

Biology-Botany

Improving knowledge on *Viviania linostigma* R.Knuth (Francoaceae), a threatened species from southern Brazil

Ampliando o conhecimento sobre *Viviania linostigma* R.Knuth (Francoaceae), uma espécie ameaçada de extinção do sul do Brasil

Juliana Schaefer¹ , Cleusa Vogel Ely¹ , Ilsi Iob Boldrini¹ ,
Sérgio Augusto de Loreto Bordignon^{II} 

^I Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil

^{II} Universidade La Salle, Canoas, RS, Brazil

ABSTRACT

Viviania linostigma is restricted to the Brazilian territory, considered a threatened and endemic species of a small region in the Araucaria Forest. This species has been recorded only in southeast Santa Catarina State and the extreme northeast of Rio Grande do Sul State, Brazil. Here, we report four new records of *V. linostigma* for Rio Grande do Sul, expanding its known distribution by 262 km to the south and improving knowledge about the conservation status of the species. These novelties reinforce that species conservation requires more investment in fieldwork, especially in little sampled regions.

Keywords: Araucaria Forest; Brazilian flora; IUCN

RESUMO

Viviania linostigma é restrita ao território brasileiro, considerada uma espécie ameaçada e endêmica de uma pequena região da Floresta de Araucária. Essa espécie tem sido registrada apenas no sudeste de Santa Catarina e no extremo nordeste do estado do Rio Grande do Sul, Brasil. Aqui, relatamos quatro novos registros de *V. linostigma* para o Rio Grande do Sul, expandindo sua distribuição conhecida em 262 km ao sul e ampliando o conhecimento sobre o estado de conservação da espécie. Essas novidades reforçam que a conservação de espécies requer mais investimento em trabalhos de campo, especialmente em regiões pouco amostradas.

Palavras-chave: Floresta de Araucária; Flora brasileira; IUCN

1 INTRODUCTION

Brazil has the most diverse flora of the Americas, with 34,766 vascular plant species, 55% of them endemic (ULLOA ULLOA *et al.*, 2017; FLORA DO BRASIL, 2020). However, with only 0.59 plant specimens collected per km², the Brazilian flora is still far from satisfactorily known (SOBRAL AND STEHMANN, 2009). Collected materials are mostly charismatic species from iconic or protected areas, with a geographical bias towards areas around large urban centers or with good accessibility in general, especially in the coastal region (NERVO; WINDISCH; LORSCHBITTER, 2010; POSSINGHAM; BALL; ANDELMAN, 2000).

The Atlantic Forest domain covers 15% of the Brazilian territory and includes a variety of ecosystems such as highland grasslands, forests, *restingas*, marshes, as well as coastal and oceanic islands (BOND-BUCKUP AND DRELER, 2010). In southern Brazil, mosaics of *Campos* (grasslands) and Araucaria Forest shape the Atlantic Forest landscapes (BEHLING AND PILLAR, 2007). In the Rio Grande do Sul (RS) State, biodiversity inventories carried out in the Araucaria Forest are mainly concentrated in protected areas of São Francisco de Paula municipality (CAPORAL AND EGGERS, 2005; FERREIRA AND EGGERS, 2008; ISERHARD *et al.*, 2010; CAPPELATTI AND SCHIMIDT, 2011), which stresses the poor collection efforts made in this region.

Vivianiaceae, as previously accepted (APG III, 2009), is restricted to South America, occurring in Chile, Argentina, Uruguay, and in the southern half of Brazil (LEFOR, 1975; FLORA DO BRASIL, 2020). Recently, Vivianiaceae was included in Francoaceae (APG IV, 2016), which is why we follow here this new classification. Most species of *Viviania* occur in central-southern Chile, where the genus is more diverse (PALAZZESI, 2007). In Brazil, only two species of *Viviania* are recognized: *V. albiflora* (Cambess.) Reiche and *V. linostigma* R.Knuth (FERREIRA, 2020). *Viviania albiflora* is a widespread species that occurs in several Brazilian states, besides the Argentine and Uruguayan territories (FERREIRA, 2020). On the other hand, *V.*

linostigma is an endangered species (VU), considered endemic to the *Serra Geral*, where it was only known for southeastern Santa Catarina and the extreme northeast of RS (FERREIRA *et al.*, 2016). Here, we present four new records of *V. linostigma* from the Araucaria Forest in RS, increasing its known distribution by 262 km to the south, and use the updated distribution data to reassess its conservation status.

2 MATERIAL AND METHODS

The study was based on field expeditions and a literature review. Specimens' identification was confirmed through the analysis of the protologue, type specimens available in the Kew (K) virtual herbarium, and specialized literature (FERREIRA *et al.*, 2016). Vouchers were incorporated into the ICN herbarium (THIERS, continuously updated). A distribution map was constructed in the software Quantum Gis v. 2.18, using WGS-84 datum. GeoCAT webtool (BACHMAN *et al.*, 2011) was used to reevaluate the conservation status of *V. linostigma*, following Red List Criteria (IUCN 2012, 2019).

3 RESULTS

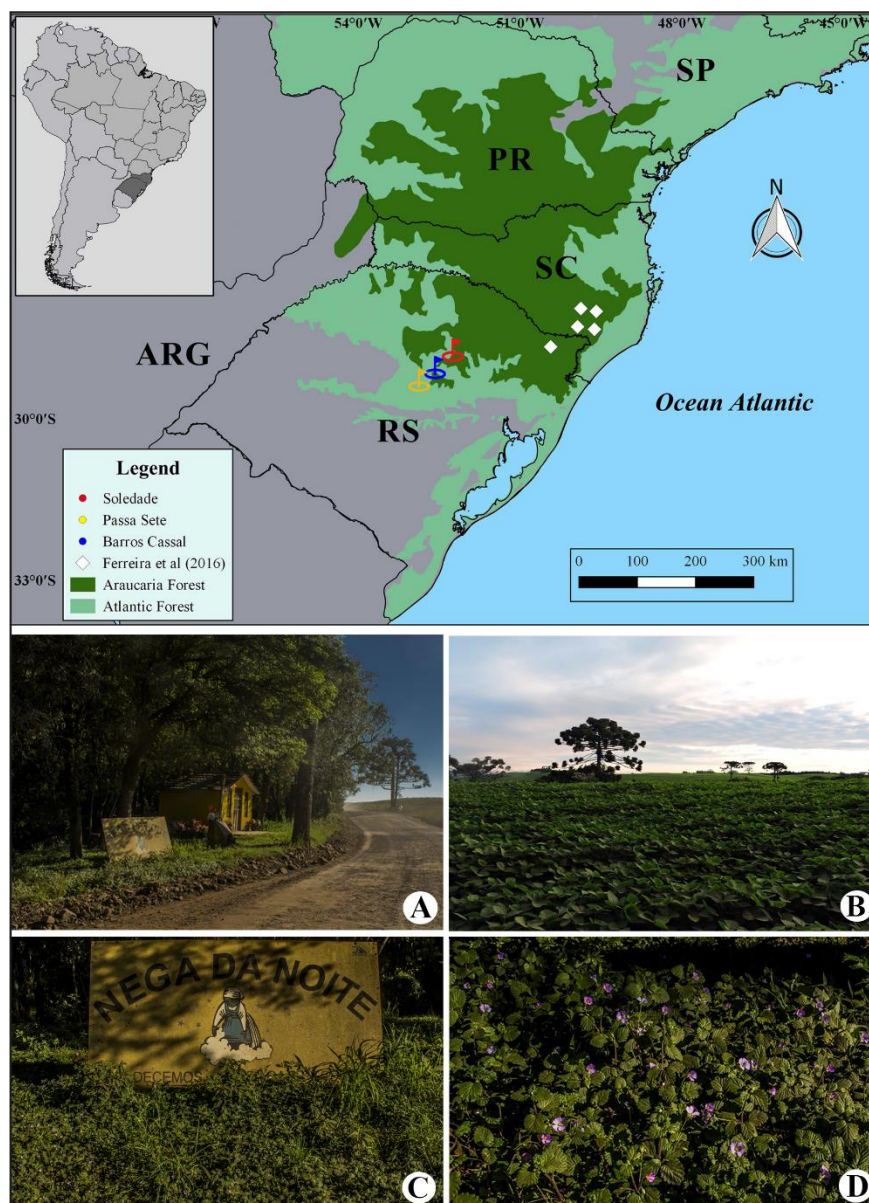
***Viviania linostigma* R.Knuth, Pflanzenr: 4 (129): 573, 1912. ≡ *Linostigma petiolatum* Klotzsch, Linnaea, 10: 439, 1836.** (Adapted from FERREIRA *et al.*, 2016)

Prostrate herb, with sprawling stems, usually radican in the lower nodes. Stems subcylindrical, hirsute. Leaves opposite, petiolate, petiole 0.2–1.3 cm long, pilose. Leaf 1–2.7 × 1–2.6 cm, generally as wide as long, ovate to broadly ovate, orbicular, base truncate, subcordate, less commonly obtuse, margins crenate, dark green adaxially, with sparse pubescence between the veins, abaxially albotomentose. Flowers tetramerous, arranged mainly in the axils of the upper nodes, in groups of 3 per node, subtended by four leaves. Calyx tomentose, campanulate,

sepals fused, calyx lobes acute. Petals light pink to white, obtriangular, apex crenate. Stamens 8, nectary glands alternating with two series of stamens, 4 as long as the sepals and 4 shorter than sepals. Ovary 2-locular, trichomes concentrated at the apex of the ovary. Fruit a capsule, hirsute.

Habitat: *Viviania linostigma* is associated with Araucaria Forest (Fig. 1), preferentially at forest edges and humid environments.

Figure 1 – Geographic distribution of *Viviania linostigma*. **A.** *Viviania linostigma* in Passa Sete municipality (roadside). **B.** Habitat of *Viviania linostigma* converted to a soybean crop. **C-D.** *Viviania linostigma* at the religious tourist point of Passa Sete municipality



Comments: The three municipalities of RS where *V. linostigma* was newly recorded (Barros Cassal, Soledade and Passa Sete) are characterized by rather small-scale agriculture. In Passa Sete, for example, *V. linostigma* grows in sympatry with *V. albiflora* at a religious site in *Campo do Sobradinho*, adjacent to a soybean crop (Fig. 1A-D).

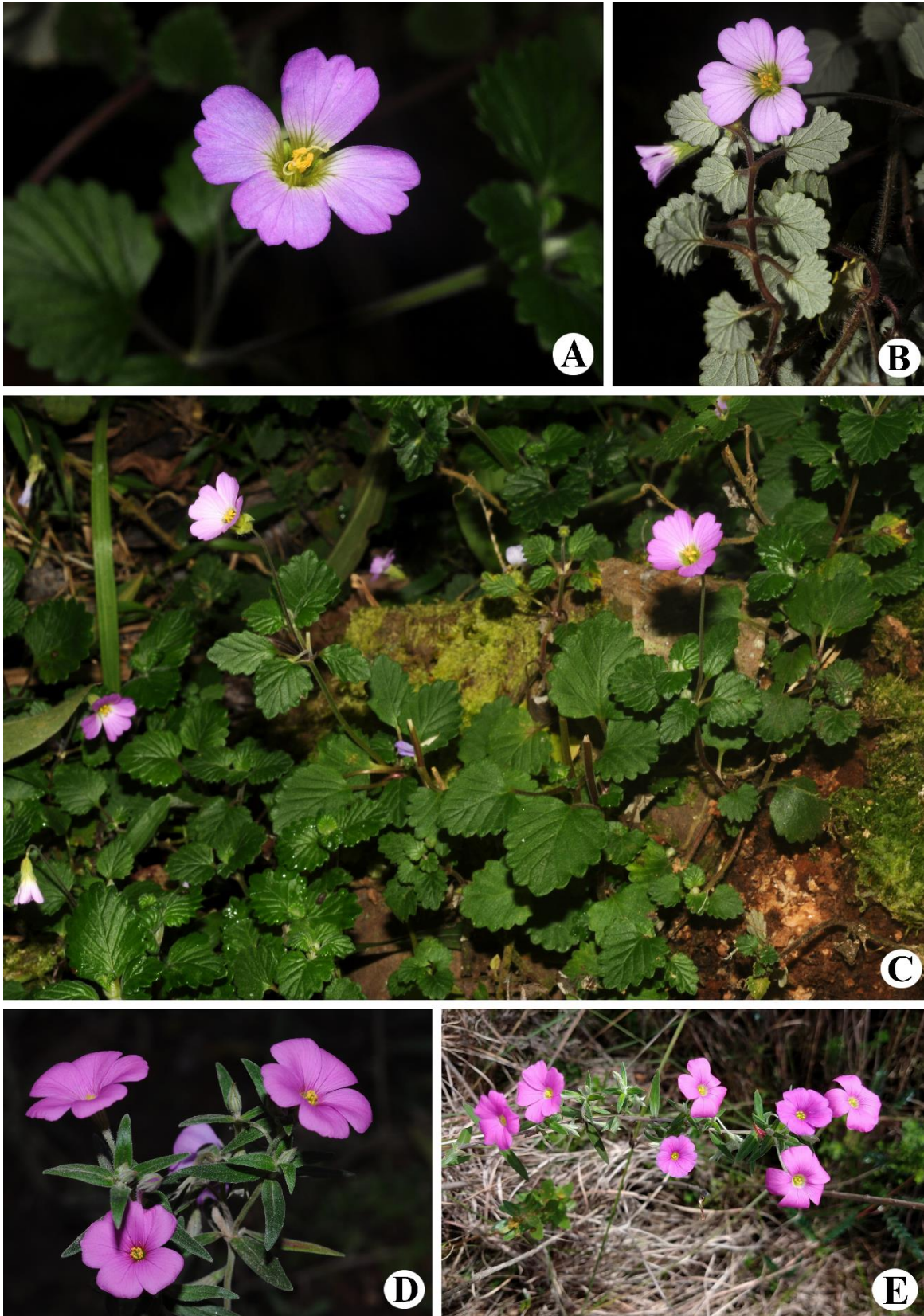
Examined Material: Brazil. RIO GRANDE DO SUL: Bom Jesus, entre Bom Jesus e Rio Pelotas, *E. Pereira 6422 & Pabst 6249*, 23 October 1961 (RB 115531, image on Jabot!); **Barros Cassal**, 29°09'56" S, 52°37'10.1" W, 425 m, *J. Schaefer s.n.*, 9 February 2019 (ICN 200676!); 29°09'24.3" S, 52°39'37.6" W, 419 m, *J. Schaefer s.n.*, 9 February 2019 (ICN 200677!); **Passa Sete**, Campo do Sobradinho, 29°24'41.2" S 52°55'08.6" W, 597 m, *R. Rigon s.n.*, 10 October 2018 (ICN 199776!); **Soledade**, 28°51'14.00" S, 52°23'9.00" W, 686 m, *S.A.L. Bordignon & M. Grings s.n.*, 20 September 2018 (ICN 200110!). SANTA CATARINA: Bom Jardim da Serra, Aparados da Serra, Serra do Oratório, *R. Reitz & R.M. Klein 6986*, 21 August 1958 (L.2007788, image on SpeciesLink!; PACA 65209, photo!; HBR, n.v.); Urubici, Parque Nacional de São Joaquim, *R. Trevisan 1423*, 8 December 2013 (FLOR 51308, image on SpeciesLink!); Parque Nacional de São Joaquim, *R. Trevisan 1716*, 3 December 2015 (FLOR 59153, image on SpeciesLink!); Parque Nacional de São Joaquim, *L.A. Funez, D.H. Costa-Rezende, W. Ribeiro-Nardes, M. Comin 8196*, 10 November 2018 (FLOR 67059, image on SpeciesLink!).

Table 1 – Morphological differences between *V. albiflora* and *V. linostigma*

	<i>V. albiflora</i>	<i>V. linostigma</i>
Leaves	lanceolate, sessile or petiolate Fig. 2D	ovate to broadly ovate, sometimes orbiculate, always petiolate Fig. 2B-C
Sepals	5	4
Petals	5, with obtuse apex Fig. 2D-E	4, with crenate apex Fig. 2A-C
Stamens	10	8
Ovary/ Ovules	tricarpellary / 2 ovules	bicarpellary / 1 ovule

Font: Adapted from FERREIRA *et al.*, 2016

Figure 2– **A-C.** *Viviania linostigma*. **A.** Tetramerous flowers. **B.** Ovate to broadly ovate or orbicular leaves. **C.** Prostrate habit. **D-E.** *Viviania albiflora*. **D.** Lanceolate leaves and pentamerous flowers. **E.** Fertile branch



4 DISCUSSION

Viviania linostigma was initially described as *Linostigma petiolatum* Klotzsch, and later synonymized with *Viviania albiflora*, of which it may be easily distinguished (see Table 1; FERREIRA *et al.*, 2016, 2020). In 2016, *V. linostigma* was reestablished as a distinct taxon by FERREIRA *et al.* (2016), who also indicated it as a species of elevated conservation concern. Although these authors have not mentioned potential threats nor explored other aspects justifying its conservation status, *V. linostigma* was assessed as Vulnerable based on the IUCN criterion that deals with the geographic range (B criterion).

Our findings show that *V. linostigma* is not restricted to the *Aparados da Serra Geral*, as previously assumed (FERREIRA *et al.*, 2016, 2020), but has a wider distribution in the southern part of the Araucaria Forest region (Fig. 1). The increase in the known distribution of *V. linostigma*, about 262 km to the south, required a reevaluation of its conservation status, given the previous categorization was based on a smaller Area of Occupancy (AOO). Furthermore, *V. linostigma* was newly recorded in highly fragmented landscapes, in which the main threat to these southern subpopulations appears to be land-use change, mainly by soybean and tobacco cultivation. Transition zones between ecosystems are often considered of low conservation importance and overlooked in research. Nevertheless, as shown here, small fragments might reveal unexpected occurrences of rare or threatened species. Cataloging the diversity extensively can help us to fulfill collection gaps and refine our understanding of conservation priorities within the Atlantic Forest and other ecosystems (VOGEL ELY AND BOLDRINI, 2015; HASSEMER *et al.*, 2015; LUBER *et al.*, 2016).

Fieldwork is essential to describe and understand ecosystems, serving as support for policy decision-making on biodiversity conservation (DIJKSTRA, 2016). Unfortunately, the lack of funding and incentives for this kind of study is a known problem (VOGEL ELY *et al.*, 2017; MENEZES *et al.*, 2018, SALDAÑA *et al.*, 2018). Even

so, we emphasize that an investment in sampling efforts, especially in Araucaria Forest, is necessary to ensure effective conservation actions for endangered species such as *V. linostigma*.

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Authorship Contribution

1 – Juliana Schaefer

Doutoranda em Botânica

<https://orcid.org/0000-0001-9967-7115> – julianaschaeferbio@gmail.com

Contribution: Conceptualization, Investigation, Writing – Draft, Writing – review & editing

2 – Cleusa Vogel Ely

Doutora em Botânica

<https://orcid.org/0000-0001-9094-9524> – cleusavely@gmail.com

Contribution: Conceptualization, Investigation, Writing – review & editing

3 – Ilsi Iob Boldrini

Doutora em Zootecnia

<https://orcid.org/0000-0003-1028-8864> – ilsi.boldrini@ufrgs.br

Contribution: Supervision, Writing – review & editing

4 – Sérgio Augusto de Loreto Bordignon

Doutor em Ciências Farmacêuticas

<https://orcid.org/0000-0001-5041-1148> – sergio.bordignon@unilasalle.edu.br

Contribution: Investigation, Writing – review & editing

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