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Tillandsia bernalensis (Tillandsioideae; Bromeliaceae), a new species from the state of Querétaro, Mexico

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Abstract

Tillandsia bernalensis, a new species from the state of Querétaro, Mexico, is described and illustrated. The proposed species is compared to *T. parryi*, *T. suesilliae* and *T. tonalaensis*, taxa with some similarities. Images and a distribution map of the four species are included.

Keywords: Endemism, Monocots, Peña de Bernal, Poales, saxicolous

Resumen

Se describe e ilustra *Tillandsia bernalensis*, una nueva especie del estado de Querétaro, México. La especie propuesta se compara con *T. parryi*, *T. suesilliae* y *T. tonalaensis*, taxa con algunas similitudes. Se incluyen imágenes y un mapa de distribución de las cuatro especies.

Palabras clave: Endemismo, Monocotiledóneas, Peña de Bernal, Poales, rupícola

Introduction

Tillandsia Linnaeus (1753: 286) is distributed from southern United States to Northern Argentina and is classified in the subfamily Tillandsioideae (Givnish *et al.* 2007; Smith & Downs 1977). According to Gouda *et al.* (2022, continuously updated), the genus includes 771 species and 150 infraspecific taxa; in Mexico 239 species are present, 181 (75.7 %) endemic to the country (Espejo-Serna 2012; Espejo-Serna & López-Ferrari 2018), including those described in the last two years (Flores-Cruz *et al.* 2020; Gouda 2020; Hernández-Cárdenas *et al.* 2020). The state of Oaxaca has the highest number of species (112) and endemic taxa (37) (Espejo-Serna *et al.* 2007a; Espejo-Serna & López-Ferrari 2018), followed by Chiapas (77) (Espejo-Serna *et al.* 2017b; Espejo-Serna & López-Ferrari 2018) and Guerrero (51) (Pulido-Esparza *et al.* 2004; Espejo-Serna & López-Ferrari 2018).

As a result of botanical explorations for the project Bromeliaceae of Mexico, we collected individuals of a *Tillandsia* species at Peña de Bernal, the world third largest volcanic monolith (Inselberg) located in the municipality of Ezequiel Montes, in the state of Querétaro. Initially, we thought that this plant could correspond to *T. parryi* Baker (1887: 277). However, a careful and detailed examination of the living material, herbarium specimens, type material, and the corresponding protologues, allowed us to determine that this plant should be considered as a new species here proposed.

Material & methods

The gathering of the specimens was carried out in accordance with Aguirre León (1986). The material collected was examined and measured, and descriptions were prepared. Measurements were taken from dried material. The morphological terms used in the descriptions were based on Brown & Gilmartin (1984), Radford *et al.* (1974), and Scharf & Gouda (2008). The type material was deposited at UAMIZ (acronyms according to Thiers 2022, continuously updated). We revised herbarium material of the genus *Tillandsia* deposited at ENCB, IEB, MEXU, QMEX and UAMIZ (Appendix 1). To ensure the status of the new species proposed, we reviewed protologues, herbarium specimens and type material of *T. parryi*, *T. suesilliae* Espejo-Serna *et al.* (2007b: 86), and *T. tonalaensis* Ehlers (2003: 17), taxa with which *T. bernalensis* *sp. nov.* shares morphological similarities. The geographical distribution of *T. parryi* was taken from Espejo-Serna *et al.* (2017a).

Taxonomy

Tillandsia bernalensis Hern.-Cárdenas, Espejo, López-Ferr. & L. Hern., *sp. nov.* (Figs. 1, 2, 3A, A1. Table 1)

The new species is similar to *Tillandsia parryi* but differs in the width of the leaf blades ($6\text{--}7 \times$ vs. $3.5\text{--}3.7$ cm in *Tillandsia parryi*), in the rachis exposure in mature spikes (not exposed vs. exposed), in the color of the floral bracts (bicolored, vinaceous at the apex, green at the base vs. unicolored, red to orange), in the floral bracts form and keel (obovate to oblong, ecarinate vs. elliptic to narrowly elliptic, carinate at the apex), and in the width of the sepals ($1.1\text{--}1.3$ vs. $0.75\text{--}1$ cm).

TYPE:—MÉXICO. Querétaro: municipio de Ezequiel Montes. Acantilados de la Peña de Bernal ($20^{\circ}44'53.88''\text{N}$, $99^{\circ}56'43.10''\text{W}$), 2,265 m, March 3, 2022, *R. Hernández-Cárdenas 2607* (holotype UAMIZ!, isotype MEXU!).

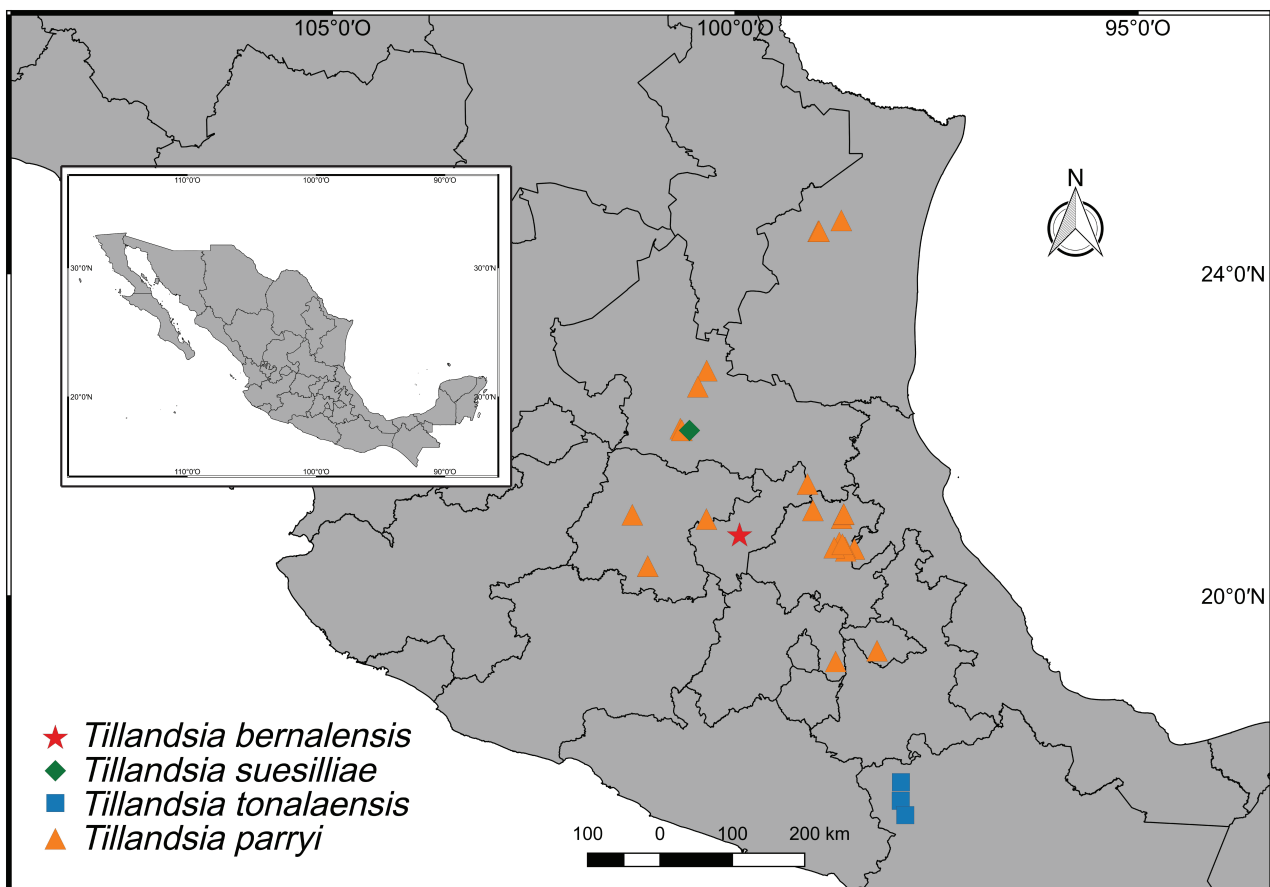


FIGURE 1. Distribution map of *Tillandsia bernalensis* Hern.-Cárdenas, Espejo, López-Ferr. & L. Hern., *T. parryi* Baker, *T. suesilliae* Espejo, López-Ferr. & W. Till, and *T. tonalaensis* Ehlers.

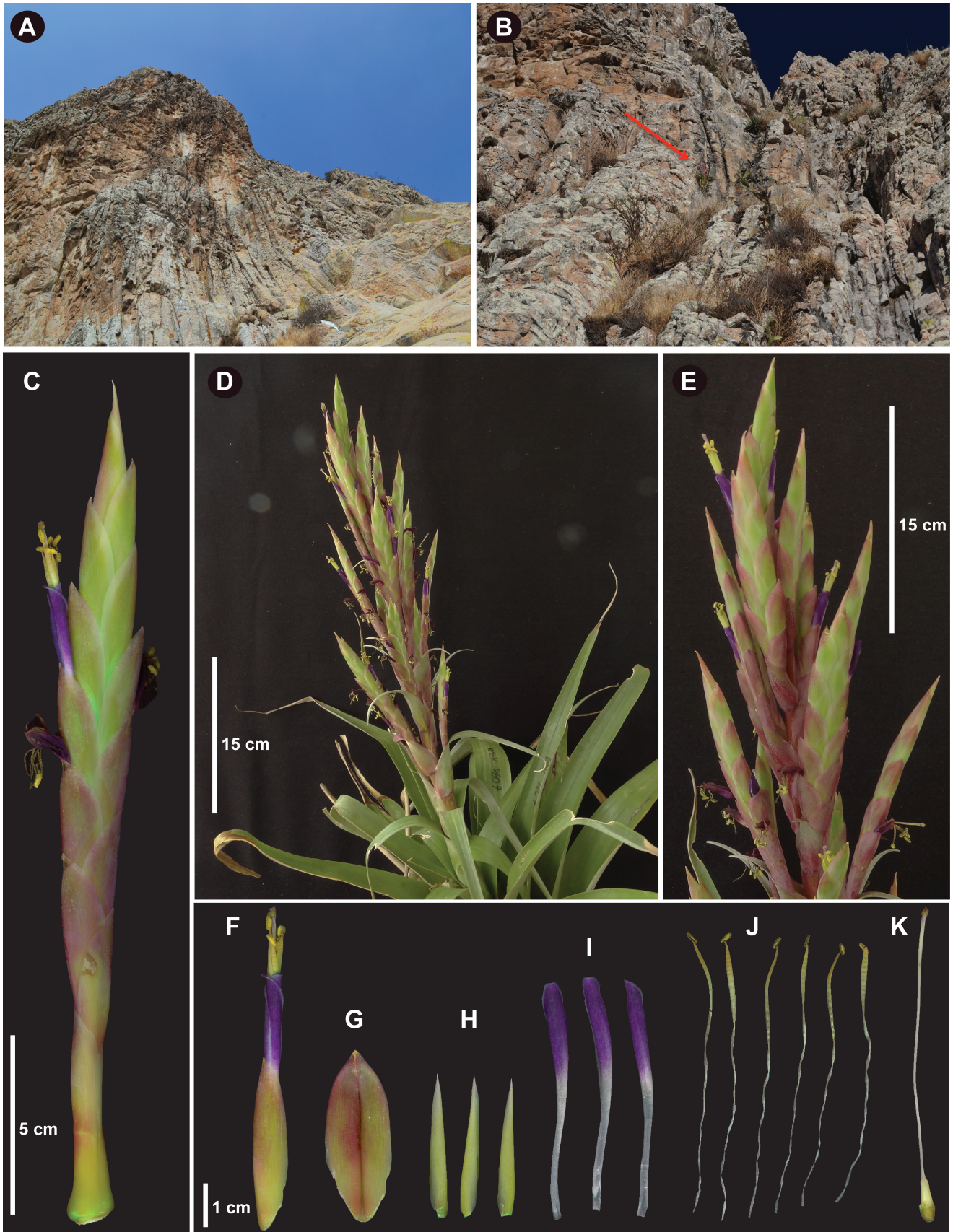


FIGURE 2. *Tillandsia bernalensis* Hern.-Cárdenas, Espejo, López-Ferr. & L. Hern. **A–B.** Habitat at type locality. **C.** Detail of a spike. **D.** Plant in bloom. **E.** Detail of the inflorescences. **F.** Flower. **G.** Floral bract. **H.** Sepals. **I.** Petals. **J.** Stamens. **K.** Pistil. (Photographs A–B by R. Hernández-Cárdenas; C–K by A. Espejo-Serna).

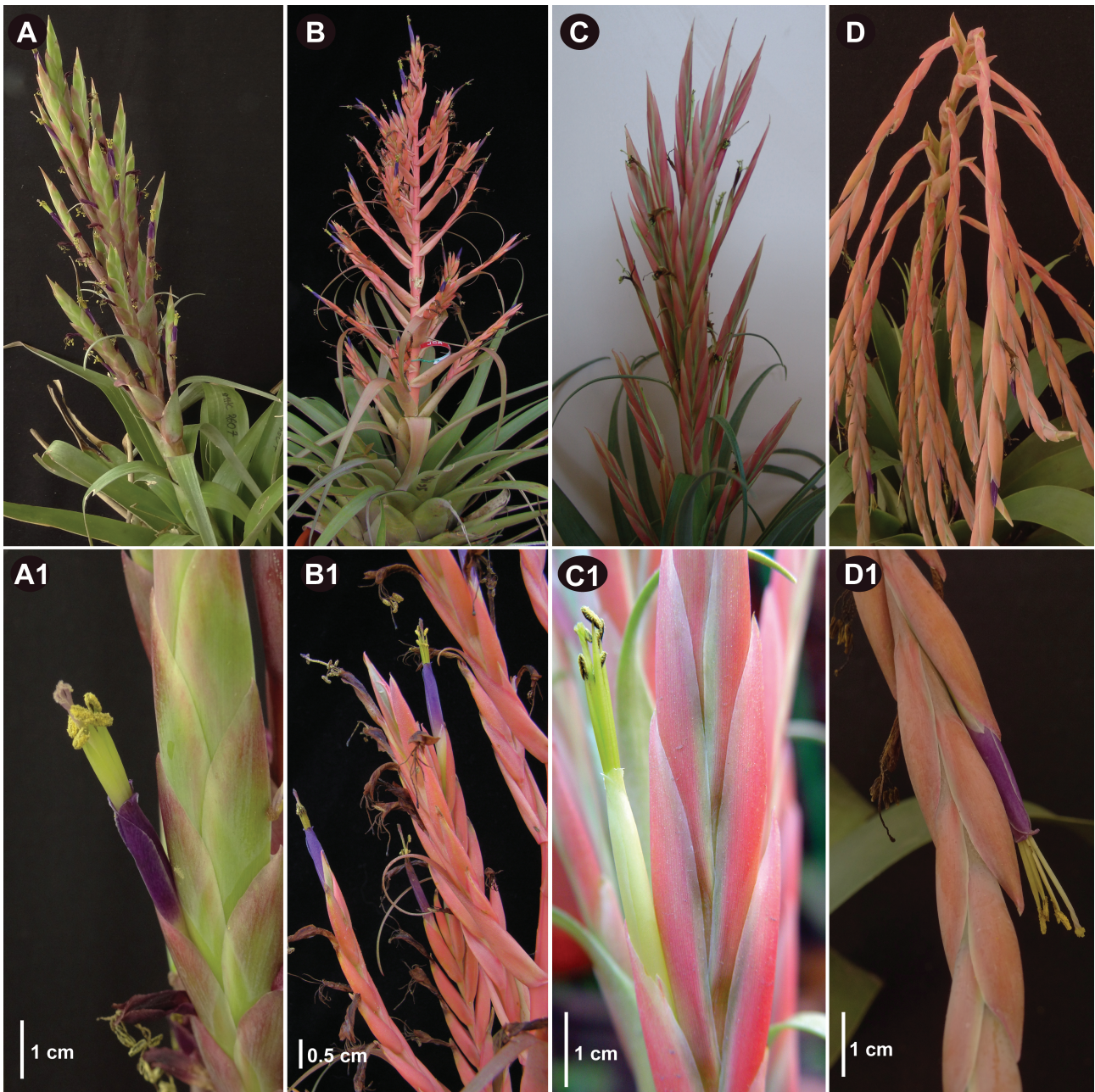


FIGURE 3. Comparison of plants and spikes of: *Tillandsia bernalensis* Hern.-Cárdenas, Espejo, López-Ferr. & L. Hern. (**A, A1**), *T. parryi* Baker (**B, B1**), *T. suesilliae* Espejo, López-Ferr. & W. Till (**C, C1**), and *T. tonalaensis* Ehlers (**D, D1**). (Photographs by A. Espejo-Serna).

Plants saxicolous, in flower ca. 87 cm tall; *rosettes* acaulescent, 55–50 cm high, 60–75 cm in diameter, solitary or forming clumps of two to four rosettes. **Leaves** more than 20; *sheath* pale brown on both surfaces, oblong to ovate, 15–18 cm long, 6–11 cm wide, glabrous near the base and lepidote distally on both surfaces; *blade* pale green, narrowly triangular, 45–60 cm long, 6–7 cm wide, long attenuate, lepidote on both surfaces. **Inflorescence** terminal, erect, once branched of 16–20 sub-erect to ascending spikes; *peduncle* pale brown, terete, 4–8 cm long, 0.8–1.5 cm in diameter, glabrous, fully covered by the sheaths of the peduncle bracts, internodes 2–3 cm; *peduncle bracts* pale green, foliaceous, gradually decreasing in size distally, exceeding the internodes, lepidote on both surfaces, imbricate; *axis* red, pale brown when dry, terete, 25–28 cm long, 0.5–1 cm in diameter, glabrous, internodes 1.5–3 cm long; *primary bracts* vinaceous to reddish-green, pale brown to gray when dry, the sheath ovate, 3–5 cm long, 1.5–2.5 cm wide, the blade triangular to linear, gradually decreasing in size distally, the lower ones much exceeding the spike by the blade, the distal ones shorter than the spike, glabrous near the base and lepidote distally on both surfaces. **Spikes** flattened to subterete, distichously 5–12-flowered, 13–18 cm long, 1.4–1.8 cm wide; *stipes* terete, 4.5–5.5 cm long, 0.3–0.4 cm

in diameter, glabrous, bracteate; *stipe bracts* 2–3, elliptic, 2.5–3 cm long, 1–1.2 cm wide, glabrous, nerved; *rachis* greenish red, pale brown when dry, terete, 1–2 mm in diameter, covered by the floral bracts, internodes 7–8 mm long; *floral bracts* green at the base, dirty vinaceous toward the apex and margins when fresh, obovate to oblong, 3–3.5 cm long, 1.5–1.7 cm wide, over four times longer than the internodes, exceeding the sepals, imbricate, acute, glabrous on both surfaces, nerved, ecarinate. **Flowers** appressed to the rachis, actinomorphic; corolla tubular, more slender at the base; *receptacle* 1–2 mm long; *sepals* free, green, narrowly elliptic, 2.8–3.0 cm long, 1.1–1.3 cm wide, acute, hyaline at the margins, the adaxial ones slightly carinate; *petals* free, white toward the base, violet in upper (exposed) part, narrowly oblanceolate to spatulate, 5–5.2 cm long, 0.8–0.95 cm wide, rounded at the apex, the apical margins slightly recurved, corolla apex constraining the filaments; *stamens* subequal, exserted; *filament* free, twisted, white toward the base, green distally, flat at the base, dilated, fleshy and subterete in the distal part, filiform, 5.5–5.8 cm long, 0.6–1.5 mm wide; *anther* black, narrowly oblong to narrowly elliptic, 3–3.3 mm long, 1.0–1.2 mm wide, sub-basifixed; *ovary* green, narrowly conic to narrowly ovoid, 9–10 mm long, 4–6 mm in diameter; *style* green, filiform, 5.5–6 cm long, 1–1.3 mm wide, equaling to exceeding the stamens; *stilar branches* dirty light-purple, conduplicate-spiral, ca. 3 mm long. **Fruits** unknown.

TABLE 1. Comparative characters of *Tillandsia bernalensis* Hern.-Cárdenas, Espejo, López-Ferr. & L. Hern., *T. parryi* Baker, *T. suesilliae* Espejo, López-Ferr. & W. Till, and *T. tonalaensis* Ehlers.

Characters	<i>T. bernalensis</i>	<i>T. parryi</i>	<i>T. suesilliae</i>	<i>T. tonalaensis</i>
Habit	saxicolous	epiphytic or saxicolous	saxicolous	saxicolous
Blades width	6–7 cm	3.5–3.7 cm	3.5–4.2 cm	6–7 cm
Rachis	covered by the floral bracts at anthesis and afterward	visible at anthesis and afterward	covered by the floral bracts at anthesis and afterward	covered by the floral bracts at anthesis, visible afterward
Floral bract	ecarinate	carinate at the apex	carinate at the apex	slightly to strongly carinate
Floral bract color	bicolored, vinaceous at the apex, green at the base	unicolored, red to orange	unicolored, rose to green	bicolored, red or greenish-red and hyaline at the margins
Floral bract indument	glabrous on both surfaces	lepidote to glabrescent abaxially	lepidote abaxially	glabrous abaxially
Floral bract form	obovate to oblong	elliptic to narrowly elliptic	narrowly elliptic	ovate to lanceolate
Floral bract size	3–3.5 × 1.5–1.7 cm	2.7–3.6 × 1.2–1.6 cm	3.9–5 × 1.3–1.8 cm	3–4 × 1.3–1.8 cm
Sepal color	green	green	green	apical part yellow, green toward base
Sepal size	2.8–3 × 1–1.2 cm	2.3–3 × 0.75–1 cm	3.4–3.5 × 0.9–1 cm	3–3.5 × 0.8–1 cm
Petal color	violet	violet	green	dark violet
Petal size	5–5.2 × 0.8–0.95 cm	4.6–5.2 × 0.65–0.7 cm	5.2–6.1 × 0.88–1 cm	4.2–4.8 × 6–7 cm
Style length	5.5–6 cm	5.5–6 cm	6.3–6.5 cm	4.3–5.1 cm

Distribution and habitat:—*Tillandsia bernalensis* is only known from the type collection at the Peña de Bernal monolith, in the municipality of Ezequiel Montes, in the state of Querétaro (Fig. 1) that is part of the biogeographic province of the Chihuahuan desert (according to Morrone *et al.* 2017). The Peña de Bernal is a dacite Mesozoic monolith with a porphyritic structure composed mainly by plagioclase and hornblende crystals, and is isolated from the rest of geological formations, promoting the presence of endemic plant species (Aguirre-Díaz *et al.* 2013). The new

species grows saxicolous on vertical rock walls where xerophilous scrub (according to Rzedowski 1978) with species of *Agave*, *Hechtia*, Fabaceae, and *Opuntia* predominates. *Tillandsia bernalensis* grows at elevations between 2,250 and 2,290 m a.s.l. and blooms from March to April.

Etymology:—Specific epithet refers to the porphyritic monolith Peña de Bernal, on whose cliffs the new species grows.

Observations:—*Tillandsia bernalensis* also has some similarities with *T. suesilliae* and *T. tonalaensis*. However, *T. bernalensis* differs from *T. suesilliae* in the width of the spikes (1.3–1.8 vs. 1.7–2.3 cm), in the length of the floral bracts (3–3.5 vs. 3.9–5 cm), in the size of the sepals (2.8–3 × 1–1.2 vs. 3.4–3.5 × 0.9–1 cm), and in the color of the petals (violet vs. green), amongst other differences (see Table 1). *Tillandsia bernalensis* can also be confused with *T. tonalaensis* but differs from it in the shape of the floral bracts (obovate to oblong vs. ovate to lanceolate), in the size of the sepals (2.8–3 × 1–1.2 vs. 3–3.5 × 0.8–1), and in its geographical distribution (Guanajuato vs. Oaxaca), see also Table 1 and Figure 3.

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APPENDIX 1. Examined specimens

Tillandsia parryi Baker. ESTADO DE MÉXICO: *J. Rzedowski* 32714 (ENCB). GUANAJUATO: *F. Guevara* 5959 (MEXU); *J. Gutiérrez & E. Solano* 128 (IEB). HIDALGO: *J. Ceja et al.* 1298 (UAMIZ); *J. Ceja et al.* 1961 (UAMIZ); *J. Ceja et al.* 1300 (UAMIZ); *L. González* 342 (ENCB); *A. R. López-Ferrari et al.* 3282 (UAMIZ); *A. R. López-Ferrari et al.* 3285 (UAMIZ); *J. López-García* 411 (MEXU, QMEX, UAMIZ); *Matuda* 38659 (MEXU); *J. Rzedowski* 32687 (ENCB); *J. Uiley & K. Burt-Utley* 7325 (MEXU). NUEVO LEÓN: *A. Contreras s.n.* (MEXU); *C. Granados et al.* 343 (MEXU); *C. H. Müller* 890 (MEXU); *J.A. Villareal & I. Ramírez* 9280 (MEXU). QUERÉTARO: *E. Carranza* 2976 (IEB); *S. Zamudio* 5951 (IEB, UAMIZ); *S. Zamudio* 9108 (IEB, MEXU, QMEX, UAMIZ); *S. Zamudio & E. Carranza* 10233 (IEB, UAMIZ); *S. Zamudio & E. Pérez* 9918 (IEB). SAN LUIS POTOSÍ: *H. Hernández* 3273 (MEXU, UAMIZ); *Hernández Macías et al.* 3157 (MEXU); *A. Rivera* 29 (ENCB). TAMAULIPAS: *G. B. Hinton et al.* 25188 (IEB); *M. Martínez* 4215 (QMEX); *M. Martínez & J. Martínez* 2042, 2046 (MEXU); *M. Martínez et al.* 345 (MEXU, MO); *S. Zamudio* 11891 (UAMIZ).

Tillandsia suesilliae Espejo, López-Ferr. & W. Till. SAN LUIS POTOSÍ: *J. Ceja et al.* 1745 (UAMIZ).

Tillandsia tonalaensis Ehlers. OAXACA: *A. Espejo et al.* 7668 (UAMIZ); *R. Hernández-Cárdenas* 2345 (UAMIZ), 2385 (UAMIZ).