

Hohenbergia erecta (Bromeliaceae: Bromelioideae), a new once-branched species from Chapada Diamantina, Bahia state, Brazil

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Abstract

Hohenbergia is one of the most diverse genera in Bahia state, inhabits almost all region of the state. As a result of ongoing studies on the genus *Hohenbergia* in Bahia, Brazil, here we describe and illustrate *Hohenbergia erecta*, endemic to the municipality of Mucugê, at Chapada Diamantina. *Hohenbergia erecta* differs from its morphologically related, *H. catingae*, by an elongated aspect provided by the tubular rosette (vs short stem with a crateriform rosette), and a once-branched cylindrical inflorescence (vs 2–3-branched pyramidal inflorescence), with branches congested at the apex (vs branches laxly arranged). Due to a small distribution area in the Caatinga forest and based on a spatial analysis we categorized it as Endangered (EN), following the IUCN criteria. *Hohenbergia erecta* is endemic of the central region of Chapada Diamantina, being described as dominant in the area, where no other *Hohenbergia* species inhabits. It is important, however, that new field expeditions are conducted in the region to observe the richness of the genus at Chapada Diamantina.

Introduction

Hohenbergia Schult & Schult.f is a bromeliad genus centered in Brazil, mainly in the Atlantic Forest (Benzing, 2000; Aguirre-Santoro et al., 2016; Cavalcante et al., 2017). Most of the species occur in the State of Bahia (42 spp.), where most of them are endemic or microendemic, with at least 13 *Hohenbergia* species occurring at Chapada Diamantina present in *Caatinga* and *Campos Rupestres* (rocky fields) areas (Gonçalves-Oliveira et al., 2020).

Currently, this genus includes a single subgenus, *Hohenbergia* subg. *Hohenbergia* Mez. It is remarkable that their morphological traits appear not to be phylogenetically constrained, showing a strong niche conversion. As such, different *Hohenbergia* species sharing the same environment, such as the Atlantic Forest, near the coast, or *Campos Rupestres* and *Caatinga*, more inland, show more morphological similarities among themselves than when compared with their closest phylogenetic relatives, creating a convergent morphological pattern, or two very distinct morphological groups for one species, readily observed in populations found in Bahia (Baracho, 2004; Oliveira, 2016; Cavalcante et al., 2020).

Species occurring in the Atlantic Forest (mesic environment) are mainly epiphytic plants, with long leaves (> 100 cm long) with brownish leaf sheaths with a similar width to the leaf blade, forming a deep funnelform rosette; plants bearing a prominent 2-5-branched and laxly arranged inflorescence, with long branches; flowers with purple, yellow or, rarely, white petals (Baracho, 2004; Cavalcante et al., 2020). The species of *Hohenbergia* that occur in xeric environments (*Campos Rupestres* and *Caatinga*) form another informal group, which is characterized by a saxicolous life form, or growing in sandy soil banks, have shorter leaves (blades commonly smaller than the sheaths in both length and width) with quite developed sheaths that form the developed tank, resulting in a lageniform or tubular rosette, with a great capacity to store water; sub-cylindrical inflorescence, two or three times higher than the rosette; and short pedunculate lateral branches with flowers bearing purple petals (Baracho, 2004; Oliveira, 2016; Cavalcante et al., 2018).

Considering the peculiarities of these two morphological groups, the genus may be recognized by the well-developed rosette, forming a large water-tank, and a well-developed inflorescence (representing up to 2/3 of the total plant height when flowering) (Baracho, 2004). In addition, the inflorescence is covered by a dense lanate indument, with strobilate spikes, bearing small flowers (shorter than 4 cm), the ovaries are ventrally flattened and covered by asymmetrical and spinescent floral bracts (Baracho, 2004).

As a result of at least ten years of field and herbarium studies with this genus in the State of Bahia, six new species have been discovered, (Leme et al., 2011; Leme, 2012; Maciel and Louzada, 2014; Oliveira et al., 2017; Cavalcante et al., 2020), including the new species described here, which is illustrated and compared with its morphologically similar species. In addition, its conservation status, blooming period, and taxonomic comments and notes are provided.

Results

Taxonomy: *Hohenbergia erecta* B.P. Cavalcante, Versieux & A.P. Martinelli, **sp. nov.** Type: Brasil. Bahia: Mucugê, distrito de Brejo de Cima, Estrada Mucugê para Rio de Contas, 13°18'18.6"S, 41°33'06.2"W, 1153 m.s.m., 20 May 2019, *B.P. Cavalcante, K.R. Silva & E.H. Souza* 39. (holotype HURB 25311) (Figs. 1–3, Table 1).

Table 1

Morphological comparison between *Hohenbergia erecta* and *H. catingae*. Measurements are based on the original description of each species and were complemented by observations of living plants.

Characteristics/species	<i>Hohenbergia erecta</i>	<i>Hohenbergia catingae</i>
Plant height (in blooming)	140 cm	Up to 180 cm
Rosette shape	Tubular	Crateriform
Rosette diameter	35 cm	100 cm
Leaf position	Erect	Curved to sub-erect
Leaf sheath	Elliptic, dilated and wider than leaf blade	Ovoid, not dilated, similar to the leaf blade width
Leaf blade	Linear-lanceolate	Linear
Inflorescence indumentum	Brown-lanate	White-lanate
Inflorescence peduncle length	80 cm long	60 cm long
Inflorescence fertile part	Once-branched, 25 cm long, spikes sessile and congested at apical portion of the peduncle	2–3-branched, 70 cm long, spikes long pedunculate and laxly arranged
Inflorescence shape	Cylindrical	Pyramidal
Inflorescence branch length (including the lateral peduncle)	Up to 6 cm long	Up to 30 cm long
Flower length	1.6–1.8 cm long	1.8–2.0 cm long
Petal	Spatulate with an erect apex, light purple	Spatulate with a reflexed apex, deep purple
Stigma	Shorter than stamens	Longer than the stamens

Hohenbergia erecta is closely related to *H. catingae*, but they differ on vegetative propagation (stolon vs short basal shoots), tubular rosette (vs crateriform rosette), linear-lanceolate leaves with erect and caudate apices (vs linear leaves with acuminate apices), sheaths wider than the leaf blades (vs sheaths and blades of the same width), once-branched inflorescence (vs 2–3-branched inflorescence) covered by a brownish indument (vs whitish indument), petals with rounded apices (vs petals with acuminate apices), and included stigma (vs exerted stigma).

Plants ca. 90 cm tall when sterile and 140 cm tall when flowering, with an elongate stem, giving a caulescent and erect aspect to the plant, reproducing by robust stolons, heliophyte, growing on sandy soils or on naked rocks in *Caatinga* vegetation; rosette tubular with a high capacity to impound water,

tank ca. 35 cm diam. × 50 cm height; leaves 80–90 cm long, coriaceous, erect, greenish, more than 15 in number, marcescent; sheaths 20–24 × 13–16 cm, greenish, elliptic, dilated, margins smooth; leaf blades 60–70 × 3–6 cm, linear-lanceolate with an acuminate apex, spines black and conspicuous, 0.2 cm long; *apical mucro* 0.5–1 cm long, blackish, conspicuous. Peduncle 70–80 × 0.6–0.9 cm, reddish, covered by a brownish lanate indument; peduncle bracts 7–9 cm long, lanceolate, papyraceous, smooth margins, covered by a brown-lanate indument, shorter than the internode in length, apex acuminate but inconspicuous in color; inflorescence 20–25 cm long (fertile portion), cylindrical, congested at the apical portion of the peduncle, once-branched, with short and strobilate spikes, lateral spikes sessile (basal spike rarely sub-sessile); primary bracts ca. 6 cm long, similar to the bracts of the peduncle in shape and color, covered by a brown-lanate indument, longer than the branches; basal spike 4–5 cm long, sessile or rarely sub-sessile, strobilate, sometimes hidden by the primary bract, covered by a brown-lanate indumentum, with less than 13 flowers per spike; distal spikes 3–4 cm long, sessile, grouped in the apical portion of the inflorescence and covered by a brown-lanate indument, presenting up to 8 flowers per spike. Floral bracts ca. 0.8–1.0 × 1.2 cm, green and coriaceous at the base and brownish, strongly nerved and papyraceous at the apex, triangular, with an acuminate apex, longer than the sepals; flowers 1.6–1.9 cm long, tubular, sessile, diurnal anthesis (ca. 4 am–3 pm) with a slightly sweet odor; sepals 0.5–0.7 × 0.8 cm, green, triangular with an acute apex and lacking a visible wing; petals 0.8–1.0 cm long, spatulate, purple; petal appendages ca. 2–3 mm long, fringed, on the basal portion of the petals; stamens 0.8–0.9 cm long, white, included; anthers 0.2–0.3 cm long, cylindrical, yellowish, exceeding the style; style 0.5–0.6 cm long, white, erect, shorter than the stamens; stigma conduplicate-spiral, lobes congested, exserted; ovary 0.2–0.3 × 0.4 cm, ovoidal, ventrally flattened and covered by floral bracts, with interocular nectaries; ovule numerous, anatropous, with a developed chalazal appendage; fruit berry 1.5–1.7 cm long, green or blue when ripe; seeds 0.9–2 mm long, lightly ellipsoidal and brownish.

Etymology: The specific epithet refers to the erect and elongated aspect of the rosette and inflorescence.

Phenology: The beginning of flowering was not observed, but blooming individuals were found in May and kept blooming until July.

Distribution and habitat: *Hohenbergia erecta* was found growing in sandy soils in *Caatinga* vegetation of Chapada Diamantina (Bahia), near rocks fields, in an unnamed road that connects the municipality of Mucugê to Brejo de Cima, sympatric with other bromeliads, such as species of *Ortophytum* sp., *Encholirium* sp., and *Neogloziobia variegata*. No other *Hohenbergia* species was observed at this location. The region has a *Caatinga*-type vegetation, with a few trees, large to medium sized shrubs, herbs and a great number of rocks. The climate in this area is dry, with a short rainy season (March to May), slightly cold in the morning and at night, and hot in the afternoon.

Conservation status: The type locality is an extensive *Caatinga* forest close to a small community (Brejo de Cima) in the municipality of Mucugê and signs of illegal collections were observed in the area. In addition, it grows in a region that is being affected by deforestation events for road construction. When we plot the known occurrences of this species in Geocat software (geocat.kew.org), the estimated extent

of occurrence was 0.385 km², while the area of occupancy is estimated as 8.000 km². Given these areas, the conservation status suggested was Critically Endangered (CR), however the area of occurrence of the species is a vast area of *Caatinga*, making it difficult to accurately estimate the total area of its distribution. Nonetheless, considering the impacts observed and projected for the area, we place this new species as Endangered (EN), according to the IUCN definition (IUCN, 2021).

Discussion

Hohenbergia erecta has a “caulescent” habit, even in ramets growing from the plants in a greenhouse, a unique feature for the genus. The older leaves commonly remain attached to the rosette base only by the sheaths – this resembles a stem (pseudostem) and assists in the species identification in combination with the once-branched and very narrow cylindrical inflorescence. *Hohenbergia correia-araujo* Pereira & Moutinho and *H. lanata* Pereira & Moutinho, also occurring in the *Caatinga* forests (Baracho, 2004), also have a tubular rosette, but lack the caulescent habit.

Hohenbergia erecta bears some affinity with *H. catingae* by their habitat (both growing on sand soil banks) in addition to their long and thin leaves with prominent apices; long reddish peduncle, covered by a dense indumentum; green floral bracts with brownish and papyraceous apices; and flowers with purple petals. It is important to highlight that all these features are uncommon for species of *Hohenbergia* that grow in *Campos Rupestres* and *Caatinga*.

Comparing both species (Table 1), *H. erecta* is easily identified by its appearance (caulescent habit with a tubular rosette and a cylindrical once-branched inflorescence), but other features may also be considered to facilitate its recognition. These features include the width of the rosette (ca. 35 cm diam. in *H. erecta* vs 100 cm diam. in *H. catingae*), the color of the indument of the inflorescence (brown-lanate indument in *H. erecta* vs white-lanate in *H. catingae*), and the height of the peduncle (80 cm in *H. erecta* vs 60 cm in *H. catingae*) – although the height of the peduncle is longer in *H. erecta*, the total length of the inflorescence is longer in *H. catingae*. Given the elegant aspect of the rosette with its marcescent and erect leaves, we believe this species will be of horticultural and landscaping interest, particularly for xeriscape gardens.

About 51 species of *Hohenbergia* are known from Latin America, most of them from the state of Bahia, and in the last years, many species were described from Chapada Diamantina, showing the taxonomic potential of the region. *Hohenbergia erecta* is endemic to the central region of Chapada Diamantina, being described as dominant in the area, where no other *Hohenbergia* species inhabits. New field expeditions should be conducted in the region to observe the richness of the genus in Chapada Diamantina.

Methods

Our collection expeditions through the State of Bahia have been carried out over the past three years and the morphological studies have been performed based on living materials under natural conditions as

well as studying images of herbarium specimens available on-line. Specimens of the new species were taken to a greenhouse for cultivation and observation of possible structural variations in plant architecture (Silva et al., 2018, 2020); these specimens were deposited in the germplasm bank of bromeliads (BGB Bromélias) of Embrapa Mandioca e Fruticultura, located in Cruz das Almas, Bahia, Brazil, and Centro de Energia Nuclear na Agricultura, Universidade de São Paulo, in Piracicaba, São Paulo, following the guidelines recommended by the article 9 of the Convention on Biological Diversity for *ex situ* conservation (1993).

The taxonomic description and illustrations were based on living plants, dissected samples and herbarium specimens using a stereomicroscope (Leica EZ4E). The descriptive terminology follows Smith and Downs (1979), with the modifications suggested by Scharf and Gouda (2008). The type specimen was deposited at Herbário do Recôncavo da Bahia (HURB), Cruz das Almas, Bahia.

The conservation status was inferred based on the occurrence of the species in the GeoCAT program (<http://geocat.kew.org/>) following the categories and criteria of the IUCN (2021).

Declarations

Availability of data and material

All sources of information are included in this published article. Material collected in the field was deposited at HURB herbarium [*B.P. Cavalcante, K.R. Silva & E.H. Souza* 39. (holotype HURB 25311)]

Ethics approval and consent to participate

Plant field collections were registered at “Sistema Nacional de Gestão do Patrimônio Genético e do Conhecimento Tradicional Associado, Brasil”.

Contributions

BPC, KRS, EHS collected the plant material in the field, prepared and deposited the holotype in the herbarium; BPC prepared the initial species description and the first draft of the manuscript; all authors read and discussed the results of the manuscript; APM and LMV critically reviewed the drafts of the manuscript; all authors approved the final version.

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Figures

Figure 1

Hohenbergia erecta. **A.** Habit. **B.** Inflorescence spike. **C.** Flower with floral bract. **D.** Petal with petal appendages and stamen. **E.** Sepal. **F.** Stigma. Drawn by Brayan Paiva Cavalcante. Bars: A = 20 cm; B = 12 mm; C = 5 mm; D = 2 mm; E = 2.6 mm = F: 0.5 mm.



Figure 2

Hohenbergia erecta. **A.** Habit (flowering individual on the left); **B.** Inflorescence; **C.** Inflorescence spike with one flower at anthesis.



Figure 3

Holotype of *Hohenbergia erecta* (HURB25311).