

# New record and expansion of the geographic distribution of *Parodia mueller-melchersii* (Frič ex Backeb.) N. P. Taylor (Cactaceae) in the southern region of Rio Grande do Sul, Brazil

Renan Silveira Pittella<sup>1\*</sup> , Thamiris Barbosa dos Santos<sup>2</sup> , Hélió Ramirez Farias<sup>3</sup> 

<sup>1</sup> Universidade Federal do Rio Grande do Sul, Departamento de Ecologia, Avenida Bento Gonçalves, 9500, CEP 91501-970, Porto Alegre, Rio Grande do Sul, Brasil

\*Autor para correspondência: renanpittella@gmail.com

<sup>2</sup> Universidade Federal do Rio Grande do Sul, Departamento de Paleontologia e Estratigrafia, Avenida Bento Gonçalves, 9500, CEP 91501-970, Porto Alegre, Rio Grande do Sul, Brasil

<sup>3</sup> Instituto Meridionalis de Estudos da Flora, Caixa Postal 64, CEP 96300-000, Jaguarão, Rio Grande do Sul, Brasil

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**ABSTRACT** – *Parodia mueller-melchersii* is an endemic species from the Pampa Biome, presenting severely fragmented populations. In this study, we describe a new record of the species from the Municipality of Jaguarão, located in the extreme South of the State of Rio Grande do Sul (Brazil). This new record increases the distribution of *P. mueller-melchersii* by approximately 260 km to the southeast and represents its southernmost known point of occurrence from now. Additionally, we present illustrations and comments about the environment where the species was found and a short discussion about the conservation status of natural populations in the State.

**Keywords:** biogeography, cactus, grasslands, threatened species

**RESUMO** – Novo registro e ampliação da distribuição geográfica de *Parodia mueller-melchersii* (Frič ex Backeb.) N. P. Taylor (Cactaceae) na região sul do Rio Grande do Sul, Brasil. *Parodia mueller-melchersii* é uma espécie endêmica do Bioma Pampa, apresentando populações fortemente fragmentadas. Neste estudo, descrevemos um novo registro da espécie para o Município de Jaguarão, localizado no extremo sul do Estado do Rio Grande do Sul. Este novo registro aumenta a distribuição de *P. mueller-melchersii* em aproximadamente 260 km ao sudeste e representa o ponto de ocorrência mais ao sul até o momento. Também apresentamos ilustrações e comentários sobre o ambiente onde a espécie foi encontrada, bem como uma pequena discussão sobre o status de conservação das populações naturais no estado.

**Palavras-chave:** biogeografia, cacto, campos, espécie ameaçada

## INTRODUCTION

Cactaceae Juss. is almost endemic to the American continent where it has approximately 120 genera with over 1300 species distributed from Canada to the Patagonia (Hunt *et al.* 2006). The Neotropical region is known to present the highest species richness of this family (Zappi & Taylor 2008), with Mexico, the southwest of the United States, the central Andes and eastern Brazil as main centres of diversity (Zappi *et al.* 2018). Recognized as the third most important centre of Cactaceae diversity (Silva *et al.* 2011), Brazil holds 39 genera (14 endemics), about 261 species and 92 subspecies (BFG 2015). These are distributed across all phytogeographic domains of the country, yet predominantly at the Caatinga, the Cerrado, the Atlantic Forest (Taylor & Zappi 2004) and the Pampa (Carneiro *et al.* 2016).

*Parodia* Speng. comprises a group of terrestrial plants with globose to short- cylindrical stem bearing prominent

ribs. It is distributed in Argentina, Bolivia, Paraguay, Uruguay and Brazil. At the latter country, this genus is only present at the southern States (MS, PR, RS, SC), dwelling in open fields and vegetation associated with rocky outcrops (Flora do Brasil 2019). According to Hunt *et al.* (2006) the genus initially comprised 58 species; however, several were later published, resulting in the currently 94 accepted taxa, including the subspecies (The Plant List 2013). Many of these taxa present a limited geographic distribution (Machado *et al.* 2008). In the Brazilian state of Rio Grande do Sul, 32 species are found, some of them 13 being endemic (Carneiro *et al.* 2016).

*Parodia mueller-melchersii* (Frič ex Backeb.) N.P. Taylor is considered endemic to the Pampa Biome, where its occurrence is predominantly associated with rocky outcrops and stony soils (Carneiro *et al.* 2016). It is found mainly in northern Uruguay and west of Rio Grande do Sul (Hunt *et al.* 2006). However, it is not abundant and some of its populations are severely affected by livestock

activities and by *Eucalyptus* plantations, according to an evaluation made by Larocca *et al.* (2013) following the guidelines of the International Union for Conservation of Nature (IUCN). Consequently, it is considered Endangered [criterion A4ac + B1ab (iii, v)] in Rio Grande do Sul (FZB 2014), where its populations known so far are restricted to the western region (Anceschi & Magli 2018) and have been continually declining (IUCN 2019).

In this study, we present an expansion of the geographic distribution of *P. mueller-melchersii* and include a new record for the occurrence of the species in the extreme south of Rio Grande do Sul State. In addition, we present photos and comments about the environment where the species occurs and a brief discussion about the conservation status of their populations.

## MATERIAL AND METHODS

This record is the result of a cactus survey conducted on a native field fragment in the rural area of Jaguarão, Rio Grande do Sul (32°33'57"S 53°22'33"W). Following the recommendations of Meijaard and Nijman (2014) for endangered species and aiming at the preservation, the exact coordinates of the population are not given here, however they will be available for research purposes, on request. We found a population of *P. mueller-melchersii* on a rocky outcrop located in a rural property on a field trip made in August 2018. To create the geographic distribution map (Fig. 1) we used the observation data of *P. mueller-melchersii* population from our field trip and

the information available in the databases SpeciesLink, Reflora, Ralph Martin's field number finder and Global Biodiversity Information Facility combined with the species distribution information reported in the literature. The relevant specimen data were recorded in the field and the plants photographed with a Canon EOS Rebel T5 digital camera.

The species has been identified based on specialized literature (Anceschi & Magli 2018, Carneiro *et al.* 2016, Hunt *et al.* 2006). We also examined living specimens under cultivation in the cactus collection of Fundação Zoobotânica do Rio Grande do Sul and digital images available in the same databases used to create the distribution map. The nomenclature used to designate phytophysiognomies follows the proposal of Carneiro *et al.* (2016).

## RESULTS

***Parodia mueller-melchersii*** (Frič ex Backeb) N.P. Taylor, Bradley; Yearbook of the British Cactus and Succulent society 5:93. 1987.

**Synonyms:** *Notocactus eugeniae* Vliet, *Notocactus gutierrezii* W.R. Abraham, *Notocactus mueller-melchersii* Frič ex Backeb, *Notocactus rutilans* Daniker & Krainz, *Notocactus veenianus* Vliet, *Parodia mammulosa* subsp. *eugeniae* (Vliet) Hofacker, *Parodia mueller-melchersii* subsp. *gutierrezii* (W.R. Abraham) Hofacker, *Parodia mueller-melchersii* subsp. *winkleri* (Vliet) Hofacker, *Parodia rutilans* (Daniker & Krainz) N.P. Taylor, *Parodia rutilans* subsp. *veeniana* (Vliet) Hofacker.



**Fig. 1.** *Parodia mueller-melchersii* distribution map. Previous records (orange); New record of occurrence from this study (red).

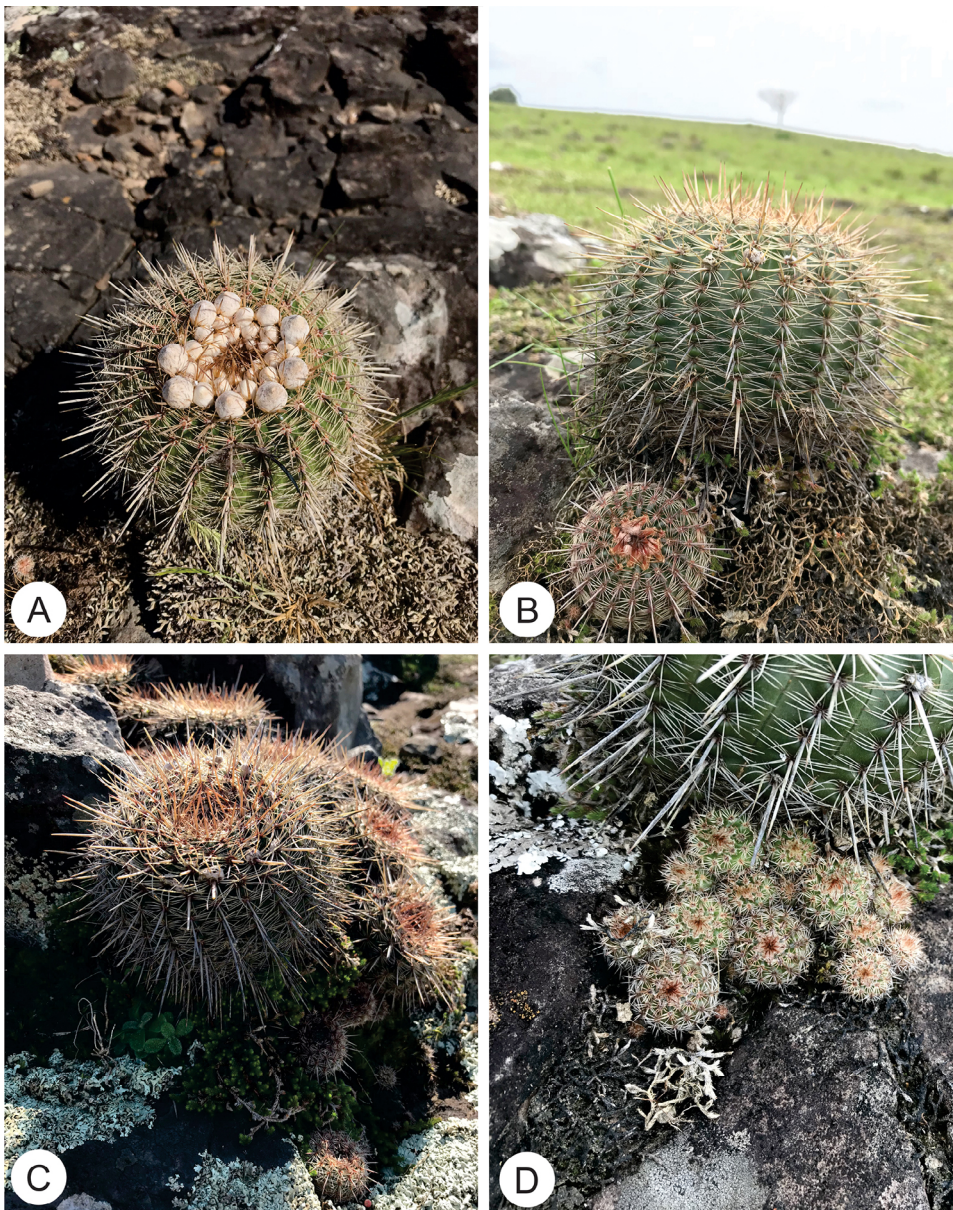
**New record:** Brazil, Rio Grande do Sul, Jaguarão (32°33'57"S 53°22'33"W), 3° Subdistrito Quilombo, observed by Renan Pittella, Thamiris Barbosa e Hélio Ramirez, 18.VIII.2018 (population size ca. 180 individuals) (Fig. 1).

**Voucher:** *Parodia mueller-melchersii*, BRASIL, RIO GRANDE DO SUL, Jaguarão, 3° Subdistrito, Fazenda Rincão da Coronilha, 22.X.2019, R. Farias-Singer, R. Pittella, H. Ramirez, P. Martins & F. S. Petry 2.051 (HAS 96644).

**Additional specimens examined:** BRASIL, RIO GRANDE DO SUL, Santana do Livramento, road to Cerros Verdes, 5.XII.2005, Machado M. 692 (HUEFS 105018 [image]); road to Cerros Verdes, 15.XI.2006, Machado M. 893 (HUEFS 135168 [image]); Uruguaiiana, Estancia Jiquiri, 21.X. 2009, Ari Delmo Nilson e Ricardo Aranha Ramos s/n° (FZB/RS CAC329); No location data,

4.V.1964, No collector data (WAG 1878616 [image]); SOUTH AMERICA, 16.V.1969, Buining s/n° (WAG 1878617 [image]); No location data, 4.IV.1966, B. K. Boom 44650 (WAG 1918811 [image]).

**Description:** Solitary or clustered cactus, terrestrial, elongated globular shape, 10-15 cm in height x 10-15 cm in diameter, dark green, poorly pronounced ribs (21-14), with small circular tubercles, areoles with white wool in young plants; central spines 1-3, 4-20 mm long, straight, subulate to acicular, whitish or light yellow, dark at base and apex; radial spines 14-18 or more, 2-8 mm long, slightly acicular, divergent, white; flower ca. 3 x 4.5-5 cm, yellow (pale golden-yellow; citrus yellow) or pink; elongated fruit with thin walls, ca. 2-3 cm high x 1.8 cm in diameter, dry, with the appearance of white felt, with reddish thorns, black seeds (Figs. 2A-D).

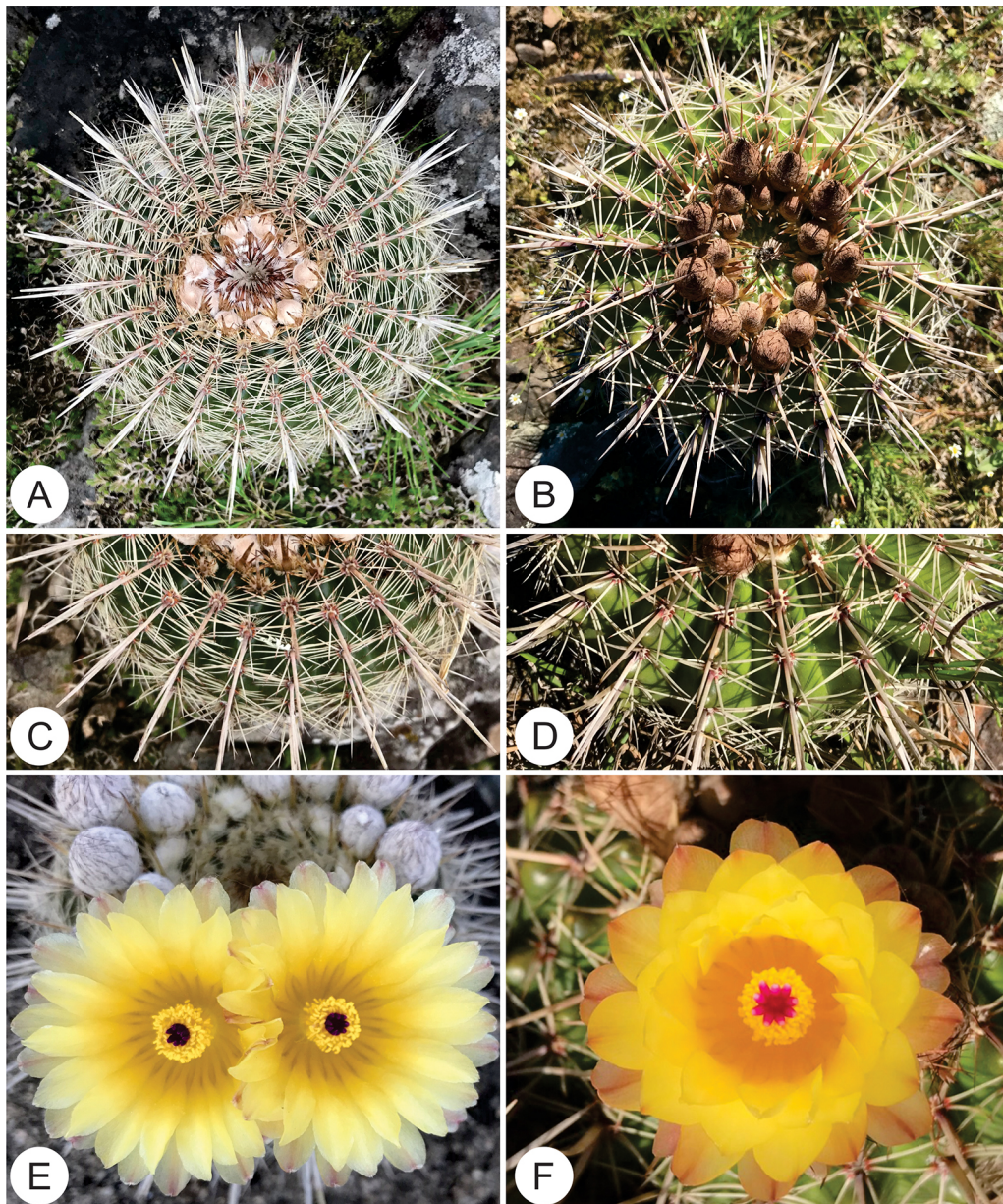


**Figs. 2A-D.** *Parodia mueller-melchersii*. A. General appearance (frontal view); B. General appearance (lateral view); C. Habitats; D. Juvenile specimens.

The specimens found in this study are in accordance with the above description adapted from Anceschi & Magli (2018) and Carneiro *et al.* (2016). Although the subspecies *P. mueller-melchersii* subsp. *gutierrezii* is no longer a valid name, this name applies for the populations with pink flowers. However, the individuals of the population reported in this study only have yellow flowers.

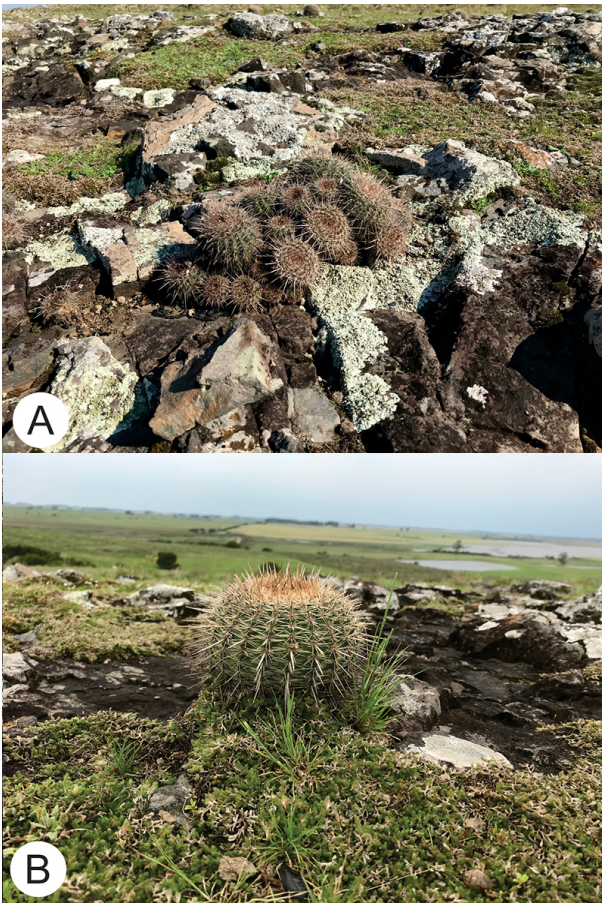
According to Anceschi & Magli (2018), *P. mueller-melchersii* differs from *Parodia mammulosa* (Lem.) N.P. Taylor, the most morphologically similar species, by its higher number of ribs (21-24 *vs.* 13-21) (Figs. 3A-B), by its not-flattened central spines and by its thinner radial spines (Figs. 3C-D). According to Carneiro *et al.* (2016)

the flowers of *P. mammulosa* (1-3.5 x 2-3.5 cm) have a funiliform, densely woolly hypanthium, with bristly thorns which is absent in the flowers of *P. mueller-melchersii* flowers. Additionally, we observed other differences regarding floral morphology in the populations of the two species found in this study, such as longer, lanceolate, pale golden-yellow tepals; the lobed, red-purple stigma with close lobes pointing upwards (“closed shape”) in *P. mueller-melchersii* (Fig. 3E); while *P. mammulosa* presented flowers with shorter, tubular lanceolate tepals of bright golden-yellow coloration, lobed red-pink stigma with distant lobes pointing outside (“open shape”) (Fig. 3F).



**Figs. 3A-F.** Morphological differences between *P. mueller-melchersii* and *P. mammulosa*. **A.** *P. mueller-melchersii* ribs; **B.** *P. mammulosa* ribs; **C.** *P. mueller-melchersii* spines; **D.** *P. mammulosa* spines; **E.** *P. mueller-melchersii* flower; **F.** *P. mammulosa* flower.

**Distribution and habitat:** Currently, this species is known to occur in Rio Grande do Sul (BR) and Uruguay (Fig. 1); yet exclusively in the Pampa Biome, where inhabits rocky soils and outcrops at 150-300 m high (Anceschi & Magli 2018). A natural population was found growing in a dry-field area (elevation 60-70 m above the sea level) in the shrub fields phytophysognomy region in the 3<sup>rd</sup> subdistrict of Jaguarão/RS. The place where the population occurs is characterized as a rocky place, composed by volcanic rocks from the Serra Geral Formation, slightly lighter in color compared to basalts *strictu sensu*, with crystallized quartz and volcanic glass in its composition (Glauco Ribeiro personal communication); located on the hillside of a small hill (locally known as “coxilha”), surrounded by a vegetation dominated by grasses and bryophytes (Figs. 4A-B). Near the same region other species of cacti can be found associated with the same habitat, such as *P. mammulosa*, *Parodia erinacea* (Haw.) N. P. Taylor and *Frailea gracillima* (Lem.) Britton & Rose.



**Figs. 4A-B.** *Parodia mueller-melchersii* habitat in Jaguarão, RS. A. Rocky outcrop; B. Surrounding vegetation.

## DISCUSSION

*Parodia mueller-melchersii* was originally known from northern Uruguay and western Rio Grande do Sul (Anceschi & Magli 2018). The record for the region of the 3<sup>rd</sup> subdistrict of the municipality of Jaguarão extends the geographical distribution by approximately 260 km southeast and represents the southernmost known locality of occurrence for the species. This record shows that *P. mueller-melchersii* is not restricted to the shallow soil fields at geomorphological unit Cuesta do Haedo, as was previously known (Carneiro *et al.* 2016). The population reported here occurs in a transitional region between the Planície Costeira (coastal fields) and Planalto Sul-riograndense (shrub fields) (Hasenack *et al.* 2010), in the extreme south of the state of Rio Grande do Sul.

According to Carneiro *et al.* (2016), this species hasn't been recorded in any protected area and faces a very high risk of extinction in the wild (IUCN category EN). However, it was already recorded near *Cerros Verdes* (see Additional specimens examined) which is an area located inside the APA do Ibirapuitã, a conservation area for sustainable use. Its extent of occurrence is small and populations are already declining due to several factors, among which the main threats are related to the intensive forestry and livestock activities developed at Rio Grande do Sul State. The record in Jaguarão was made in a privately rural area that develops activities of the same nature, corroborating the threat status and pressures that the species has been suffering in this region. The Municipality is located in a highly restricted area between southern Rio Grande do Sul and northern Artigas/UY (~ 500 km<sup>2</sup>), an area with high richness of threatened cacti (Goettsch *et al.* 2015). In this sense, it is emphasized the need of measures such as these already suggested in literature (see Carneiro *et al.* 2016), like actions on environmental education (especially in rural areas) as well as to promote good practices in agricultural activities which could ultimately reflect on the conservation of the remaining natural cacti populations.

Our work increases the number of records in the Pampa Biome and expands the known area of occurrence for the species; which may be useful to understand its spatial distributional pattern and to assist in locating additional, as yet not perceived populations. In addition to contributing to future biogeographic studies, these data may also be useful for updating conservation status and for understanding other aspects of *P. mueller-melchersii* ecology.

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