet red coloured tepals, internally with a greenish-white central stripe for up to half of their length (vs tepals salmon or orange, rarely pink, internally yellowish to green at their base and forming a circular pattern in *H. puniceum*). Furthermore, *H. curupira* has a hypanthium tube up to 1.8 cm long, paraperigone absent and stigma trifid (vs hypanthium tube over 2 cm in length, paraperigone fimbriate and stigma capitate to trilobed in *H. puniceum*).

Hippeastrum laklano Campos-Rocha & M.Peixoto, **sp. nov.**

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Figs 3D–E, 4–5

Type. BRAZIL • Santa Catarina, Santa Terezinha, Taipas; 17 Apr. 2008; fl.; *J.H.A. Dutilh s.n.*; holotype: UEC-174153.

Diagnosis. *Hippeastrum laklano* is morphologically related to *H. striatum* (Lam.) H.E.Moore, from which it is readily distinguished by its paraperigone with conspicuous fimbriae and dark-vinaceous area at the base of the tepals (vs paraperigone absent and tepals greenish at the base in *H. striatum*).

Description. Geophytic perennial herb up to 75 cm tall at flowering. Bulb 6–8 cm long × 3.8–5.6 cm diameter, subterranean, oval; neck formed by sheathing leaf bases up to 4.5 cm long. Leaves 1–8, 24–58 × 1.4–2.8 cm, lorate, canaliculate proximally adaxially, becoming flattened above, reclinate, apex acute, asymmetric, margins slightly revolute to revolute, projecting midrib on the abaxial surface, dark green adaxially, pale green abaxially, occasionally with vinaceous pigmentation on the margins and near the base. Inflorescence 2–6 flowered; scape 35–55 cm long × 1–1.5 cm diameter, erect, subcylindrical, laterally compressed, hollow, greenish, sometimes with vinaceous pigmentation, glaucous; spathe bracts 2, up to 6 cm long, free, lanceolate to obovate, apex acute, greenish, marcescent; bracteoles 2–7, subulate. Pedicels 2.4–5.6 cm long × 2–4 mm diameter at anthesis, green, triangular to obtusely triangular in cross section, elongating as fruit matures. Perigone 5–6.6 cm long, infundibuliform; hypanthium tube 0.4–0.7 cm long, greenish proximally, vinaceous distally; paraperigone of fimbriae, partially connate. Tepals in free portion coral red, dark vinaceous adaxially at their base and forming a circular pattern at the throat, with cream coloured stripes for half their length; sepals (outer whorl) wider than petals (inner whorl), apex acute with apicule subapical 1–2.5 mm long; upper 5.2–6.2 × 1.6–2.1 cm, oblanceolate, symmetric, slightly recurvated; lateral 5–6 × 1.2–1.7 cm, narrowly elliptic to

oblanceolate, slightly asymmetric; petals (inner tepals) slightly smaller than the sepals, lower petal narrower than the laterals, apex acute with apicule inconspicuous or absent; lateral 4.9–5.6 × 1.1–1.7 cm, narrowly elliptic to oblanceolate, slightly recurvated; lower 5–5.6 × 0.8–1.2 cm, narrowly elliptic. Stamens 6, of four different lengths, inserted at the mouth of the hypanthium tube, shorter than limb segments; filaments fasciculate, declinate-ascending, reddish in the free portion, whitish at apex, upper episepalous 2.3–3 cm long, lateral episepalous 2.4–3.2 cm long, lateral epipetalous 3.2–4 cm long, lower epipetalous 2.6–3.3 cm long; anthers 4–5.5 mm long after anthesis, oblong, cream, pollen golden-yellow. Ovary 0.7–1.2 cm long × 4–5 mm diameter, obovoid, green; ovules 32–40. Style 5–5.5 cm long, slightly shorter or similar in length to the limb segments, filiform, declinate to slightly ascending, reddish; stigma trifid, lobes 2–3 mm long, recurved, whitish. Fruit 1.2–1.8 cm long × 2.2–2.6 cm diameter, capsule globose-compressed, greenish to straw coloured; seeds 0.85–1.2 × 0.65–0.9 cm, half-discoid, flattened.

Distribution and habitat. *Hippeastrum laklano* is known only from a single locality in the North Plateau of Santa Catarina State, close to the border between the municipalities of Santa Terezinha and Itaiópolis (Fig. 3A). The region is characterized as a transition zone between Dense and Mixed Ombrophilous Forest (Leite 2002). The word "taipas" written on the holotype label means a traditional type of wall or its construction process (Ferreira 1986), referring to the species' habitat, which was found on a steep rocky wall near a waterfall (Fig. 3D). Co-occurring species included ferns and herbaceous plants, such as *Ctenanthe* sp. (Marantaceae), *Commelina* sp. (Commelinaceae), *Peperomia urocarpa* Fisch. & C.A.Mey. (Piperaceae), and *Sinningia macropoda* (Sprague) H.E.Moore (Gesneriaceae), plus some shrubs and small trees. The local climate is of the Cfbl type, according to the Köppen classification, defined as mild temperature and fully humid with warm summers. The precipitation is 1800 mm annually, with the highest average monthly occurring between December and March, and the lowest occurring between June and August; the annual average temperature is around 18°C, with a maximum average of 26°C in the summer and a minimum average of 7°C in the winter (Corrêa 2005). Four more species of *Hippeastrum* have known records for the northern region of Santa Catarina, found mainly in the Ombrophilous Dense Forests of the mountainous regions; *H. aulicum* (Ker Gawl.) Herb., *H. glaucescens* (Mart.) Herb., *H. puniceum*, and *H. striatum*. *Hippeastrum aulicum* is a species distributed in the Atlantic Forest of southern and southeastern Brazil, more frequent in mountainous and humid forests, near the coast or in coastal regions, and occurring in seasonal forests in the interior of the state of Paraná (Oliveira 2012). It is usually an epiphyte or understory species, growing in litter-rich rocky outcrops or trees, rarely in more open humid areas. *Hippeastrum glaucescens* is a species widely distributed in Brazil through the Atlantic Forest and Cerrado, reaching neighbouring localities of Argentina and Paraguay (Oliveira 2012). It is more frequent in higher altitude regions, in open or partially shaded habitats, amid rocky outcrops or in grassland formations. For information on distribution and habitat of *H. puniceum* and *H. striatum* see the subsection Distribution and habitat of *H. curupira*.

Phenology. *Hippeastrum laklano* was found with flowers and immature fruits in early March. Specimens in cultivation flowered from January to April, and they were shown to be self-compatible.

Etymology. The specific epithet is a noun in apposition and refers to the Laklãnõ people, member of the Southern Jê linguistic family, who inhabited vast areas of southern Brazil, including almost the entire northern plateau of Santa Catarina (Santos 1973). With the arrival of European settlers in the region, particularly between the mid-nineteenth and early twentieth centuries, the Laklãnõ were severely decimated through actions supported by government authorities and private colonization companies (Santos 1973; Selau 2006; Wittmann 2007). The only known place of occurrence of the new species is located close to the limits of the Ibirama-Laklãnõ Indigenous Territory, where the main remaining Laklãnõ community is confined. Established in 1926 with an area of 20,000 hectares that would never be delimited, the indigenous land was expanded to around 37,000 hectares in 1999, and declared permanent indigenous possession by an ordinance of the Ministry of Justice four years later (Santos 1973; FIOCRUZ 2022). However, the indigenous land continued to suffer constant invasions by settlers and loggers, intensified from the 1950s, mainly for the purpose of exploiting its natural resources, which would result in the depletion of the juçara-palm (*Euterpe edulis* Mart.) and timber reserves (Santos 1973; Namem 1994; Nigro 2004). The Federal Supreme Court of Brazil is judging two lawsuits filed by the state government and environmental agency demanding the annulment of the Laklãnõ land demarcation process (FIOCRUZ 2022). One of the lawsuits was declared of general repercussion and will serve as a guideline for the federal government and all instances of justice with regard to demarcation procedure, placing the Laklãnõ people and their struggle at the heart of this issue in the country today (Silva and Souza Filho 2021; FIOCRUZ 2022). Laklãnõ is a self-denomination that gained momentum among indigenous people from the 1990s onwards, as part of an effort to revitalize their language, as opposed to the name Xokleng, that would have a pejorative meaning and would represent the colonizer's view of the community (Gakran 2005, 2020). According to the Laklãnõ language, the word "laklãnõ" means "those of the sun clan" or "those who are descendants of the sun" (Gakran 2005).

Preliminary IUCN conservation assessment. Critically Endangered CR B1ab(iii)+B2ab(iii); D. *Hippeastrum laklano* should be considered critically endangered (CR) according to the subcriteria B1ab(iii)+B2ab(iii), due to the number of locations (1) and decline in habitat quality, and criterion D, due to the low number of known

Figure 4. *Hippeastrum laklano*. **A**. Habit. **B**. Leaves (abaxial surface). **C**. Detail of leaf venation. **D**. Spathe bracts. **E**. Flower, frontal view. **F**. Flower, lateral view. **G**. Sepals and petals: shape and apices. **H1**. Upper sepal. **H2**. Lateral petal. **H3**. Lateral sepal. **H4**. Lower petal. **I**. Flower with removed perigone, showing stamens and style. **J**. Stigma. **K**. Longitudinal section of ovary and hypanthium tube. **L**. Cross section of the ovary. **M**. Capsule. **N**. Seed. Drawn by Klei Sousa from *A. Campos-Rocha 3355* and *A. Campos-Rocha 3356*.

Figure 5. *Hippeastrum laklano*. **A**. Sepals and petals. **B**. Apex of the upper sepal. **C**. Apex of the lateral sepal. **D**. Flower with removed perigone, showing stamens and style. **E**. Detail of anthers and stigma. **F**. Detail of paraperigone. **G**. Anther. **H–I**. Stigma at different developmental stages. **J**. Inflorescence, top view. **K**. Leaf apex. **L**. Detail of leaf venation, abaxial surface. **M**. Detail of the spot at the base of the tepals. **N**. Inflorescence, frontal view. **O**. Longitudinal section of the ovary. **P**. Fully developed leaves. **Q**. Base of leaves and inflorescence. **R**. Bulb and bulblet. **S**. Habit. **T–U**. Detail of spathe bracts and bracteoles. **V**. Immature capsule. **W**. Mature capsule exposing the seeds. **X**. Seeds. **Y–Z**. Seedlings. A–L, N–Z by Antonio Campos-Rocha; M by Mauro Peixoto.

individuals. The new species was collected in its natural habitat in 2006, and since then a few specimens have been kept under cultivation on private property in the state of São Paulo. We do not have updated information on this population and locality of occurrence. Although the European colonization of the North Plateau of Santa Catarina started in the 17th and 18th centuries, most of its forests would remain preserved until the beginning of the 20th century (Carvalho 2012). With the construction of railroads and highways throughout the region, logging activities intensified, resulting in an almost 50-year cycle of deforestation (Valentini 2009; Carvalho 2012). The original vegetation cover in this region is now reduced to small, isolated forest fragments, restricted mainly to riverbanks or steeper areas, and surrounded by agriculture, pastures and homogeneous planted forests (Scariot and Reis 2010; Schaadt and Vibrans 2015). In recent years, Itaiópolis has led the deforestation ranking in Santa Catarina several times (Soethe and Carvalho 2012).

Additional specimens examined. BRAZIL – **Santa Catarina** • Santa Terezinha, em cultivo no estado de São Paulo; 29 Jan. 2022; fl.; *A. Campos-Rocha 3355*; UEC • Santa Terezinha, em cultivo no estado de São Paulo; 24 Mar. 2022; fr.; *A. Campos-Rocha 3356*; UEC.

Taxonomic notes. *Hippeastrum laklano* presents some similarities in floral morphology to *H. striatum*, from which it can be distinguished by having a shorter hypanthium tube (representing about 1/10 of the total length of perigone), conspicuously fimbriated paraperigone, and the dark vinaceous spot at the base of the tepals adaxially (vs tube representing about 1/5 of the total length of perigone, paraperigone absent and tepals cream to greenish at the base adaxially in *H. striatum*). A few populations of *H. striatum* are known to have a dark spot at the base of the tepals, although their colour and position are different from those of *H. laklano*. In addition, the flowers of *H. laklano* usually have a shorter perigone than those of *H. striatum* (5–6.6 cm vs 5.5–12.5 cm). *Hippeastrum laklano* can also be compared to *H. santacatarina* (Traub) Dutilh, a red-flowered species endemic to southern Brazil. However, *H. santacatarina* is a more robust species, typically found in marshy and swampy fields, and flowering mainly in spring, while *H. laklano* is a saxicolous plant and flowers in autumn in the wild. Furthermore, in *H. santacatarina* the hypanthium tube represents about 1/7 of the total length of perigone and the tepals are whitish at the base adaxially, with a whitish central stripe but without spot.

Key to *Hippeastrum* species occurring in the Brazilian Atlantic Forest

The Brazilian states with occurrence records for the domain are given in brackets: AL Alagoas; BA Bahia; CE Ceará; ES Espírito Santo; GO Goiás; MG Minas Gerais; MS Mato Grosso do Sul; PB Paraíba; PE Pernambuco; PR Paraná; RJ Rio de Janeiro; RN Rio Grande do Norte; RS Rio Grande do Sul; SC Santa Catarina; SE Sergipe; SP São Paulo.

1. Leaves strongly falcate, subfleshy; perigone nearly actinomorphic, salverform; stamens inserted (within the hypanthium tube), ending at the same height (ES, MG) (Fig. 6V) ..... ***H. velloziiflorum***
– Leaves lorate, falcate, lanceolate to oblanceolate, slightly spatulated, linear, chartaceous; perigone zygomorphic to ultrazygomorphic, campanulate to infundibuliform; stamens exserted (from the hypanthium tube), ending at different heights..... **2**
2. Leaves lanceolate to oblanceolate, pseudopetiolate to obscurely pseudopetiolate; ovary with up to 12 ovules per locule; interior of mature capsule bright red; seeds globose (BA, ES, MG, PR, RJ, SC, SP) (Fig. 6R)..... ***H. reticulatum***
– Leaves lorate, falcate, slightly spatulated, linear, sessile; ovary with > 12 ovules per locule; interior of mature capsule not pigmented; seeds papery, flattened **3**
3. Leaves linear, up to 1 cm wide (MG) (Fig. 6I) ..... ***H. cipoanum***
– Leaves lorate, falcate, slightly spatulated, > 1 cm wide..... **4**
4. Stigma capitate **5**
– Stigma trilobed to trifid..... **8**
5. Free portion of the tepals white or cream to light green; hypanthium tube over 7 cm long; paraperigone absent (BA, CE) (Fig. 6J) ..... ***H. elegans***
– Free portion of the tepals salmon, coral or dark red, carmine, orange, rarely pink; hypanthium tube up to 4 cm long; paraperigone fimbriae flanking the base of the staminal filaments or a ring of fimbriae..... **6**
6. Free portion of the tepals salmon; staminal filaments exceeding the length of the perigone; paraperigone fimbriae flanking the base of the staminal filaments (AL, BA, CE, PB, PE, RN, SE) (Fig. 6U) ..... ***H. stylosum***
– Free portion of the tepals coral or dark red, carmine, orange, rarely pink; staminal filaments shorter than the perigone; paraperigone a ring of fimbriae **7**
7. Free portion of the tepals coral red or orange, rarely pink (yellowish/greenish at the base adaxially and forming a circular pattern at the throat) (AL, BA, CE, ES, GO, MG, MS, PB, PE, PR, RJ, RN, RS, SC, SP) (Fig. 6P)..... ***H. puniceum***
– Free portion of the tepals dark red to carmine (greenish/whitish at the base adaxially with extensions to the middle of the limb) (ES, MG, RJ, SP) (Fig. 6Q) ..... ***H. reginae***
8. Free portion of the tepals white or cream to light green; hypanthium tube over 6 cm long (ES, MG, RJ, SP) (Fig. 6E) ..... ***H. brasilianum***

– Free portion of the tepals red, carmine, coral, bright scarlet or dark red, orange, salmon, green, sometimes greenish proximally and reddish distally, purplish, white, pinkish or whitish-pink; hypanthium tube up to 4 cm long **9**
9. Staminal filaments exceeding the length of the perigone **10**
– Staminal filaments shorter than the perigone **11**
10. Leaves lorate; perigone ultrazygomorphic; free portion of the tepals reddish, sepals recurved at the apex; stigma trilobed (PR, RS, SP) (Fig. 6B) ..... ***H. angustifolium***
– Leaves falcate; perigone zygomorphic; free portion of the tepals greenish, sepals inflexed at the apex; stigma trifid (ES, MG, PR, RJ, SP) (Fig. 6G) ..... ***H. calyptratum***
11. Paraperigone absent or inconspicuous **12**
– Paraperigone a ring of scales or fimbriae, scales flanking the base of the tepals or fimbriae alternated with scales **15**
12. Free portion of the tepals white (MG) (Fig. 6A) ..... ***H. abatinguara***
– Free portion of the tepals orange, coral, or bright scarlet red **13**
13. Free portion of the tepals bright scarlet red; hypanthium tube representing between 1/6 and 1/9 of the total length of perigone (BA) ..... ***H. curupira* sp. nov.**
– Free portion of the tepals orange or coral red; hypanthium tube representing between 1/3 and 1/6 of the total length of perigone.. ..... **14**
14. Perigone 12–14.6 cm long; free portion of the tepals greenish/yellowish at the base; stamens generally wine coloured (PR, RJ, SC, SP) (Fig. 6D) ..... ***H. blossfeldiae***
– Perigone 5.5–12.5 cm long; free portion of the tepals whitish/cream at the base; stamens generally cream coloured (BA, ES, MG, MS, PR, RJ, RS, SC, SE, SP) (Fig. 6T) ..... ***H. striatum***
15. Paraperigone a ring of scales or scales flanking the base of the tepals, fimbriae absent **16**
– Paraperigone a ring of fimbriae or fimbriae alternated with scales **17**
16. Leaves falcate with a long acuminate apex; perigone over 9 cm long; free portion of the tepals greenish at the base; paraperigone a hard conspicuous ring of large scales (ES, MG, PR, RJ, RS, SC, SP) (Fig. 6C) ..... ***H. aulicum***
– Leaves lorate with a more rounded apex; perigone up to 8.5 cm long; free portion of the tepals red or pinkish at the base; paraperigone small scales flanking the base of the tepals (MG) (Fig. 6H) ..... ***H. carassense***
17. Leaves falcate; flowers laterally compressed; paraperigone conspicuous fimbriae on a more or less continuous base; upper petals larger than sepals (RS, SC) (Fig. 6N) ..... ***H. papilio***
– Leaves lorate or slightly spatulated; flowers not laterally compressed; paraperigone a ring of fimbriae; upper petals equal to or narrower than sepals **18**
18. Perigone < 8 cm long **19**
– Perigone > 8 cm long **22**
19. Leaves slightly spatulated; perigone less than 5 cm long (RJ) (Fig. 6L) ..... ***H. idimae***
– Leaves lorate; perigone 5 cm or more long **20**
20. Perigone campanulate; free portion of the tepals white to pinkish (PR, RS, SC) (Fig. 6F) ..... ***H. breviflorum***
– Perigone infundibuliform; free portion of the tepals red, coral red or dark red **21**
21. Leaves generally reclinate and canaliculate; free portion of the tepals coral red and dark vinaceous at the base adaxially (forming a circular pattern at the throat) ..... ***H. laklano* sp. nov.**
– Leaves generally erect and flat; free portion of the tepals red or dark red and whitish at the base adaxially (with a whitish central stripe extending to the middle of the limb) (PR, RS, SC) (Fig. 6S) ..... ***H. santacatarina***
22. Free portion of the tepals with pink stripes; hypanthium tube over 3 cm long (PR, RS, SC) (Fig. 6W) ..... ***H. vittatum***
– Free portion of the tepals without pink stripes; hypanthium tube less than 2.5 cm long **23**
23. Upper sepal much larger than lower petal, lateral sepals asymmetrically falcate **24**
– Tepals more or less equal and symmetrically elliptic, obovate or oblanceolate **25**
24. Bulbs subterranean; hypanthium tube 1.4–2 cm long; paraperigone a pellicle of fused fimbriae (BA, ES, MG, PR, RJ, RS, SC, SP) (Fig. 6K) ..... ***H. glaucescens***
– Bulbs exposed growing on rocks; hypanthium tube 2–2.4 cm long; paraperigone callose with faint linear scratches between the base of the expansions on the three upper tepals (MG, PR, SP) (Fig. 6O) ..... ***H. psittacinum***
25. Leaves generally erect, deciduous; free portion of the tepals red or orange at the base adaxially (with a greenish/white central stripe extending to the middle of the limb); stigma lobes 2 mm or more long (ES, MG, RJ, SP) (Fig. 6M) ..... ***H. morelianum***
– Leaves generally reclinate, evergreen; free portion of the tepals whitish at the base adaxially (with a whitish central stripe extending to the middle of the limb); stigma lobes up to 1.5 mm long (SC) ..... ***H. verdianum***

DISCUSSION

The Atlantic Forest houses approximately 125 million people, which corresponds to more than 70% of the Brazilian population and accounts for about 2/3 of the national GDP (Rezende et al. 2018). The region hosts the main research institutions in Brazil, making the Atlantic Forest the best sampled phytogeographic domain in the country (Galindo-Leal and Câmara 2003; Sobral and

Stehmann 2009; Oliveira et al. 2019), with its flora well represented in local herbaria (Morellato and Haddad 2000; Stehmann et al. 2009). However, no other Brazilian phytogeographic domain has contributed so many new species that have been described in recent decades, with the Atlantic Forest accounting for almost half of them between 1990 and 2006 (Sobral and Stehmann 2009), This justifies the identification and description of new species as the first topic of the research agendas in the region (Joly et al. 2014). This is true even for groups that are well-studied and relatively well-sampled, as is the case for Amaryllidaceae in Brazil. In recent years, several new species have been described for the country, mostly endemic to the Atlantic Forest (Oliveira et al. 2017; Campos-Rocha et al. 2017a, 2017b, 2018b, 2019, 2022a, 2022b), including another species of *Hippeastrum* from Santa Catarina (Büneker and Bastian 2018), considered the Brazilian state with the best studied and sampled flora (Reis et al. 2011; Sousa-Baena et al. 2014). The description of two new species highlights the importance of continued collection efforts in all regions of the domain. It also reinforces the value of the work done by specialist taxonomists and field studies for their research. The species published here are known only from collections made by the authors, and there is no additional record in the herbaria or other scientific collections consulted over almost forty years of investigation.

Hippeastrum has a long and complicated taxonomic history. Since the end of the 19th century, several infrageneric classifications have been proposed, based mainly on floral attributes (for a detailed overview, see Dutilh 1987 and Oliveira 2012). The molecular studies, however, revealed that most of the traditional characters were highly homoplastic, resulting in classifications based on groups all para- or polyphyletic (Oliveira 2012; García et al. 2014). García et al. (2019) proposed a consensus classification for tribe Hippeastreae based on molecular, morphological and cytogenetic data, and divided *Hippeastrum* into two subgenera. While *H*. subg. *Hippeastrum* covers all species previously recognized as *Hippeastrum*, subg. *Tocantinia* includes only those three species formerly described as *Tocantinia* Ravenna, endemic to the Brazilian Cerrado and transition zones to the Caatinga, which have a peculiar external morphology. The two species described here show all the diagnostic features of the typical subgenus (leaves lorate; scape multiflowered; spathe bivalved, free from the base; flowers pedicellate, without fragrance; perigone infundibuliform, mainly reddish in colour; ovules numerous, 24 or more per locule), in which they should be positioned. A molecular phylogenetic analysis conducted by Oliveira (2012) based on the nuclear marker ITS placed *H. laklano* in a weakly supported clade with *H. angustifolium* Pax, *H. breviflorum* Herb., *H. santacatarina*, and *H. vittatum* (L'Hér.) Herb., species distributed throughout southern Brazil. ITS sequences have proven sufficiently informative to place most South American species of Amaryllidaceae in the genera and tribes in which they are currently circumscribed, although of limited use in resolving phylogenetic relationships at the infrageneric level (Meerow et al. 2000; Meerow 2010). For the genus *Hippeastrum* in particular, phylogenetic inferences also provided evidence of the importance of reticulation events in shaping the history of the group, closely related to geographic and environmental factors, especially in southern Brazil (Oliveira 2012).

The Red List of the Brazilian Flora recognized most species of *Hippeastrum* that occur in the Atlantic Forest as threatened with extinction (Ministério do Meio Ambiente 2014), many also included in regional lists (COPAM 2008; CONSEMA 2014; SMA 2016; Fraga et al. 2019). Both species described here have a single known record, and were classified as Critically Endangered, the category for species with the highest risk of extinction. Although they occur in legally protected areas, the species are exposed to several types of threats and without any guarantee of protection. *Hippeastrum curupira* was collected in one of the most vulnerable regions of the Atlantic Forest region of southern Bahia, which is experiencing a rapid and uncontrolled urbanization process, accompanied by real estate speculation, pressure from tourist activities and, more recently, the implementation of mega-projects, such as the Porto Sul Complex (Viana 2011; Dias et al. 2014; Souza Filho et al. 2019). Its type location is situated in the EPA of the Lagoa Encantada and Rio Almada, the largest conservation unit in the municipality of Ilhéus and one of the largest in southern Bahia (Santos et al. 2009; GAMBA 2012). EPAs are conservation units of sustainable use, characterized by presenting areas that are usually quite extensive, consisting of both private and public land (Government of Brasil 2000). Established as the less restrictive category of Brazilian protected areas, they are frequently unable to ensure the effective conservation of biodiversity and natural resources (Sousa 2012; WWF-Brasil and ICMBio 2017; Jeronymo et al. 2021). Local reports indicate increasing pressures on EPA of the Lagoa Encantada and Rio Almada, including deforestation, the occupation of protected areas and mining activities (GAMBA 2012; CEAMA 2014). The conservation unit has a management plan published in the mid-1990s, not including the areas added in 2003, which represent more than 90% of its current area (GAMBA 2012). It also precedes the National System of Nature Conservation Units (SNUC), adopted as law in 2000. According to the environmental zoning of the EPA, *H. curupira* was found in the border between the agroforestry and agricultural zones and, therefore, outside protected or conservation zones (INEMA 2002).

The type locality of *H. laklano* should be considered a Permanent Preservation Area (PPA) according to the Brazilian Forest Code, as a slope with a declivity greater than 45 degrees, equivalent to 100% in the line of maximum gradient (Government of Brasil 2012). Together with conservation units, PPAs are the main legal instrument for the protection of biodiversity in Brazil, comprising spaces with inherent environmental vulnerability, where

Figure 6. Species of *Hippeastrum* native from Brazilian Atlantic Forest. **A**. *H. abatinguara* Campos-Rocha & A.S.Medeiros. **B**. *H. angustifolium*. **C**. *H. aulicum*. **D**. *H. blossfeldiae* (Traub & J.L.Doran) Van Scheepen. **E**. *H. brasilianum* (Traub & J.L.Doran) Dutilh. **F**. *H. breviflorum*. **G**. *H. calyptratum* (Ker Gawl.) Herb. **H**. *H. carassense* Campos-Rocha & R.C.Mota. **I**. *H. cipoanum* (Ravenna) Meerow. **J**. *H. elegans* (Spreng.) H.E.Moore. **K**. *H. glaucescens*. **L**. *H. idimae* Dutilh & R.S.Oliveira. **M**. *H. morelianum* Lem. **N**. *H. papilio* (Ravenna) Van Scheepen. **O**. *H. psittacinum* (Ker Gawl.) Herb. **P**. *H. puniceum*. **Q**. *H. reginae*. **R**. *H. reticulatum*. **S**. *H. santacatarina*. **T**. *H. striatum*. **U**. *H. stylosum* Herb. **V**. *H. velloziiflorum* Campos-Rocha & Meerow. **W**. *H. vittatum*. A, C, K, M, O, P, R, T by Antonio Campos-Rocha; B by Germán Roitman; D by Plínio Senna; E by Claudio Fraga; F, G, I, N, S, U, W by Mauro Peixoto; H by Rubens da Mota; J by Ulf Mehlig; L by Julie Dutilh; Q by João Stehmann; V by Luiz Menini Neto.

no human activity is allowed, and vegetation clearing is permitted only in exceptional cases. In the northern plateau of Santa Catarina, most PPAs showed conflicting land use, which was less evident in PPAs of slopes than in water PPAs (Caldas 2007; Palivoda and Povaluk 2015). The preservation of native vegetation in PPAs is the responsibility of their owners (Government of Brasil 2012). The closest protected areas to the type locality of *H. laklano* are the State Biological Reserve (Rebio) of Sassafrás and the Area of Relevant Ecological Interest (ARIE) of Serra da Abelha. Together with the Ibirama-Laklãnõ Indigenous Territory, the conservation units cover the most important forest remnants in the northern plateau of Santa Catarina and neighbouring areas of the Itajaí Valley (SOSMA and INPE 2021). Established in 1990 as a federal conservation unit for sustainable use, the ARIE of Serra da Abelha records conflicts of use and occupation since its foundation (Salles 2003; APREMAVI 2015), including overlapping of most of its 4500 thousand hectares of area with the indigenous land (Pereira 2004; Schmitz 2018). The Rebio Sassafrás is a full protection conservation unit created in the late 1970s, in a regional context of over-exploitation of timber resources, with the main purpose of conserving wood species, especially the remaining populations of "canela-sassafrás" (*Ocotea odorifera* (Vell.) Rohwer), abundant in the area (FATMA 2010). The reserve also overlaps with the indigenous land, which, although representing less than 10% of its area, corresponds to the sites where the infrastructure of the conservation unit is installed (Pereira 2004; FATMA 2010). In addition to ecologically similar environments around the type locality, we believe that efforts to search for new accessions of *H. laklano* could be directed to both conservation units, whose herbaceous flora is still poorly studied, based on the available literature (FATMA 2010; APREMAVI 2015) and online databases consulted. However, the uncertain legal status of the region makes the only known record of *H. laklano* and possible new ones even more vulnerable. Following the efforts of locating additional records of the described species, urgent conservation actions are needed and should concentrate on effective protection of the known remaining accessions to ensure their long-term survival.

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