



## A new species of *Calea* (Neurolaeneae, Asteraceae) from the Espinhaço Range, Minas Gerais, Brazil

GENILSON ALVES DOS REIS E SILVA<sup>1,2</sup> & JIMI NAOKI NAKAJIMA<sup>3</sup>

<sup>1</sup>Programa de Pós Graduação em Botânica, Universidade Federal de Viçosa, Departamento de Biologia Vegetal, P.H. Rolfs s/n., Centro, 36570-000, Viçosa, MG, Brazil; email: genilson.alves@ifpi.edu.br

<sup>2</sup>Instituto Federal de Educação, Ciência e Tecnologia do Piauí, Avenida Joaquim Manoel, s/n, Novo Horizonte, Valença do Piauí - PI, 64300-000, Brazil.

<sup>3</sup>Universidade Federal de Uberlândia, Instituto de Biologia, Campus Umuarama, Bloco 2D, Uberlândia, Minas Gerais, 38400-902, Brazil.

### Abstract

A new species of *Calea* sect. *Calea*, endemic to the rocky grasslands of the municipality of Diamantina, Minas Gerais, southeastern Brazil, is described. *Calea diamantinensis* is morphologically similar to *Calea lantanoides* which differs by its leaf blade elliptic (vs. ovate to widely ovate), margin entire and straight (vs. crenate and revolute), surface solely glandular-punctuated (vs. villous), receptacle paleae obtrullate (vs. narrowly elliptic), capitulescence composed by 3–4 heads (vs. 6–12 heads), cypselae glandular-punctuated ca. 2.7–3 mm long (vs. non-glandular, ca. 1.8–2.5 mm long) and pappus scales ca. 15–17 (vs. 20–25). Illustration, photos, distribution map, habitat considerations and conservation status are provided, as well as an identification key for *Calea* species from the municipality of Diamantina, Minas Gerais.

**Keywords:** *Calea* sect. *Calea*, Campos rupestres, Compositae, Diamantina

### Resumo

Uma nova espécie de *Calea* sect. *Calea*, endêmica dos campos rupestres do município de Diamantina, Minas Gerais, Sudeste do Brasil, é descrita. *Calea diamantinensis* é morfologicamente semelhante a *Calea lantanoides*, da qual difere por apresentar lâmina foliar elíptica (versus ovada a largo ovada), margem inteira e plana (vs. crenada e revoluta) e superfície somente glanduloso-pontuada (vs. vilosa), páleas do eixo da inflorescência obtruladas (vs. estreito elípticas), capitulescência composta por 3–4 capítulos (vs. 6–12 capítulos), cipselas glanduloso-pontuadas ca. 2.7–3 mm compr. (vs. eglandulosas, ca. 1.8–2.5 mm compr.) e páleas do pápus ca. 15–17 (vs. 20–25). Ilustração, fotos, mapa de distribuição, considerações sobre o hábitat e estado de conservação são apresentados, bem como uma chave de identificação para as espécies de *Calea* que ocorrem no município de Diamantina, Minas Gerais.

**Palavras-chave:** *Calea* sect. *Calea*, Campos rupestres, Compositae, Diamantina

### Introduction

The Neotropical genus *Calea* Linnaeus (1763: 1179) was established with only three species included, *C. jamaicensis* L., *C. oppositifolia* L. and *C. amellus* L. Subsequently, Linnaeus (1767) supplied the first description for the genus which was diagnosed by imbricate phyllaries, paleate receptacle and setaceous pappus.

The current studies estimate that the genus includes approximately 110 to 125 species (Pozo & Hind 2013; Silva & Teles 2018) and represents more than 80% of the species diversity of the Neurolaeneae tribe (Baldwin 2009). The greatest diversity of the genus is concentrated in southern Brazil, the Andes and the Guyana Highland (Pruski 1984).

The *Calea* species can be diagnosed by their leaves simple, generally opposite, less commonly alternate, subopposite or whorled, generally palmately veined, less commonly pinnately veined, glandular-punctuated, usually with moniliform hairs; phyllaries all striate, the outer series ca. 2–4 herbaceous or herbaceous-tipped bracts, the inner bracts scarious; corollas glabrous or glandular-punctuated, never hairy, usually yellow, uncommonly white or reddish;

styles heliantheous and anthers yellow; cypselae all fertile, usually black, non-striate, prismatic to slightly flattened with a curved carpodium or strongly angled and stipitate (Pruski 1984, Pruski & Urbatsch 1988).

The current infrageneric classification of *Calea* is based on the analysis of capitulescences and pappus features, which allow recognition of five sections (Pruski 1998): *C. sect. Calea*, *C. sect. Meyeria* (Candolle 1836: 670) Benth (1873: 391), *C. sect. Lemmatium* (Candolle 1836: 669) Benth (1873: 390), *C. sect. Haplocalea* (Lessing 1832: 241) Pruski (1998: 683) and *C. sect. Monanthocalea* (Lessing 1832: 242) Pruski (1998: 684).

According to Urbatsch *et al.* (1986), the species grouped in *C. sect. Calea* are mainly characterized by umbelliform to cymose capitulescences, shorter cypselae and pappus longer than the cypselae length. This section is the most diverse and widespread of the genus (Urbatsch *et al.* 1986).

## Material and methods

The study of *Calea* in Minas Gerais State, Brazil Reis-Silva (2019) is based on the analysis of collections deposited at BHCB, BHZB, CEN, CESJ, DIAM, ESA, HUFU, HUSC, MBM, OUPR, PAMG, RB, R, SPF, SP, UB, UEC, UPCB and VIC (acronyms according to Thiers 2019, continuously updated). During our revision of herbarium specimens and fieldwork in Minas Gerais, a new species of the *Calea* genus was collected in the municipality of Diamantina, located in an orogenic complex known as “Cadeia do Espinhaço”. The new species is described and illustrated, along with its affinities and occurrence. Additionally, an identification key for *Calea* species from the municipality of Diamantina is provided.

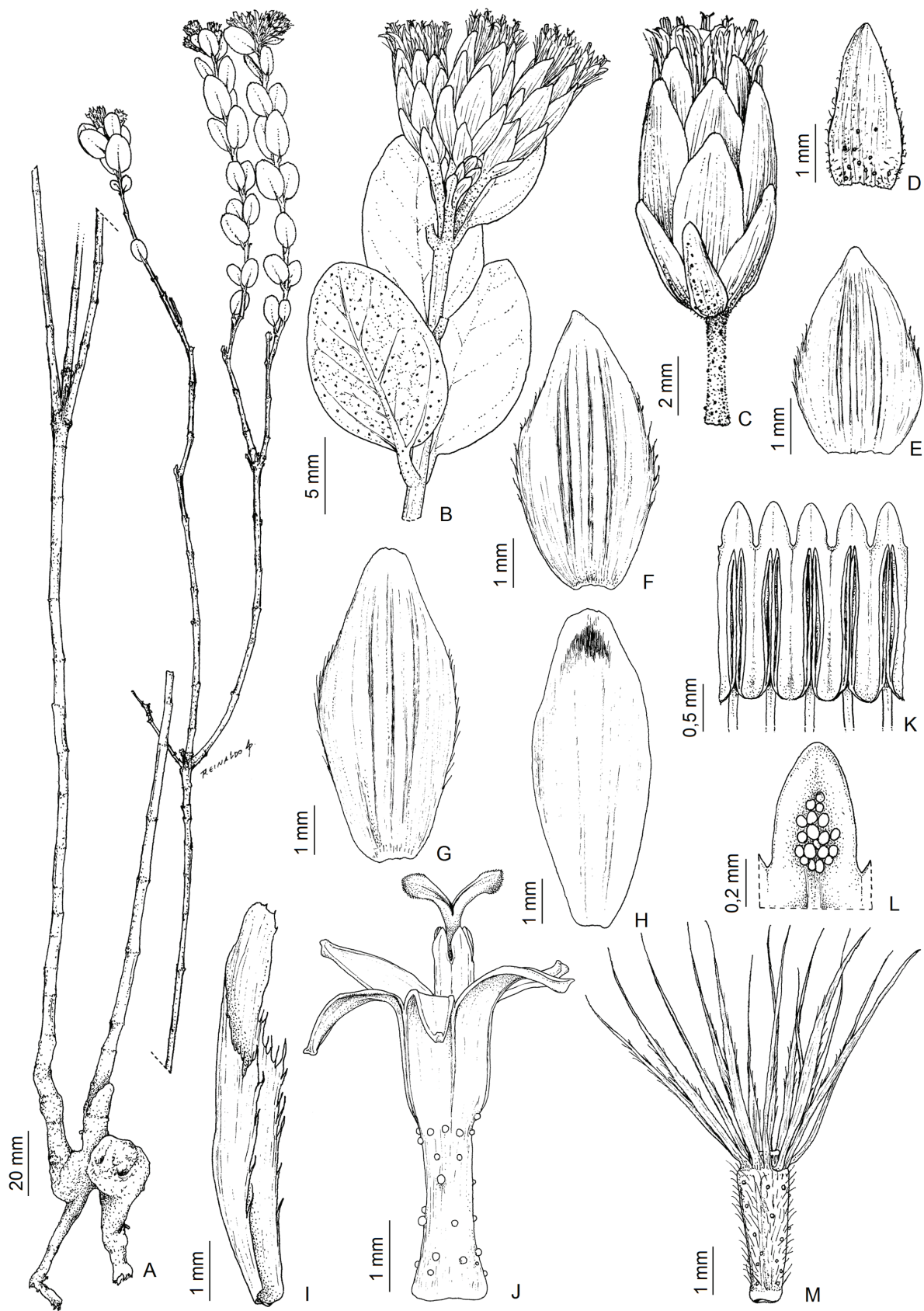
## Taxonomic treatment

*Calea diamantinensis* G.A. Reis-Silva & J.N. Nakaj., *sp. nov.* (Figs. 1 A–K and 2 A–E)

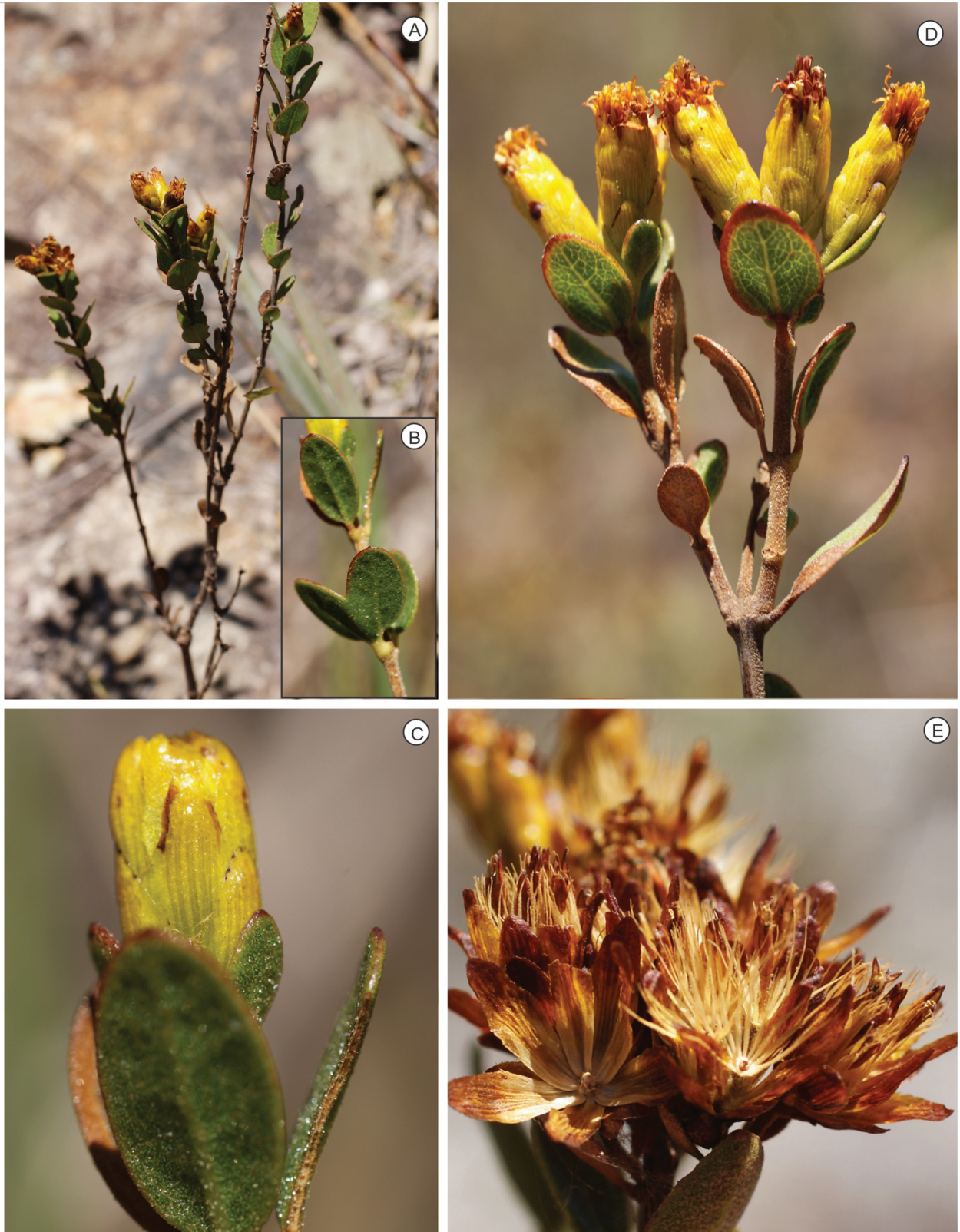
The new species is related to *Calea lantanoides* from which it differs by its leaf blade elliptic (*vs.* ovate to widely ovate), margin entire and straight (*vs.* crenate and revolute), surface solely glandular-punctuated (*vs.* villous), receptacle paleae obtrullate (*vs.* narrowly elliptic), capitulescence composed of 3–4 heads (*vs.* 6–12 heads), cypselae glandular-punctuated ca. 2.7–3 mm long (*vs.* non-glandular, ca. 1.8–2.5 mm long) and pappus scales ca. 15–17 (*vs.* 20–25).

Type:—BRASIL. Minas Gerais: Diamantina, lado esquerdo da estrada Diamantina a Conselheiro Mata, 18°16'24.8"S, 43°42'39.3"W, 1427 m, 11 October 2017, fl., fr., G.A. Reis-Silva *et al.* 289 (holotype VIC!; isotype MO!, K!, HUFU!, RB!).

*Shrub* perennial, xylopodial. *Stems* erect, 0.3–1.5 m tall, terete, slightly furrowed, glabrous at base to strigillose toward apex, sparsely glandular-punctuated, *internodes* 0.8–2.5 cm long. *Leaves* opposite, decussate, ascending, only in the apex of the branches, petiole 1–2 mm long, glandular-punctuated; *blade* elliptic, coriaceous, concolorous, green, 0.9–1.8 × 0.6–0.9 cm, apex rounded, base rounded, margin entire, both sides only with conspicuous glandular-punctuated trichomes, translucent, regularly scattered on surface, venation eucamptodromous. *Inflorescence* terminal, umbelliform, frequently with 3–4 heads, peduncles 1.4–5.4 mm long, strigillose and densely glandular-punctuated. *Head* discoid, homogamous; *involucre* monomorphic, cylindrical, 7–9.4 × 3.5–5.2 mm, phyllaries 5-seriate; outer series 2–5.6 mm × 1–2.8 mm, ovate, apex obtuse, margin ciliate, scarious, inconspicuously 5–7-striated, strigillose, slightly glandular-punctuated on upper surface to glabrous; inner series 4.8–8 mm × 2.5–3.5 mm, narrowly elliptic to elliptic, apex rounded, margin entire to slightly ciliate, scarious basally and herbaceous apically, conspicuously 6–9-striated, glabrous; receptacle convex, paleaceous, *paleae* 2–4, 6.7–8.6 × 1.2–3 mm, obtrullate, cymbiform, apex rounded, margin erose, entire at base, glabrous, conspicuously 3–4-striated. *Florets monoclinal*, 7–9, corollas 5.2–6.2 mm long, tubular, yellowish, tube 2–2.6 mm long, densely glandular-punctuated, throat 2.4–3.7 mm long, non-glandular, lobes 1.5–2 mm long, lanceolate, squarrose, glabrous to slightly glandular-punctuated on upper surface; anthers yellowish, 2.3–3 mm long, apical appendage acute, glandular-punctuated abaxially; style 4.8–6.8 mm long, base dilated, branches 0.8–1.5 mm long, apex deltate with short papillae. *Cypselae* 2.7–3 × 1.1–1.4 mm, prismatic, 4-angled, sericeous, glandular-punctuated, carpodium conspicuous and decurrent, *pappus* scales 15–17, free, 4–5 mm long, subequal, linear-lanceolate, apex aristate, margin slightly ciliate.



**FIGURE 1.** *Calea diamantinensis* G.A. Reis-Silva & J.N. Nakaj. **A.** Habit. **B.** Capitulescence. **C.** Detail of a head. **D, E, F, G.** Involucral bracts. **H.** Paleae of receptacle. **I.** Corolla. **J.** Anthers. **K.** Cypsela. (All illustrations made from the holotype. Drawings by Reinaldo Pinto).



**FIGURE 2.** *Calea diamantinensis* G.A. Reis-Silva & J.N. Nakaj. **A.** Flowering shoot. **B.** Details of leaves. **C.** Immature head. **D.** Capitulescences. **E.** Cypselae on mature heads. Photos by G.A. Reis-Silva.

**Additional specimens examined (paratypes):**—BRAZIL. Minas Gerais: Diamantina, estrada Diamantina–Conselheiro Mata, km 187, 18°16'29"S, 43°42'46"W, 1405 m, 24 September 2008, fl., *R. Romero 8164 et al.* (HUFU, UFG); estrada Diamantina–Conselheiro Mata, campo rupestre ao lado esquerdo da estrada, 18°16'24.8"S, 43°42'39.3"W, 1427 m, 11 October 2017, fl., *G.A.Reis-Silva et al. 284* (VIC); fl., fr., *G.A.Reis-Silva et al. 287* (VIC, BHCB); fl., fr., *G.A.Reis-Silva et al. 288* (VIC); fl., *G.A.Reis-Silva et al. 290* (VIC); fl., fr., *G.A.Reis-Silva et al. 291* (VIC); fl., *G.A.Reis-Silva et al. 292* (VIC, TEPB); fl., fr., *G.A.Reis-Silva et al. 293* (VIC, UEC, DIAM); estrada Gouveia a Curvelo, ca. 20 km de Diamantina, 18°33'36"S, 43°51'14"W, 1060 m, 23 September 2008, fl., *J.N. Nakajima et al. 4994* (HUFU).

**Distribution:**—*Calea diamantinensis* is currently found only in the municipality of Diamantina, Minas Gerais State (Figure 3).



**FIGURE 3.** A. Location of the Minas Gerais state in Brazil. B. Location of *Calea diamantinensis* G.A.Reis-Silva & J.N. Nakaj. C. Three-dimensional map showing part the known distribution of *C. diamantinensis*. Images by IBGE.

**Habitat:**—*Calea diamantinensis* occurs in small populations that grow in the rocky grassland (*campos rupestres*) vegetation, with quartzitic rock soils of sandy texture and low capacity of water retention. The elevation varies between 1060 and 1430 m a.s.l.

**Phenology:**—The species flowers and sets fruit between September and October. Probably blooming in early September, after burnings that often occur in the region during August.

**Conservation status:**—The new species, following the IUCN criteria (2017), is considered Critically Endangered (CR; subcriterion B2a – the number of locations equals to one).

**Etymology:**—The specific epithet is a tribute to the historic city of Diamantina, which in 18<sup>th</sup> century Colonial Brazil expanded in size and population due to the high production of diamonds. Today it is recognized as a UNESCO World Heritage site.

**Taxonomic position and affinity:**—*Calea diamantinensis* fits neatly into *C.* sect. *Calea* by its umbelliform capitulescences, short cypselae and long pappus scales. In the section, *C. diamantinensis* is more closely related to *C. lantanoides*, with which it shares the morphological characters as follows: subshrub erect with lignified branches, leaf blade coriaceous, discoid heads with less than 10 florets, involucre monomorphic and cylindrical, outer phyllaries ovate, receptacle paleaceous, pappus scales free and longer than the cypselae length.

The morphological characters such as perennial subshrub with lignified branches, leaf blade elliptic and coriaceous; capitulescences with 3–4 heads, involucre cylindric, 5-seriate; and corolla lobes squarrose show that *C. diamantinensis* also resembles *C. intermedia* Pruski & Urbatsch (1988: 351). However, the latter species belongs to *C.* sect. *Lemmatium* Benth (1873: 163) which has a pappus with 12 lanceolate scales, connate or sometimes free and not as long as the cypselae length (Pruski 1986; Pruski & Urbatsch 1988). Besides, the new species can be distinguished from *C. intermedia* by its leaves without non-glandular trichomes (*vs* pubescent), margin entire (*vs* serrate), involucre monomorphic (*vs* dimorphic), paleae obtusate (*vs* oblanceolate), monocline florets 7–9 (*vs* 16–18) per head and pappus scales 15–17, longer than the cypselae length (*vs.* ca 12, shorter than the cypselae length).

### Diagnostic key to the *Calea* species from the municipality of Diamantina, Minas Gerais, Brazil

1. Heads radiate ..... 2
- Heads discoid..... 7
2. Pappus scales basally to completely connate ..... *Calea rotundifolia*
- Pappus scales distinct ..... 3
3. Ray florets 10–13; pappus scales oblong ..... *Calea myrtifolia*
- Ray florets 2–8; pappus scales linear or linear-lanceolate ..... 4
4. Leaves sessile; involucre campanulate; receptacle paleae linear ..... 5
- Leaves petiolate; involucre cylindric; receptacle paleae oblanceolate..... 6
5. Leaf blade linear; internodes 2–9 cm; receptacle paleae conduplicate; cypselae sericeous; pappus scales 3–5 mm long ..... *Calea graminifolia*
- Leaf blade narrowly elliptic; internodes 0.8–2 cm; receptacle paleae flat; cypselae glabrate; pappus scales 1–2 mm long..... *Calea abbreviata*
6. Venation acrodromous suprabasal; phyllaries acute; receptacle paleae glandular-punctuated; cypselae glabrous, angles pilose..... *Calea oxylepis*
- Venation eucamptodromous; phyllaries rounded; receptacle paleae glabrous; cypselae tomentose..... *Calea nitida*
7. Leaf blade elliptic; capitulescence umbelliform; 7–9 florets by head; cypselae 2.7–3 mm long; pappus scales longer than the cypselae length ..... *Calea diamantinensis*
- Leaf blade ovate; capitulescence corymbiform; 4–5 florets by head; cypselae 5–7 mm; pappus scales shorter than the cypselae length ..... *Calea fruticosa*

### Acknowledgments

The authors thank the Instituto Federal de Educação, Ciência e Tecnologia do Piauí for granting a license to the first author, and to the Programa de Pós Graduação em Botânica of Universidade Federal de Viçosa, Minas Gerais for assistance. We are grateful to the curators of the Herbarium HUFU, Rosana Romero, and the Herbarium RB, Rafaela Forzza, for sending herbarium specimens on loan, to the botanists Letícia Oliveira and Cristielle Costa for assistance with fieldwork, to Michael Castro for elaboration of the map, to anonymous referees for their comments, and to Reinaldo Pinto for preparation of the illustration.

### References

- Baldwin, B.G. (2009) Heliantheae alliance. In: Funk, V., Susanna, A., Stuessy, T.F. & Bayer, R.J. (Eds.) *Systematic, evolution and biogeography of Compositae*. IAPT, Institute of Botany, University of Vienna, pp. 689–711.
- Benth, G. (1873) *Compositae*. In: Benth, G. & Hooker, J.D. (Eds.) *Genera Plantarum*, vol. 2 (1). Reeve, London, pp. 163–533.
- Candolle, A.P. de (1836) *Prodromus systematis naturalis regni vegetabilis*, vol. 5. Treuttel & Würtz, Paris, 706 pp.

- IUCN (2017) *Guidelines for using the IUCN Red list categories and criteria*. Version 2017-3. Available from: <http://jr.iucnredlist.org/documents/RedListGuidelines.pdf> (accessed 7 July 2018)
- Lessing, C.F. (1832) *Synopsis generum Compositarum earumque dispositionis novae tentamen monographiis multarum Capensium interjectis*. Duncker & Humblot, Berlin, xi + 473 pp.  
<https://doi.org/10.5962/bhl.title.51470>
- Linnaeus, C. (1763) *Species plantarum* (ed. 2), vol. 2. L. Salvius. Stockholm, pp. 785–1179.
- Linnaeus, C. (1767) *Systema Naturae* (ed. 12), vol. 2. L. Salvius. Stockholm, pp. 533–1328.
- Pozo, P. & Hind, D.J.N. (2013) A New Species of *Calea* sect. *Meyeria* (Compositae: Heliantheae: Neurolaeninae), *Calea woodii*, from Santa Cruz, Bolivia. *Kew Bulletin* 68: 511–515.  
<https://doi.org/10.1007/s12225-013-9463-z>
- Pruski, J.F. (1984) *Calea brittoniana* and *Calea kristinae*: Two New Compositae from Brazil. *Brittonia* 36(2): 98–103.  
<https://doi.org/10.2307/2806617>
- Pruski, J.F. (1998) Novelties in *Calea* (Compositae: Heliantheae) from South America. *Kew Bulletin* 53: 683–693.  
<https://doi.org/10.2307/4110487>
- Pruski, J.F. & Urbatsch, L.E. (1988) Five new species of *Calea* (Compositae: Heliantheae) from Planaltine Brazil. *Brittonia* 40: 341–356.  
<https://doi.org/10.2307/2807644>
- Reis-Silva, G.A. (2019) *O gênero Calea L. (Neurolaeneae, Asteraceae) em Minas Gerais, Brasil*. Tese de Doutorado (Botânica). Universidade Federal de Viçosa. Viçosa, Minas Gerais.
- Silva, G.H.L. & Teles, A.M. (2018) *Calea* (Asteraceae, Neurolaeneae) no estado de Goiás, Brasil. *Rodriguésia* 69: 1851–1875.  
<https://doi.org/10.1590/2175-7860201869422>
- Thiers, B.M. (2019 continuously updated) *Index Herbariorum: A global directory of public herbaria and associated staff*. New York Botanical Garden's Virtual Herbarium. Available from: <http://sweetgum.nybg.org/ih/> (accessed 15 December 2019)
- Urbatsch, L.E., Zlotzky, A. & Pruski, J.F. (1986) Revision of *Calea* sect. *Lemmatium* (Asteraceae: Heliantheae) from Brazil. *Systematic Botany* 11: 501–515.  
<https://doi.org/10.2307/2419029>