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Encholirium deodorinae (Bromeliaceae, Pitcairnioideae): a new species with bicolored sepals from the Espinhaço Mountain Range, Minas Gerais, Brazil

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Abstract

A new species, *Encholirium deodorinae*, endemic to the *Campos Rupestres* of the Espinhaço Mountain Range (municipality of Itacambira, Minas Gerais State, Brazil), is described, illustrated, and compared with four morphologically similar species: *E. viridicentrum*, *E. agavoides*, *E. magalhaesii*, and *E. irwinii*. The new species is distinguished from other species of the genus by a unique combination of characters, including recurved to reflexed leaves, the central ones grayish-green and the older ones turning reddish; inflorescence with subsessile, densely arranged flowers; bicolored sepals (green basally and brown apically); exerted stamens and stigma, the stigma positioned below the anthers; brown floral bracts; a short fertile portion of the inflorescence in relation to the peduncle length (approximately 1:4–9); and floral bracts and sepals frequently bearing dendritic trichomes—an unusual feature in the genus. It differs from *E. viridicentrum*, the morphologically most similar species, by its shorter fertile portion of the inflorescence and longer peduncle; brown to stramineous floral bracts (*vs.* green to stramineous); bicolored sepals (green proximally and brown distally *vs.* uniformly green or green or with light brown apical spot); and the stigma positioned below the anthers at anthesis (*vs.* above the anthers). According to IUCN criteria, the species is preliminarily assessed as Critically Endangered (CR) due to its extremely narrow endemism and exposure to severe environmental pressures including habitat degradation and climate change impacts.

Key words: *Dyckia*, *Encholirium*, monocots, rocky fields, rocky outcrops, xerophytes

Introduction

The family Bromeliaceae stands out for its remarkable morphological, ecological, and adaptive diversity, and it is widely distributed throughout the tropical and subtropical regions of the Americas (Givnish 2011). It is particularly rich in endemic species in montane and rocky environments of Brazil (Versieux & Wendt 2007, Forzza *et al.* 2025 [continuously updated]).

No genus within the xeric clade of Pitcairnioideae was recovered as monophyletic in the phylogenetic study by Gomes-da-Silva *et al.* (2019), which led to the proposal of merging *Deuterocohnia* Mez (1894: 506) and *Encholirium* Mart. *ex* Schultes & Schultes f. (1830: 1233) into *Dyckia* Schultes & Schultes f. (1830: 1194). This taxonomic change was adopted in Flora e Funga do Brasil (Guarçoni *et al.* 2025 [cont. updated]), but it has not been accepted by several specialists, given contradictions with earlier phylogenetic studies based on molecular data (Krapp *et al.* 2014, Pinangé *et al.* 2016, Schütz *et al.* 2016). The genera were retained as accepted in the Encyclopaedia of Bromeliads (Gouda *et al.* 2025 [cont. updated]), the most comprehensive repository of taxonomic information for Bromeliaceae. Furthermore, several recent publications have described new species and combinations while continuing to recognize *Encholirium* as a distinct genus (*e.g.* Braun & Tank 2021, Leme *et al.* 2025). There are ongoing considerations about the strong evidence of paraphyly in this group and suggestions that more advanced molecular studies are needed to better express the clear morphological differences already recognized between these two genera (Büneker 2021, Braun & Tank 2021, Leme *et al.* 2025). While *Encholirium* is characterized by a terminal inflorescence, free stamens, and absence of nectaries on the sepals, *Dyckia* shows an axillary inflorescence, stamens usually connate at the base, and extraxillary nectaries located on the sepals. In the present work a more conservative position was adopted, maintaining the genera as separate entities, following the traditional circumscription of Smith & Downs (1974) and Forzza (2005).

Encholirium comprises 48 exclusively Brazilian species (Gouda *et al.* 2025 [cont. updated]) and includes predominantly rupicolous species, highly adapted to xerophytic environments, such as CAM photosynthetic metabolism, thickened epidermis and hypodermis, adaxial and abaxial aquiferous parenchyma, and stomata covered by scales (Pita 1997, Santos-Silva *et al.* 2013). These species are frequently associated with rocky outcrops vegetation of the Espinhaço Mountain Range, extending through the states of Minas Gerais and Bahia, which hosts the *Campos Rupestres*, a vegetation type occurring on litholic or sandy, predominantly quartzitic soils, usually above 900 m elevation (Silveira *et al.* 2016).

The *Campos Rupestres* exhibit high plant diversity and remarkable rates of endemism: among the 4,928 angiosperm species reported for this ecosystem, 1,951 (39.6%) are endemic (BFG 2015). Although *Campos Rupestres* occupy only 0.78% of Brazil's territory they harbor about 16% of the country's vascular flora, being considered one of the most biodiverse ecosystems in the world (Silveira *et al.* 2016, BFG 2025 [cont. updated]). This *formation* constitutes an important center of endemism for Bromeliaceae: of the 1,417 known species, 199 (14%) occur in this ecosystem (Forzza *et al.* 2025 [cont. updated]), of which 39% are endemic (Oliveira 2017). In *Encholirium*, endemism reaches approximately 75% (Oliveira 2017). Although the flora of the *Campos Rupestres* has been studied for decades—mainly in the Serra do Cipó region and the Diamantina Plateau—significant knowledge gaps remain, as demonstrated by the continued discovery of new species in the region. The northern portion of the southern Espinhaço Mountain Range, where the new species was recorded, remains insufficiently documented floristically.

The restricted occurrence of the species, together with the pressures from mining activities and frequent fires in this rupicolous ecosystem, accentuates its risk of extinction and emphasizes the urgent need for conservation measures. Therefore, the present study aims to describe a new species of *Encholirium*, detailing its morphological characteristics and comparing it with morphologically related species—*E. viridicentrum* Leme & O.C.B. Ribeiro (*in* Leme *et al.* 2014: 86), *E. agavoides* Forzza & Zappi (2011: 282), *E. magalhaesii* L.B. Smith (1966: 152), and *E. irwinii* L.B. Smith (1970: 284)—as well as to discuss aspects of its conservation within the context of the flora of the Alto Jequitinhonha region. The geographic distribution of these species is illustrated in Figure 1.

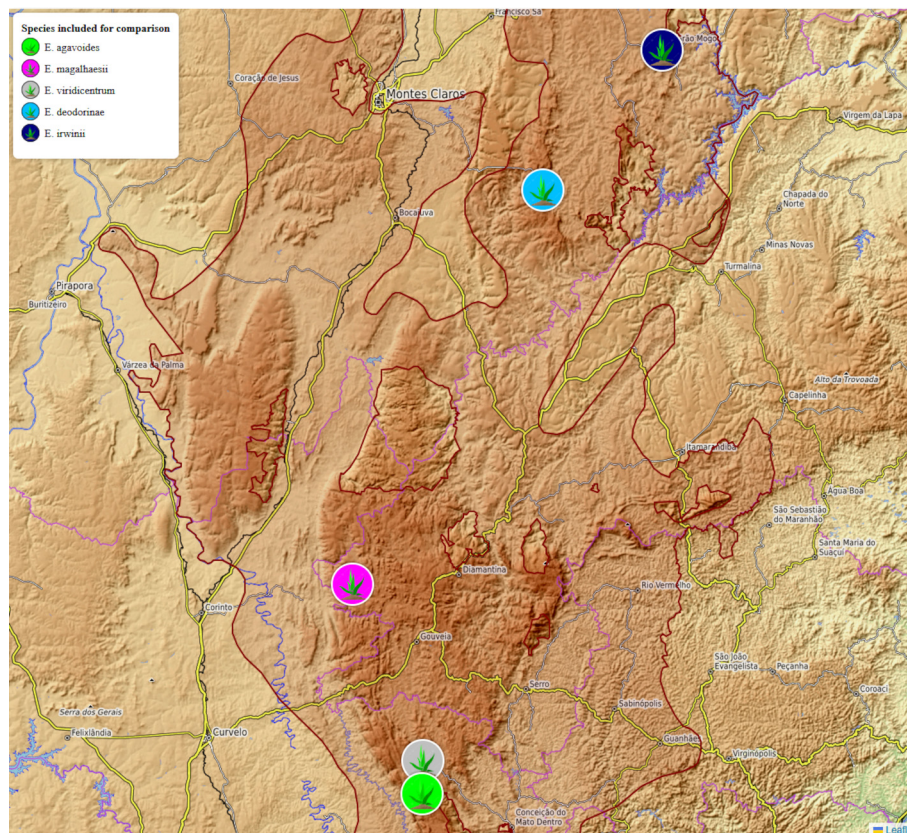


FIGURE 1. Geographic distribution of *Encholirium agavoides*, *E. viridicentrum*, *E. magalhaesii*, *E. deodorinae*, and *E. irwinii*. The red-shaded area indicates the Serra do Espinhaço, with the municipality of Montes Claros as a geographic reference.

Materials and methods

The new species of *Encholirium* was collected during field expeditions in the *Campos Rupestres*, approximately 8 km north of the city of Itacambira, Minas Gerais, Brazil. The plants were collected on quartzitic rocky outcrops with typically saxicolous and psammophilous vegetation, in two populations about 3 km apart, at elevations of 1,185 m and 1,270 m.

The discovery of the new species was made independently by both authors. Only within the context of this study was it recognized that both collections belonged to the same taxonomic entity. Tank examined a specimen in 2019, and in 2024 living specimens were collected and maintained in cultivation in Brasília, and one of these reached anthesis in May 2025, allowing a detailed examination of its floral morphology. Martins documented the species in the field, where living specimens were collected in 2024, one of which flowered under cultivation in May 2025. A return to the region was carried out during the flowering period, and two additional specimens, still in early stages of inflorescence development, were collected and cultivated until full anthesis, which occurred approximately one month later. The specimens were pressed, dried, and deposited in the herbaria CEN, HDJF, SP and BHZB.

Morphological descriptions were based on four fertile specimens observed from living cultivated material. Measurements were taken using millimeter scales, accounting for intraspecific variation. Floral structures were dissected and examined under a stereomicroscope to detail diagnostic characters. The model adopted for the descriptions followed Smith & Downs (1974), with adaptations according to Scharf & Gouda (2008).

Photographs of cultivated plants were taken to document their general morphology, as well as vegetative and reproductive structures. An illustrated plate was prepared from these photographs to highlight the most important diagnostic morphological features.

Morphological comparisons were conducted using peer-reviewed literature, including original descriptions and illustrations, as well as images from digital databases such as the *speciesLink network* (CRIA 2025 [cont. updated]), Flora e Funga do Brasil (BFG 2025 [cont. updated]), and Encyclopaedia of Bromeliads (Gouda *et al.* 2025 [cont. updated]), focusing on morphologically related species, mainly *E. agavoides*, *E. viridicentrum*, *E. magalhaesii*, and *E. irwinii*. The preliminary conservation status assessment of the new species was based on field observations and on the criteria of the IUCN (2012, 2024), considering the extent of occurrence, geographic distribution, number of mature individuals observed, and the degree of threat from anthropogenic disturbances, particularly recurrent fires.

For the preparation of Figure 1, the boundaries of Minas Gerais State were obtained from codigomunicipal.click_that_hood (ODbL); the background map was derived from OpenTopoMap based on OpenStreetMap data (ODbL); and locality data were obtained from the authors' own field collections and literature records.

Taxonomic treatment

Encholirium deodorinae S.E. Martins & K.-H. Tank, *sp. nov.* Figures 2A–M; 3A–C; and 4A–F.

Diagnosis:—*Encholirium deodorinae* differs from the morphologically similar species *E. viridicentrum* by its shorter fertile portion of the inflorescence (3.5–6.5 cm *vs.* 6.5–11 cm) and longer peduncle (18–47 cm *vs.* 14–16 cm); brown to stramineous floral bracts (*vs.* green to stramineous); bicolored sepals (green proximally and brown distally *vs.* uniformly green or with a light brown apical spot); and the stigma positioned below the anthers at anthesis (*vs.* above the anthers).

Type:—BRAZIL. Minas Gerais: Itacambira, margem direita da MG-308, *ca.* 8 km da cidade, campo rupestre, 1,185 m elev., 14 June 2024 (collected vegetative/in bud by K.-H. Tank; flowered in cultivation at Zenilton J.G. Miranda, Brasília, on 15 July 2025), *K.-H. Tank 2266* (holotype: CEN 1366824).

Description:—*Herb* saxicolous or psammophilous, 25–52 cm tall when flowering; *rosettes* symmetrical, 9–18 cm in diameter, *ca.* 5 cm high; rhizomes very short, forming dense clumps. *Leaves* 35–52 in number, densely arranged, slightly recurved to reflexed, succulent, rigid; *sheath* 1.1–1.5 (–3.5) × 1.5–2.5 cm, whitish, with a brown spot in the central portion, margin entire, glabrous or nearly so; *blade* 4–8 × 0.5–0.9 cm, narrowly triangular, attenuate toward the apex, grayish-green at the base, becoming gray-reddish to vinaceous toward the apex, the older ones gray-reddish to vinaceous, adaxial surface densely lepidote or lepidote only basally and glabrescent toward the apex, abaxial surface light gray, lepidote along the veins, margin spinose-serrate; *spines* 1.5–8 mm long, retrorse to patent. **Inflorescence**

terminal, erect; **peduncle** 18–47 cm long, green with minute vinaceous longitudinal stripes and spots to entirely vinaceous, glabrous; **peduncle bracts** 1.7–3.6 (–5.8) cm long, narrowly triangular, surpassing the internodes, erect to recurved, the lower ones foliaceous, with a brownish sheath sparsely lepidote, blade gray-green, lepidote, margin spinose-serrate; upper bracts with brown sheath, blade lanceolate, sparsely lepidote, margin serrulate, gradually reduced until becoming only the apex of the sheath, turning stramineous toward the apex; **fertile portion of the inflorescence** 3.5–6.5 × 3–4.7 cm, simple, flowers densely arranged, covering the rachis; **rachis** green with minute vinaceous stripes or entirely vinaceous, glabrous; **floral bracts** 0.7–2.2 × 0.2–0.8 cm, triangular to ovate, the lower ones surpassing the flowers, the upper ones equaling or shorter than the sepals, brown, becoming stramineous toward the apex, glabrous or with sparse villous indument of white dendritic trichomes, apex aristate, margin entire. **Flowers** 12–17.4 mm long (including stamens), subsessile; **pedicel** up to 2 mm long, green, glabrous; **sepals** 5–9 × 2.5–5 mm, elliptic-lanceolate to ovate, symmetric or asymmetric, green with brown apex, glabrous or with sparse villous indument of white dendritic trichomes, apex acute or rounded; **petals** 7–13 × 4–6 mm, lanceolate to ovate, symmetric, green or green with brown apex, glabrous, margin hyaline, apex acute to obtuse; **stamens** 9–17 mm long, exserted; **filaments** free, green; **anthers** ca. 3.8 mm long, sagittate, green, base bilobed, apex obtuse, dorsifixed near the base; **ovary** 3–5 mm long, sulcate, green; **style** exserted, 2–7 mm long, green; **stigma** conduplicate-spiral, light green, positioned at anthesis below the level of the anthers.

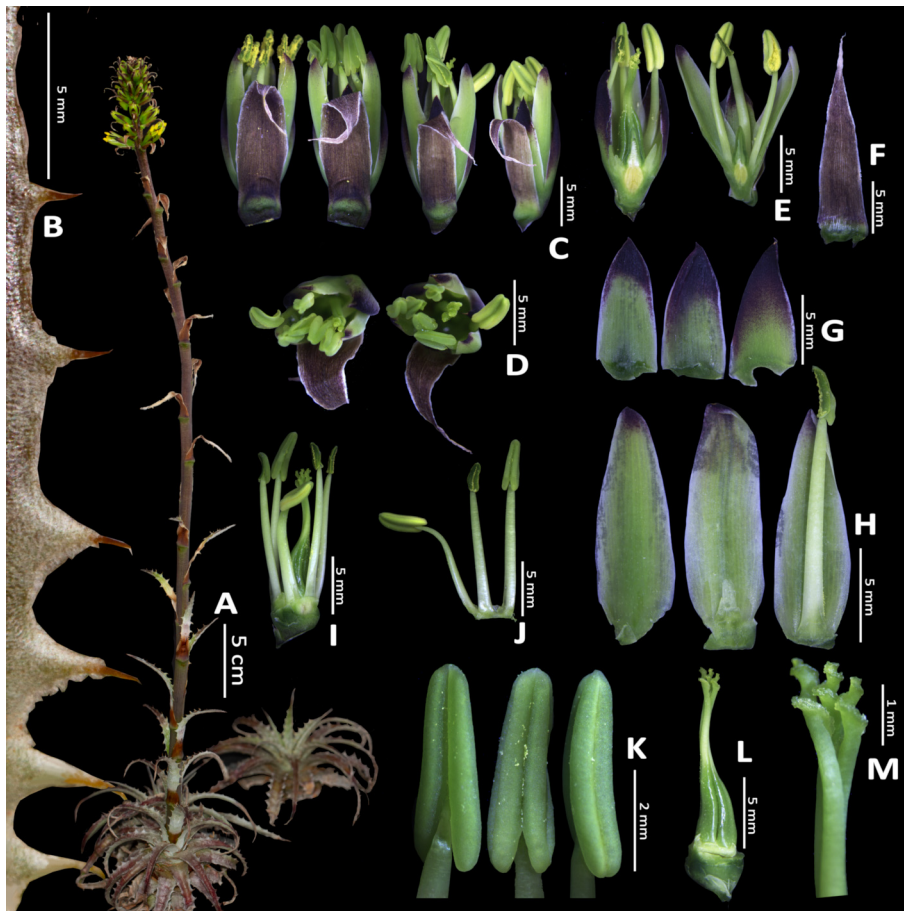


FIGURE 2. *Encholirium deodorinae* (Tank 2266) **A.** Habit. **B.** Proximal view of the leaf blade. **C.** Flowers (abaxial view) and floral bracts. **D.** Flowers (frontal view). **E.** Longitudinal section of the flower. **F.** Floral bract. **G.** Sepals. **H.** Petals and antepetalous stamen. **I.** Androecium and gynoecium. **J.** Stamens. **K.** Dorsal, ventral and lateral views of the anther (left to right). **L.** Pistil. **M.** Stigma. Photos Zenilton J.G. Miranda.

Paratypes:—BRAZIL. Minas Gerais: Itacambira, beira da estrada MG-308, em fendas de rocha ou terreno arenoso, campo rupestre, 1,277 m elev., 4 June 2025 (flowered in cultivation), *S.E. Martins, E.L.F. Menezes & V.L. Silva 1219* (HDJF 11726, BHZB); *ibidem*, 1,273 m elev., 4 July 2025 (flowered in cultivation), *S.E. Martins & V.L. Silva 1220* (SP).

Etymology:—The epithet ‘*deodorinae*’ refers to the fictional character Diadorim, from the classic Brazilian novel *Grande Sertão: Veredas* by Guimarães Rosa (first edition published in 1956)—a woman disguised as a man, a ‘*jagunço*’ (a backlands outlaw living in armed bands led by a local chief) and the secret love of Riobaldo, the

protagonist and narrator of the novel. Only after Diadorim's death does Riobaldo discover her true identity, and name: Maria Deodorina da Fé Bettancourt Marins. The connection with the plant lies in the fact that this species was found in the municipality of Itacambira, the same municipality where Maria Deodorina was baptized in the Church of Santo Antônio de Itacambira. By choosing this epithet, we pay tribute both to this literary figure and to the distinguished author, while also emphasizing the local origin of the species from Itacambira.

Distribution and habitat:—*Encholirium deodorinae* is known only from two nearby populations, *ca.* 3 km apart, both located in the Serra Resplandecente, Itacambira, Minas Gerais (Brazil), within the Espinhaço Mountain Range. It grows in *Campos Rupestres*, on quartzitic rocky outcrops or in rock crevices with sandy soil, under intense solar radiation, at elevations around 1,200 m. The area is situated near a watershed divide, on slopes facing the headwaters of the Itacambiruçu River. The species forms dense clumps, ranging from a few to more than 90 individuals, and occurs in association with typical xeromorphic vegetation, mainly species of Eriocaulaceae, Velloziaceae, Cyperaceae, and other Bromeliaceae (Fig. 3A).



FIGURE 3. A. General view of *Campos Rupestres* vegetation at the type locality. B, C. Habit, showing the variation in the intensity of the indument and color of the leaves. Photos A–B. Suzana E. Martins; C. Karl-H. Tank.

Conservation:—The species represents a critical case of micro-endemism, with a restricted distribution of approximately 8 km², known from only two localities, inhabiting rocky outcrop habitats above 1,100 m near the headwaters of the Itacambiruçu River, in the Alto Jequitinhonha region. Despite its ecological importance, this area is subject to recurrent environmental pressures, including uncontrolled seasonal anthropogenic fires, proximity to a state highway, expansion of pastures planted with exotic grasses, and, most notably, mineral exploitation—particularly quartzite and crystal extraction—which is highly destructive to the native vegetation. Despite being located within the Environmental Protection Area (APA) Serra Resplandecente, land-regularization processes and the effective implementation of management measures remain incomplete.

According to IUCN (2012) criteria, we propose a preliminary conservation status of Critically Endangered (CR: B2abiii), based on the extremely restricted distribution of the species, high degree of endemism, and the ongoing threats affecting its habitat.

Observations:—*Encholirium deodorinae* presents a unique combination of morphological features that support its delimitation as a distinct taxon within the genus *Encholirium*. It is characterized by short rhizomes; small and symmetrical rosettes forming dense clumps; recurved to reflexed, rigid leaves; an inflorescence with sessile, densely arranged flowers; a short fertile portion (3.5–6.5 cm long) relative to the peduncle (18–47 cm long), in a ratio of approximately 1:4–9; brown floral bracts, glabrous or sparsely villous with dendritic trichomes—an unusual feature in the genus; bicolored sepals (green basally and brown apically), sometimes bearing trichomes; and flowers with exerted stamens and style, with the stigma positioned below the anthers.

The density of leaf trichomes varies considerably between populations. In one locality, plants were densely lepidote, giving a silvery appearance to the clumps, whereas in another population, trichomes were restricted to the leaf base, with the remaining blade green and the apex reddish (Fig. 3B–C).

Encholirium deodorinae shows morphological affinity with *E. agavoides*, *E. viridicentrum*, *E. magalhaesii*, and *E. irwinii*, and a comparison with these species is presented in Table 1. These species share small to medium-sized rosettes, clustered growth in clumps or mounds, exerted stamens and style, and a racemose inflorescence. All of these species are related to *E. subsecundum* (Baker 1889: 135) Mez (1896: 540), which is the most widespread species in the Espinhaço Mountain Range.

TABLE 1. Comparative morphological characters of *Encholirium deodorinae*, *E. agavoides*, *E. viridicentrum*, *E. magalhaesii*, and *E. irwinii*.

Species / Character	<i>E. deodorinae</i>	<i>E. agavoides</i>	<i>E. viridicentrum</i>	<i>E. magalhaesii</i>	<i>E. irwinii</i>
Plant height when flowering	25–52 cm	(15–) 30–44 cm	25–30 cm	45–100 cm	80–100 cm
Growth habit	forming dense clumps	growing close together to form dense mats	isolated or more often densely aggregated groups	isolated or forming mounds	forming mounds
Rosette diameter, and symmetry	9–18 cm, symmetrical	6–10 cm, symmetrical	12–15 cm, symmetrical	8–25 cm, symmetrical	20–30 cm, asymmetrical
Leaves (orientation)	slightly recurved to reflexed	suberect to patent	spreading recurved	erect-patent	secund, rarely erect-patent
Leaf blade (length × width)	4–8 × 0.5–0.9 cm	3.2–3.7 × 2–3 cm	5.5–7 × 0.4–0.8 cm	8–23 × 0.5–0.9 cm	22–28 (35) × 0.7–1.1 cm
Leaf blade (shape)	narrowly triangular	triangular	narrowly lanceolate	narrowly triangular to linear	narrowly triangular to linear
Peduncle length	18–47 cm	12–22 cm	14–16 cm	28–70 cm	43–72 (90) cm
Peduncle bracts	surpassing the internodes	surpassing the internodes	surpassing the internodes	shorter than the internodes	surpassing the internodes
Fertile portion of inflorescence (length)	3.5–6.5 cm	6–18 cm	6.5–11 cm	(10) 23–40 cm	29–40 cm
Flowers in the inflorescence	densely arranged	densely arranged	densely arranged	laxly arranged	laxly arranged
Floral bracts (color)	brown, becoming stramineous toward the apex	green at base and stramineous at apex or completely stramineous	green, soon stramineous toward the apex to completely stramineous	green at the base, becoming strawlike at the apex	strawlike
Floral bracts (length relative to flowers)	the lower ones surpassing the flowers, the upper ones equaling or shorter than the sepals	surpassing the flowers	equaling the flowers (including the stamens)	not surpassing the flowers	not surpassing the flowers
Flowers	sessile	pedicelate	sessile	pedicelate	pedicelate
Pedicel (length)	up to 2 mm	2–3 mm	2 mm, inconspicuous	5–8 mm	5–9 mm
Sepals (coloration, indumentum)	green with brown apex	green	green or with light brown spot at apex	green or sometimes with apex slightly chestnut brown	green or with purple spot at apex
Petals (coloration)	green or green with brown apex	green	green	green	green
Position of stigma at anthesis relative to anthers	below the level of the anthers	below the level of the anthers	above the level of the anthers	at the same level as or above the anthers	below the level of the anthers

Although *E. viridicentrum* and *E. agavoides* occur in Serra do Cipó, at a considerable distance from the locality of *E. deodorinae* (ca. 220 km) (Figure 1), they share several morphological characteristics with the new species, including small plant size (rosette diameter and height when flowering), symmetrical rosettes, peduncle bracts surpassing the internodes, and densely arranged flowers on the inflorescence. *Encholirium viridicentrum* additionally shares similar leaf dimensions and shape, as well as sessile flowers. In its natural habitat, some individuals have been observed at anthesis bearing flowers with green sepals marked by a light brown apical spot, a feature also shared with the new species. *Encholirium agavoides* shares a similar peduncle length, floral bracts surpassing the flowers, and the stigma positioned below the anthers.

The new species differs from both *taxa* by its shorter fertile portion of the inflorescence, brown to stramineous floral bracts (*vs.* green to stramineous), and bicolored sepals (green proximally and brown distally *vs.* uniformly green). It further differs from *E. agavoides* by its longer and narrowly triangular leaves (*vs.* triangular) and sessile flowers (*vs.* pedicellate); and from *E. viridicentrum* by its longer peduncle, floral bracts surpassing the flowers (*vs.* equaling the flowers) and stigma positioned below the anthers (*vs.* above the anthers).

The morphologically similar *Encholirium* species that occur geographically closest to the locality of *E. deodorinae* are *E. irwinii*, endemic to the Grão Mogol region (ca. 50 km away), and *E. magalhaesii*, which inhabits the Diamantina Plateau (ca. 150 km away) (Figure 1). These species mainly share similar sepal coloration (green or sometimes bicolored) and the stigma positioned below the anthers. *Encholirium magalhaesii* resembles *E. deodorinae* by the symmetrical rosette of similar diameter, whereas *E. irwinii* by the bracts of the peduncle surpassing the internodes.

Encholirium deodorinae differs from both species by its smaller size (shorter leaves, peduncle, and fertile portion of the inflorescence), densely arranged flowers on the inflorescence (*vs.* laxly arranged), floral bracts surpassing the flowers (*vs.* not surpassing the flowers), sessile flowers (*vs.* pedicellate), and brown to stramineous floral bracts (*vs.* green to stramineous). It further differs from *E. magalhaesii* by peduncle bracts surpassing the internodes (*vs.* shorter than the internodes); and from *E. irwinii* by its slightly recurved to reflexed leaves and symmetrical rosette (*vs.* second leaves and asymmetrical rosette), smaller rosette diameter and shorter peduncle.

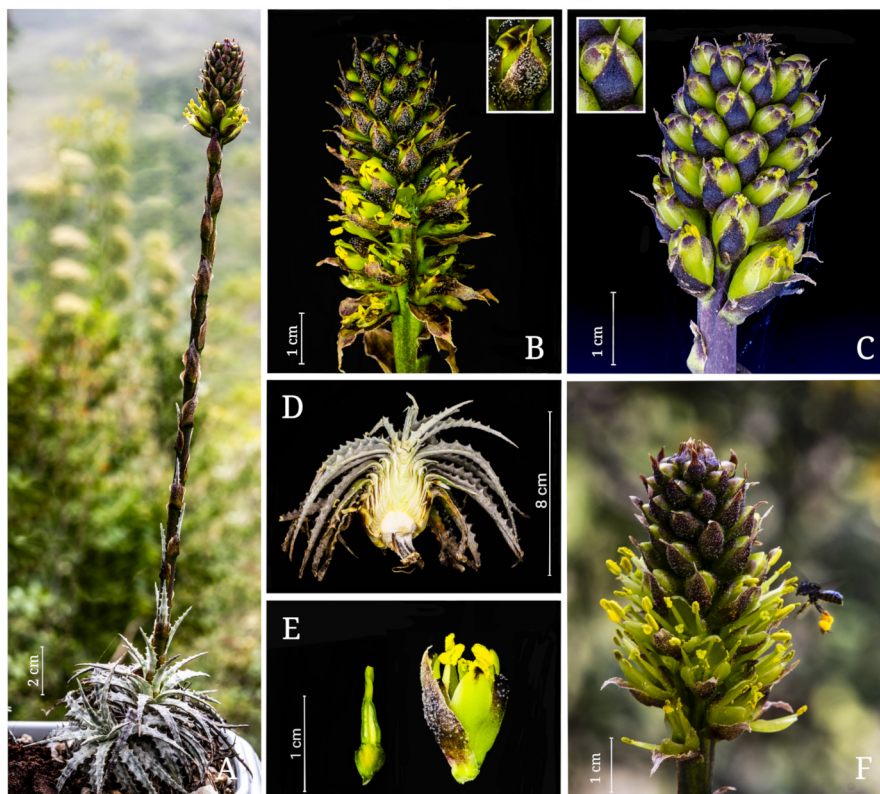


FIGURE 4. *Encholirium deodorinae*. **A.** Habit of flowering specimens in cultivation. **B.** Inflorescence and details of the floral bracts and sepals sparsely villous with dendritic trichomes. **C.** Inflorescence, stigmas exposed before anthesis and details of the floral bracts and sepals without trichomes. **D.** Median longitudinal section of the rosette. **E.** Longitudinal section of the pistil, showing the nectary and the ovary with ovules (left), and flower with indument on the floral bract and sepal (right). **F.** Bee (*Trigona spinipes*) pillaging the abundant pollen. Photos based on Martins *et al.* 1219 (**A, B, D–F**) and Martins & Silva 1220 (**C**). Photos Suzana E. Martins.

Regarding reproductive aspects, abundant nectar was observed inside the flowers, suggesting, along with other floral traits, adaptations to specialized pollinators such as hummingbirds and bats (Queiroz *et al.* 2016). However, under cultivation, only visits by *Trigona spinipes* (Apidae, Meliponinae) were observed, collecting large amounts of pollen (Fig. 4F); this bee is known to pillage and damage flowers, not acting effectively as a pollinator (Jorge *et al.* 2021).

In one inflorescence, the stigma was exposed while the flower was still closed (Fig. 4C) suggesting protogyny and herkogamy as mechanisms to prevent self-pollination—phenomena already reported for several Bromeliaceae species (Martinelli 1994).

The discovery of *Encholirium deodorinae* reinforces the importance of continuous botanical studies in environmentally complex regions such as the *Campos Rupestres* of the Espinhaço Mountain Range, which still harbor taxa unknown to science. This description is expected to contribute to the conservation and supports its inclusion in protection strategies for Brazil's threatened flora.

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