BALDUINIA
Núcleo de Estudos Botânicos
Balduíno Rambo
ISSN 1808-2688 (impresso)
ISSN 2358-1980 (online)

BALDUINIA, ano XIX, nº 71: 2-5. 2023.
Publicado em 5 de setembro de 2023.
DOI: 10.5902/2358198085000

A new combination for the genus *Notocactus* (Cactaceae)

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Abstract. A new combination for the genus *Notocactus* (Cactaceae).
Parodia Hofackeriana is transferred to *Notocactus*, and additional information about morphological related species, geographic distribution and environments of occurrence are assessed.
Key words: Biodiversity; endemism; Pampa biome; *Parodia*.

Resumo. Uma nova combinação para o gênero *Notocactus* (Cactaceae).
Parodia Hofackeriana é transferida para *Notocactus*, sendo inferida informações adicionais sobre espécies próximas, distribuição geográfica e ambientes de ocorrência.
Palavras-chave: Bioma Pampa; Biodiversidade; endemismo; *Parodia*.

The broad concept of *Parodia* Speg. was initially proposed by Hunt & Taylor (1986) and was followed by most members of the IOS (International Organization for Succulent Plant Study), among them Hunt & Taylor (1990), Hofacker & Braun (1998), Hofacker (1998), Hunt (1999), Hunt et al. (2006), Hunt (2012), Hunt (2016). More recently, Anceschi & Magli (2018) proposed a taxonomic synopsis of *Parodia sensu lato*, establishing several synonyms and some new combinations. In its broad concept, *Parodia* is morphologically heterogeneous, as it includes distinct taxa, which can be properly grouped as independent genera, as suggested by Lodé (2015) (are they *Acanthocephala* Backeb., *Bolivicactus* A.B. Doweld, *Brasiliparodia* F. Ritter, *Eriocephala* Backeb., *Notocactus*, *Wigginsia* D.M. Porter and *Parodia*) or even infrageneric entities as recommended by Eggli *et al.* (2008). On the other hand, Gerloff & Neduchal (2004) based mainly on seeds morphology treated Notocactus *sensu lato*. More recently, phylogenetic studies have shown that *Notocactus* is segregated from *Parodia*, being closely associated with *Wigginsia* (Nyffeler 2017). Notwithstanding, some names in *Notocactus*, which were pending to be transferred to *Parodia* were recently established (Hofacker *et al.*, 2020; Oliveira & Pontes, 2022).

Parodia Hofackeriana Oliveira & Pontes (2023: 284) was discovered by me in 2015, and the material was collected and cultivated. It was later identified as a new species morphologically close to *Notocactus Eugeniae* Vliet of the subgenus *Neonotocactus*. However, recently this taxon was described as a new species subordinate to *Parodia*. The authors differentiated it from the two most common species in the group: *Parodia mammulosa* (Lem.) N.P. Taylor [*Notocactus mammulosus* Lem.] and *Parodia Mueller-Melchersii* (Backb.) N.P. Taylor [*Notocactus Mueller-Melchersii* Backb.] (Oliveira & Pontes 2023). Thus, this article aims to transfer *Parodia Hofackeriana* to the genus *Notocactus* and infer additional information about related taxa, geographic distribution and environments of occurrence os this species.

Taxonomic treatment

Notocactus Hofackerianus (A.S. Oliveira & R. Pontes) Deble, ***comb. nova***. Bas.: *Parodia Hofackeriana* A.S. Oliveira & R. Pontes, Phytotaxa 598 (4): 284. 2023. Typus: BRAZIL. Rio Grande do Sul: Santana do Livramento, 265m, 12 October 2015, *A.S. Oliveira & L.P. Deble 84b* (holotypus PACA non visus, isotypus PACA non visus). Figure 1.

Accepted on July 21, 2023.

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Saxicolous plants with succulent habit, usually solitary, rarely sprouting basally. Stem, globose or depressed-globose (short-cylindrical in cultivated specimens) 4–10 cm high × 5–9 cm wide, epidermis olive-green, opaque, slightly squamosa, with umbilicate apex; with 18–20 ribs, more or less sinuose, well-defined but slightly tuberculate, with little sinuses between successive tubercles, 0.1–0.2 cm tall × 0.9–1.1 cm thick, with almost with no prominent edges below the areoles. Areoles located at the slightly sinuses between consecutive tubercles, rounded, 0.3–0.5 cm diameter, densely set, 0.7–0.8 cm apart, with whitish wool when juvenile, later glabrescent. Spines prominent, acicular, straight, pungent; radial spines 11–20, 0.4–1.3 × 0.03–0.05 cm, reddish-brown to grey (when older), with a red macula towards at base; central spines 1–2 (3), 1–2.5 × 0.07–0.1 cm reddish-brown to grey (shorter in cultivated specimens), with a red macula towards at base. Flowering areoles producing longer and thicker spines, up to 4 cm, often dark reddish-brow to dark-brown. Flower buds with a dense cover of white to pale brown wool and bristles. Flowers subapical, diurnal, opening in the early afternoon and closing circa 3–4 hours later, self-fertile. Corolla infundibuliform 4.0–4.5 cm, 4–6 cm in diameter (bigger in cultivated specimens); floral tube to ca. 1 cm; internal walls pale yellow and external walls yellowish green, with triangular bract scales subtending areoles that bear white to pale brownish hairs and long reddish brown bristles to 1.5–2.0 cm; tepals yellow or golden-yellow, perianth multiseriate, segments pale pinkish-yellow oblanceolate; stamens numerous, spreading, arranged along the inner walls of the floral tube and around the style; filaments with 1.6–2 cm, style pale-yellow, ca. 1.6–2.0 cm; stigma lobes wide open, exserted, 9–10, bright pink. Fruit 2.0–2.5 × 1.0–2.0 cm, green to dark purple, pericarpel with areoles bearing long brown hairs and bristles, dehiscing at the base and later falling off, pulp white; dry perianth remnants either persistent on the fruit or falling off; seeds broadly oval, 0.9–1.2 mm broad, 1.1–1.4 mm long, 1.1–1.3 mm high, dark brown, matt, border little expanded around hilum, testacells uniform, elongated, antilclinal boundaries cannelled, cells on the bottom black, on top light brown, hilum basal, superficial, hilum microphylar region oval, microphyle conjunct.

Distribution and Habitat– In the original description the authors mentioned "The species was found in three isolated locations in the area between the municipalities of Alegrete, Rosário do Sul and Santana do Livramento" (Oliveira & Pontes, 2023: 286). I found *Notocactus Hofackerianus* in dry environments, in the lower areas of "Serrania do Caverá" between Santana do Livramento and Alegrete municipalities, southwest Rio Grande do Sul state, Brazil. The specimens grow on rocky soils developed on basalts of the Mesozoic fissure volcanic domain (CPRM, 2009). The type population it is sympatric with *Frailea perumbilicata* F. Ritter, *Gymnocalycium denudatum* (Link & Otto) Pfeiffer subsp. *angulatum* Pestlé, *Notocactus ottonis* (Lehm.) A. Berger, and *N. tenuicylindricus* F. Ritter. Other species occurring in the same environments are *Arachis Burkartii* Handro, *Calydorea luteola* Klatt, *Cypella discolor* Ravenna, *Dyckia remotiflora* Otto*, Hysterionica chamomilloides* Deble, *Nothoscordum bonariense* Beauverd*, Oxypetalum microphyllum* Hook. & Arn., *Portulacca papulifera* D. Legrand*,* among others delicate Cyperaceae and Poaceae species. In Catimbau locality, southern Alegrete municipality I found *N. Hofackerianus* grows sympatric with *Frailea castanea* Backeb.*, F. phaeodisca* (Speg.) Backeb. & F.M. Knuth*, F. pumila* Britton & Rose, *Notocactus linkii* (Lehm.) Herter and *N. mammulosus.*

Comments– *Notocactus Hofackerianus* belongs to *Notocactus* subg. *Neonotocactus*. In the original description, Oliveira & Pontes (2023) differ the new species from *N. mammulosus* [as *Parodia mammulosa*] and *N. Mueller-Melchersii* [as *Parodia Mueller-Melchersii*]. They recognized the new taxon as distinct from these species by its smaller size, areoles with central spines hemispherical (vs. flat), among others characters (Oliveira & Pontes, 2023). In fact, *Notocactus mammulosus* and *N. Mueller-Melchersii* are very easily separated from *N. Hofackerianus* because they are not morphologically the more close to *N. Hofackerianus*. *Notocactus mammulosus* and *N. Mueller-Melchersii* were probably used in the comparison by the authors because they are the two most common "names" linked to several different taxa within *Notocactus* subg. *Neonotocactus.* In true, the pattern identified as *N. Mueller-Melchersii* in Brazil is much more robust (10–20 cm in height and diameter), and

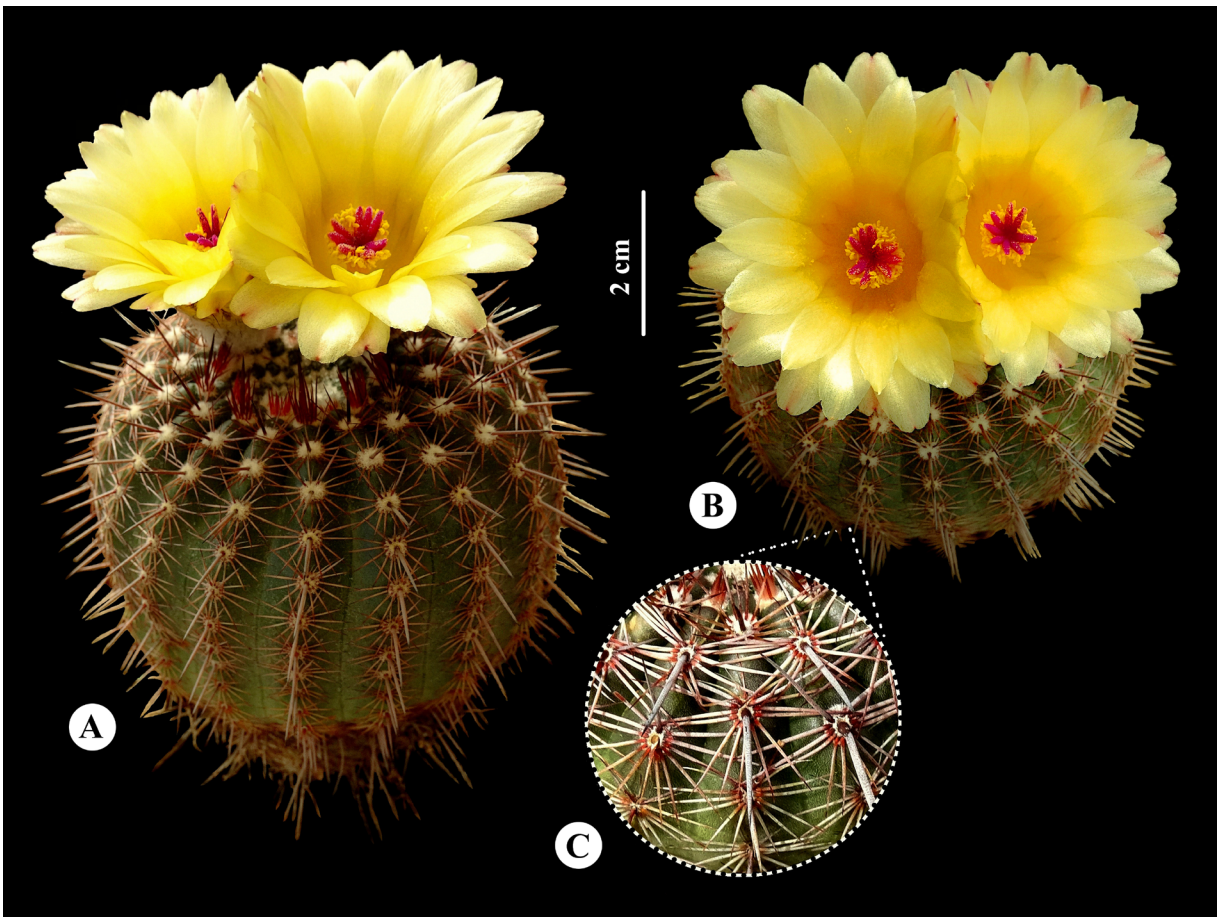

Figure 1. *Notocactus Hofackerianus*. A and B Cultivated specimen in bloom. C. Detail of the ribs and areoles.

the areoles display a single and flat central spine (see Pitella et al., 2020). In northwestern Uruguay and western Rio Grande do Sul state (Brazil) I found populations with distinct patterns, which include specimens with fewer ribs, smaller height and diameter, areoles with cylindrical spines, among others morphological characters. Oliveira & Pontes (2023) considered *Notocactus Mueller-Melchersii* [as *Parodia Mueller-Melchersii*] in its broad sense, and even so, these morphological variations were not considered for they when *N. Mueller-Melchersii* was compared with *Parodia Hofackeriana*. For all these circumstances the correct delimitation of this new species becomes very difficult (Oliveira & Pontes, 2023).

Notocactus Hofackerianus is undoubtedly morphologically more related to *Notocactus Eugeniae* Vliet and others taxa poorly known of *Notocactus* subg. *Neonotocactus*. I had the opportunity to cultivate several taxa of this subgenus side by side and to compare with *N. Hofackerianus*.

Notocactus Hofackerianus is morphologically related to *N. Eugeniae* and *N. Winkleri*, both taxa share with *N. Hofackerianus* their size, their areoles with cylindrical central spines and the same number and size of radial spines, and their similar flowers in shape and size. Nevertheless, *Notocactus Hofackerianus* differs from *N. Eugenieae* by its globose or depressed-globose stems (vs. short-cylindrical or cylindrical), with 18–20 ribs, 9–11 mm wide at the base (vs. 21–24, 6–8 mm wide at the base), central spines of areoles with up to 2.5 cm (vs. up to 4 cm), and lobules of the style with branches ascendant-patent, 5–6 mm long (vs. branches erect or slightly porrect, 3–4 mm long). *Notocactus Hofackerianus* is segregated from *N. Winkleri* Vliet by its globose or depressed-globose stems (vs. short-cylindrical), shape and wide of ribs (more or less sinuous, well-defined but slightly tuberculate, 9–11 mm wide vs. straight, tuberculate, 7–8 mm wide), central spines reddish-brown to grey with a red macula towards at the base, even when very old (vs. central spines light brown, becomes purplish

brown at top when young), tepals wider, yellow or golden-yellow (vs. light yellow or citrine-yellow), and lobules of the style with branches ascendant-patent, bright pink (vs. branches erect or slightly porrect, dark-purple or purple).

The northernmost populations of *Notocactus Eugeniae* are located in southeast of Masoller, southwest of Rivera department, Uruguay, distant about 60 km from the type population of *Notocatus Hofackerianus*. The populations of *Notocactus Winkleri* more close to *N. Hofackerianus* are located in south of Cañas, northeast of the department of Tacuarembó, are about 90 km from the typical population of *N. Hofackerianus*. It should also be mentioned that some populations of *Notocactus Mueller-Melchersii* located in the department of Artigas, Uruguay and between the municipalities of Uruguaiana and Quaraí, west of Rio Grande do Sul state, Brazil are smaller in size, display cylindrical stems, and areoles with 1–2 purplish-gray and cylindrical central spines, and 15–20 pinkish-white radial spines, which becomes gray with age, and which may, due to these morphological characteristics, can be confused with *N. Hofackerianus*.

Acknowledgements
I would like to thank Bárbara Pinheiro Moreira for your kindness in the preparing figure 1.

Declaration of competing of interest
The author declares that him have no known competing financial interests or personal relationships that could have appeared to undermine the objectivity or integrity of the work reported in this paper.

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