

Increasing the knowledge on the distribution of *Phyla* (Verbenaceae): a new record for the state of Santa Catarina, Southern Brazil

Manuela Kich Wegener^{1*} , Gustavo Pedroso de Moraes² , Nataly O'Leary³ , Christian Silva¹ 

¹Universidade do Estado de Santa Catarina, Centro de Educação Superior da Região Sul, R. Cel. Fernandes Martins 270, Progresso, Laguna, Santa Catarina, Brasil

*Autor para correspondência: manuelakwegener@gmail.com

²Universidade Federal de Santa Maria, Centro de Ciências Naturais e Exatas, Av. Roraima 1000, Camobi, Santa Maria, Rio Grande do Sul, Brasil

³Instituto de Botánica Darwinion (ANCEFN-CONICET), Labardén 200, CC 22, B1642HYD, San Isidro, Buenos Aires, Argentina

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ABSTRACT – *Phyla nodiflora* var. *nodiflora* (Verbenaceae) is reported for the first time for Santa Catarina state, in southern Brazil. This is also the first mention of the genus *Phyla* for the State. The species was found in an area of restinga in the municipality of Laguna, which is part of the Baleia Franca Environmental Protection Area. We provide notes on the morphology, habitat, distribution, and uses of the species, and how to distinguish it from Brazilian congeners, as well as photos of the plant and a map of the new occurrence.

Keywords: biogeography, flora, restinga vegetation, Wallacean shortfall.

RESUMO – **Ampliando o conhecimento sobre a distribuição de *Phyla* (Verbenaceae): um novo registro para o estado de Santa Catarina, sul do Brasil.** *Phyla nodiflora* var. *nodiflora* (Verbenaceae) é apresentada pela primeira vez para Santa Catarina, Região Sul do Brasil. Este é o primeiro registro do gênero *Phyla* para o Estado. A espécie foi encontrada em uma área de restinga no município de Laguna, inserida na Área de Proteção Ambiental da Baleia Franca. Apresentamos comentários sobre a morfologia, habitat, distribuição e usos da espécie, bem como sua distinção de congêneres brasileiros, fotografias da espécie em campo e mapa da nova ocorrência.

Palavras-chave: Biogeografia, déficit Wallaceano, flora, vegetação de restinga.

INTRODUCTION

The family Verbenaceae is an important element of the American flora and currently includes 32 genera and ca. 800 species distributed mainly in tropical and warm temperate regions (Marx *et al.* 2010, Cardoso *et al.* 2021). It exhibits high species richness in Brazil, where there are 15 genera and 288 species, of which 66% are endemic to the country (Salimena *et al.* 2020). These taxa occur in a wide range of habitats, from moist forests to open and dry formations, and are more diverse in the Cerrado, Atlantic Forest, and Caatinga domains (Salimena *et al.* 2020).

To date, no modern integral taxonomic studies exist for Verbenaceae in the state of Santa Catarina, in southern Brazil. However, with the progress promoted by the Brazilian Flora 2020 project (BFG 2015, 2021a, 2021b), 57 species were confirmed for the state, which are distributed in 11 genera: *Aloysia* Palau, *Bouchea* Cham., *Citharexylum* L., *Duranta* L., *Glandularia* J.F.Gmel., *Lantana* L., *Lippia* L.,

Petrea L., *Recordia* Moldenke, *Stachytarpheta* Vahl, and *Verbena* L. (Salimena *et al.* 2020).

Phyla Lour. is a monophyletic genus that belongs to tribe Lantaneae and includes five species and three varieties (O'Leary & Múlgura 2012). It is native to the Americas and widely distributed in the Neotropical region, except for *P. nodiflora* (L.) Greene that is also found in other tropical and temperate regions of the world (O'Leary & Múlgura 2012, Lu-Irving *et al.* 2021). In Brazil, it is represented by two species and three varieties: *P. betulifolia* (Kunth) Greene, *P. nodiflora* var. *nodiflora*, *P. nodiflora* var. *minor* (Hook.) N.O'Leary & Múlgura, and *P. nodiflora* var. *reptans* (Kunth) Moldenke (O'Leary 2020). Here we report the first record of the genus *Phyla* for Santa Catarina: *Phyla nodiflora* var. *nodiflora*. This novelty for Santa Catarina results from an ongoing floristic survey in an area of restinga on the southern coast of the state that is within the Baleia Franca Environmental Protection Area (BFEP) limits, the largest conservation unit in the state (ICMBIO 2018).

MATERIAL AND METHODS

The specimen was collected in November 2021 in an area of restinga adjacent to Cardoso Beach, in Cape Santa Marta, in municipality of Laguna, Santa Catarina, within the BFEPA. The area is within the limits of the Atlantic Forest (IBGE 2012) and the climate is humid subtropical (type Cfa) according to the Köppen-Geiger classification (Peel *et al.* 2007). The annual mean temperature is 19.7°C and the annual mean rainfall is 1400 mm (Wrege *et al.* 2011). Following Falkenberg (1999), the vegetation of the restinga close to Cardoso Beach is mainly herbaceous/subshrubby, with scattered shrubs and trees, which occupy the beach, frontal and internal dunes, and permanently and temporarily flooded depressions.

Sampling and processing techniques followed Mori *et al.* (1989). A voucher was deposited in the Anita Garibaldi Herbarium (LAG) (Thiers 2022) at the Centro de Educação Superior da Região Sul of the Universidade do Estado de Santa Catarina. Additionally, searches for *Phyla* specimens from Santa Catarina were made using the *speciesLink* (CRIA 2022) and *Reflora* (2022). The identification was made using information on Verbenaceae available on the Flora e Funga do Brasil website (O'Leary 2020, Salimena *et al.* 2020). *In situ* photographs were taken using a digital camera. Geographic coordinates were obtained using a Garmin eTrex portable GPS. The distribution map was built using the software ArcMap v.10.1 (ESRI 2012).

RESULTS AND DISCUSSION

Phyla nodiflora (L.) Greene var. *nodiflora*, Pittonia 4: 46. 1899.

New record: BRAZIL, SANTA CATARINA, Laguna, Cabo de Santa Marta, Restinga da Praia do Cardoso, APA da Baleia Franca, às margens da Estrada Geral do Farol, 28°36'15"S, 48°49'48"W, 11.XI.2021, M.K. Wegener & A.O. Garcia 138 (LAG).

Phyla nodiflora var. *nodiflora* was found in an herbaceous-subshrubby restinga area, in sandy and humid soil, growing on the side of the road that crosses the internal dunes and goes to the Santa Marta Lighthouse (Fig. 1A-B). Our search of the virtual herbaria for other possible records of *Phyla* from Santa Catarina resulted in three records. Two were identified as *Phyla dulcis* (Trevir.) Moldenke (Oliveira s.n. [FLOR 36457]) and *P. scaberrima* (Juss. ex Pers.) Moldenke (Ritter 1514 [ICN 200678]), but they are *Lippia dulcis* Trevir, an exotic species native to Central America that is widely used as a medicinal herb (Compadre *et al.* 1986). The third one was identified as *P. canescens* (Kunth) Greene (= *P. nodiflora* var. *minor*) (Nuernberg & Mello 1033 [FLOR 48373]), but it is *Enydra anagallis* Gardner,

a hygrophilous Asteraceae that resembles *P. nodiflora* in habit and leaf phyllotaxis and shape (Roque 2020).

Phyla nodiflora var. *nodiflora* can be recognized by the following: creeping stems (Fig. 1 A - B); leaves thick, obovate, margins dentate on the upper half (Fig. 1 C); florescences solitary, erect, ovoid to slightly oblong, with purple bracts (Fig. 1 D - E); and corollas white to lilac, with a yellow throat (Fig. 1 F). The color of the stem, leaves, and florescence peduncles vary from green to vinaceous (Fig. 1 A - D), and the plant is covered with malpighiaceous hairs, which are exclusive within Verbenaceae to the genus *Phyla* (O'Leary & Múlgura 2012). It differs from the other *Phyla* species found in Brazil, namely *P. betulifolia*, by the presence of one florescence per leaf axil (vs. 2 to 3 per leaf axil in *P. betulifolia*) and sessile or subsessile leaves (vs. leaves with a petiole 1–2 cm long) (O'Leary 2020). The varieties of *P. nodiflora* differ in the leaf margin, apex, indumentum, and venation according to O'Leary & Múlgura (2012) and O'Leary (2020); these traits are summarized in Tab. 1.

The center of origin of *Phyla nodiflora* is estimated to be in southern North America and Central America; however, the species dispersed to Africa, Eurasia, and Oceania by natural and anthropogenic vectors via multiple events (Gross *et al.* 2017). Before this study, *P. nodiflora* var. *nodiflora* was known only from the state of Rio Grande do Sul, Brazil (O'Leary 2020). Our finding in Cape Santa Marta, in the municipality of Laguna, extends its distribution to the north (Fig. 1G). Thus, our collection is the first confirmed record of *Phyla* for the state of Santa Catarina, reducing the Wallacean shortfall (*i.e.*, gaps in the knowledge of geographic distribution; Hortal *et al.* 2015) for the genus. Human influence on the biogeographic and evolutionary history of the species is probably linked to its medicinal potential. The plant has been used in treatments of several diseases (*e.g.*, asthma, hemorrhoids, hepatitis) due to its antimicrobial, antitumor, anti-inflammatory, antidiabetic, antimelanogenic, hepatoprotective, and antioxidant biological activities (Jabeen *et al.* 2016).

The area where we found the species in Santa Catarina is close to the southern boundary of the BFEPA, a territory classified as a restricted use zone (ICMBIO 2018). Our floristic survey is revealing high richness in the area, with > 120 species catalogued that are mostly native. The new record of *Phyla* for the state highlights the importance of this protected area for conserving biodiversity. New records and new species for the state have been frequently published in the last years (*e.g.*, Funez *et al.* 2017, Sobral *et al.* 2019). These findings fill gaps in primary biodiversity data, which are highly relevant in studies about urgent environmental issues, especially in relation to planning conservation strategies (Anderson *et al.* 2020).

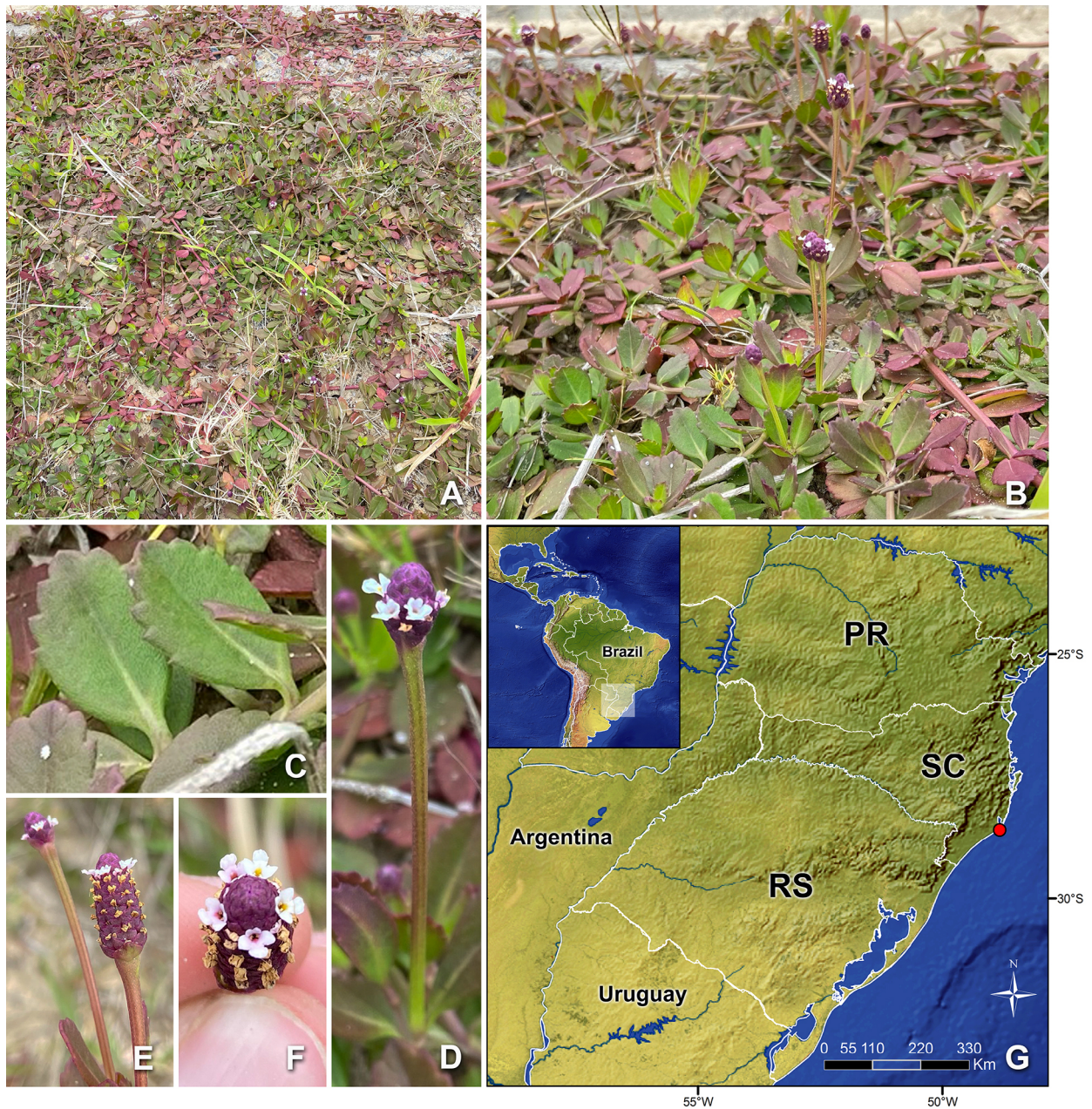


Figure 1. *Phyla nodiflora* var. *nodiflora*. A - B. Habitat and habit; C. Leaves; D - F. Florescences; G. Map showing the new record (red circle) for the state of Santa Catarina, Brazil (Wegener & Garcia 138 - LAG). Acronyms (map): PR = Paraná; SC = Santa Catarina; RS = Rio Grande do Sul.

Table 1. Distinctive morphological traits among the varieties of *Phyla nodiflora* in Brazil (based on O'Leary & Múlgura 2012 and O'Leary 2020).

Trait	<i>P. nodiflora</i> var. <i>nodiflora</i>	<i>P. nodiflora</i> var. <i>minor</i>	<i>P. nodiflora</i> var. <i>reptans</i>
Leaf blade shape	obovate, spathulate	elliptic or obovate	ovate to rhombic-ovate
Leaf blade size	2–4(–7.5) × 0.5–1.5(–3) cm	0.5–2(–4) × 0.2–1 cm	3–5(–8) × 1.5–3 cm
Leaf blade margins	entire or serrate towards the distal part of the blade, with 4 to 8 pairs of acute teeth	entire or serrate towards the distal part of the blade, with 3 to 7 spreading and wells-spaced, shallow teeth	serrate all along blade, with 8 to 10 pairs of teeth or toothed towards the distal part of the blade
Leaf blade apex	subobtuse	acute	acute
Leaf venation	only midvein prominent abaxially	only midvein prominent abaxially	pinnate venation prominent abaxially

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