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***Blumea axillaris* (Inuleae, Asteraceae): the first record of an invasive exotic weed in the Americas and the first record of the genus in Brazil**

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Abstract

Blumea is one of the largest genus within the tribe Inuleae, Asteraceae, with approximately 100 species across tropical Asia, Africa, Oceania, and the Americas. It is characterized by disciform capitula, one large oxalate crystal in each cypsela epidermis cell, radial anther endothecium thickenings, and tailed anthers. There are no native species of *Blumea* in the Americas and Hawaii. However, two species have been documented, and both were introduced. Thus, this work documents the first records of *Blumea axillaris* in the Americas and the first report of this genus in Brazil. We provided a morphological description of the species, with ecological observations, a key for identifying the *Blumea* among the genera of the tribe Inuleae found in Brazil, and illustrations. This record serves as a warning since it is an invasive exotic species that, by all indications, has already firmly established itself as a weed and can represent significant challenges for agriculture and the environment.

Key words: alien species, Compositae, exotic species, Inulinae, invasive species

Introduction

Blumea was established by Candolle (1833: 514) in honor of the Dutch botanist C.L. Blume to accommodate several notable species previously described under *Conyza* Lessing (1832: 203) (Randeria 1960). This genus comprises about 100 species, making it one of the largest within the tribe Inuleae, Asteraceae, and it is distributed throughout tropical Asia, Africa, Oceania, and the Americas (Randeria 1960, Nesom 1983, Fayed & Mohamed 1991, Anderberg 2009, Pornpongrueng *et al.* 2016). The highest diversity of the genus is found in tropical Asia, and most of its species are common weeds widespread in disturbed areas (Peng *et al.* 2020). Nonetheless, several species are geographically and ecologically restricted (Pornpongrueng *et al.* 2007).

According to Pornpongrueng *et al.* (2007, 2009, 2016), *Blumea* is a monophyletic genus supported by molecular data. It can be morphologically circumscribed by the following characteristics: disciform capitula, one large oxalate crystal in each cypsela epidermis cell, radial anther endothecium thickenings, and tailed anthers (Randeria 1960, Anderberg & Eldeñas 2007).

There are no native species of *Blumea* in Europe or the Americas (Randeria 1960). So far, just two species of *Blumea* have been documented in the Americas and Hawaii, and both were introduced. *Blumea viscosa* (Miller 1768) Badillo (1974: 9) is reported in South America (Bolivia, Colombia, Ecuador, and Venezuela), Central America (Costa Rica, El Salvador, Guatemala, Honduras, and Panama), the Caribbean islands (Barbados and Cuba), and North America (Mexico and the United States). *Blumea sinuata* (Loureiro 1790: 497) Merrill (1935: 388) is found in the Pacific (the Hawaiian Islands) (Nesom 1983). This work presents the first record of *Blumea axillaris* (Lamarck 1786: 84) Candolle (1836: 434) in the Americas and the first record of the genus in Brazil. We provided a morphological description of the species, with ecological observations, a key for identifying the *Blumea* among the genera of the tribe Inuleae found in Brazil, and illustrations.

Material and Methods

The specimens were collected using standard techniques in plant taxonomy (*e.g.*, Mori *et al.* 2011) and were deposited in the herbarium of the Federal University of Goiás, UFG (UFG herbarium). Duplicates were also sent to ECT and RB herbaria (acronyms as per Thiers 2024). The species was morphologically described using a stereomicroscope. Dimensions of vegetative and reproductive structures were measured from fresh and dried herbarium material. The morphological terminology agrees with Roque & Bautista (2008) and Beentje (2016).

The identifications were supported by specific bibliographies (*e.g.*, Randeria 1960, Pornpongrungrueng *et al.* 2016, Peng *et al.* 2020) and further validated using images of type specimens available online (*e.g.*, MNHN 2024). Abbreviations for the publications cited in this work and for the authors of genera and species followed the guidelines provided by the International Plant Names Index (IPNI 2024).

Taxonomic treatment

Blumea axillaris (Lamarck 1786: 84) Candolle (1836: 434). (Figures 1 and 2)

Annual aromatic herbs, up to 1.5 m tall, sometimes woody at the base with one or more shoots; whole plant viscid. *Taproot* tuberous in old specimens. *Stems* erect, terete, densely villous and glandular. *Leaves* simple, alternate, spirally arranged, smaller toward the apex, petiolate; lamina 1.9–15 × 1.5–6 cm, basal leaves lyrate, caulinar leaves elliptic to ovate, base and apex obtuse, margins erose to lacerate, sinuate, penninerved, densely villous and glandular on both faces; petioles 3–5 mm long, villous and glandular. *Capitulescence* axillary, terminal, lax to densely paniculate. *Capitula* heterogamous, disciform; peduncle 3–15 mm long, densely villous and glandular, ebracteolate; involucre 4–5 × 3–4 mm, urceolate, calyculate; calycular bract 1, ca. 1.5 mm long, lanceolate, densely villous and glandular; phyllaries 3-seriate, lanceolate to linear, gradually smaller externally, first series phyllaries ca. 1.1 × 0.1 mm, second series phyllaries ca. 2.2 × 0.2 mm, third series phyllaries ca. 3.3 × 0.1 mm, apex acute, scarious margins, densely villous and dorsally glandular; receptacle flat to convex (at maturity), alveolate. *Outer florets* ca. 100, pistillate, in ca. 11 rows, corolla filiform, 2.5–3 × 0.2 mm, whitish, apex shortly 2–3-dentate, glabrous; style ca. 4 mm long, style-branches ca. 0.5 mm long. *Inner florets* 11–13, bisexual, corolla tubulose, pale purple, 3.5 × 0.7 mm, 5-lobed, lobes 0.5 mm long, dorsally glandular; anthers 1.2–1.5 mm long, dark purple, anther bases calcarate, tailed, apical anther appendages oblong; style 4–4.5 mm long, style-branches 0.5 mm long, apex subulate, sweeping hairs up to the bifurcation point, base cylindrical. *Cypsela* 0.8–1 mm long, narrowly fusiform, 3-ribbed, slightly setuliferous, carpodium annuliform, inconspicuous; pappus ca. 3 mm long, uniseriate, capillary, composed of barbellate bristles, whitish, persistent.

Examined specimens:—BRAZIL. Goiás: Goiânia, Setor Jaó, Parque Municipal Maracanã - Iolane Prudente Marques, 16°38'45"S, 49°13'40"W, 712 m, 28 September 2021, *A.M. Teles, A.O. Teles & J.O. Teles 40/2021* (ECT, UFG); *ibidem*, Setor Jaó, Parque Liberdade, 16°38'57"S, 49°14'4"W, 04 August 2022, *A.M. Teles & A.C. Cercilian 30/2022* (UFG); *ibidem*, Setor Jaó, estacionamento do Educandário Yara, 16°38'55"S, 49°13'24"W, 09 August 2022, *A.M. Teles 31/2022* (UFG); *ibidem*, Setor Jaó, esquina da Rua J-12 com a Alameda Maracanã, 16°38'44"S, 49°13'46"W, 21 August 2022, *A.M. Teles 32/2022* (UFG); *ibidem*, Setor Jaó, Parque Beija-Flor, 16°39'4"S, 49°13'48"W, 19 July 2023, *A.M. Teles 120/2023* (UFG); *ibidem*, Setor Itatiaia, UFG, campus Samambaia, em frente ao almoxarifado do IQ, 16°36'10"S, 49°15'43"W, 17 August 2023, *A.M. Teles 121/2023* (UFG); *ibidem*, Setor Central, Rua 18, terreno baldio, 16°40'39"S, 49°15'17"W, 17 August 2023, *A.M. Teles 122/2023* (UFG); Chácaras Recreio Samambaia, 16°35'17"S, 49°16'47"W, 27 August 2023, *A.M. Teles 124/2023* (UFG); Roselândia, margem do Rio Caldas, Chácara da Dona Gleide, 16°51'5"S, 49°5'24"W, 19 August 2023, *A.M. Teles, J.O. Teles & A.O. Teles 123/2023* (UFG).

Distribution and ecology:—*Blumea axillaris* is widespread throughout Asia and Africa, but it is also found in Australia and New Caledonia (Randeria 1960, eFloras 2008). We document its first report in the Americas and the first report of the genus in Brazil. According to Randeria (1960), eFloras (2008), and Pornpongrungrueng *et al.* (2016), the species is commonly found in dry fields, on hillslopes, along roadsides, on old walls, and in other disturbed and anthropic areas. In Brazil, the species was found, so far, in urban and rural disturbed areas in the state of Goiás, specifically in the municipalities of Goiânia and Bela Vista de Goiás (Roselândia district) (Figure 2).

Phenology:—Specimens in florets and fruits were collected between July and September, which is the dry season in the Cerrado biome.

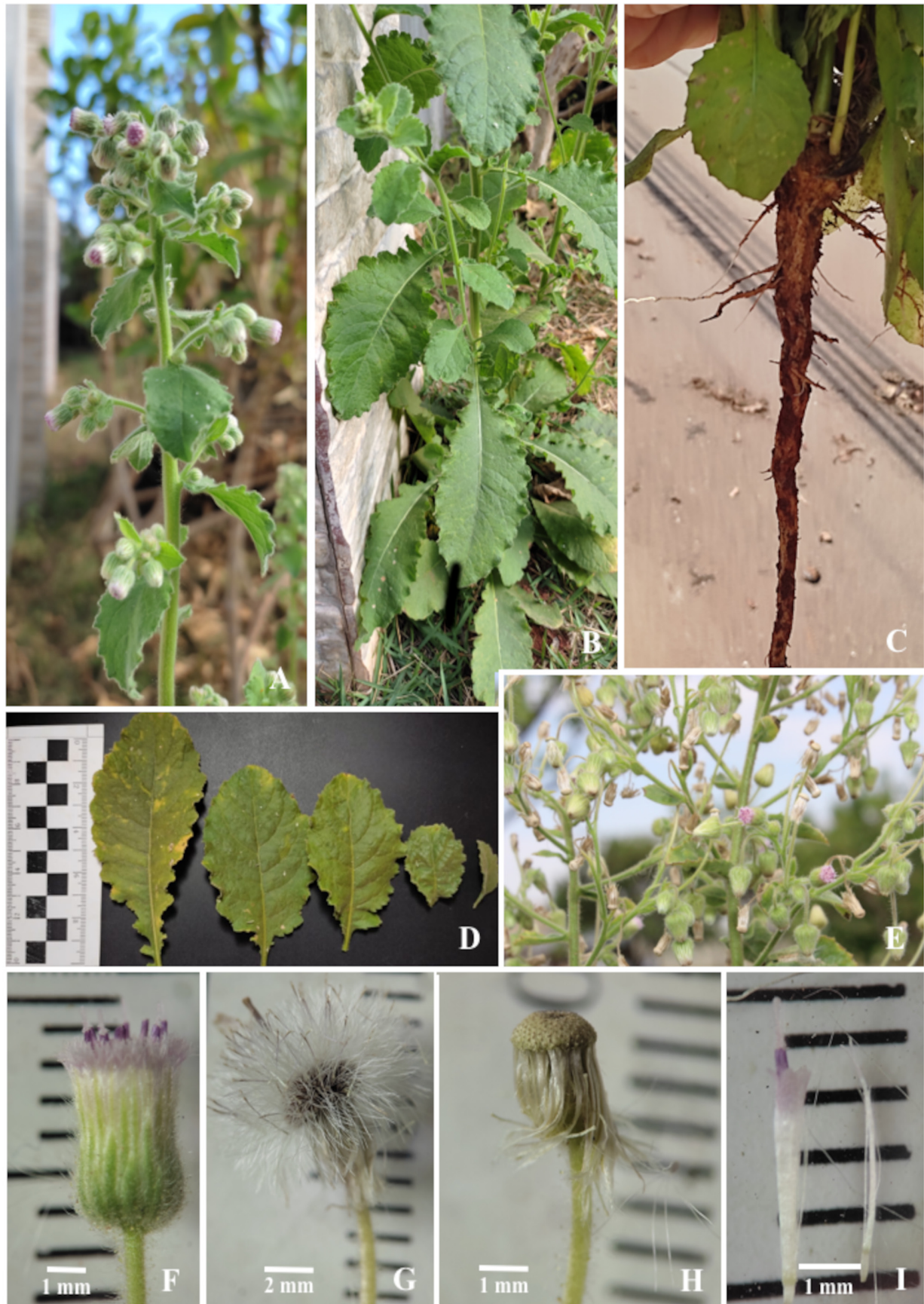


FIGURE 1. *Blumea axillaris*. **A.** Apical part of the plant with the upper leaves and capitulescence. **B.** Basal part of the plant with the lower leaves. **C.** Taproot. **D.** Variation of the leaf blade. **E.** Detail of the capitulescence. **F.** Disciform capitulum. **G.** Capitulum dispersing the cypselae. **H.** Capitulum with the convex and alveolate receptacle after releasing the cypselae. **I.** Florets in detail, the outer filiform and pistillate floret (on the right-hand side) and the inner tubulose and bisexual floret (on the left-hand side). **A.–I.** by A.M. Teles.

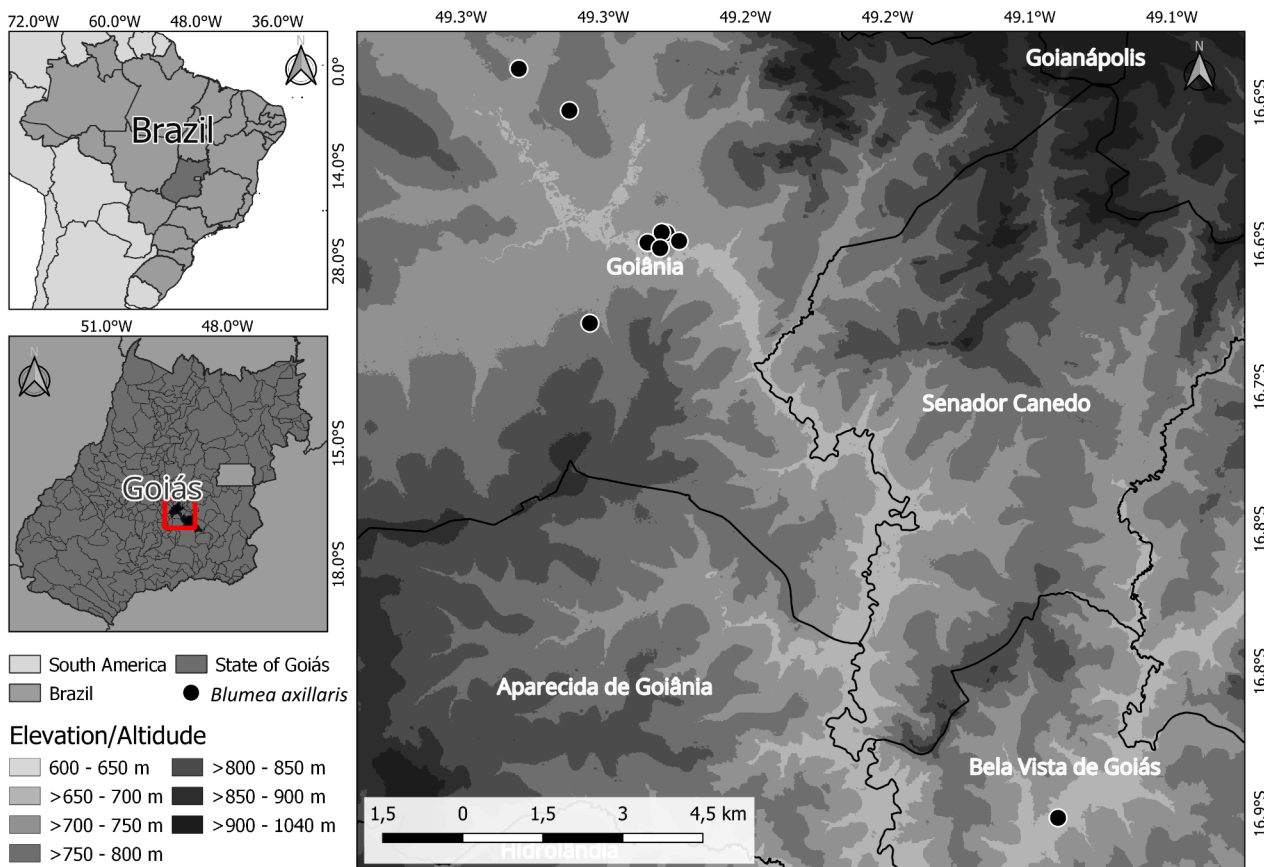


FIGURE 2. Geographical distribution map showing the distribution of *Blumea axillaris* in Brazil.

Discussion:—A single specimen of *Blumea axillaris* was observed and collected in 2021, making it the first record of this species in Brazil. In 2022, new collections of the species were made near the area where it was initially recorded, with a remarkable increase in frequency and broader dispersion of the original population. In 2023, the species was collected again, with a significant increase in population and a notable dispersion of them. As stated by Nesom (1983), all species of the genus have an efficient mechanism for anemochorous dispersal facilitated by the pappus. Randeria (1960) noted that the genus is expanding its geographic range. This was supported by the records of *Blumea* from places where it had not been previously reported. The origin of *B. axillaris* in the Americas remains unknown, with questions on how and when it was introduced. It may be impossible to determine the exact date of the dispersal event that introduced *B. axillaris* to the Americas. However, the first author’s observations over the past twenty-five years, especially in Brazil, strongly suggest a recent introduction since older specimens than the current ones were not found up to now. Nevertheless, we can make some hypotheses. The less likely one is the natural dispersion by migratory water birds. The more plausible scenario is the facilitation of diaspore dispersion through contamination linked to animal fur or human clothing, along with the importation of potted plants, crop seeds, or agricultural machinery as discussed by Davies & Sheley (2007). In any case, this record serves as a warning since it is an invasive exotic species that, by all indications, has already become well-established as a weed and can represent significant challenges for agriculture and the environment. In Brazil, Inuleae is represented by 22 species grouped into five genera (Monge *et al.* 2017, Monge & Semir 2024). Considering the new record reported in this work, the number of genera of the tribe Inuleae in Brazil increases to six and the number of species to 23.

Key for the identification of Inuleae genera occurring in Brazil

- | | | |
|----|--|--------------------|
| 1. | Pappus absent | <i>Epaltes</i> |
| - | Pappus present | 2 |
| 2. | Winged branches | 3 |
| - | Apterous branches | 4 |
| 3. | Capitulae sessile; inner florets bisexual, up to 6 per capitulum | <i>Pterocaulon</i> |
| - | Capitulae pedunculate; inner florets functionally staminate, 25–50 per capitulum | <i>Pluchea</i> |

4.	Rosulate basal leaves	<i>Stenachaenium</i>
-	Leaves all cauline	5
5.	Inner florets bisexual	<i>Blumea</i> (<i>B. axillaris</i>)
-	Inner florets functionally staminate.....	6
6.	1–15 inner florets per capitulum.....	<i>Tessaria</i>
-	More than 50 inner florets per capitulum.....	<i>Pluchea</i>

Conclusion

The discovery of *Blumea axillaris* in Brazil represents the first record of this genus in the country and marks a significant expansion of its known distribution in the Americas. Previously, *Blumea* was represented in the Americas and Hawaii by only two introduced species: *B. viscosa* and *B. sinuata*. With the recording of *B. axillaris*, the genus now comprises three introduced species in the Americas and Hawaii, reinforcing its ability to thrive in diverse environments. This new record raises concerns about the potential invasive behavior of *B. axillaris*, as it has shown rapid population growth and dispersion in the state of Goiás. Its establishment in anthropic and disturbed areas suggests that it could pose challenges to local ecosystems and agricultural lands. Further studies are needed to assess the ecological impact of *B. axillaris* and to develop effective management strategies to control its spread. This discovery underscores the importance of continuous monitoring of exotic species in Brazil to mitigate potential environmental risks

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