


New combinations and taxonomic notes in Cereinae (Cactoideae, Cactaceae) of Brazil

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Two new combinations are proposed for two names of Brazilian cacti in *Xiquexique* Lavor, Calvente & Versieux (in Lavor *et al.* 2020: 63) and *Cereus* Miller (1754: unpaginated [308]) based on observations of living and herbarium materials, analysis of pertinent literature, and insights from molecular studies recently published. *Xiquexique braunii* (Esteves) M.Köhler *comb. nov.* and *Cereus alexbragae* (P.J.Braun & Esteves) M.Köhler *comb. nov.* are proposed for the ‘xique-xique-da-pedra-preta’ and the ‘mandacaru-anão-dourado-do-cerrado’, respectively, with notes for the recognition of their status as species (see the below taxonomic treatment). The ‘splitter’ approach here followed intends to incorporate the morphological, ecological, and genetic diversity of cacti into the current taxonomic framework of cactus and the ongoing (present) process of speciation and diversification of the group (see e.g., Köhler *et al.* 2021).

Xiquexique is a replacement name for *Pilosocereus* subg. *Gounellea* Zappi (1994: 36), which has been shown as a lineage separated from *Pilosocereus* Byles & G.D.Rowley (1957: 66) by molecular and morphological characters (Lavor *et al.* 2020). Currently, *Xiquexique* includes three species, i.e. *X. frewenii* (Zappi & N.P.Taylor 2011: 132) Lavor & Calvente (in Lavor *et al.* 2020: 64), *X. tuberculatus* (Werdermann 1933: 101) Lavor & Calvente (in Lavor *et al.* 2020: 64), and *X. gounellei* (F.A.C.Weber ex K.Schum. 1899: 188) Lavor & Calvente (in Lavor *et al.* 2020: 63–64). Of these, *X. gounellei* is the most widespread species across the northeast region of Brazil, being a typical element of the Caatinga ecosystem (see e.g., Taylor & Zappi 2004), and traditionally includes two subspecies (Zappi 1994), i.e. subsp. *gounellei* and subsp. *zehntneri* (Britton & Rose 1920: 35) Lavor & Calvente. *Xiquexique gounellei* subsp. *gounellei* is broadly widespread occurring in several edaphic conditions (sandy and argillaceous soils, or gneissic and granitic rocky outcrops). The name *X. gounellei* subsp. *zehntneri* has been applied to a taxon growing on minor patches of limestones (Bambu formation, “pedra-preta”) distributed especially through Caatinga and Cerrado (Zappi 1994, Taylor & Zappi 2004). However, studies of the type specimen and type locality have shown that *X. gounellei* subsp. *zehntneri* corresponds to another taxon that is not the one occurring on the limestones, currently under study (N.P.Taylor, pers. comm.). Consequently, a previously synonymized name, *Pilosocereus braunii* Esteves (in Braun & Esteves-Pereira 1987: 132), should be regarded as the valid, correct, and accepted name for the taxon previously referred to *X. gounellei* subsp. *zehntneri*. In the companion of recent molecular studies that sampled the limestone species, ecological and morphological data, a new combination is proposed for *P. braunii* on the rank of species in *Xiquexique* (see below).

Estevesia P.J.Braun (in Braun & Esteves-Pereira 2009: 64) is a monotypic genus comprising only *E. alex-bragae* P.J.Braun & Esteves (2009: 64–65) which has been recently sampled in molecular studies (Romeiro-Brito *et al.* 2023b, Taylor *et al.* 2023). Both studies have placed *E. alex-bragae* nested within *Cereus* and closely related to *C. mirabella* N.P.Taylor (in Hunt & Taylor 1991: 85) and *C. albicaulis* (Britton & Rose 1920: 125) Luetzelburg (1923: 111). However, Taylor *et al.* (2023) regarded *E. alex-bragae* as a heterotypic synonym of *C. mirabella*, making the latter paraphyletic, as they do not synonymize *C. albicaulis*—which I agree as a valid species. In the companion of morphological data, a new combination is proposed for *E. alex-bragae* in *Cereus* (see below), with notes on its status at species level.

Xiquexique braunii (Esteves) M.Köhler, *comb. nov.* ≡ *Pilosocereus braunii* Esteves (1987: 132).

Type:—BRAZIL. ““Brasília”, in partem occidentem Bahia state [west of Rio São Francisco], 400–550 m a.s.l., June 1979”, Braun 70 (holotype consisting of a dry specimen, ZSS20582!, and a spirit accession of flower and fruits, ZSS26756!; isotypes K000101837!; B100745434!).

Notes:—*Pilosocereus braunii* was first described in Braun & Esteves-Pereira (1987), and later illustrated and commented with emended description in Esteves-Pereira (1989) and Braun & Esteves-Pereira (1992a,b). The authors emphasized the distinction of *P. braunii* from sympatric and putative closely related species, and regarded *Cephalocereus zehntneri*

Britton & Rose (1920: 35–36) (basionym of *X. gounellei* subsp. *zehntneri*) as a synonym of *X. gounellei*. However, later, Zappi (1994) reinterpreted *C. zehntneri* and claimed that it included *P. braunii* in its most extreme form, accompanying the interpretation of Ritter (1979), which had treated *C. zehntneri* as the one occurring on limestones, but under *Pilosocereus*. Reviewing the type material of *C. zehntneri* (lectotype designated in Zappi 1994 on the specimen US00115547!; isolectotype NY00120571!), several features that do not fit with the taxon that grows on limestone outcrops are noted: thin stems (dried ca. 2–3 cm diam.) with 5–6 ribs, large areoles (ca. 1 cm diam.) distantly ca. 1 cm or more from each other in rib-line, and not occurring in limestones—besides the type locality being absent of limestone outcrops. Otherwise, *P. braunii* comprises well the taxon from the limestones currently treated as *X. gounellei* subsp. *zehntneri*, showing thicker stems (ca. 5–10 cm, 4–6 when dried) with ca. 10–17 ribs, bluish stems, areoles ca. 0.5 cm distantly less than 1 cm from each other in rib-line, and usually forming a lateral gray sunken cephalium (Fig. 1). Recent molecular analyses based on multiple nuclear, plastidial, and mitochondrial loci positioned with strong statistical support materials of limestone sampled as *X. gounellei* subsp. *zehntneri* (SORO004934!) as a sister lineage of *X. frewenii* (a microendemic species restricted to limestone outcrops), with accumulated genetic divergence from the material of *X. gounellei* sampled (Romeiro-Britto *et al.* 2023a), suggesting that the transitions to limestone outcrops may play an important role in cacti speciation. So, accompanied by morphological and ecological differences, the combination in the status of species is justified and proposed. The authorship of the later Eddie Esteves Pereira is used here as the standard form reported on IPNI (2023), although frequently cited as Esteves-Pereira. Zappi (1994) also designated *P. superfloccosus* (Buining & Brederoo 1974: 60) F.Ritter (1979: 84) in synonym of *P. gounellei* subsp. *zehntneri* (including *P. braunii*), but current studies of the present author with collaborators have indicated that it is a distinct taxon not related to *X. braunii* or *X. gounellei* subsp. *zehntneri*, and should not be regarded as a synonym of them. Variations in the presence of the true sunken cephalium when flowering have been seen in the field among populations of the west or east of the São Francisco River (Fig. 1B–D), which can act as a biogeographical barrier, suggesting that additional studies should be carried out.

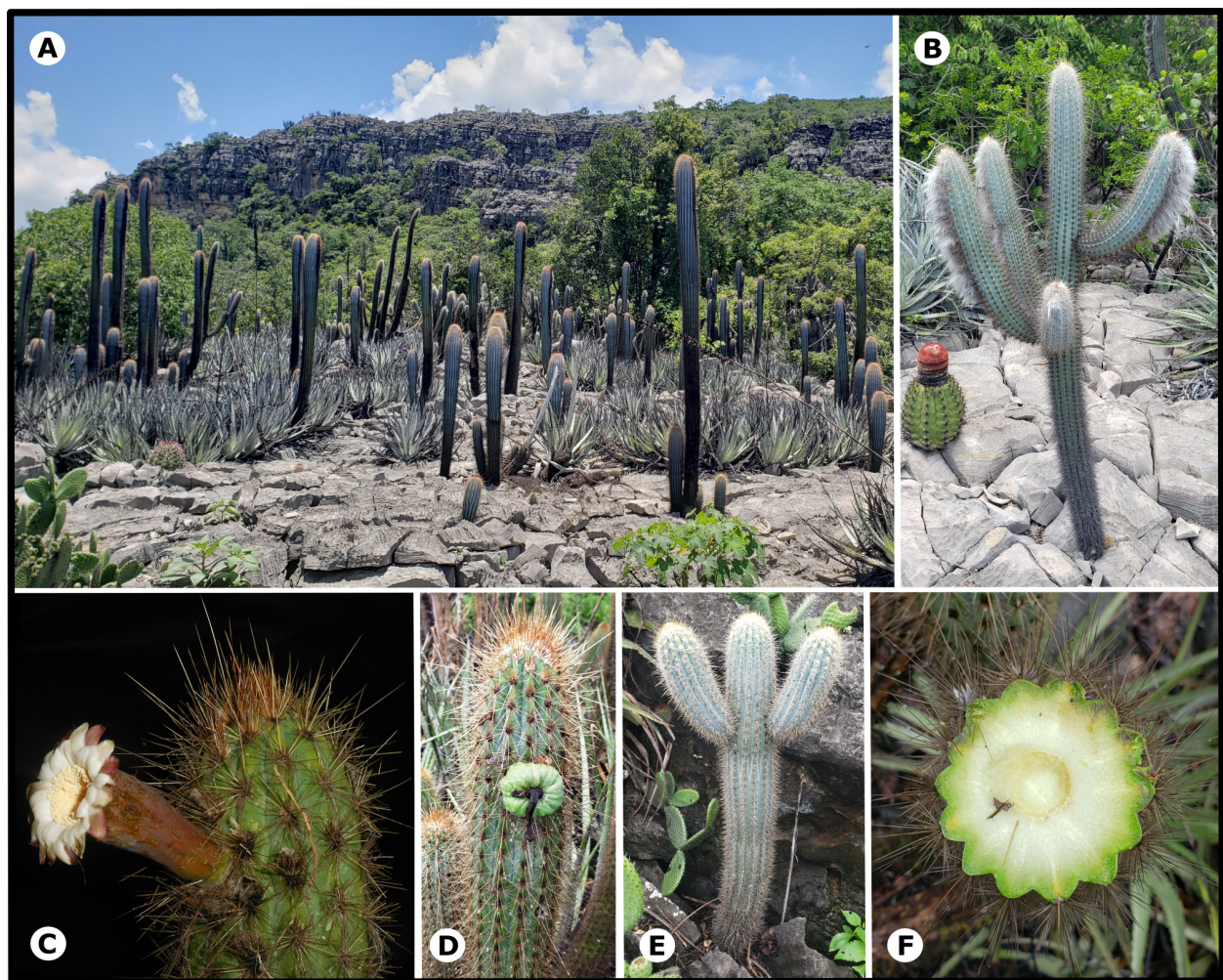


FIGURE 1. *Xiquexique braunii* A. Characteristic habitat of limestone outcrops. B. Growing specimen with well-developed lateral cephalium (MK 625—Carinhanha, Bahia). C. Flowering specimen (MK 613—Iuiu, Bahia). D. Ripening fruit (Carinhanha, Bahia) E. Young specimen showing branch pattern (MK 585—Montes Claros, Minas Gerais) F. Stem medule, ribs and spination (MK 613).

Cereus alexbragae (P.J.Braun & Esteves) M.Köhler, *comb. nov.* \equiv *Estevesia alex-bragae* [as “*alex-bragai*”] P.J.Braun & Esteves (2009: 64–65).

Type:—BRAZIL. Goiás state, *boreali-orientalis*, *campo cerrado*, *plantae crescent in rupibus graniticis atris vel solo saxoso inter gramineas, herbas, bromeliaceas, cactaceas, [...], frutices et arbores*, 790 m a.s.l., July 2007, *Nascimento 84* (holotype consisting of two spirit accessions, one of stems, UFG40476/1!, and other of flowers, UFG40476/2!).

Notes:—Taylor *et al.* (2023) synonymized *C. alexbragae* with *C. mirabella* claiming that the remarkable morphological differences among them are mere forms. *Cereus mirabella*, as has been circumscribed (see specimens cited and shown in Hunt & Taylor 1991, 1992; Taylor & Zappi, 2004; Zappi & Taylor 2023), comprises erect to scrambling cacti with 3–5 marked and sharply ribs, areoles distant ca. 2–3 cm from each other with ca. (2–)3(–6) strong, stout, gray (reddish to goldish when growing) spines ca. 2–3 cm, while *C. alexbragae* is remarkable by the erect stems with 7–10 ribs, frequently unmarked to not marked ribs as in *C. mirabella*, areoles distant < 1 cm from each other, with numerous spines, 6–11(–13), ca. 1.5 cm long, yellow, acicular, flexible and slender (Figs. 1–10 in Braun & Esteves-Pereira, 2009; Fig. 2). Additionally, the flowers of *C. alexbragae* also differ from *C. mirabella* by showing remarkably developed areoles and spines on the pericarpel and hypanthial tube, and the seeds with cells markedly protruding (vs. flattened in *C. mirabella*; Figs. 11–18 in Braun & Esteves-Pereira, 2009). Alternatively, *C. albicaulis* is distinguished of both by the bluish/glaucous epidermis of the stems, whitish medular wood (vs. yellowish in *C. mirabella*), undeveloped underground structure, and being a typical Caatinga element, while the formers are from the Cerrado. Molecular studies derived from hundreds of nuclear loci have placed with strong statistical support and genetic divergence *C. alexbragae* as a sister lineage of *C. mirabella* + *C. albicaulis* (Fig. 4 in Romeiro-Brito *et al.* 2023b; and Fig. 1 in Taylor *et al.* 2023). The clade involving these lineages comprises low-spreading to large-scrambling cacti (e.g., *C. estevesii* P.J.Braun (2004: 20)) with sparse distribution between the Caatinga and Cerrado ecoregions, and despite eventual difficulty in circumscription among these closely related lineages, I argue that *C. alexbragae* should be accepted as a correct and accepted name for a species distinct from *C. mirabella* and *C. albicaulis*, based on the combination of morphological characters, geographical distribution, and genetic divergence.

Notes on the epithet:—The new combination has the epithet of the basionym corrected according to Art. 60.11 of *Shenzhen Code* (Turland *et al.* 2018), since the given name do not stand independently because is not separately latinized (Art. 60.11, Ex. 40 and 41).



FIGURE 2. Selected specimens of *C. alexbragae* and *C. mirabella* illustrating distinguish features. **A–B.** Original material of *C. alexbragae* (© UFG, photo credit Wilmar Gomes). **C.** Representative material of *C. mirabella* (K000100074 © RBG Kew). Herbarium sheets reproduced with permission from the Herbário UFG, and the Royal Botanic Gardens, Kew.

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