

## A synopsis of the genus *Parodia* Spegazzini s.l. (Cactaceae)

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**Summary:** The history of the ex-segregates of the genus *Parodia* Spegazzini s.l. (Cactaceae), since 1819 has been reviewed. A rather conservative approach is adopted to sum up the large number of the proposed names within 62 natural species. For each accepted species, a complete synonymy is given down to the subspecies level (varieties are included only in the case of basionyms). An enlarged description is taken from the field data, along with etymology, information about distribution, biome, ecological region and habitat, maps and, where necessary, an update on the conservation status expressed by the IUCN assessors.

**Zusammenfassung:** Die Geschichte der bisherigen (seit 1819 aufgestellten) Segregate der Gattung *Parodia* Spegazzini s.l. (Cactaceae) wurde überprüft. Es wird ein eher konservativer Ansatz verfolgt, um die große Zahl vorgeschlagener Namen in 62 natürlichen Arten zusammenzufassen. Für jede akzeptierte Art wird eine vollständige Synonymie bis auf die Ebene der Unterarten vorgelegt (Varietäten werden nur als Basionyme berücksichtigt). Eine erweiterte Beschreibung erfolgt basierend auf Felddaten und wird mit Angaben zur Etymologie, zur Verbreitung, zum Biom, zur ökologischen Region und zum Lebensraum, Karten und, falls erforderlich, einer aktualisierten Einschätzung des Gefährdungsstatus anhand der IUCN-Kriterien präsentiert.

**Resumen:** La historia de los ex segregados del género *Parodia* Spegazzini s.l. (Cactaceae), desde 1819 ha sido revisada. Se adopta un enfoque más bien conservador para resumir la enorme cantidad de nombres propuestos dentro de 62 especies naturales. Para cada especie aceptada, se da una sinonimia completa hasta el nivel de subespecie (se incluyen variedades solo en el caso de basiónimo). Se toma una descripción expandida por los datos de campo, junto con la etimología, información sobre la distribución, el bioma, la región ecológica y el hábitat, los mapas y, cuando necesario, una actualización de el estado de conservación expresada por los evaluadores de la UICN.

### Introduction and History 1984

In *The genera of the Cactaceae: towards a new consensus* (Hunt & Taylor, 1986) the IOS Working Party members, present at Kew on 2–3 August 1984, (i.e. E. F. Anderson, W. Barthlott, D.R. Hunt, B.E. Leuenberger, H. Sanchez-Mejorada, N.P. Taylor), in the list of genera recommended for adoption, the genus *Parodia* Spegazzini was accompanied with the following note: “Unfortunately there are non-practical means whereby *Notocactus* can be distinguished from *Parodia*”. Thirty three years later, after 12 years of study journeys to populations in South American habitats, in addition to the acquisition of molecular evidence on the genus brought to light since 2002 (Nyffeler) until today, basically - apart from the group *Eriocactus* Backeberg or *Erioccephala* Backeberg, which shows signs of distinction with respect to the rest of the segregates of *Parodia* s.l. (Anceschi & Magli, 2013a) - we agree with the IOS members’ 1984 report. It should be noted that, in the same issue of *Bradleya*, W. Glaetzle and K.H. Prestlé (1986) presented a study on the seed micromorphology of the genus *Notocactus* and segregates, based on scanning electron microscope images (Jeol, JSM 35) (ibid.: 79–96). Evaluating the differences between the seeds is a good starting point for dividing the taxon into 7 infrageneric groups (1. *N. ottonis* - *N. linkii*, 2. *N. concinnus* - *N. scopa*, 3. *N. mammulosus* - *N. uebelmannianus*, 4. *Brasilicactus*, 5. *Malacocarpus*, 6. *Eriocactus*, 7. *Brasiliparodia*). They also pointed out that a comparison with seeds belonging to members of *Parodia* Spegazzini s.s., showed the close relationship between the two genera. In addition, they added that, at the time of the study, there were no doubts about the common origin of *Parodia* and *Notocactus*, a clade that would later divide into a high mountain line (the former) and to another of the Pampas (the latter). Indeed, including *Notocactus* (K. Schumann) Frič into *Parodia* Spegazzini in 1984, is only the latest of a series of proposed divisions and mergers, which had previously involved the segregates of the genus *Notocactus* s.l., now merged into *Parodia* s.l.

## From *Cactus erinaceus* Haworth to *Brasiliparodia Ritter*

The first described taxon that is currently referable to a *Parodia* s.l. is *Cactus erinaceus* Haworth (the current *Parodia erinacea* (Haworth) N.P. Taylor), which appeared in 1819. Three other taxa were described by Lehmann between 1826 and 1827; first *Cactus langsdorfii*, then *Cactus linkii* and *Cactus ottonis* (respectively *Parodia langsdorfii* (Lehmann) D.R. Hunt, *Parodia linkii* (Lehmann) R. Kiesling and *Parodia ottonis* (Lehmann) N.P. Taylor). In 1827, Link & Otto grouped the 4 taxon-mentioned above into *Echinocactus*, along with *Echinocactus tephroanthus* Link & Otto (now a synonym for *P. erinacea*). Another small group was published in the second half of the 1830s: *Echinocactus muricatus* Otto ex Pfeiffer and *Echinocactus mammulosus* Lemaire in 1837, and in 1839 *Echinocactus concinnus* Monville i.e. *Parodia muricata* (Otto ex Pfeiffer) Hofacker, *Parodia mammulosa* (Lemaire) N.P. Taylor and *Parodia concinna* (Monville) N.P. Taylor respectively. It should be noted that the first 9 taxa published at specific level, were amongst those that have become *Parodia* s.l. components of the Pampas area, eight of these are currently being confirmed by us at the rank of species (excluding *E. tephroanthus*, now a synonym for *P. erinacea*). Among these in turn, 3 represent the dominant species of the genus in the Biome of reference, i.e. *P. erinacea*, *P. mammulosa* and *P. ottonis*. We confirm that *E. tephroanthus* is a synonym of one of the 3, and *P. scopia* is probably a former dominant, now with fragmented distribution. This supports our own hypothesis based on the idea that usually within a genus, the first to be discovered, described and published are the dominant species. This is because they have populations that are more common and/or numerous and therefore more evident in the habitats. In this sense, there would be a correspondence between the first taxon that was published and the most distributed and/or numerous one.

We have to wait until the end of 19<sup>th</sup> and the early 20<sup>th</sup> century to have a new series of descriptions (9) of current *Parodia* s.l. members: *Echinocactus haselbergii* Haage ex Rümpler, 1886 [*Parodia haselbergii* (Haage ex Rümpler) F.H. Brandt]; *Echinocactus concinnus* var. *tabularis* Cels ex Rümpler, 1886 [*Parodia concinna* (Monville) N.P. Taylor]; *Echinocactus schumannianus* Nicolai, 1893 [*Parodia schumanniana* (Nicolai) F.H. Brandt]; *Pilocereus leninghausii* K. Schumann, 1895 [*Parodia leninghausii* (K. Schumann) F.H. Brandt]; *Echinocactus grossei* K. Schumann, 1899 (*P. schumanniana*); *Echinocactus nigrispinus* K. Schumann, 1899 [*Parodia nigrispina* (K. Schumann) F.H. Brandt]; *Echinocactus graessneri* K. Schumann, 1903 (*P. haselbergii*); *Echinocactus elachisanthus* F.A.C. Weber, 1904 (*P. haselbergii*

again); *Echinocactus apricus* Arechavaleta, 1905 (*P. concinna*). In 1850, Salm-Dyck set up the genus *Malacocarpus*, transferring 6 species from the genus *Echinocactus*, with *Echinocactus corynodes* Otto ex Pfeiffer, 1837, as the type. In 1898 there is the birth of *Notocactus* that Schumann uses for one of the two subgenera into which he divides *Echinocactus*, the other is *Malacocarpus*. In 1922, Britton & Rose, in the third volume of their *The Cactaceae*, re-introduced *Malacocarpus* to identify a genus that now appears to be quite heterogeneous, containing taxa belonging to distinct phyletic lines, such as *Malacocarpus maassii* (Heese) Britton & Rose; *Malacocarpus mammulosus* (Lemaire) Britton & Rose; *Malacocarpus ottonis* (Lehmann) Britton & Rose; *Malacocarpus schumannianus* (Nicolai) Britton & Rose and *Malacocarpus tephroanthus* (Link & Otto) K. Schumann, 1890. These taxa are now part of *Parodia* s.l., coming both from *Parodia* s.s. (*Parodia maassii*), and the others from segregates of *Notocactus* s.l. They stretched the generic boundaries considerably by also including *Malacocarpus pulcherrimus* (Arechavaleta) Britton & Rose, now a synonym of *Frailea pygmaea* (Spegazzini) Britton & Rose; *Malacocarpus islayensis* (C.F. Förster) Britton & Rose and *Malacocarpus strausianus* (K. Schumann) Britton & Rose, the latter two belonging to *Eriosyce* s.l.; or *Malacocarpus patagonicus* (F.A.C. Weber ex Spegazzini) Britton & Rose, now *Austrocactus bertinii* (Cels ex Henricq) Britton & Rose.

After the genus *Malacocarpus*, the third volume of *The Cactaceae* continued with the new genus *Hickenia*, type *Echinocactus microspermus* F.A.C. Weber. The genus is monotypic, with the only species *Hickenia microsperma*; type locality Tucumán, Argentina; distribution: North Argentina. Britton & Rose were unaware that the name *Hickenia* had been published three years earlier by Lillo (1919) as a genus of the Asclepiadaceae. Finally, in 1923, Carlos Spegazzini described the genus *Parodia* s.s., type *Echinocactus microspermus* = *Parodia microsperma* (F.A.C. Weber) Spegazzini to replace the illegitimate name *Hickenia* published by Britton & Rose.

In the same year, Spegazzini published *Parodia paraguayensis* (now a synonym for *Parodia ottonis* (Lehmann) N.P. Taylor). It is essential to note how the author of the genus *Parodia*, in addition to *P. microsperma*, already considered *P. ottonis* to be a part of it. The idea that *Parodia* and *Notocactus* are part of the same phyletic line was born in the same year of the genus publication.

In *Kakteen* (1929), filtering the work of Britton & Rose, Alwin Berger maintained the genus *Malacocarpus* Salm-Dyck for only 6 species with a woolly apex and a pink and soft fruit thus limiting it to *M. sellowii*, *M. corynodes*, *M. erinaceus*, *M. arachavaletai*, *M. langsdorfii* and *M. fricii*. He esta-

blished *Notocactus*. This could be considered to be the true birth of *Notocactus*, since this was the first time it was given full generic status, from the first publication of the name made by Fric (1928) for another group of species previously included in *Malacocarpus* by Britton & Rose, in a sense close to the current concept of *Notocactus* s.l. (i.e. considering taxa such as *N. mammulosus*, *N. ottonis*, *N. scopa*, *N. schumannianus*, *N. leninghausii* and *N. haselbergii* as belonging to the same phyletic line. In the same publication, Berger added *Parodia maassii* (Heese) A. Berger to the genus *Parodia* Spegazzini s.s., a taxon that was previously included in *Malacocarpus* by Britton & Rose. We emphasize that, even in the line of the Andean parodias, our idea of a relationship between the first taxa published within a genus and the dominant species in the genus itself seems to work. Indeed, *P. maassii* and *P. microsperma* are the two dominant species in the Andean branch of *Parodia* s.l.

In 1964, D.M. Porter replaced the name *Malacocarpus* Salm-Dyck with *Wigginsia* D.M. Porter, since the former appeared to be a homonym of *Malacocarpus* Fisher & May, a genus of the Rutaceae that had been published in 1834. In the Backeberg era, in his *Kakteenlexikon* (1966), the great German collector and expert accepted D.M. Porter's proposal, bringing the number of *Wigginsia* species to 15, and divided Berger's *Notocactus* concept into 3 genera:

1) *Eriocactus* Backeberg, distinguished by the height of the stems at maturity, the oblique and woolly apical crown and the wide flowers. Composed of *Eriocactus leninghausii* (K. Schumann.) Backeberg and *Eriocactus schumannianus* (Nicolai) Backeberg.

2) *Brasilicactus* Backeberg, for the 3 globular species with a highly specialized flower. *Brasilicactus elachisanthus* (F. A.C. Weber) Backeberg, *Brasilicactus graessneri* (K. Schumann) Backeberg and *Brasilicactus haselbergii* (Haage ex Rümpler) Backeberg. All now assimilated into *Parodia haselbergii* (Haage ex Rümpler) F. H. Brandt.

3) *Notocactus* (K. Schumann) Frič *sensu* Backeberg, containing 16 species divided into two subgenera, namely *Notocactus* and *Neonotocactus*, distinguished on the basis of the differences of the fruits: the first comprising *N. ottonis* and *N. scopa*, the second the remainder. It is to be noted that the already mentioned work of Glaetzle and Prestlé, based on the study of the seed micromorphology, did not confirm Backeberg's two subgenera (1986).

In Backeberg's work, classified within the genus *Parodia* Spegazzini s.s. (now made up of about 80 species, compared to the 2 recognized in 1923), a group of globular plants also appeared which were difficult to attribute and were morphologically similar to the Andean parodias, but originating from Southern Brazil. They are *Parodia*

*alacriportana* Backeberg & Voll, *Parodia brevihamata* W. Haage ex Backeberg and *Parodia buenekeri* Buining. Currently the three taxa are included in *Parodia* s.l. and all attributable to *P. alacriportana*. Afterwards it was Buxbaum in Krainz (1967) who suggested the transfer of *Brasilicactus*, *Eriocactus*, *Wigginsia* and "the Brazilian parodias" into *Notocactus*. This represents the birth of the modern concept of *Notocactus* s.l. In the same publication it was, however, stated that *Notocactus* had an undoubtedly common origin with *Parodia*. Previously, the same author, in *Die Kakteen* had split *Parodia* Spegazzini s.s. into 3 subgenera based on flower and seed differences. These were Subgenus *Parodia* Spegazzini, type *Parodia microsperma* (F.A.C. Weber) Spegazzini = *Echinocactus microspermus* F.A.C. Weber; subgenus *Protoparodia* F. Buxbaum, type *Parodia maassii* (Heese) A. Berger = *Echinocactus maassii* Heese and subgenus *Obtextosperma*, type *Parodia ayo-payana* Cárdenas.

The first era of the history of the classification of *Parodia* s.l. segregates ended, in our opinion, with the creation by Ritter (1979) of the genus *Brasiliparodia*, into which he transferred Backeberg's "Brazilian parodias", along with *Notocactus rechenensis* Buining, and added his *Brasiliparodia catarinensis* Ritter (now a synonym of *P. alacriportana*). Ritter justified the new genus by stating that the *Brasiliparodia* seed is closer to *Brasilicactus* than to *Notocactus*, and that it could therefore be considered a subgenus of *Brasilicactus*, but that could be distinguished from the latter because it does not have the highly specialized flower. The author pointed out that *Brasiliparodia*'s closest relatives appeared to be certain parodias from the centre of Bolivia, identifiable with the subgenus *Protoparodia*, series *oblongisperma* of Buxbaum.

### The Modern Era. From the IOS to the ICSG classification

After the consensus reached among the IOS members, as a result of the 1984 meeting, the subsequent IOS Working Party meetings (1987–90), in which 23 additional specialists participated, accepted *Parodia* s.l. with >80% support (Hunt & Taylor, 1990). As proposed by the IOS members in 1990, *Parodia* Spegazzini included 50 species and the following synonymy at a generic level: *Malacocarpus* Salm-Dyck (1850) non Fischer & Meyer; *Notocactus* (Schumann) Frič (1928); *Erioccephala* Backeberg (1938) (non *Erioccephalus* L.); *Brasilicactus* Backeberg (1942); *Eriocactus* Backeberg (1942); *Wigginsia* D.M. Porter (1964); *Brasiliparodia* F. Ritter (1979).

In October 1996, *Cactaceae Consensus Initiatives* was born, compiled by David Hunt, who presented it as "An occasional bulletin for participants

in the ‘consensus’ discussion of the IOS Cactaceae Working Party and for collaborators on the second edition of the Cites Cactaceae Checklist...”. It is in fact whilst preparing CCC2 (CCC1 had been released in 1992) that many *Parodia* specialists proposed their taxonomic approach to the genus in its new way s.l.. Among these, the greatest contributions are by John Brickwood (1997) who, based on the geographic distribution and morphology of plants, suggested to circumscribe the Andean parodias into 12 species and 21 subspecies. Subsequently Reto Nyffeler (1997) revised the 65 ‘limbo’ species present in CCC1, taxa of the *Parodia*’s Pampean line (*Notocactus* s.l.) and Ken Preston-Mafham (1997) with John Brickwood, partially revised the previous Brickwood proposal, following some rather significant discoveries made in Bolivia by Inter-*Parodia* members (IPK), amounting to the acceptance of 5 species previously included in *P. schwebsiana*. Andreas Hofacker and Pierre Braun (1998) and Andreas Hofacker (1998) made some nomenclatural adjustments relevant to the transfer of taxa from *Notocactus* to *Parodia*, mainly due to the trend of transferring taxa from the rank of species or variety to that of subspecies (Anceschi & Magli, 2010). Finally, with Reto Nyffeler’s work (1999), we come to the molecular study, still the most enlightening on the internal relationships between the components of the genus *Parodia* s.l.. The author proposed to the IOS Cactaceae Working Party members a classification based on the molecular analysis conducted using ITS (nuclear ribosomal DNA) and *trnL-trnF* (cp DNA) as molecular markers to investigate the relationships between the members of the subtribe Notocactinae, and especially among those internal to *Parodia* s.l. (i.e. *Brasilicactus*, *Brasiliparodia*, *Eriocactus*, *Notocactus*, *Parodia* and *Wigginsia*). After detecting the basal position of *Brasilicactus* / *Brasiliparodia* and *Eriocactus* in the group, which in the Nyffeler’s words “are not true parodias”, three options were proposed: 1) Include everything in *Parodia* s.l., including *Brasilicactus* / *Brasiliparodia*, *Eriocactus*, ‘*Notocactus*’ s.s., and *Wigginsia*. 2) Recognize *Brasilicactus* / *Brasiliparodia* [in one genus only], *Eriocactus* and *Parodia* s.l. (including ‘*Notocactus*’ s.s., and *Wigginsia*). 3) Recognize *Brasilicactus* / *Brasiliparodia* [in one genus only], *Eriocactus*, and probably up to 5 different genera for the rest of the members, from ‘*Notocactus*’ s.s., *Parodia* s.s., and *Wigginsia*. Obviously, the solution in point 1) was more in line with the IOS preferences of the time, and was the one chosen by Hunt (1999). With the CCC2 publication (Hunt, 1999) 89 taxa were recognized in *Parodia*, of which 66 were species and 23 heterotypic subspecies.

In June 2000, following the decision of the 15 IOS members, attending the Zurich meeting in March 2000, the IOS Cactaceae Working Party be-

came the International Cactaceae Systematics Group (ICSG). It was an ICSG’s member, Edward F. Anderson, who in 2001, with his book *The Cactus Family*, published the first modern treatment after the work of Britton & Rose (1919–1923) and the Backeberg era. The author circumscribed the genus *Parodia* s.l. in 89 taxa divided into 66 species and 23 subspecies. In general, the classification proposed by Anderson, by the author’s own admission (2001) corresponds more or less to the ICSG contemporary thought. There will always remain curiosity about the possible results of a more personal approach to the Cactus Family, led by the student of the only true “lumper” of modern times: Lyman Benson, to whom Anderson’s work was dedicated.

In 2006, the ICSG members’ joint efforts produced the two volumes of *The New Cactus Lexicon*, where Hunt *et al.* established their vision of *Parodia* s.l. in 66 taxa, 58 species and 8 heterotypic subspecies. We recall that in the English edition of Backeberg’s *Kakteenlexikon* (Translated by Glass, L., 1977, *Cactus Lexicon*), the current *Parodia* s.l. comprised, excluding varieties, 157 taxa at a specific level (3 *Brasilicactus*, 4 *Eriocactus*, 33 *Notocactus*, 117 *Parodia*).

Meanwhile, Gerloff & Neduchall (2004), specialists and supporters of the genus *Notocactus* s.l. based essentially on the seed character (but see also the aforementioned Glaetzle & Prestlé’s study) and not supported by molecular evidence (Nyffeler, 1999; Nyffeler & Eggli, 2010; Barcenás *et al.*, 2011), divided the genus into 6 sub-genera consisting of 151 taxa comprising species, varieties and forms. Regarding the similarities between *Parodia* and *Notocactus* the two authors say there are few and those due to convergence phenomena.

In 2011, the new German edition of Anderson’s book *Das grosse Kakteen-Lexikon*, translated and edited by Urs Eggli was published. For *Parodia* s.l. Eggli confirmed Anderson’s approach of 89 taxa with the same 66 species and 23 subspecies. In the re-edition of NCL’s Atlas, renamed *The New Cactus Lexicon Illustrations* (2013), D. Hunt brought the recognized taxa from 66 to 68, by adding the mysterious *Parodia saint-pieana* Backeberg (formerly among the synonyms of *Parodia chrysacanthion* in NCL 2006, and confirmed within the synonyms of this taxon in our synopsis), in addition to the most recently discovered *Parodia gaucha* Machado & Larocca (2008).

In the following CCC3 (2016), Hunt maintained the 68 taxa of NCL 2 Illustrations, but added *Parodia hegeri* Diers, Krahn & Beckert, and re-included *P. saint-pieana* among the synonyms of *P. chrysacanthion*.

Between the two Hunt publications, the last monograph to be printed so far on the family *Cactaceae* appeared, the two volume *Taxonomy of the*

Cactaceae by J. Lodé (2015). The author, mainly following his interpretation of molecular data, divided *Parodia* s.l. into 7 genera, comprising a total of 86 taxa at specific level. *Acanthocephala* Backeberg (ex *Brasilicactus* Backeberg): 2; *Boliviacactus* A.B. Doweld: 17; *Brasiliparodia* F. Ritter: 2; *Erioccephala* Backeberg (ex *Eriocactus* Backeberg): 6; *Notocactus* (K.M. Schumann) A.V. Frič: 42; *Parodia* Spegazzini: 8; *Wigginsia* D.M. Porter: 9.

### **Current understanding of *Parodia* s.l.**

Actually, by applying the principle of monophyly in Hennig's sense (1966) (see next section), the molecular evidence has confirmed *Parodia* s.l. The already mentioned results obtained by Nyffeler in this direction (1997: 6-8), were confirmed by Nyffeler & Eggli (2010). The data of Barcenás *et al.* (2011: 475, 481) are in contrast to the previous authors, and they point out that, to be monophyletic *sensu* Hennig, the current *Parodia* s.l. should probably also include *Eriosyce* s.s. (2 sp.), *Neowerdermannia* (2 sp.) and *Islaya* (3 sp.), the latter now part of *Eriosyce* s.l. A further extension of *Parodia* s.l. in this direction would imply at most the inclusion of 7 more species in total. Considering that the latter analyses have a rich variety of phylogenetic approaches (Bayesian, ML, MP), but constructed using nucleotide sequences from a single region of the genome (*trnK-matK*), and are in contrast with the previous molecular outcomes, we prefer to wait for confirmation before considering further adjustments relevant to the definition of the genus.

### **Molecular results and principle of monophyly. Some clarifications**

Since the pioneering study of Wallace (1995), during the last decades, changes at the genus level and the higher taxa in the family Cactaceae, have almost always been proposed by new evidence emerging from molecular analysis. Examples are Nyffeler (1999), for Notocactinae/*Parodia* s.l.; Nyffeler & Eggli (2010), for subfamilies, tribes and subtribes of the Cactaceae; Schlumpberger & Renner (2012), Trichocereae or Trichocereinae/*Echinopsis* s.l.; Schlumpberger (2012), ex-segregates of *Echinopsis* s.l.; Charles (2012) *Borzicactus* s.s.; Anceschi & Magli (2013b, 2013c), on *Echinopsis* s.l.; Hunt (2013) for subfamilies, tribes, genera and groups of the family; Lodé (2015) subfamilies, tribes, sub-tribes, genera. In the creation of their taxonomic systems, all these authors invoke the principle of monophyly to support the formation of their groups (even with opposite results), as opposed to the principles of paraphyly and polyphyly. It is evident, at least to us, that we are talking about the principle of monophyly in the sense of Hennig (1950, 1966), being the concept of paraphyly a new concept proposed by this author. Prior to Hennig systematists generally recognized two kind of groups relative to phylogeny, monophyletic and

polyphyletic groups, with the exception of Naef, 1919 (Wiley & Liebermann, 2011). Given the varied approaches about the phylogenetic hypotheses adopted by the various authors to support their monophyletic groups starting, from the same principle, we would like to clarify how we apply the theory also in the case of *Parodia* s.l.

#### **a. Premise**

We agree with Gel-Mann (1994), that certain sciences are “more fundamental” than others, as physics is more fundamental than chemistry, we also agree “that phylogenetic trees inferred from genetic data are better than those inferred from phenotypic data because genes are ‘causally prior’ to phenotypes”. (Zuckerandl & Pauling, 1965, quoted from Sober, 2008).

#### **b. Theory and theory application**

Although literally a supra-specific taxon can be defined as “any named assemblage of two or more species” (Wiley & Liebermann, 2011), Hennig (1966) uses the equivalent higher taxa to define families, suborders, orders, subclasses, classes. The methodological tool provided by Hennig to distinguish natural groups (monophyletics) from non-natural ones (para- and polyphytics) in higher taxa (for the comparison at a specific level he uses the semaphoront's figure (Ibid: 6–7, 32–33, 63, 65–67)), is that the first ones are joined by synapomorphies (homologous characters derived from a recent common ancestor), the second ones by symplesiomorphies (ancestral homologous characters derived from the stem species), and the third ones are joined by characters due to convergence or parallelism (analogous characters not derived from a common ancestor).

We emphasize that this instrument was designated by the author to define large groups of species, such as to show quantitative and qualitative characters, “in order to be interpreted as ancestral or derivatives, and then to draw reliable phylogenetic conclusions on the analyzed taxa.” (quoted from Anceschi & Magli, 2013b).

We are saying that the more a monophyletic group is extended to a large number of species and the more are the common derivative characters supporting it, the greater will be the probability that this group will be really monophyletic. In the author's words the concept is summarized as follows: “For phylogenetic systematics this means that the reliability of its results increases with the number of individual characters that can be fitted into transformation series”.

We are saying that basing phylogeny by invoking the principle of monophyly on groups consisting of a low number of species, is a contradiction in Hennigian terms.

Finally, in our approach towards the definition of monophyletic groups, we find useful Nelson's

(1971: 472) redefinition of the concepts of paraphyly and polyphyly *sensu* Hennig. Nelson defines paraphyletic as groups lacking one species or monophyletic group, and polyphyletic as groups lacking two or more species or monophyletic groups. The much-feared “danger” of paraphyly (Hunt, 2012: 4; Lodé, 2015, 1: 51, 110, 127, 230; 2: 84, 114, 268), as already demonstrated in the case of *Echinopsis* s.l. (Anceschi & Magli, 2013c: 24) does not exist, unless it is decided to separate *a priori* one of the taxa that the analyses are showing to belong to the monophyletic group under investigation. The fact that at molecular level many genera currently recognized are not monophyletic (i.e. not sufficiently extended and not supported by a sufficient number of synapomorphies), is thus “solved” by Barchenas *et al.* (2011: 488) in one of the most comprehensive studies of molecular biology on the family Cactaceae: “... our least inclusive groupings are significantly larger than currently accepted genera... However, although many genera are not monophyletic, many of these follow a pattern of a monophyletic core, with one or two outliers suggesting relatively robust groups with ‘fuzzy edges’ so that in several cases small adjustments to classifications (i. e. moving outside of the genus) may produce monophyletic groups without significant nomenclatural changes.”. Obviously we do not agree with this way of doing science.

### Systematic position within the family

Regarding the systematic position in the family Cactaceae, in the latest treatments the genus *Parodia* s.l. is considered part of the subfamily Cactoideae, tribe Notocacteae, along with *Eriosyce* s.l., *Neowerdermannia*, *Rimacactus* and *Yavia* (Nyffeler & Egli, 2010). It has the same position with the addition of *Austrocactus*, *Blossfeldia*, *Cintia*, *Corryocactus*, *Copiapoa*, *Eulychnia*, *Frailea* and the exclusion of *Rimacactus* (Anderson & Egli, 2011 [in Anderson 2001, *Corryocactus* was not present]). The same position but only with *Eriosyce*, *Blossfeldia*, *Frailea* and *Yavia* (Hunt 2013 [in Hunt *et al.* 2006, Atlas, *Copiapoa* was also present]). All authors divide the genus into informal groups, which correspond with slight variations of the segregates of *Parodia* s.l., with the exception of Anderson (2001) who does not distinguish any subgroup.

### Materials and study methods

**Field research.** Since 2005 the authors have spent 50 months in the South American habitats, divided into journeys and study areas as follows:

First - 01 Oct. 2005 / 01 Apr. 2006: AR (LR, JY, MZ, MN, SA, TM), BR (RS), CL (AN, AT), UY (MA); Second - 07 Nov. 2006 / 01 Aug. 2007: AR (CT, CB, JY, MZ, MN, SA, SJ, SL, TM), BO (LP, SC, PO), BR (RS), CL (AP), PE (AR, CS), PY (BQ, CR, PG), UY

(CO, MA, RV, RO); Third - 02 Sep. 2008 / 27 May 2009: AR (FM), BR (MG, PR, RS), CL (BI), PY (CR, GU, PG, SP), UY (CL, RN, RV, TA, TT); Fourth - 15 Feb. 2011 / 30 Dec. 2011: AR (CT, CB, JY, LR, MN, SA, TM), BO (CQ, SC, TR), BR (MS, RS), PY (AG, AM, CN, CR, IT, PG), UY (MA, MO); Fifth 04 Nov. 2013 / 01 Jun. 2014: AR (BA, CT, LR, SA, SL), BO (CQ, CB, PO, SC, TR), PE (AP, AR, IC, LR), UY (RN); Sixth - 16 Nov. 2015 / 2 Aug. 2016: AR (CB, CN, JY, SA, SF, TM), BO (CB, PO, SC), BR (BA, MG, RS), UY (CL). A key to locality abbreviations can be found in Appendix III, page 161.

In total 659 surveys were carried out, involving 1467 populations (A&M 1-1467), relating to 46 genera and 347 species currently accepted in the cactusinhabitat.org system. Of the total populations visited, 260 belong to the genus *Parodia* (of which 162 are in the Pampas area and 98 are in the Andean area), equal to 17,72% of the total. In our conservative vision of the genus, the 62 taxa accepted in *Parodia* (37 from the Pampas regions and 25 from the Andean region) are all at a specific level (according to Darwin “No clear line of demarcation has as yet been drawn between species and subspecies” (1859).

With the exception of *P. formosa* and *P. gibbiflora*, all species have been studied and documented in their distribution areas.

The documental materials collected in habitat amount to 38,644 digital images and to 12 notebooks, with a total of 842 pages of notes related to the morphology and dimensions of the examined species.

**Operational concepts.** For the definition of boundaries and relationships between the species in habitat, we find useful, when applicable, some operational concepts, such as:

(a) comparative holomorphology between semaphoronts (Hennig, 1966: 32–33, 66–67), based on the comparison of characters constant enough to be considered discrete (distinct growth phases or semaphoronts), in the ontogenetic processes of the analyzed taxa (see also Anceschi & Magli, 2013, 31–32).

(b) Mayr’s biological species concept (1942: 120) in its first broader formulation and extension, that is, considering two populations that can potentially cross each other, as representatives of the same taxon (see also Anceschi & Magli, 2014: 67). In our idea, species are simply the largest detected samples of really or potentially self-perpetuating organisms, that show the greatest number of common characters among them.

(c) About our theoretical approach to the results of molecular analysis, often in line with the results of our field data, we have already argued in “Molecular results and principle of monophyly. Some clarifications” (see above).

**Comment guidelines.** In our identification system of the relationship between species in their habitats, the dominant species in the Darwinian-evolutionary sense (Darwin, 1859) has a crucial role.

1) For dominant species we mean “the species more opportunistic and therefore better at adapting to different habitats [conditions], resulting in a greater numerical progression of individuals and populations, and higher variability” (Anceschi & Magli, 2012a:27). A dominant species may show: a) Strong or weak internal vicariants (geographical races, subspecies, demes), depending on the degree of extinction risks afflicting its components. For internal vicariants we intend, in agreement with Hennig, in his definition of species, “a complex of spatially distributed reproductive communities, or if we call this relationship in space ‘vicariance’, a complex of vicarying communities of reproduction.” (1966: 47).

Substantially, defining one or more taxa as internal vicariants of a species is recognizing that at least potentially (Mayr, 1942: 120) all these components might cross each other as part of the same biological unit. Being the same biological unit, the internal vicariants of a species do not require a taxonomical rank. b) Strong or weak external vicariants (or close relatives). For external vicariants we mean “the taxa probably belonging to the same ancestral line with which, despite the morphological and territorial proximity, a potential genetic flow is not evident, or it is not assumed (Anceschi & Magli, 2014: 67). Apart from the alleged potential of crossing (or not), if molecular tests are missing or insufficient, to investigate such low levels of genetic relationships, a useful operational concept to distinguish between all the populations of a dominant species, an internal vicariant from an external one, is comparative homomorphy between semaphoronts (Hennig, 1966: 66–67). The method can be used as an accessory science to recognize genetic relationships that are to be presented in the taxonomic system. In the case of internal vicariance, the semaphoronts which are identifiers of the group in question, are actually found even among the populations of the type species. In the case of external vicariance, increased genetic autonomy is inferred by the fact that some semaphoronts which are identifiers of the taxonomic group are not found in the type species (for a case study in *Parodia*, see Anceschi & Magli, 2014: 7).

The other elements that complete our reference system for defining the relationships between taxa in their habitats are: 2) Relatively dominant species in a restricted area, i.e. where the dominance is revealed within a very specific geographical area (ecological niche). 3) Ex-dominant species, now with fragmented distribution, when in presence of taxa on which a previous dominance and territorial continuity can be inferred, now strongly fragmen-

ted, usually due to anthropic intervention. 4) Finally, non-dominant species (or endangered species, at different degrees), usually these taxa have fragmented or severely fragmented distribution, when populations are not already reduced to 1–2 units at most.

**Names.** The synonymy of the genera included in *Parodia* s.l. (19 taxa) was obtained by conducting a search of *Index Nominum Genericorum* (ING), Botany, Smithsonian Institution (<http://botany.si.edu/ing/>; 2017) and Anderson, E.F. (2011). The recordings of the 62 accepted species and 661 synonyms considered in the synopsis were obtained by conducting a research carried out mainly through *The International Plant Names Index* (IPNI) (<http://www.ipni.org/ipni/plantnamesearchpage.do>; 2017) and supplemented by the following additional sources: *Global Biodiversity Information Facility* (GBIF) (<https://www.gbif.org/species/search>; 2017); *Tropicos* (<http://tropicos.org/>; 2017); JSTOR (<http://plants.jstor.org/>; 2017); Herbarien UZH (<http://www.herbarien.uzh.ch/de.html>; 2017); *NCL* (Hunt *et al.* 2006); *Das grosse Kakteen-Lexikon*. (Anderson & Egli, 2011); Gerloff, N. & Neduchal, J. (2004). *Taxonomische Neubearbeitung Der Gattung Notocactus Frič. Internoto* 25(2): 1–130; Egli, U. & Leuenberger, B.E., 2008. Type specimens of Cactaceae names in the Berlin Herbarium (B). *Wilddenowia*, 38(1): 213–280.

**Biomes.** The definition of Biomes and Ecological Regions is based on Olson, D.M. *et al.*, (2001). *Terrestrial Ecoregions of the World: A New Map of Life on Earth. BioScience* 51(11): 933–938.

**Occurrence data.** The dataset of occurrence record (2,312 in total) of the 62 accepted species and their main synonyms, was obtained using the following sources: a) A&M numbers 2005–2016, b) Ralph Martin’s field number finder (<http://www.fieldnos.bcss.org.uk/finder.html>; 2017), c) Gf numbers 1989–2011 (ex-*Notocactus* s.l. only), d) GBIF.org (<https://www.gbif.org/species/search>; 2017), e) Ritter, F., 1980 (*P. soto-mayorensis* only), f) Schlumberger, B.O., 2012, *CSI* 28: 27–28 (*P. saint-pieana* only). The PDF of the dataset is available from the authors, on request.

**Mapping.** The 2312 occurrence data, subdivided into the 62 species considered, grouped in turn into 10 membership groups (see below), based on the relationship between the dominant species and their vicariant (see Comment), were first placed as data of occupancy on 10 paper Nelles Maps (Nelles Verlag GmbH, Munich), then traced as shapes corresponding to the extension of occurrence of taxa, on National Geographic electronic maps (<https://mapmaker.nationalgeographic.org/> (2017).

**Groups.** Total occurrence data per species and species group:

- 1) *P. maassii* complex: *P. maassii* (163), *P. aurei-centra* (21), *P. commutans* (22), *P. otaviana* (12), *P. subterranea* (22), *P. tuberculata* (26); total 271
- 2) *P. microsperma* complex: *P. microsperma* (140), *P. horrida* (36); total 176
- 3) Relatively dominant species in a restricted area (Andean area): *P. ayopayana* (17), *P. chrysanthion* (11), *P. columnaris* complex: *P. columnaris* (16), *P. ocampoi* (7), *P. gibbulosa* (2), *P. hausteiniana* (7), *P. mairanana* (9), *P. prestoensis* (11), *P. procera* (11), *P. ritteri* (31), *P. schwebiana* (10), *P. stuemeri* (39), *P. taratensis* (4); total 169
- 4) Non-dominant species with fragmented or very fragmented distribution (Andean area): *P. comarapana* (8), *P. formosa* (18), *P. hegeri* (7), *P. nivosa* (25); total 58
- 5) *P. erinacea* (c. 126)
- 6) *P. mammulosa* complex: *P. mammulosa* (450) (*mammulosa* (218), *submammulosa* (222) and *turecekiana* (10) populations), *P. curvispina* (23), *P. maldonadensis* (17), *P. mueller-melchersii* (37); total 527
- 7) *P. ottonis* complex: *P. ottonis* (362), *P. carambeiensis* (7), *P. gaucha* (1), *P. ibicuiensis* (15), *P. linkii* (152), *P. muricata* (18), *P. oxycostata* (26), *P. stockingeri* (1), *P. tenuicylindrica* (26); total 608
- 8) Ex-dominant species, now with fragmented distribution (Pampas area): *P. concinna* (79), *P. scopa* (59); total 138
- 9) Non-dominant species with fragmented or very fragmented distribution (Pampas area): *P. allosiphon* (4), *P. buiningii* (13), *P. calvescens* (3), *P. crassigibba* (31), *P. herteri* (12), *P. horstii* (7), *P. langsdorfii* (44), *P. neobuenekeri* (3), *P. neohorstii* (8), *P. nothorauschi* complex: *P. nothorauschi* (11), *P. fusca* (24), *P. werdermanniana* (1); total 161
- 10) Ex-*Brasilicactus*/*Brasiliparodia* group: *P. alacriportana* (20), *P. haselbergii* (20), *P. rechensis* (2); ex-*Eriocactus* group: *P. claviceps* (7), *P. leninghausii* (7), *P. magnifica* (5), *P. nigrispina* (6), *P. schumanniana* (7), *P. warasii* (3); total 77

Total occurrence data: 2312

### Taxonomy

The following list, consisting of 62 taxa recognized by the authors as sufficiently distinct at a specific level, is based on their studies in habitat and the approach to the molecular evidence in considering the theories adopted and the operational concepts used, as previously specified. Descriptions are based on a mix that consider *The Cactus Family* (Anderson, 2001), *The New Cactus Lexicon*

(Hunt *et al.*, 2006), *Das Grosse Kakteen Lexicon* (Anderson & Eggl, 2011), expanded by our field data [in square brackets].

As in Anderson (2001), no informal group is recognized at the sub-generic level, to distinguish the ex-segregates of *Parodia* s.l..

All references to the International Code of Nomenclature refer to The Melbourne Code (McNeil *et al.*, 2012).

***Parodia*** Spegazzini, *Anales Soc. Ci. Argent.* **96**: 70. (1923). **T.**: *P. microsperma* (Weber) Spegazzini (*Echinocactus microspermus* Weber).

***Malacocarpus*** Salm-Reifferscheid-Dyck, *Cact. Horto Dyck*. 1849: 24. Apr 1850, nom. illeg. (Art. 53.1), (non F.E.L. Fischer & C.A. Meyer, 1843). **LT.**: *M. corynodes* (Pfeiffer) Salm-Reifferscheid-Dyck (*Echinocactus corynodes* Pfeiffer) (vide N.L. Britton & Rose, *Cact.* **3**: 187. 1922).

***Hickenia*** N.L. Britton & J.N. Rose, *Cact.* **3**: 207. 12 Oct 1922, nom. illeg. (Art. 53.1), (non Lillo 1919). **T.**: *H. microsperma* (Weber) N.L. Britton & J.N. Rose (*Echinocactus microspermus* Weber).

***Notocactus*** (K.M. Schumann) A.V. Frič, *Cacti Price-List* **1928**: [3]. 1928. **LT.**: *N. ottonis* (Lehmann) A. Berger (*Kakteen*: 343. Jul–Aug 1929) (*Cactus ottonis* Lehmann) (vide Backeberg, *Blätt. Kakteenf.* **1938**(6): Jun 1938) *Echinocactus* subg. *Notocactus* K.M. Schumann, *Gesamtbeschr. Kakteen*: 292. 1 Jan 1898.

***Brasilicactus*** A.V. Frič ex K. Kreuzinger, *Verzeichnis Amer. Sukk. Revision Syst. Kakteen*: 19. 30 Apr 1935, nom. illeg. (Art. 52.1).

***Microspermia*** A.V. Frič, *Möller's Deutsche Gärtner-Zeitung* **45**: 43. 1 Feb 1930, nom. illeg. (Art. 52.1). **T.**: *Echinocactus microspermus* Weber.

***Neohickenia*** A.V. Frič, *Cacti Price-List* **1928**: [3]. 1928, nom. illeg. (Art. 52.1). **T.**: *Echinocactus microspermus* Weber.

***Acanthocephala*** Backeberg, *Blätt. Kakteenf.* **1938**(6): [22], [23]. 1938. **T.**: *A. graessneri* (K. Schumann) Backeberg (*Echinocactus graessneri* K. Schumann).

***Eriocephala*** Backeberg, *Blätt. Kakteenf.* **1938**(6): [21], [23]. 1938. **T.**: *E. schumanniana* (Nicolai) Backeberg (*Echinocactus schumannianus* Nicolai)

***Brasilicactus*** Backeberg, *Cactaceae* **1941**(2): 36, 76. Jun 1942, nom. illeg. (Art. 52.1?). **T.**: *Brasilicactus graessneri* (K. Schum.) Backeb. (*Echinocactus graessneri* K. Schum.).

***Eriocactus*** Backeberg, *Cactaceae* (Berlin) **1941**(2): 37. Jun 1942, nom. illeg. (Art. 52.1). **T.**: *E. schumannianus* (Nicolai) Backeberg (*Echinocactus schumannianus* Nicolai).

***Dactylanthocactus*** Y. Ito, *Explor. Diagr. Austro-echinocact*: 294. 30 Mar 1957, nom. illeg. (Art.



52.1). **T.:** *Dactylanthocactus graessneri* (K. Schum.) Y. Ito (*Echinocactus graessneri* K. Schumann).

*Sericocactus* Y. Ito, *Explor. Diagr. Austro-echinocact*: 223, 293. 30 Mar 1957. **T.:** *Sericocactus haselbergii* (F. Haage ex Forst.) Y. Ito (*Echinocactus haselbergii* F. Haage).

*Wigginsia* D.M. Porter, *Taxon* **13**: 210. Jul 1964. **LT.:** *W. corynodes* (Pfeiffer) D.M. Porter (*Echinocactus corynodes* Pfeiffer) (vide N. L. Britton & Rose, *Cact.* **3**: 187. 12 Oct. 1922).

*Brasiliparodia* F. Ritter, *Kakteen Südamerika* **1**: 144. 1979. **T.:** *B. buenekeri* (A. F. H. Buining) F. Ritter (*Parodia buenekeri* A. F. H. Buining).

*Aparadoa* van Vliet (1986), nom. inval. (Art. 36.1, 37.1).

*Peronocactus* A.B. Doweld, *Sukkulenty* **1999**(2): 20. 25 Dec 1999, nom. illeg. (Art. 52.2b). **T.:** *P. ottonis* (Lehmann) A.B. Doweld (*Cactus ottonis* Lehmann).

*Ritterocactus* A.B. Doweld, *Sukkulenty* **1999**(2): 22. 25 Dec 1999. **T.:** *R. mammulosus* (Lemaire) A.B. Doweld (*Echinocactus mammulosus* Lemaire).

*Boliviacactus* A.B. Doweld, *Sukkulenty* **3**: 62. 31 Aug 2000. **T.:** *B. maassii* (E. Heese) A.B. Doweld (*Echinocactus maassii* E. Heese).

**Description:** Plants simple or clustering. Stems mostly small, globose to shortly cylindrical (<180cm), ribbed or tuberulate. Areoles usually densely woolly when young. Spines few to many, straight or hooked, variable. Flowers borne subapically, diurnal, funnelliform to bell shaped, brightly coloured; floral tubes and pericarps often with hairs and bristles, bristles sometimes restricted to the upper parts of the tubes. Fruits globose to clavate to cylindrical, woolly or bristly, dry or nearly so; thin walled and disintegrating at or near base, or thick walled and dehiscent laterally, or pink and fleshy at first, later hollow and dry. Seeds diverse in shape (due to adaptations to different dispersal strategy), reddish brown to black, small, with large hilum, some with spiny or hairlike projection, with or without strophiola.

**Etymology:** The name *Parodia* honors the memory of Dr. Domingo Parodi, one of the first researchers of the Paraguayan flora who provided the first botanical articles on the then emerging Argentine Scientific Society (Societad Cientifica Argentina).

**Distribution, biomes, ecological regions & habitat:** Species are distributed in two centres of diversity; one is located on the eastern slopes of the Andes in northwestern Argentina and eastern Bolivia. This centre involves the Tropical and Subtropical Moist Broadleaf Forests, the Tropical and Subtropical Dry Broadleaf Forests and the Montane Grasslands and Shrublands Biomes (Olsen *et*

*al.*, 2001:11, 934). The ecological regions involved are the Southern Andean Yungas, the Dry Chaco, the Bolivian Montane Dry Forest, the Central Andean Puna and the High Monte. Habitats: arid inter-Andean rocky valleys, occasionally in deciduous forest, pre-puna rocky slopes, puna rocky outcrops, and arid 'Precordillera' valleys and 'quebradas', 500–4200m. A second centre is found in the lowland pampas regions of northeastern Argentina, southern Brazil, eastern Paraguay, and Uruguay. This involves the Tropical and Subtropical Moist Broadleaf Forests, the Tropical and Subtropical Grasslands, Savannas, and Shrublands, the Temperate Grasslands, Savannas, and Shrublands, and the Flooded Grasslands and Savannas Biomes (*ibid.*). The ecological regions involved are the Alto Paraná Atlantic forests (Mata Atlantica & Selva Misionera), in eastern Argentina, southern Brazil and eastern Paraguay, the Humid and Semi-arid Pampas of Argentina, Uruguay and Southern Brazil, the Low Monte, and the Paraná flooded savanna. Habitats: pampa grasslands with rocky outcrops, monte desert, wooded savanna of the Rio Uruguay, rocky outcrops on the ex-Mata Atlantica area in eastern Paraguay (ex-*Eriocactus* components), and rocky walls on the rivers basins of the Serra Geral formation, surrounded by humid subtropical forest (ex-*Eriocactus* components and *P. haselbergii*), 20–1500m.

**Occurrence:** AR (BA, CB, CH, CN, CT, ER, JY, LP, LR, MN, MZ, RN, SA, SE, SJ, SL, TM); BO (CB, CQ, LP, OR, PO, SC, TR); BR (PR, RS, SC); CO (DC); PY (CR, GU, IT, PG); UY(AR, CA, CL, CO, DU, FD, FS, LA, MA, MO, PA, RN, RV, RO, SA, SO, TA, TT)

**Accepted species list** (62 in total): 1)*P. alacriportana*, 2)*P. allosiphon*, 3)*P. aureicentra*, 4)*P. ayo-payana*, 5)*P. buiningii*, 6)*P. calvescens*, 7)*P. carambeiensis*, 8)*P. chrysacanthion*, 9)*P. claviceps*, 10)*P. columnaris*, 11)*P. comarapana*, 12)*P. comutans*, 13)*P. concinna*, 14)*P. crassigibba*, 15)*P. curvispina*, 16)*P. erinacea*, 17)*P. formosa*, 18)*P. fusca*, 19)*P. gaucha*, 20)*P. gibbulosa*, 21)*P. haselbergii*, 22)*P. hausteiniiana*, 23)*P. hegeri*, 24)*P. herteri*, 25)*P. horrida*, 26)*P. horstii*, 27)*P. ibiciensis*, 28)*P. langsdorfii*, 29)*P. leninghausii*, 30)*P. linkii*, 31)*P. maassii*, 32)*P. magnifica*, 33)*P. mairanana*, 34)*P. maldonadensis*, 35)*P. mammulosa*, 36)*P. microsperma*, 37)*P. mueller-melchersii*, 38)*P. muricata*, 39)*P. neobuenekeri*, 40)*P. neohorstii*, 41)*P. nigrispina*, 42)*P. nivosa*, 43)*P. nothorauschi*, 44)*P. ocampo*, 45)*P. otaviana*, 46)*P. ottonis*, 47)*P. oxycostata*, 48)*P. prestoensis*, 49)*P. procera*, 50)*P. rechenensis*, 51)*P. ritteri*, 52)*P. schumanniana*, 53)*P. schwebsiana*, 54)*P. scopa*, 55)*P. stockingeri*, 56)*P. stuemeri*, 57)*P. subterranea*, 58)*P. taratensis*, 59)*P. tenuicylindrica*, 60)*P. tuberculata*, 61)*P. warasii*, 62)*P. werdermanniana*

1. *Parodia alacriportana* Backeb. & Voll, *Arch. Jard. Bot. Rio de Janeiro* 9: 166, Fig. (1950). T.: BR, Rio Grande do Sul, serro nr Porto Alegre, 1939, H. Berger, *Jard. Bot. Rio de Janeiro*, np. LT.: D.R. Hunt & N.P. Taylor *Cactaceae Syst. Init.* 21: 9 (2006): *Arch. Jard. Bot. Rio de Janeiro* 9: 166 (1950), Fig. 1.

### Homotypic Synonyms

*Brasiliparodia alacriportana* (Backeb. & Voll) F. Ritter, *Kakteen Südamerika* 1: 149 (1979).

*Brasilicactus alacriportanus* (Backeb. & Voll) Doweld, *Sukkulenty* 2(3): 24 (1999), incorrect name (Art. 11.4?).

*Notocactus alacriportanus* (Backeb. & Voll) Buxb. in Krainz, *Kakteen* (H. Krainz) 35: C VIc. (1967).

### Heterotypic Synonyms

*Parodia brevihamata* W. Haage ex Backeb., *Descr. Cact. Nov.* 1: 31 (1956). T.: BR, Rio Grande do Sul, nd.

*Brasiliparodia brevihamata* (W. Haage ex Backeb.) F. Ritter, *Kakteen Südamerika* 1: 151 (1979). Basionym: *Parodia brevihamata* W. Haage ex Backeb.

*Parodia alacriportana* ssp. *brevihamata* (W. Haage ex Backeb.) Hofacker & P.J. Braun, *Cactaceae Consensus Init.* 6: 10 (1998). Basionym: *Parodia brevihamata* W. Haage ex Backeb.

*Brasilicactus brevihamatus* (W. Haage ex Backeb.) Doweld, *Sukkulenty* 2(3): 24 (1999), incorrect name (Art. 11.4?). Basionym: *Parodia brevihamata* W. Haage ex Backeb.

*Notocactus brevihamatus* (W. Haage ex Backeb.) Buxb. in Krainz, *Kakteen* (H. Krainz) 35: C VIc. (1967). Basionym: *Parodia brevihamata* W. Haage ex Backeb.

*Parodia buenekeri* Buining, *Succulenta* 41: 99, Fig. 49, (1962). T.: BR, border of Rio Grande do Sul and Santa Catarina, 1400m, 1961, Buining & Bueneker (U).

*Brasilicactus buenekeri* (Buining) Doweld, *Sukkulenty* 2(3): 24 (1999), incorrect name (Art. 11.4?). Basionym: *Parodia buenekeri* Buining.

*Brasiliparodia buenekeri* (Buining) F. Ritter, *Kakteen Südamerika* 1: 149 (1979). Basionym: *Parodia buenekeri* Buining.

*Notocactus buenekeri* (Buining) Buxb., *Kakt. and. Sukk.* 17: 195 (1966). Basionym: *Parodia buenekeri* Buining.

*Parodia alacriportana* ssp. *buenekeri* (Buining) Hofacker & P.J. Braun, *Cactaceae Consensus Init.* 6: 10 (1998). Basionym: *Parodia buenekeri* Buining.

*Brasiliparodia catarinensis* F. Ritter, *Kakteen Südamerika* 1: 152, Figs. 88, 234 (1979) T.: BR, Santa Catarina, Bom Jardim da Serra, *Horst* 40 in *Ritter* 1401a.



**Figure 1.** *Parodia alacriportana*. Brazil, Rio Grande do Sul, Cambará do Sul, W of Cambará do Sul, 23 Nov. 2011, A&M 828. .

*Brasilicactus catarinensis* (F. Ritter) Doweld, *Sukkulenty* 2(3): 24 (1999), incorrect name (Art. 11.4?). Basionym: *Brasiliparodia catarinensis* F. Ritter.

*Notocactus catarinensis* (F. Ritter) S. Theun., *Succulenta* 60: 142 (1981). Basionym: *Brasiliparodia catarinensis* F. Ritter.

*Parodia catarinensis* (F. Ritter) F.H. Brandt, *Kakteen Orch. Rundschau* 7(4): 65 (1982). Basionym: *Brasiliparodia catarinensis* F. Ritter.

*Parodia alacriportana* ssp. *catarinensis* (F. Ritter) Hofacker & P.J. Braun, *Cactaceae Consensus Init.* 6: 10 (1998). Basionym: *Brasiliparodia catarinensis* F. Ritter.

**Description:** Habit solitary or clustering, stem globose to short cylindrical, [3.9–5.7]cm high × [4]–8cm diameter. Ribs c. 15–29, more or less vertical, well-defined, [but divided in very pronounced mammilla]. Spines [flexible], setaceous, often forming a brush-like tufts around the stem-apex. Central spines [2]–[4]–6, straight, [the lower] curved or hooked at apex, 0.5–[1.7]–(–5)cm long, brown, [reddish], yellow, or white. Radial spines c. 14–20, bristle-like, spreading, 0.4–2.3cm long, yellow, [pale yellow with reddish base], creamy white [or greyish]. Flower 2.6–4cm high × 3.5–4cm diameter, golden yellow, flower areoles with tufts of brown wool and a few bristles. [Fruit, a reddish berry, bearing bracts scales with white hairs and white little spines, it seems dehiscent laterally, 1.1–1.7cm high × 1.1–1.3cm diameter].

**Etymology:** Points to the occurrence of the species near Porto Alegre, Rio Grande do Sul, Brazil, from Latin *portus alacer*, Portuguese ‘Porto Alegre’, merry port.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Southern Brazil, at the border with the Alto Paraná Atlantic forests ecoregion, 800–1400m.



**Figure 2.** *Parodia allosiphon*. Brazil, Rio Grande do Sul, Santana do Livramento, Espinilho, 8 Nov. 2011, A&M 811.



**Figure 4.** *Parodia ayopayana*. Bolivia, Cochabamba, Ayopaya, below Yayani, 2090m, 8 Apr. 2014, A&M 1128.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands.

**Occurrence:** BR(RS,SC). Map 10.

**Comment:** This taxon, as currently conceived, includes a group of globular populations from southern Brazil, morphologically similar to the Andean parodias. This group, already assigned by Backeberg (1966) to *Parodia* Spegazzini, in addition to *P. alacriportana* includes *P. brevihamata* W. Haage ex Backeberg, and *P. bueneker* Buining. With the subsequent creation by Ritter (1979: 145–152) of the genus *Brasiliparodia*, for the group of taxa constituted by Backeberg’s “Brazilian parodias”, *Brasiliparodia catarinensis* Ritter is added to the present synonymy of *P. alacriportana*. Also this author highlights the close relationship of the new genus, with some parodias of the center of Bolivia, identifiable with the subgenus *Protoparodia*, series *oblongisperma* of Buxbaum. Modern mole-



**Figure 3.** *Parodia aureicentra*. Argentina, Salta, Cachi Adentro, Cerro San Miguel, 11 May 2011, A&M 496.

cular analysis showed that genetically the closest relative to the group of populations belonging to *P. alacriportana* is *P. haselbergii* (Haage ex Rümpler) F.H. Brandt (Nyffeler, 1999: 7; Nyffeler & Eggli, 2010; Barcenás *et al.*, 2011: 475). These two taxa live on rocky outcrops (*P. haselbergii* also on canyons walls), surrounded by grasslands and/or wet subtropical forest, in the Serra Geral formation BR (RS, SC). There are no known cases of sympatry. In evolutionary terms, the species appears to be a non-dominant with fragmented distribution, that lives in areas with a strong anthropic impact (in the areas we visited, in the region of Cambara do Sul (RS) BR, mainly plantations of exotic trees for industrial use, with related deforestation).

**2. *Parodia allosiphon*** (Marchesi) N.P. Taylor, *Bradleya* 5: 93 (1987). Basionym: *Notocactus allosiphon* Marchesi.

#### Homotypic Synonyms

*Notocactus allosiphon* Marchesi, *Bol. Soc. Argent. Bot.* 14(3): 246, Fig. (1972). T.: UY, Rivera, Valle ar. Platón, 21 Feb. 1966, *Marchesi* CHN 649 (MVFA).

*Ritterocactus allosiphon* (Marchesi) Doweld, *Sukkulenty* 2(3): 22 (1999).

**Description:** Habit solitary, stem globose, [3.6–]8–12cm high × [3.6–]11–13cm diameter, dull green. Ribs [14–20], straight, well defined, [sometimes sharpened], with low tubercles below the areoles. Spines: [awl shaped, red, grey, or light grey with a red base]. Central spines: 4, [forming a cross], 0.8[–2.3]cm long. Radial spines: 2[–4(–8)], thinner, [sometimes rounded and pointed, <0.7cm long]. Flower 5.5cm high × 5cm diameter, [from light yellow to pinkish yellow], pericarpel + hypanthium much shorter than the tepals. [Stigma lobes 11, from pinkish to magenta]. Fruit dry at maturity,

indehiscent, greenish yellow, <3cm long. Seeds flattened, globose, dull black, tuberculate.

**Etymology:** From Greek *alios*, other or another, and Greek *siphon*, tube; for the floral tube that is said to distinguish the taxon from related species.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Uruguay and Southern Brazil, up to 350m.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands.

**Occurrence:** BR(RS);UY(AR,RV). Map 9.

**Comment:** This species was described in 1972 as *Notocactus allosiphon*, by the Uruguayan botanist Eduardo Marchesi, on the basis of a single collection made in February 1966, in the Uruguayan Dept. of Rivera, type locality “Valle ar. Platón” (type: *Marchesi* CHN 649). Apparently, due to the sharp ribs and the awl-shaped spines, the morphologically closest populations to *P. allosiphon* appear to be those parts of *P. mammulosa* (Lem.) N.P. Taylor, that were previously identified as *Notocactus orthacanthus* (Link & Otto) van Vliet (= *Echinocactus orthacanthus* Link & Otto), a confused name proposed by Hofacker (2003) as an earlier name for *Parodia mammulosa*, but treated as an ‘unreferred name’ by Hunt (2006, text: 323). The taxon seems to have a very restricted geographical range in the upper reaches of the Río Cuareim (Spanish) or Río Quaraí (Portuguese), which forms the border between the Dept. of Rivera (UY) and the state of Rio Grande do Sul (BR). Some new populations of the species were detected by Nyffeler & Egli (2007: 37–44) in the Artigas Dept. (UY), and they represented a significant expansion of the known range towards the West, but in the same watershed. We studied *P. allosiphon* in the zone known as Espinillo, on basaltic rocky outcrops, in the pampas west of Santana do Livramento, in the Brazilian part of the distribution area, where the taxon lives in sympatry with scattered groups of *Parodia buiningii* (Buxb.) N.P. Taylor. *P. allosiphon* represents a non-dominant species with fragmented distribution, locally abundant in the few known populations.

**3. *Parodia aureicentra*** Backeb., *Kaktus-ABC*: 268, 416, (1936). **T.:** AR, Salta, nr Cachi-Pampa, nd.

#### Homotypic Synonym

*Boliviacactus aureicentrus* (Backeb.) Doweld, *Sukkulenty* 3(1–2): 62 (2000).

#### Heterotypic Synonyms

*Parodia muhrrii* F.H. Brandt, *Kakteen Orch. Rundschau* 3(1): 14–17 (1978), (AR, Salta, Payogasta).

*Parodia rauschii* Backeb. ex D.R. Hunt, *Cactaceae*

*Consensus Init.* 4: 4 (1997), (AR, Salta, Q. del Toro). **T.:** Backeberg, *Cactus Lexicon*, ed. 3: 719, Fig. 313 (1976).

*Parodia variicolor* F. Ritter, *Taxon* 13: 117 (1964), (AR, Salta, N Cachi). **T.:** U 0180543.

**Description:** Habit solitary or clustering, stem globose to elongate, c. 15–40cm high × 8–15cm diameter. Ribs c. 13–20, more or less spiraled, tuberculate. [In adult stems, apex and areoles very woolly]. Central spines [4, forming a cross, golden yellow with dark tip, thicker than radials, the lower] <7cm long, [straight or slightly hooked]. Radial spines 20–40, bristles like, [straight or twisted, some thicker], <1.2cm long, white or yellowish. Flower <4cm diameter, [from light wine red to deep orange red]. Fruit [elliptical, very flattened, light fuchsia (inside too), covered by tufts of white hairs, 2.1–3.5cm high] × 1[–1.4cm diameter, REM persistent]. Seeds small, [drop-shaped], brown [or matt black].

**Etymology:** From Latin *aureus*, yellow, and Latin *centrum*, middle; and refers to the colour of the central spines.

**Habitat & Distribution:** Pre-Puna rocky slopes, 2000–3000m.

**Ecological regions:** Central Andean Puna.

**Biomes:** Montane Grasslands and Shrublands.

**Occurrence:** AR(SA). Map 1.

**Comment:** *Parodia aureicentra* Backeb. is identifiable as an external vicariant, occupying the extreme south-west area, in the complex of the dominant *Parodia maassii* (Heese) A. Berger. The vicariant is relatively strong, because despite the small extent of occurrence, i.e. 2000km<sup>2</sup> (data gathered from: Ortega-Baes, P. & Kiesling, R. 2013. *Parodia aureicentra*. The IUCN Red List of Threatened Species 2013. Downloaded on 21 September 2017), the populations are not fragmented, and constituted by a large number of individuals. Our surveys on the taxon were held in the pre-Puna rocky outcrops, between Cachi Adentro (Cerro S. Miguel and Cerro Virgen areas) and Ruta 33 (National Park Los Cardones area), Salta, Argentina.

**4. *Parodia ayopayana*** Cárdenas, *Cact. Succ. J.* (Los Angeles) 23: 98, Figs. 53–54 (1951). **T.:** BO, Cochabamba, Ayopaya, between Morochata and Independencia, Puente Pilatos, 2700m, Oct 1949, *Cárdenas* 4398 (LIL 531548, holo.; US, iso.).

#### Homotypic Synonym

*Ritterocactus ayopayanus* (Cárdenas) Doweld, *Sukkulenty* 3(1–2): 61 (2000).

#### Heterotypic Synonyms

*Parodia borealis* F. Ritter, *Taxon* 13: 116 (1964). **T.:** BO, La Paz, border of prov. Larecaja and Muñecas, Rio Consata Valley, 1954, *Ritter* 120.



**Figure 5.** *Parodia ayopayana*. Bolivia, Cochabamba, Ayopaya, below Yayani, 2090m, 8 Apr. 2014, A&M 1128.

*Parodia buxbaumiana* F.H. Brandt, *Kaktus* (Odense) **10**(4): 81 (1975), (BO).

*Parodia comosa* F. Ritter, *Cactus* (Paris) **17** (75): 21–22 (1962). **T.**: BO, La Paz, border of prov. Loayza and Sud Yungas, valley of La Paz river, 1953, Ritter 111.

*Parodia cotacajensis* F.H. Brandt, *Kakteen Orch. Rundschau* **6**(3): 56 (1981), (BO).

*Parodia echinus* F. Ritter, *Taxon* **13**: 117 (1964). **T.**: BO, La Paz, border of prov. Murillo and Loayza, La Paz river valley, 1953, Ritter 747.

*Parodia elata* F.H. Brandt, *Cactus (Wijnegem)* **8**: 33–36 (1976).

*Parodia macednosa* F.H. Brandt, *Cactus (Wijnegem)* **9**: 42–45 (1977).

*Parodia miguillensis* Cárdenas, *Cact. Succ. J.* (Los Angeles) **33**: 109, Fig. 63 (1961). **T.**: Bolivia, La Paz, Sud Yungas, on the way from Miguilla to La Plazuela, 1200m, Cárdenas 5539 (LIL).

*Ritterocactus miguillensis* (Cárdenas) Doweld, *Sukkulenty* **3**(1–2): 61 (2000). Basionym: *Parodia miguillensis* Cárdenas.

*Parodia pseudoayopayana* Cárdenas, *Cact. Succ. J.* (Los Angeles) **42**(4): 188, Fig. 8, 12 (1970). **T.**: Bolivia, Cochabamba, Ayopaya, near Cotacajes, 1500m, Sep 1969, *E. Meneces* 6318 (herb. Cárdenas).

**Description:** Habit solitary or clustering, [groups <94cm long × 57.5cm wide, or more], stem globose to elongate, 6–[18](–60)cm high × 6–10(–12)cm diameter, fresh green. Ribs 11–[14], vertical, well defined, <2cm high. Areoles large, very woolly, c. 1.2cm apart. Central spines [3]–4, awl-shaped, straight, [thicker than radials, especially the lower one, thicker and longer, 2.1]–3.5 cm, [the upper central is less evident (when present)], light brown to whitish. Radial spines 6–11, needle-like, 1.2–2cm long, whitish. Flower <3cm high, orange yellow, hypanthium stout, flower areoles with dense white to orange wool, the uppermost with inconspicuous bristles. Fruit long, red. Seeds small, spherical, with strophiole, tuberculated, dull black, in lower part of the fruit only.

**Etymology:** For the occurrence in Prov. Ayopaya, Dept. Cochabamba, Bolivia.

**Habitat & Distribution:** Arid inter-Andean rocky valleys, occasionally in deciduous forest, 2090–2700m.

**Ecological regions:** Bolivian Montane Dry Forest.

**Biomes:** Montane Grasslands and Shrublands.

**Occurrence:** BO(CB,LP). Map 3.

**Comment:** Despite the relatively small extent of occurrence of the taxon, i.e. 2,000km<sup>2</sup> (data gathe-



**Figure 6.** *Parodia buiningii*. Brazil, Rio Grande do Sul, Santana do Livramento, BR 293 towards Quaraí, 29 Nov. 2006, A&M 78.

red from: Lowry, M. & Carr, J. 2013. *Parodia ayopayana*. The IUCN Red List of Threatened Species 2013. Downloaded on 22 September 2017), considering the abundance of populations and individuals within them, *Parodia ayopayana* Cárdenas is identified as a relatively dominant species within the restricted colonized areas. Our studies in the taxon's habitats were carried out in the dry inter-Andean valley of the Rio Morochata, in the area below the village of Yayani, Ayopaya, Cochabamba (BO). There, a copious population of the species has developed on a wide and compact front, characterized by large groups (see description), on the west side of Ruta 25, between Morochata and Independencia, starting from an altitude of 2090m down to the river, which is 1.5km away from where the first individuals can be detected.

**5. *Parodia buiningii*** (Buxb.) N.P. Taylor, *Bradleya* 5: 93 (1987). Basionym: *Notocactus buiningii* Buxb.

#### Homotypic Synonyms

*Notocactus buiningii* Buxb., *Kakt. and. Sukk.* 19: 229–231, Fig. (1968). T.: UY, border with BR, Rio Grande do Sul, SW of Livramento/Rivera, 1966, *Buining* H 90(U).

*Ritterocactus buiningii* (Buxb.) Doweld, *Sukkulenty* 2(3): 22 (1999).

**Description:** Habit solitary, stem depressed globose to globose, 8cm high × 12cm diameter, pale grey or glaucous green. Ribs c. 16, straight, thin and sharply acute, with narrow blade-like tubercles between the areoles. Areoles sunken under the tubercles, oblong. Central spines (3)–4, when 4 forming a cross, straight, stiff, 2–3cm long, pale yellow, dark brown at base. Radial spines c. 2–3 similar to the centrals but smaller. Flower <7cm high × 8cm diameter, yellow, flower areoles with



**Figure 7.** *Parodia calvescens*. Brazil, Rio Grande do Sul, N of Barra do Quaraí, Parque Estadal do Espinilho, 9 Nov. 2008, A&M 275.

thick dark to light brown wool. Fruit <3cm long, [orange when ripe]. Seeds tuberculate, matt black.

**Etymology:** Named to honour Alfred F.H. Buining, Dutch cactus explorer and author.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Uruguay and Southern Brazil, 150–300m.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands.

**Occurrence:** BR(RS);UY(AR,RV,SA). Map 9.

**Comment:** *Parodia buiningii* (Buxb.) N.P. Taylor is a very distinctive species, with morphological characters that are not easily attributable to other members of the genus. The taxon appears to be a non-dominant species with very fragmented distribution. The populations, or rather the small groups, live on rocky outcrops in the pampas, in a corridor that follows the border between northern Uruguay and southern Brazil. We randomly detected the taxon a few times, in the area to the west of Santana do Livramento, RS (BR), while looking for other more evident taxa on the territory (we report sympatry with *P. allosiphon* and *P. mammulosa*). Usually the scattered groups we detected have less than 10 individuals, in rather wet areas, close to small waterways.

**6. *Parodia calvescens*** (N. Gerloff & A.D. Nilson) Aneschi & Magli, *Cact. Explor.* 6: 33 (2012) [e-published]. Basionym: *Notocactus calvescens* N. Gerloff & A.D. Nilson.

#### Homotypic Synonyms

*Notocactus calvescens* N. Gerloff & A.D. Nilson, *Internoto* 15(3): 78 (1994). T.: BR, Rio Grande do Sul, N of Barra do Quaraí, AN 384 (JBPA 32.896, holo.).



**Figure 8.** *Parodia carambeiensis*. Brazil, Paraná, Ponta Grossa, P.E. Vila Velha, 13 Oct. 2008, A&M 253.

*Wigginsia calvescens* (N. Gerloff & A.D. Nilson) Font, *Internoto* 28(1): 14 (2007).

*Parodia turbinata* ssp. *calvescens* (N. Gerloff & A.D. Nilson) Hofacker, *Kakt. and. Sukk.* 63(2): 46 (2012) [publ. Jan 2012].

*Wigginsia turbinata* ssp. *calvescens* (N. Gerloff & A.D. Nilson) Guiggi, *Cactology* 3: 9 (2012).

**Description:** Habit solitary, stem depressed globose to globose, [1.5 (part emerged from the ground)–8.5cm high × 7–15cm diameter], grey-blue-green. Ribs 13–[27], slightly sharpened only in juveniles, then flattened, strongly wavy, resolved in low and round tubercles. Once at maturity areoles completely bare, sunken in the tubercles on the ribs. Delicate spination only as a juvenile, which comprises 3–6 whitish radial spines, 0.2–0.5cm long. Flower <2.3cm high × 3.5cm diameter, cup shaped, silky white-yellow, with deep red throat, stigma lobes 8, red brown to dark purple, stamens mainly purple, anthers golden yellow. Fruit barrel-shaped, initially whitish, <0.5–0.7cm high, later pink, <1.2cm high, longitudinally splitting, REM persistent. Seeds, few, hat-shaped, 0.9–1mm high × 1.1mm diameter, dark brown.

**Etymology:** Latin, becoming bare (from Latin *calvus*, bare). Refers to the fact that once at maturity the old areoles lose their spines, and the new ones cease to produce them, leaving the plant completely bare.

**Habitat & Distribution:** Wooded savanna of the Rio Uruguay.

**Ecological regions:** Paraná flooded savanna.

**Biomes:** Flooded Grasslands and Savannas.

**Occurrence:** AR(CN);BR(RS). Map 9.

**Conservation status:** Endangered, EN B2ab(ii,iii,v)

**Comment:** Previously referred, in the *New Cactus Lexicon* (Hunt *et al.* 2006, text: 311, 359), to *Parodia turbinata* (Arechav.) Hofacker. As already di-



**Figure 9.** *Parodia chrysacanthion*. Argentina, Jujuy, Volcán, 26 Dec. 2015, 2123m, A&M 168. See also the front cover.

scussed (Anceschi & Magli, 2012b:26–33), the taxon with basionym *Echinocactus sellowii* var. *turbinatus* Arechavaleta, is actually a synonym of *Parodia erinacea* (Haworth) N.P. Taylor, one of the dominant species of the genus *Parodia* Spegazzini in the pampas area. *Parodia calvescens* (N. Gerloff & A.D. Nilson) Anceschi & Magli, instead shows olomorphological characters (i.e. morphological, physiological, ecological and chorological) distinct from *P. erinacea*, deserving full recognition at the species level. In summary: a) the normal evolutionary progression of the spines from the juvenile phase to adulthood in *P. erinacea* populations, strongly contrasts with the unique feature of *P. calvescens* to definitively “block” the growth, once the age of reproduction is reached. Once at maturity, the old areoles lose their spines, and the new ones cease to produce them (Gerloff & Nilson, 1994: 76–77, 83), leaving the plant completely bare. Hence the epithet ‘calvescens’. b) another distinctive element is illustrated by the fact that the description of *N. calvescens* (ibid: 75–78) shows a plant with slightly sharpened ribs, and again only in juveniles, to become then rounded and divided by the typical serpentine shape in adulthood. Instead, the description of *P. erinacea* and the images that illustrate it in *NCL* (Hunt *et al.*, 2006, atlas: 307, Fig. 307.4; 308, Fig. 308.4), highlight a taxon with acute ribs tout-court. This difference is confirmed by the populations of the two taxa in habitat. c) Even the topology of the habitat occupied by *P. calvescens* is quite specific. The taxon seems to prefer phytogeographic areas constituted by ‘espinales’, in the wooded savanna of the Rio Uruguay and tributaries, populated by various arboreal members of the *Leguminosae* family, such as the Espinillo (*Acacia caven*), the Inhanduvai (*Prosopis affinis*) and the Algarrobo (*Prosopis nigra*). It grows between herbs, in a sandy soil with a strong chalky component. We don’t know of any populations that are adapted to

live on rocky outcrops, something that is rather common in *P. erinacea*. Moreover, even if the latter can adapt to territories similar to those of *N. calvescens*, for example in the 'blanqueales' of the Rio Negro in Uruguay, there are no known cases of sympatry, an element that considering the extreme diffusion, and variety of habitats of *P. erinacea* gives further evidence for distinct phyletic lines for the two taxa. The specificity of the phytogeographical distribution area, the small number of populations (only 2 known), and the low numerical progression inside them, plus the only slight variability of *N. calvescens*, identify it as a non dominant species, with very fragmented distribution. We studied *P. calvescens* in the area of the type locality, in the Parque Estaudal do Espinilho, N of Barra do Quaraí, RS (BR). The other known location (i.e. the area around the bridge on the Rio Miriñay, Corrientes (AR), was flooded when we were there, in May 2016. Finally, *P. turbinata* in the sense of the *NCL* (Hunt *et al.* 2006, text: 224, 311, 359; atlas: 308, Fig. 308.5; 309, Fig. 309.1), appears to be a confused taxon, as it includes two distinct lineages (i.e. *P. calvescens* and *P. erinacea*).

**7. *Parodia carambeiensis*** (Buining & Brederoo) Hofacker, *Cactaceae Consensus Init.* **6**: 11 (1998). Basionym: *Notocactus carambeiensis* Buining & Brederoo.

#### Homotypic Synonyms

*Notocactus carambeiensis* Buining & Brederoo, *Kakt. and. Sukk.* **24**(1): 1 (–3), Figs. (1973). T.: BR. Paraná, near Carambei, N of 'Ponta Grossa', c. 1000m, 24 Nov 1966, Horst & Uebelmann 140A (U).

*Peronocactus carambeiensis* (Buining & Brederoo) Doweld, *Sukkulenty* **2**(3): 20 (1999), incorrect name (Art. 11.4). Basionym: *Notocactus carambeiensis* Buining & Brederoo.

#### Heterotypic Synonyms

*Notocactus villa-velhensis* (Backeb. & Voll) Slaba, *Kaktusy (Brno)* **20**(1): 7 (1984). Basionym: *Notocactus ottonis* var. *villa-velhensis* Backeb. & Voll.

*Notocactus ottonis* var. *villa-velhensis* Backeb. & Voll. *Arch. Jard. Bot.* Rio de Janeiro **9**: 172, Fig. (1950), (BR, Paraná).

**Description:** Habit solitary or clustering, stem globose to short cylindrical, 10–[12]cm high × 8–[9]cm diameter. Ribs 12–[17], <1cm high, slightly tuberculate between the areoles. Spines [pinkish white with base and red tip]. Central spines [1–3](–4), when 4 forming a cross, straight, [sometimes curved], stiff, [1.5]–3cm long. Radial spines 6–[12], [1.2]–2cm long. Flower somewhat bell-shaped, 2.5cm high × 2.5cm diameter, yellow, [style yellow], stigma lobes purple, [stamens yellow]. Fruit 1.2cm

high, at first fleshy, reddish, later drying and splitting. Seeds hatchet-shaped, dull black.

**Etymology:** In Latin *-ensis* (m., f.) means 'coming from'; *carambeiensis* referring to the place of its first discovery, near Carambei, Paraná, Brazil.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Southern Brazil, at the border with the Araucaria moist forests ecoregion, 900–1000m.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands.

**Occurrence:** BR(PR). Map 7.

**Conservation status:** Vulnerable, VU D2 (as in *NCL* 2006, text:332).

**Comment:** *Parodia carambeiensis* (Buining & Brederoo) Hofacker, represents a weak external vicariant in the complex of the components of the dominant *Parodia ottonis* (Lehmann) N.P. Taylor. The species occupies a limited area northwest of the core of the populations of the major taxon. The weakness of the populations (only seven known in the sources used, see Occurrence data on page 76), is due to the restricted area of occupancy, which we estimate to be less than 20km<sup>2</sup>. For this reason, despite the presence of the taxon within a Protected Area (see below), we prefer to restore the risk assessments about conservation status of species previously expressed in *NCL* (2006, text:332), i.e. Vulnerable, VU D2 to replace the Least Concern, LC expressed by Larocca, J. & Machado, M. for IUCN, (*Parodia carambeiensis*. The IUCN Red List of Threatened Species 2013. Downloaded on 24 September 2017). Our surveys on the taxon were carried out, with the help of the rangers, within the Protected Area Parque Estadual de Vila Velha, Ponta Grossa, Paraná (BR), where the species lives on rocky outcrops at the border of the Araucaria moist forests ecoregion.

**8. *Parodia chrysacanthion*** (K. Schum.) Backeb., *Blätt. Kakteenf.* **1935**(3): [2], (1935). Basionym: *Echinocactus chrysacanthion* K. Schum.

#### Homotypic Synonym

*Echinocactus chrysacanthion* K. Schum., *Gesamtbeschr. Kakt.*: 396 (1898). T.: AR, Jujuy, on road to Bolivia, Oct 1892, Kuntze (B?†).

#### Heterotypic Synonyms

*Parodia saint-pieana* Backeb., *Descr. Cact. Nov.*: 31 (1957). T.: AR, Jujuy, nd.

*Bolivicactus saint-pieanus* (Backeb.) Doweld, *Sukkulenty* **3**(1–2): 62 (2000). Basionym: *Parodia saint-pieana* Backeb.

**Description:** Habit solitary, stem depressed globose to short cylindrical, 12–[24]cm high × 10–[17.5]cm diameter, light green, surrounded by rings



of erect spines, apex depressed, very woolly. Ribs dissolved into spiraled tubercles. Spines 30–40, very similar between centrals and radials, straight, needle like to bristly, <3cm long, golden yellow to whitish. Flower <2cm high × 1–2cm diameter, golden yellow, pericarpel areoles mostly naked, hypanthium areoles with wool and bristles. Fruit small, ovoid, fleshy. Seeds small, with large strophiole, tuberculate, dark brown to black.

**Etymology:** From Greek *chrysos*, gold; and Greek *akanthion*, small spine; for the colour of the delicate golden spination.

**Habitat & Distribution:** Arid inter-Andean rocky valleys, occasionally in deciduous forest, 1500–2500m.

**Ecological regions:** Central Andean Puna.

**Biomes:** Montane Grasslands and Shrublands.

**Occurrence:** AR(JY). Map 3.

**Comment:** Despite being a well known taxon, which represents a very distinct and recognizable species within the genus *Parodia* s.l., there is some debate regarding what in our opinion remains its only synonym, namely *Parodia saint-pieana* Backeberg. The latter, considered conspecific with *Parodia chrysacanthion* (K. Schum.) Backeb., in Hunt *et al.* in 2006 (text: 223, 308, 363; atlas: 317, Fig. 317.4), was recognized again at specific level by Hunt, in the re-edition of the *NCL*'s atlas, named *The New Cactus Lexicon Illustrations* (2013, XIV, 317, Fig. 317.4). This new recognition was due to Schlumpberger's earlier article that appeared in *CSI* 28 (2012: 27–28), which claimed the existence of the taxon. We carried out several surveys in the pre-andean foothills north of the city of Salta, with particular attention to the Dique Campo Alegre's area, considered to be one of the localities for the taxon (*ibid.*, 28), but unfortunately we never found the species. The major difference between the two taxa (see *NCL* 2006, atlas: 317, 317.2, 317.4) seems to be the weaker spination of *P. saint-pieana*. Now, noting that this latter taxon seems to live "on vertical rocks or sometimes pendent in partly heavily shaded positions" (Schlumpberger, 2012: 27–28), we know from experience that populations or individuals of the same taxon, living in less exposed habitats, show weaker spines than the standard of the species (see also *Comment* in *Parodia haselbergii* (Haage ex Rümpler) F.H. Brandt). Finally, to demonstrate the real existence of a taxon, we believe that the availability of at least one photo of the plant in habitat is essential as supporting evidence. In this sense, in order to believe in its non-existence or existence in habitat, between the documental value of a photo of a plant in cultivation, and a photo of the same taxon in habitat, there is the same difference that can be found between "prudential acceptance" and "evidential acceptance". The latter linking evidence and "acceptance" is true, in fact, it may even be true by definition (see also Sober, 2008: 6–7).

No evidence in this sense was provided by Schlumpberger (*ibid.*), nor by other researchers. The poor photographic documentation of *P. saint-pieana* is always only based on plants in captivity. It is noteworthy that in the subsequent *CCC3*, Hunt (2016: 109) reported *P. saint-pieana* as a synonym of *P. chrysacanthion*. Over the years we have several times monitored the well-known population of *P. chrysacanthion*, which lives associated with *Deuterocohnia* (syn. *Abromeitiella*) at Volcán, Jujuy (AR), in the first area of the Quebrada de Humahuaca. During our last visit (December 2015), where we also met some new individuals in other points of the rocky mountain, we found that the core population is suffering, probably due to the thefts of plants by people who know the place very well. More generally, considering the abundant populations (fide Kiesling, R., 2013. *Parodia chrysacanthion*. The IUCN Red List of Threatened Species 2013. Downloaded on 26 September 2017), the taxon is identifiable as a relatively dominant species within the restricted colonized habitat.

**9. *Parodia claviceps*** (F. Ritter) F.H. Brandt, *Kakteen Orch. Rundschau* 7(4): 62 (1982). Basionym: *Eriocactus claviceps* F. Ritter.

#### Homotypic Synonyms

*Erioccephala claviceps* (F. Ritter) Lodé, *Cact.-Avent. Int.* 99: 25 (2013).

*Eriocactus claviceps* F. Ritter, *Succulenta* 45: 115 (1966), incorrect name (Art.11.4). T.: BR, Rio Grande do Sul, Júlio de Castilhos, *Horst in Ritter* 1283.

*Notocactus claviceps* (F. Ritter) Krainz, *Stadtische Sukkulentsammlung Zurich*, Katalog: 89 (1967).

*Erioccephala schumanniana* ssp. *claviceps* (F. Ritter) Guiggi, *Cactology* 3(Suppl. III): 1 (2012). [First used invalidly (Art. 35.1) by Guiggi in l.c. 3: 6, 2012.]

*Parodia schumanniana* ssp. *claviceps* (F. Ritter) Hofacker & P.J.Braun, *Cactaceae Consensus Init.* 6: 12 (1998).

*Eriocactus schumannianus* ssp. *claviceps* (F. Ritter) Doweld, *Turczaninowia* 3(3): 7 (2000), incorrect name (Art.11.4).

*Notocactus schumannianus* ssp. *claviceps* (F. Ritter) Doweld, *Sukkulenty* 2(3): 23 (1999).

**Description:** Habit solitary or clustering, [groups <22 stems, or more], stem globose to [clavate], 10–[71]cm high × 8–[26.5]cm diameter. Ribs 23–[38]. Spines [flexible], needle-like, sometimes curved, [wavy or twisted], pale yellow. Central spines [0]–3. Radial spines [3]–8, the lowest 2–5cm long. Flower 5.5cm high × 6cm diameter, yellow. Pericarpel + hypanthium c. 3.2 cm.

**Etymology:** From Latin *clava*, club; and Latin -



**Figure 10.** *Parodia claviceps*. Argentina, Misiones, San Ignacio, R. N. Osununú, 100m, 22 Jul. 2007, A&M 246

*ceps*, -headed; refers to the body shape of the species.

**Habitat & Distribution:** Basaltic rocky walls of the river basins of the Serra Geral formation (Jacuí and Jaguarí rivers), gradient close to 90°, in Rio Grande do Sul, Brazil, and nearly vertical rocky slopes on the Paraná river, in the R. N. Osununú - P. P. Teyú Cuaré, Misiones, Argentina, both habitats surrounded by humid subtropical forest (respectively Mata Atlantica & Selva Misionera).

**Ecological regions:** Alto Paraná Atlantic forests (Mata Atlantica & Selva Misionera), in eastern Argentina, southern Brazil and eastern Paraguay.

**Biomes:** Tropical and Subtropical Moist Broadleaf Forests.

**Occurrence:** AR:(MN);BR(RS). Map 10.

**Conservation status:** Endangered, EN B1ab(ii,iii); 2ab(ii,iii) Justification: this species is listed as Endangered because the extent of occurrence is estimated to be c. 3000km<sup>2</sup>, excluding the population living in the R. N. Osununú - P. P. Teyú Cuaré areas, respectively 0.78 + 1.7km<sup>2</sup> of extension, located 250km northwest from the core of *P. claviceps*. The area of occupancy is less than 500km<sup>2</sup>, population size is severely fragmented and the quality of the habitat is constantly declining due to human activity. The Itaúba dam on the Rio Jacuí, between the municipalities of Júlio de Castilhos e Pinhal Grande, RS (BR), is an example.

**Comment:** The *NCL* treatment (Hunt *et al.* 2006, text: 223, 310, 362) considers *Parodia claviceps* (F. Ritter) F. H. Brandt a subspecies of *Parodia schumanniana* (Nic.) F.H. Brandt. However, we consider it sufficiently different due to its usually clustering habit, shorter in height (<71cm vs. <180cm for *P. schumanniana*), fewer ribs 23–38 vs. 21–48, and the very distinct habitat, justifying its recognition as a distinct species. The taxon lives on basaltic rock walls of the Serra Geral formation, gradient close to 90°, on the Jacuí and Jaguarí ri-



**Figure 11.** *Parodia claviceps*. Brazil, Rio Grande do Sul, Agudo, Morro Finkenberg, 8 Dec. 2006, A&M 93.

vers, Rio Grande do Sul, (BR), and as revealed in our previous work, significantly enlarging the known distribution of the taxon (Anceschi & Magli, 2013: 27–39), on nearly vertical rocky slopes on the Paraná river, in the R. N. Osununú - P. P. Teyú Cuaré, Misiones (AR). On the contrary, the populations of *P. schumanniana* live in hills with granitic rock outcrops and sandstone reliefs, in the Paraguari Dpt. (PY), and sandstone reliefs in the Guairá Dpt. (PY), far from rivers. Finally, as already pointed out (*ibid.*: 36), the taxon historically related to *P. schumanniana* (and perhaps not distinct) is not *P. claviceps*, but *P. nigripina* as Gerloff *et al.* (1995: 142) already suggested. We studied the species in the Jacuí River basin, and in the protected areas R. N. Osununú and P. P. Teyú Cuaré, Misiones (AR). As per our justification concerning the *Conservation status*, the species is identifiable as non-dominant with fragmented distribution.

**10. *Parodia columnaris*** Cárdenas, *Cact. Succ. J.* (Los Angeles) **23**: 95, Figs. 49–50 (1951). T.: BO, Cochabamba, Campero, between Pérez and Puente Taperas, Angosto de Pérez, 1600m, Cárdenas 4396 (LIL, not found; US).

#### Homotypic Synonym

*Boliviacactus columnaris* (Cárdenas) Doweld, *Sukkulenty* **3**(1–2): 62 (2000).

#### Heterotypic Synonym

*Parodia echinopsoides* F.H. Brandt, *Kaktus* **11**(2): 40 (1976), (BO). T.: BO, Cochabamba, Campero, “in montis inter Rio Grande et Rio Mizque”, Brandt 10/a, holo. (HEID).

*Parodia legitima* F.H. Brandt, *Kaktusz Vilag* **5**: 5–8 (1975).

**Description:** Habit [solitary or] forming clumps to 30cm high × 25cm diameter, [or more], stem club



**Figure 12.** *Parodia columnaris*. Bolivia, Santa Cruz, Comarapa, between Comarapa and Chillon, 04 Feb. 2016, 1747m, A&M 1337.



**Figure 13.** *Parodia comarapana*. Bolivia, Santa Cruz, Comarapa, N. of the town, 1 Feb. 2016, 2159m, A&M 1319.



**Figure 14.** *Parodia comarapana*. Bolivia, Santa Cruz, Comarapa, N. of the town, 1990m, A&M 1325.

shaped to cylindrical, 7–[61]cm high × 3–[8.4]cm diameter, leaf-green. Ribs 12–[17], more or less straight, tuberculate. Spines [cone-shaped], stiff, [first reddish then yellowish, or light horn-yellow at the top, then grey with dark tip]. Central spines: 1.1–2cm long, [first porrect, then pointed downward]. Radial spines 7–[9], curved on the stem surface, 1–[1.9]cm long. Flower usually campanulate, [bright yellow], 1.5–[2.6]cm high × 1–[2.9]cm diameter, [stamens (filaments and anthers) yellow, style yellow, stigma lobes 11, yellow]. Fruit globose, nearly dry at maturity, 0.4cm diameter. Seeds very small, shiny black.

**Etymology:** Latin, column-shaped; for the growth-form or this species.

**Habitat & Distribution:** Arid inter-Andean rocky valleys, occasionally in deciduous forest, 900–1800m.

**Ecological regions:** Bolivian Montane Dry Forest.

**Biomes:** Montane Grasslands and Shrublands.



**Figure 15.** *Parodia commutans*. Bolivia, Tarija, Quebrada de Paicho Sur, road to Tomayapo, 2 Jul. 2011, A&M 602.

**Occurrence:** BO(CB,CQ,SC). Map 3.

**Conservation status:** Least Concern, LC ( as in *NCL* 2006, text: 332).

**Comment:** While considering the Near Threatened, NT, risk assessment and the fears expressed by Lowry (2013. *Parodia columnaris*. The IUCN Red List of Threatened Species 2013, Downloaded on 26 September 2017), about the conservation status of *Parodia columnaris* Cárdenas, we believe that the prosperity of some populations of the species, such as those that show hundreds of mature individuals on the road Comarapa-Chillon, starting from the “Dique” (8km from Comarapa), towards the west, are able to avoid the possible dangers (i.e. severely fragmented populations, continuing decline inferred in the area, extent and number of mature individuals). In this sense, we propose again the Least Concern evaluation, LC as already in *NCL* (2006, text: 332), considering that the taxon manifests itself as relatively dominant in the restricted colonized area. *P. columnaris* is closely re-

lated to *Parodia ocampoi* Cárdenas, which is a strong external vicariant of the first taxon.

**11. *Parodia comarapana*** Cárdenas, *Revista Agric.* (Cochabamba) 7(6): 24, Fig. (1951). T.: BO, Santa Cruz, Florida, mts. N. of Comarapa, 2000m, Nov 1950, Cárdenas 4570 (LIL 531544, holo.; US, iso.).

#### Homotypic Synonym

*Boliviacactus comarapanus* (Cárdenas) Doweld, *Sukkulenty* 3(1–2): 62 (2000).

**Description:** Habit solitary or clustering, [stem depressed globose to globose, rarely short cylindrical, (1.6–)3.5–16.3cm high × (3.4–)4–10.6cm diameter, light green]. Ribs 12–[22], straight or spiraled, forming tubercles, [tubercles rounded, breast-shaped], <1cm high × [1.8cm width (in the center of the stem)]. Spines [thin, flexible, some straight, needle-like, others wavy or twisted, some just hooked at the tip, reddish brown, reddish, fawn, or reddish ocher yellow at the apex, then mainly pale yellow or yellowish white, with some spines variegated reddish, down in the stem; or all grey]; sometimes indistinct between centrals and radials. Central spines [(1–)4], [forming a cross, straight, light grey, or pale yellow with a dark base, the lower <2.9cm; in young plants, only 1 central, dark yellow with dark tip, pointing outwards]. Radial spines [(15–)17]–35, [thinner and clearer than centrals, curved, wavy or twisted, nearly white; in young plants, straight, like mustaches, adpressed to the stem surface]. Flower [small], [1.3]–2.5cm high × 0.5–[0.9]cm diameter, orange-yellow to orange. Fruit globose, dry, <0.8cm diameter, greenish white, pink basally. Seeds blackish brown.

**Etymology:** For the occurrence in a restricted area near Comarapa, Prov. Valle Grande, Dept. Santa Cruz, Bolivia.

**Habitat & Distribution:** A restricted area in humid inter-Andean rocky slopes, 2000–2200m, around the little town of Comarapa, Prov. Caballero, Dept. Santa Cruz, Bolivia.

**Ecological regions:** Bolivian Montane Dry Forest.

**Biomes:** Montane Grasslands and Shrublands.

**Occurrence:** BO(SC). Map. 4.

**Conservation status:** Vulnerable, VU D1+2 Justification: this species is listed as Vulnerable because the population size estimated is fewer than 1000 mature individuals, and is found in a very restricted area of occupancy (less than 20km<sup>2</sup>).

**Comment:** Despite Lowry's clarifying article, in *CSI* (2012, 28: 26–27), the current understanding of *Parodia comarapana* Cárdenas remains generally rather confused. The non-comprehension of the taxon results from the fact that the populations of *Parodia mairanana* Cárdenas are assigned to it, as synonyms (Hunt *et al.* 2006, text: 221, 309, 363;

Anderson & Eggl, 2011: 497, 725; Hunt, 2016: 108). As already pointed out by Lowry (*ibid.*), the two taxa are rather different. *P. mairanana* is distinguished by the shorter, curved, sometimes hooked spines, besides the less woolly areoles and the propensity to form groups compared to *P. comarapana* (with longer and straighter spines, woolly areoles and usually solitary body). The habitat is also quite distinct, while the latter taxon occurs in a very restricted area, in humid inter-Andean rocky slopes, 2000–2200m, around the little town of Comarapa, *P. mairanana* is found further east at lower altitudes (<1800m), in semi-deciduous thorn forest. In addition, while *P. comarapana* represents a rather weak non-dominant species (see *Conservation status*), that lives in a very specific ecological niche, *P. mairanana*, despite the relatively small extent of occurrence (about 1,600km<sup>2</sup>), presents a fairly continuous front of populations, which in turn consist of a large number of individuals in the taxon's distribution area, which manifest itself as a relatively dominant species within the restricted colonized habitat. To clarify our ideas about the relationship between the two taxa in habitat, we devoted extensive researches to *P. mairanana* in 2014, in the areas between Agua Clara, Los Negros and Mataral, Santa Cruz (BO), and in 2016 we stayed for about ten days at Comarapa, to study the taxon that lives in the northern hills of the town. Some more photos of the population of *P. comarapana* in habitat (paradoxically only *P. mairanana* is documented in this sense), would help to provide "evidential acceptance" (see Comment about *P. chrysacanthion*), about the distinction between the two taxa, and therefore also about the autonomy of *P. mairanana* at the specific level.

**12. *Parodia commutans*** F. Ritter, *Succulenta* 43: 22 (1964). T.: BO, Chuquisaca, border of Sud Cinti and Sud Chichas, Impora, 1953, Ritter 729.

#### Homotypic Synonyms

*Boliviacactus commutans* (F. Ritter) Doweld, *Sukkulenty* 3(1–2): 62 (2000).

#### Heterotypic Synonyms

*Parodia maxima* F. Ritter, *Succulenta* 43: 23 (1964). T.: BO, Tarija, Mendez, Cieneguillas, 1931, Ritter 87.

*Parodia obtusa* F. Ritter, *Succulenta* 43: 44 (1964). T.: BO, Potosi, Nor Chichas, 25km W. of Cotagaita, 1963, Ritter 1125.

**Description:** Habit solitary [or forming clumps, groups <142cm width, with 16 stems], stem globose to elongate, 30–[46]–(120, fide Lowry, M., 2018, pers. comm.) cm high × 16–[22]cm diameter, somewhat grey green. Ribs 13–[18], straight [or spiraled], 1.2–1.4cm high. Spines [orange-yellow when young (at the apex), then bright grey, nearly silver].



**Figure 16.** *Parodia concinna*. Uruguay, Maldonado, Punta Ballena, 20 Dec. 2011, A&M 834.

Central spines: 4, [forming a cross, flexible, the lower one curved, <8.5cm long]. Radial spines: 12–16, [flexible, like a mustache, addressed to the stem surface], <3cm. Flower 3–3.5cm high × 2.5–3cm diameter, pale yellow. Fruit cylindrical, 2–5cm long, pale green, pale yellow or pale pink. Seeds small, black.

**Etymology:** Latin, changing; describing the variability of the taxon.

**Habitat & Distribution:** Arid inter-Andean rocky valleys, 2300–3500m.

**Ecological regions:** Bolivian Montane Dry Forest.

**Biomes:** Montane Grasslands and Shrublands.

**Occurrence:** BO(CQ,PO,TR). Map 1.

**Comment:** *Parodia commutans* F. Ritter represents an external vicariant in the complex of the dominant *Parodia maassii* (Heese) A. Berger. The populations, recognizable by the size of the stems (<46(–120) × 22cm), and the nearly silver, bright grey colour of the spines, occupy a central position within the distribution of the dominant species. The vicariant is considered strong because, despite the relatively small extent of occurrence, that is 2,800km<sup>2</sup> (data gathered from: Lowry, M. 2013. *Parodia commutans*. The IUCN Red List of Threatened Species 2013. Downloaded on 27 September 2017), the populations are vast and composed of numerous individuals. We detected the species during various surveys carried out within the Quebrada de Paicho Sur, and on the road to Tomayapo, Tarija, Bolivia.

**13. *Parodia concinna*** (Monv.) N.P. Taylor, *Bradleya* 5: 93 (1987). Basionym: *Echinocactus concinnus* Monv.

#### Homotypic Synonyms

*Echinocactus concinnus* Monv., *Hort. Universel* 1: 222 (1839). T.: UY, Montevideo, grasslands, cult. hort. Monville, np. NT.: D.R. Hunt & N.P. Taylor, *Cactaceae Syst. Init.* 21: 9 (2006); *Bot.*

*Mag.* 70: t. 4115 (1844), the first illus. of the species, cult. hort. Kew.

*Malacocarpus concinnus* Britton & Rose, *Cactaceae* (Britton & Rose) 3: 192, (1922), incorrect name (Art. 11.4).

*Notocactus concinnus* (Monv.) A. Berger, *Kakteen:* 210, 343 (1929).

*Peronocactus concinnus* (Monv.) Doweld, *Sukkulenty* 2(3): 20 (1999), incorrect name (Art. 11.4).

#### Heterotypic Synonyms

*Notocactus agnetae* Vliet, *Succulenta* 54(1): 6, Figs. (1975). T.: UY, dept. Lavalleja, 150m, Vliet 8.5 (U).

*Notocactus concinnus* ssp. *agnetae* (Vliet) Doweld, *Sukkulenty* 3(1–2): 55 (2000). Basionym: *Notocactus agnetae* Vliet.

*Parodia concinna* ssp. *agnetae* (Vliet) Hofacker, *Cactaceae Consensus Init.* 6: 11 (1998). Basionym: *Notocactus agnetae* Vliet.

*Peronocactus concinnus* ssp. *agnetae* (Vliet) Doweld, *Sukkulenty* 2(3): 21 (1999), incorrect name (Art. 11.4). Basionym: *Notocactus agnetae* Vliet.

*Echinocactus apricus* Arechav., *Anales Mus. Nac. Montevideo* 5: 205, pl. 10 (1905). T.: Uruguay, Punta de la Ballena.

*Malacocarpus apricus* Britton & Rose, *Cactaceae* (Britton & Rose) 3: 192, Fig. 204 (1922), incorrect name (Art. 11.4). Basionym: *Echinocactus apricus* Arechav.

*Notocactus apricus* (Arechav.) A. Berger, *Kakteen:* 211, 343 (1929). Basionym: *Echinocactus apricus* Arechav.

*Notocactus blaauwianus* Vliet, *Succulenta* 55 (6): 108 (–109), Figs. (1976). T.: UY, dept. Cerro Largo, 150m, Vliet 103.8 (U).

*Parodia concinna* ssp. *blaauwiana* (Vliet) Hofacker, *Cactaceae Consensus Init.* 6: 11 (1998). Basionym: *Notocactus blaauwianus* Vliet.

*Notocactus bommeljei* Vliet, *Succulenta* 47: 7 (1968), [= *Echinocactus muricatus sensu* K. Schum. 1898/GK: 386 non Pf 1837/Enum.: 49.].

*Notocactus tabularis* ssp. *bommeljei* (Vliet) Lodé, *Cact.-Avent. Int.* 98(Suppl.): 8 (2013). Basionym: *Notocactus bommeljei* Vliet.

*Parodia tabularis* ssp. *bommeljei* (Vliet) Hofacker, *Cactaceae Consensus Init.* 6: 12 (1998). Basionym: *Notocactus bommeljei* Vliet.

*Notocactus brederooianus* Prestlé, *Succulenta* 64(4): 87, Fig. (1985). T.: PR81 (U).

*Frailea caespitosa* (Spegazzini) Britton & Rose, *Cactaceae* 3: 211 (1922). Basionym: *Echinocactus caespitosus* Speg.

*Parodia caespitosa* (Speg.) N.P. Taylor, *Bradleya* 5: 93 (1987). Basionym: *Echinocactus caespitosus* Speg.

*Echinocactus caespitosus* Speg., *Anales Mus. Nac. Buenos Aires ser.* 3, 4: 495 (1905).

*Notocactus caespitosus* (Speg.) Backeb., *Kaktus-ABC*: 253 (1936). Basionym: *Echinocactus caespitosus* Speg.

*Malacocarpus caespitosus* (Speg.) Hosseus, *Arch. Esc. Farm. Fac. Sci. Med. Cordoba* no. 9: 137 (1939), incorrect name (Art. 11.4). Basionym: *Echinocactus caespitosus* Speg.

*Notocactus concinnoides* W. Prauser, *Internoto* 14(2): 53 (1993), nom. inval. (Art. 36.1, 37.1).

*Notocactus eremiticus* F. Ritter, *Kakteen Südamerika* 1: 180 (–181), Fig., (1979). T.: Ritter 1390, holo. 0115221 (U).

*Notocactus gibberulus* Prestlé, *Succulenta* 65(6–7): 142 (1986). T.: K.H. Prestlé PR 313, holo. 0008471 (U).

*Echinocactus joadii* Hook.f., *Bot. Mag.* 112: t. 6867 (1886).

*Notocactus joadii* (Hook.f.) Herter, *Revista Sudamer. Bot.* 7: 216 (1943).

*Notocactus multicostatus* Buining & Brederoo in Krainz, *Kakteen*: 55–56: CVI c, Fig. (1973), [1974]. T.: Horst & Uebelmann 100, holo. 0115292 (U).

*Notocactus concinnus* ssp. *multicostatus* (Buining & Brederoo) Doweld, *Sukkulenty* 3(1–2): 55 (2000). Basionym: *Notocactus multicostatus* Buining & Brederoo

*Peronocactus concinnus* ssp. *multicostatus* (Buining & Brederoo) Doweld, *Sukkulenty* 2(3): 21 (1999), incorrect name (Art. 11.4). Basionym: *Notocactus multicostatus* Buining & Brederoo.

*Notocactus olimarensis* Prestlé, *Internoto* 6(3): 94 (1985), nom. inval. (Art. 36.1).

*Notocactus rubrigemmatum* W.R. Abraham, *Kakt. and. Sukk.* 39(2): 40, Fig. (1988). T.: H.S. Schlosser S156 (Uruguay), holo. deposited in the herbarium of the botanical department of the Museo Nacional de Historia Natural in Montevideo, Uruguay.

*Malacocarpus tabularis* (Cels ex Rümpler) Britton & Rose, *Cactaceae* (Britton & Rose) 3: 193, Fig. 205 (1922), incorrect name (Art. 11.4). Basionym: *Echinocactus concinnus* var. *tabularis* Cels ex Rümpler.

*Notocactus tabularis* (Cels ex Rümpler) A. Berger, *Kakteen*: 211, 343 (1929). Basionym: *Echinocactus concinnus* var. *tabularis* Cels ex Rümpler.

*Parodia tabularis* (Cels ex Rümpler) D.R. Hunt, *Cactaceae Consensus Init.* 4: 6 (1997). Basionym: *Echinocactus concinnus* var. *tabularis* Cels ex Rümpler.

*Peronocactus tabularis* (Cels ex Rümpler) Doweld, *Sukkulenty* 2(3): 21 (1999). Basionym: *Echinocactus concinnus* var. *tabularis* Cels ex Rümpler.

*Echinocactus concinnus* var. *tabularis* Cels ex Rümpler, *Handb. Cacteenk.* (ed. 2): 552 (1886). T.: XC, nd.

**Description:** Habit solitary [or clustering], stem depressed globose to short cylindrical with age, 3–13cm high × 3–10cm diameter, light green. Ribs 15–32, low, with conspicuous chin-like tubercles between the areoles. Spines bristly [and flexible], [straight], curved or twisted. Central spines 1 [or 8, the more central or the lower one, sometimes curved at apex, red or reddish brown, <2.7cm; the others reddish yellow]. Radial spines, shorter, [in two series, 6–8 in the inner circle, reddish, 13 the outer, whitish; or the two series <24](–25), [mustache-like, radiant on the stem surface, some porrect, pale yellow]. Flower rather large, 5–8cm high × 5–8cm diameter, lemon yellow. Pericarpel and hypanthium elongate. Fruit ovoid to globose, thin walled, splitting or disintegrating at maturity, <1.5cm long.

**Etymology:** From Latin *concinnus*, neat, pretty, elegant.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Uruguay and Southern Brazil, 20–300m.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands.

**Occurrence:** BR(RS);UY. Map 8.

**Comment:** The taxon, which has a rather large extent of occurrence including the south of Brazil (RS), and large areas of Uruguay, represents an example of an ex-dominant species, now with fragmented distribution, due to the anthropic intervention (mainly land use change for *Eucalyptus* plantations, general decline of quality of habitat due to various human activity near the small rocky outcrops where the species lives, illegal collection, etc.). We worked several times on *Parodia concinna* (Monv.) N.P. Taylor, in the Dpt. of Maldonado (UY), where populations live on rocky outcrops (Cerro del Toro in Piriapolis and the nearby Punta Ballena), next to the waters where the delta of the Rio de la Plata meets the Atlantic Ocean.

**14. *Parodia crassigibba*** (F. Ritter) N.P. Taylor, *Bradleya* 5: 93 (1987). Basionym: *Notocactus crassigibbus* F. Ritter.

#### Homotypic Synonyms

*Notocactus crassigibbus* F. Ritter, *Succulenta* 49(7): 108 (1970). T.: BR. Rio Grande do Sul, Lavras, Horst in Ritter 1394.

*Ritterocactus crassigibbus* (F. Ritter) Doweld, *Sukkulenty* 2(3): 22 (1999).

#### Heterotypic Synonyms

*Notocactus arachnitis* F. Ritter, *Succulenta* 49(7): 108–109 (1970). T.: Ritter 1395 (Brazil), holo. deposited in the Herbarium of the University of Utrecht NL.



**Figure 17.** *Parodia crassigibba*. Brazil, Rio Grande do Sul, Caçapava do Sul, Pedra do Leão, 280m, 1 Dec. 2006, A&M 81.

*Parodia meonacantha* (Prestlé) Hofacker, *Cactaceae Consensus Init.* **6**: 11 (1998). Basionym: *Notocactus meonacanthus* Prestlé.

*Notocactus meonacanthus* Prestlé, *Internoto* **7**(2): 35 (–39), illus. (1986). T.: BR, Rio Grande do Sul, Camaquã area, Jan 1983, *Prestlé & Stockinger* in *Prestlé* 318 (U).

*Ritterocactus meonacanthus* (Prestlé) Doweld, *Sukkulenty* **2**(3): 22 (1999). Basionym: *Notocactus meonacanthus* Prestlé.

*Parodia weneri* ssp. *pleiocephala* (N. Gerloff & Königs) Hofacker, *Cactaceae Consensus Init.* **6**: 12 (1998). Basionym: *Notocactus uebelmannianus* var. *pleiocephalus* N. Gerloff & Königs.

*Notocactus uebelmannianus* ssp. *pleiocephalus* (N. Gerloff & Königs) Lodé, *Cact.-Avent. Int.* **98**(Suppl.): 8 (2013). Basionym: *Notocactus uebelmannianus* var. *pleiocephalus* N. Gerloff & Königs.

*Notocactus uebelmannianus* var. *pleiocephalus* N. Gerloff & Königs, *Internoto* **13**(4): 103–112 (1992). T.: BR, Rio Grande do Sul, Torinhas, *Gerloff* 52a (hb. Mus. Nat. Rosenstein, Stuttgart).

*Ritterocactus uebelmannianus* ssp. *pleiocephalus* (N. Gerloff & Königs) Doweld, *Sukkulenty* **2**(3): 23 (1999). Basionym: *Notocactus uebelmannianus* var. *pleiocephalus* N. Gerloff & Königs.

*Notocactus uebelmannianus* Buining, *Kakt. and. Sukk.* **19**(9): 175 (–176) (1968). T.: *Horst & Uebelmann* 78, holo.(U).

*Ritterocactus uebelmannianus* (Buining) Doweld, *Sukkulenty* **2**(3): 23 (1999). Basionym: *Notocactus uebelmannianus* Buining.

*Parodia weneri* Hofacker, *Cactaceae Consensus Init.* **6**: 12 (1998), replaced synonym: *Notocactus uebelmannianus* Buining, *Kakt. and. Sukk.* **19**(9): 175 (–176) (1968). T.: BR, Rio Grande do Sul, Caçapava, Nov 1966, *Horst & Uebelmann* 78, holo.(U).



**Figure 18.** *Parodia curvispina*. Brazil, Rio Grande do Sul, Lavras do Sul, RS 630, 5 Nov. 2011, A&M 803.

**Description:** Habit solitary [or rarely] clustering, stem depressed globose [to globose], [3–12.5]cm high × 4–17cm diameter, [bright green] to shiny dark green. Ribs 10–16, low, rounded, with broad chin-like tubercles between the areoles. Spines [mainly] white, but also grey or pale brown. Central spines 0–1, [pointed downward, <2.2cm]. Radial spines 6–14, [“spider like”, adpressed to the stem surface, rounded to the tip]. Flower 3.5–6cm high × 4.5–6cm diameter, nearly white, yellow or red purple. Fruit [spherical] to barrel shaped, 1[–1.2cm high × 0.8–1.2cm diameter, green (when unripe) to purplish (when ripe), with scales covered by white hairs and red bristles, REM persistent]. Seeds hemispheric, with a prominent corky hilum, dull black.

**Etymology:** From Latin *crassus*, thick; and Latin *gibba*, swelling, gibbosity; refers to the large humps on the ribs.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Southern Brazil, up to 300m.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands.

**Occurrence:** BR(RS). Map 9.

**Comment:** The current understanding of the taxon also includes the populations of *Parodia weneri* Hofacker and *Parodia weneri* ssp. *pleiocephala* (N. Gerloff & Königs) Hofacker, initially distinguished by Hofacker (1998: 12) only by the colour of the flower. Considering the limited occupied area, by rather fragmented populations with a small number of individuals, *Parodia crassigibba* (F. Ritter) N.P. Taylor shows up as a non-dominant species with fragmented distribution. We studied the species several times in habitat in the area between Caçapava do Sul and Minas Do Camaquã, RS (BR). Particularly exhaustive were the surveys carried out on the taxon in the area of Caçapava do

Sul, precisely on the rocky outcrops of sandstone conglomerates of the formation Pedra do Segredo. One of these, the Pedra do Leão, is located on the Galpão da Pedra property, which ensures good protection against ill-intentioned visitors. It was just in the area of the Pedra do Leão, that we could see how *Notocactus arachnitis* F. Ritter (one of the synonyms of *P. crassigibba*), is actually only a juvenile semaphoront (see materials and methods) within the taxon's ontogenesis process.

**15. *Parodia curvispina*** (F. Ritter) D.R. Hunt, *Cactaceae Consensus Init.* 4: 6 (1997). Basionym: *Notocactus curvispinus* F. Ritter.

#### Homotypic Synonyms

*Notocactus curvispinus* F. Ritter, *Kakteen Südamerika* 1: 189, Fig. (1979). T.: BR, Rio Grande do Sul, Dom Pedrito, *Horst & Uebelmann* 338 p.p. in *Ritter* 1479 (originally 1455a; Egli *et al.* 1996/Engl. 16: 565).

*Ritterocactus curvispinus* (F. Ritter) Doweld, *Sukkulenty* 2(3): 22 (1999).

#### Heterotypic Synonyms

*Notocactus arnostianus* Lisal & Kolarik, *Internoto* 7(1): 8, Fig. (1986). T.: BR, Rio Grande do Sul, W environs of Dom Pedrito, *Horst & Uebelmann* 338 p.p. (Herbarium. Arb. Mus. Sil. Opava-Novy Dvur).

*Parodia arnostiana* (Lisal & Kolarik) Hofacker, *Cactaceae Consensus Init.* 6: 11 (1998). Basionym: *Notocactus arnostianus* Lisal & Kolarik.

*Ritterocactus arnostianus* (Lisal & Kolarik) Doweld, *Sukkulenty* 2(3): 22 (1999). Basionym: *Notocactus arnostianus* Lisal & Kolarik.

*Notocactus cristatoides* F. Ritter, *Kakteen Südamerika* 1: 190 (–191), Fig. (1979). T.: BR, Rio Grande do Sul, near Ibare, in the Pampa at some rocky places, *Ritter* 1478, holo. (U).

*Notocactus rubropedatus* F. Ritter, *Kakteen Südamerika* 1: 189 (–190), Fig. (1979). T.: *Ritter* 1484 (Brazil). Seeds deposited in the Herbarium of the former Municipal Succulent collection Zurich / CH.

*Notocactus vilanovensensis* C.E. Koch, *Internoto* 24(2): 15 (13–19; Fig. 14), (2003). T. *Koch* 001 (Brazil), deposited in Herbario Anchieta, Sao Leopoldo, RS Brazil.

**Description:** Habit solitary or rarely clustering, stem depressed globose to globose, 4[–9]cm high × 4[–10]cm diameter, green to dark green. Ribs [18]–30, straight, forming small chin-like tubercles. Central spines 1–2(–3), [thicker than radials], sometimes one longer and curved downward, <2cm, [pinkish with dark tip]. Radial spines 10–[21], thinner, curved, 0,4–1cm long, [white with dark tip]. Flower 4–6cm high × 7–7.5cm diameter, lemon to

sulfur yellow, style purplish. Fruit elliptical, <[2]cm high × 1.4cm diameter, [dark reddish green (probably red when ripe), covered by scales with fluent white hairs and twisted dark red bristles]. Seeds tuberculate, black.

**Etymology:** From Latin *curvus*, curved, bent; and Latin *spina*, spine; probably, for one of the central spines, longer and curved downward.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Southern Brazil, up to 100m.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands.

**Occurrence:** BR(RS). Map 6.

**Conservation status:** Data Deficient, DD

**Comment:** The *NCL* treatment (2006, text: 219, 322) considers it to be of uncertain status, in view of the opinion expressed by Lisal & Kolarik (1986: 3–19) that the plants grown under the field number HU 338, i.e. the designated type of *Notocactus curvispinus* F. Ritter, actually represent three distinct taxa, namely *N. curvispinus* = *Parodia curvispina* (F. Ritter) D.R. Hunt, *Notocactus arnostianus* Lisal & Kolarik = *Parodia arnostiana* (Lisal & Kolarik) Hofacker, and *Notocactus ritterianus* Lisal & Kolarik. In disagreement with the authors, and giving a face to “another (perhaps simpler) explanation” proposed by Hunt, in the note accompanying *P. arnostiana* in *NCL* (2006, text: 218), we believe that HU 338 is representative of only two natural species. Indeed, *N. ritterianus* consists of young semaphoronts of the well known *P. mammulosa* (the first taxon is correctly considered a synonym of the second in Hunt *et al.*, 2006), while *P. arnostiana* and *P. curvispina* are identifiable in the same natural taxon. The populations of *P. curvispina* living on rocky outcrops in grassy hills, approximately 22–23km northeast of Dom Pedrito, already in the 2nd district of Lavras do Sul, RS (BR), show within them the “distinguishing elements” of the two taxa. The desire of some enthusiasts to discover always new species (Anceschi & Magli, 2010) sometimes leads to mistaking for “cases of sympatry”, the normal morphological evolutions that characterize a natural biological population. *P. curvispina* represents a weak external vicariant, in the complex of the dominant *Parodia mammulosa* (Lem.) N.P. Taylor. The weakness is due to the extreme localization of the taxon's populations. The position of *P. curvispina* completes the picture of our understanding of the internal relations within the complex of taxa next to *P. mammulosa* (Anceschi & Magli, 2013: 60–73).

**16. *Parodia erinacea*** (Haworth) N.P. Taylor, *Bradleya* 5: 93 (1987). Basionym: *Cactus erinaceus* Haw.





**Figure 19.** *Parodia erinacea*. Uruguay, Montevideo, Montevideo, Cerro de Montevideo, 17 Feb. 2011, A&M 349.



**Figure 20.** *Parodia erinacea*. Uruguay, Tacuarembó, Cerro del Portón, 25 Nov. 2008, A&M 289.

#### Homotypic Synonyms

- Wigginsia erinacea* (Haw.) D.M. Porter, *Taxon* 13: 210 (1964).  
*Cactus erinaceus* Haw., *Syn. Pl. Succ. suppl.*: 74 (1819). T.: XC, 1818, hort. Hitchin, np.  
*Malacocarpus erinaceus* (Haw.) Lem. ex C.F. Först., *Handb. Cacteenk.* ed. 2: 455 (1886).  
*Notocactus erinaceus* (Haw.) Krainz, *Kakt. and. Sukk.* 17: 195 (1966).

#### Heterotypic Synonyms

- Wigginsia acuata* (Link & Otto) F. Ritter, *Kakteen Südamerika* 1: 197 (1979). Basionym: *Echinocactus acuatus* Link & Otto.  
*Echinocactus acuatus* Link & Otto, in *Verh. Preuss. Gartenb. Ver.* iii. 424, Tab. 23 (1827), (“Habitat in Montevideo. Sellow.”). T.: Tab. 23.  
*Malacocarpus acuatus* (Link & Otto) Salm-Dyck, *Cact. Hort. Dyck.* ed. II: 25 (1850), incorrect name (Art. 11.4).  
*Notocactus acuatus* (Link & Otto) S. Theun., *Succulenta* 60(6): 142 (1981). Basionym: *Echinocactus acuatus* Link & Otto.  
*Notocactus beltranii* (Frič ex Z. Fleisch. & Schütz) G. Schäf., *Kakteen Sukkulenten* (Dresden) 14(1–4): 36 (1979 publ. 1980). Basionym: *Wigginsia beltranii* Frič ex Z. Fleisch. & Schütz.  
*Wigginsia beltranii* Frič ex Z. Fleisch. & Schütz, in *Friciana* 51: 18, 19 etc. (1976). T.: A.V. Frič 1920, holo. (SCK).  
*Malacocarpus bezrucii* Fric, *Ceskoslov. Zahradnických Listu [Kakt. Sukk.]* 1924: 31 (1924), nomen, incorrect name (Art. 11.4).  
*Notocactus bezrucii* (Fric) G. Schäf., *Kakteen Sukkulenten* (Dresden) 14(1–4): 36 (1979 publ. 1980). Basionym: *Malacocarpus bezrucii* Frič.  
*Wigginsia bezrucii* (Fric) Z. Fleisch. & Schütz, in *Friciana* 51: 17, 29, 33, 37 (1976). Basionym: *Malacocarpus bezrucii* Fric.  
*Echinocactus corynodes* Otto ex Pfeiff., *Enumeratio Diagnostica Cactearum*: 55 (1837). T.: ?, Botanische Staatssammlung München (M), M0145817, s.n., country unknown, stored under name *Malacocarpus corynodes* Salm-Dyck, Type? of *Echinocactus corynodes* Otto ex Pfeiff., *Herb. Catal.* No. 130. NT.: Hofacker, A. *The Cactus Explorer* 4: 31 (2012) [e-published].: *Curtis’s Botanical Magazine*, vol. 68 [ser. 2, vol. 15]: t. 3906.  
*Malacocarpus corynodes* (Otto ex Pfeiff.) Salm-Dyck *Cact. Hort. Dyck.* ed. II: 25, 141 (1850), incorrect name (Art. 11.4). Basionym: *Echinocactus corynodes* Otto ex Pfeiff.  
*Notocactus corynodes* (Otto ex Pfeiff.) Krainz, *Kakt. and. Sukk.* 17: 195 (1966). Basionym: *Echinocactus corynodes* Otto ex Pfeiff.  
*Wigginsia corynodes* (Otto ex Pfeiff.) D.M. Porter, *Taxon* 13: 211 (1964). Basionym: *Echinocactus corynodes* Otto ex Pfeiff.  
*Echinocactus courantii* Lem., *Cact. Aliq. Nov. Desc.*: 20 (1838).  
*Malacocarpus courantii* (Lem.) Salm-Dyck, *Cact. Hort. Dyck.* ed. II: 25, 142 (1850), incorrect name (Art. 11.4). Basionym: *Echinocactus courantii* Lem.  
*Notocactus courantii* (Lem.) S. Theun., *Succulenta* 60(6): 141 (1981). Basionym: *Echinocactus courantii* Lem.  
*Wigginsia courantii* (Lem.) F. Ritter, *Kakteen Sü-*

- damerika* 1: 195 (1979). Basionym: *Echinocactus courantii* Lem.
- Echinocactus fricii* Arechav., *Anales Mus. Nac. Montevideo* 5: 244 (1905).
- Malacocarpus fricii* (Arechav.) A. Berger, *Kakteen*: 207, 342 (1929), incorrect name (Art. 11.4). Basionym: *Echinocactus fricii* Arechav.
- Notocactus fricii* (Arechav.) Krainz, *Kakt. and. Sukk.* 17: 195 (1966). Basionym: *Echinocactus fricii* Arechav.
- Wigginsia fricii* (Arechav.) D.M. Porter, *Taxon* 13: 210 (1964). Basionym: *Echinocactus fricii* Arechav.
- Wigginsia leucocarpa* (Arechav.) D.M. Porter, *Taxon* 13: 211 (1964). Basionym: *Echinocactus leucocarpus* Arechav.
- Echinocactus leucocarpus* Arechav., *Anales Mus. Nac. Montevideo* 5: 239 (1905).
- Malacocarpus leucocarpus* (Arechav.) Backeb., *Kaktus-ABC*: 252 (1936), incorrect name (Art. 11.4). Basionym: *Echinocactus leucocarpus* Arechav.
- Notocactus leucocarpus* (Arechav.) G. Schäf., *Kakteen Sukkulanten* (Dresden) 14(1–4): 57 (1979 publ. 1980). Basionym: *Echinocactus leucocarpus* Arechav.
- Wigginsia macrogona* (Arechav.) D.M. Porter, *Taxon* 13: 210 (1964). Basionym: *Echinocactus sellowii* var. *macrogonus* Arechav.
- Malacocarpus macrogonus* (Arechav.) Herter, *Revista Sudamer. Bot.* 7: 216 (1943), incorrect name (Art. 11.4). Basionym: *Echinocactus sellowii* var. *macrogonus* Arechav.
- Notocactus macrogonus* (Arechav.) G. Schäf., *Kakteen Sukkulanten* (Dresden) 14(1–4): 60 (1979 publ. 1980). Basionym: *Echinocactus sellowii* var. *macrogonus* Arechav.
- Echinocactus sellowii* var. *macrogonus* Arechav., *Anales Mus. Nac. Montevideo* 5: 232 (1905).
- Malacocarpus martinii* Labour. ex Rümpler, *Handb. Cactenk.* ed. II: 454 (1886).
- Wigginsia pauciareolata* (Arechav.) R. Kiesling, *Monogr. Syst. Bot. Missouri Bot. Gard.* 74(2): 1246 (1999); Zuloaga & Morrone (eds.), *Cat. Pl. Vasc. Rep. Arg.* 2. Basionym: *Echinocactus pauciareolatus* Arechav.
- Echinocactus pauciareolatus* Arechav., *Anales Mus. Nac. Montevideo* 5: 246, pl. 26 (1905). T.: Pl. 26.
- Malacocarpus pauciareolatus* (Arechav.) A. Berger, *Kakteen*: 207, 342 (1929), incorrect name (Art. 11.4). Basionym: *Echinocactus pauciareolatus* Arechav.
- Notocactus pauciareolatus* (Arechav.) Krainz, *Kakt. and. Sukk.* 17: 195 (1966). Basionym: *Echinocactus pauciareolatus* Arechav.
- Notocactus pulvinatus* Vliet, *Succulenta* 49(4): 50, Figs. (1970). T.: D.J. van Vliet 25, holo. (U).
- Wigginsia rubricostata* Frič ex Z. Fleisch. & Schütz, in *Friciana* 8/50: 37 (1975). T.: Frič 1928, holo. (SCK).
- Malacocarpus rubricostatus* Frič, *Möller's Deutsche Gärtn.-Zeitung* 44: 23 (1929), Nomen, nom. inval. (Art. 36.1).
- Notocactus rubricostatus* (Frič ex Z. Fleisch. & Schütz) G. Schäf., *Kakteen Sukkulanten* (Dresden) 14 (1–4): 86 (1980). Basionym: *Wigginsia rubricostata* Frič ex Z. Fleisch. & Schütz.
- Wigginsia schaeferiana* W.R. Abraham & J. Theun., *Internoto* 9(1): 24 (1988). T.: Abraham 163 (Uruguay), deposited in the Herbarium of the Bot. Inst. of the University of Köln am Rhein/D.
- Notocactus schaeferianus* (W.R. Abraham & J. Theun.) Havlíček, *Internoto* 9(2): 39 (1988). Basionym: *Wigginsia schaeferiana* W.R. Abraham & J. Theun.
- Echinocactus sellowii* Link & Otto, in *Verh. Preuss. Gartenb. Ver.* 3: 425, t. 22 (1827). T.: UY, Montevideo, Sellow, np.
- Malacocarpus sellowii* (Link & Otto) K. Schum., *Fl. Bras.* (Martius) 4(2): 238, t. 49 (1890), incorrect name (Art. 11.4). Basionym: *Echinocactus sellowii* Link & Otto.
- Notocactus sellowii* (Link & Otto) S. Theun., *Succulenta* 60(6): 141 (1981). Basionym: *Echinocactus sellowii* Link & Otto.
- Parodia sellowii* (Link & Otto) D.R. Hunt, *Cactaceae Consensus Init.* 4: 6 (1997). Basionym: *Echinocactus sellowii* Link & Otto.
- Wigginsia sellowii* (Link & Otto) F. Ritter, *Kakteen Südamerika* 1: 196 (1979). Basionym: *Echinocactus sellowii* Link & Otto.
- Wigginsia sessiliflora* (Mackie ex Hook.) D.M. Porter, *Taxon* 8: 210 (1964) (sessiflora). Basionym: *Echinocactus sessiliflorus* Mackie ex Hook.
- Echinocactus sessiliflorus* Mackie ex Hook., *Bot. Mag.* 64: t. 3569 (1837).
- Malacocarpus sessiliflorus* (Mackie ex Hook.) Backeb., *Die Cactaceae* 3: 1621 (1959), incorrect name (Art. 11.4). Basionym: *Echinocactus sessiliflorus* Mackie ex Hook.
- Notocactus sessiliflorus* (Mackie ex Hook.) Krainz, *Kakt. and. Sukk.* 17: 195 (1966). Basionym: *Echinocactus sessiliflorus* Mackie ex Hook.
- Malacocarpus stegmannii* Backeb., *Die Cactaceae* 3: 1623 (1959), nom. inval. (Art. 37.1).
- Notocactus stegmannii* (Backeb.) Krainz, *Kakt. and. Sukk.* 17: 195 (1966). Basionym: *Malacocarpus stegmannii* Backeb, nom. inval. (Art. 37.1).
- Wigginsia stegmannii* (Backeb.) D.M. Porter, *Taxon* 13: 211 (1964). Basionym: *Malacocarpus stegmannii* Backeb, nom. inval. (Art. 37.1).
- Wigginsia tephraantha* (Link & Otto) D.M. Porter, *Taxon* 13: 210 (1964). Basionym: *Echinocactus tephraanthus* Link & Otto.
- Echinocactus tephraanthus* Link & Otto, *Verh. Vereins Beford. Gartenbaues Konigl. Preuss. Staa-*

ten 3(7): 422, t. 14, Fig. 2 (1827), ("Habitat in Brasiliae provincia Rio Grande. Sellow."). T.: t. 14, Fig. 2.

*Malacocarpus tephroanthus* (Link & Otto) K. Schum., *Fl. Bras.* (Martius) 4(2): 243 (1890), incorrect name (Art. 11.4). Basionym: *Echinocactus tephroanthus* Link & Otto.

*Notocactus tephroanthus* (Link & Otto) Krainz, *Kakt. and. Sukk.* 17: 195 (1966). Basionym: *Echinocactus tephroanthus* Link & Otto.

*Echinocactus tetraanthus* Lem., *Cact. Aliq. Nov. Desc.*: 15 (1838).

*Malacocarpus tetraanthus* (Lem.) Rud.Mey., *Monatsschr. Kakteenk.* 4: 143 (1894), incorrect name (Art. 11.4). Basionym: *Echinocactus tetraanthus* Lem.

*Notocactus tetraanthus* (Lem.) N. Gerloff *et al.* *Notokakteen*: 167 (1995), nom. inval. (Art. 34.1a). Basionym: *Echinocactus tetraanthus* Lem.

*Parodia turbinata* (Arechav.) Hofacker, *Cactaceae Consensus Init.* 6: 12 (1998). Basionym: *Echinocactus sellowii* var. *turbinatus* Arechav.

*Wigginsia turbinata* (Arechav.) D.M. Porter, *Taxon* 13: 211 (1964). Basionym: *Echinocactus sellowii* var. *turbinatus* Arechav.

*Malacocarpus turbinatus* (Arechav.) Herter, *Revista Sudamer. Bot.* 7: 216 (1943), incorrect name (Art. 11.4). Basionym: *Echinocactus sellowii* var. *turbinatus* Arechav.

*Notocactus turbinatus* (Arechav.) Krainz, *Kakt. and. Sukk.* 17: 196 (1966). Basionym: *Echinocactus sellowii* var. *turbinatus* Arechav.

*Echinocactus sellowii* var. *turbinatus* Arechav., *Anales Mus. Nac. Montevideo* ser. 2, 5: 235, t. 21 (1905). T.: UY, [Montevideo?]'penascales del Cerro', Arechavaleta, np.

*Wigginsia vorwerkiana* (Werderm. ex Backeb.) D.M. Porter, *Taxon* 13: 210 (1964). Basionym: *Echinocactus vorwerkianus* Werderm.

*Echinocactus vorwerkianus* Werderm., *Neue Kakteen*: 101 (1931).

*Malacocarpus vorwerkianus* (Werderm.) Backeb., *Kaktus-ABC*: 253 (1936) as *Vorwerckianus*, incorrect name (Art. 11.4). Basionym: *Echinocactus vorwerkianus* Werderm.

*Notocactus vorwerkianus* (Werderm.) Krainz, *Kakt. and. Sukk.* 17: 196 (1966). Basionym: *Echinocactus vorwerkianus* Werderm.

**Description:** Habit solitary [or clustering, groups <26 stems], stem depressed globose, globose, or short cylindrical, [7.5–45]cm high × 6–30cm diameter, light to dark green, very woolly apically. Ribs 12–[31], sharply acute, distinct. Areoles in notches. Spines awl-shaped, straight to strongly curved, <2cm, [white with dark tip], whitish, grey, yellowish or brown. Central spines 0–1[–2]. Radial spines 2–12, mostly flattened against the stem sur-

face. Flower 3–5cm high × 4–7cm diameter, glossy yellow, pericarpel and hypanthium short, often partly hidden in the wool of the stem apex, flower areoles with dense pale brown wool. Fruit partly naked, fleshy with sticky pulp, <1cm long, pink or tinged red at first, elongate to club shaped, dry and hollow when mature, <4cm. Seeds bell-shaped, finely roughened, black.

**Etymology:** from Latin *erinaceus*, hedgehog; for the prickly spination.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Argentina, Uruguay and Southern Brazil, up to 30m, and the wooded savanna of the Rio Uruguay in Uruguay.

**Ecological regions:** Humid and Semi-arid Pampas of Argentina, Uruguay and Southern Brazil, and the Paraná flooded savanna.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands, the Temperate Grasslands, Savannas, and Shrublands, and the Flooded Grasslands and Savannas.

**Occurrence:** AR(BA,CB,CN,LP,RN,SE);BR(RS);CO(DC);UY. Map 5.

**Comment:** *Parodia erinacea* (Haworth) N.P. Taylor is one of the three dominant species (the other two are *Parodia ottonis* (Lehmann) N.P. Taylor and *Parodia mammulosa* (Lem.) N.P. Taylor), of the genus *Parodia* Spegazzini, in the eastern part of its distribution range, consisting essentially of pampa grasslands with rocky outcrops in Argentina, Uruguay and Southern Brazil, and "Blanqueales" with allomorphic soil, in the wooded savanna of the Rio Uruguay, in Uruguay. The species as currently conceived also includes *Parodia sellowii* (Link & Otto) D.R. Hunt. In fact in a first phase of the ontogenesis process, the taxon assumes a discoid-globular aspect (the semaphoront known as *P. erinacea* /*P. turbinata*), then moves to a second phase indicated by a typical elongated shape (the semaphoront known as *P. sellowii*) (Anceschi & Magli, 2013b: 32). We also point out that *Notocactus pulvinatus* Vliet, considered by Hunt *et al.* (2006, text: 309, 359) among the synonyms for *Parodia langsdorfii* (Lehm) Hunt, is in our opinion to be ascribed to the *P. erinacea* populations. Despite the extensive distribution area of the taxon, and the number of populations, the species appears to be fairly homogeneous, without morphologically distinguishable internal vicariants. Also with regard to the relations of external vicariance, apart from the character of the apical woolliness that is common to all the ex-wigginsias, it is only thanks to the molecular data (Nyffeler & Egli, 2010), that we can resemble to *P. erinacea*, *Parodia langsdorfii* (Lehm) Hunt, as a possible external vicariant. We studied the taxon many times, in all the habitats of reference.

**17. *Parodia formosa*** F. Ritter, *Succulenta* 43: 57 (1964). T.: BO, Tarija, O'Connor, Margarita, 1958, Ritter 735.

## Heterotypic Synonyms

*Parodia bellavistana* F.H. Brandt, *Kakteen Orch. Rundschau* 7(2): 18 (–21), Figs. (1982), (BO). T.: Brandt 90 (Cult.), holo. (HEID).

*Parodia carapariana* F.H. Brandt, *Cact. Succ. J.* (Los Angeles) 49(3): 119–120, Figs. (1977). T.: BO, Tarija, O'Connor, "in the hills between Carapari and Palos Blancos", 1100m, s.a., Lau 398, [type given as "leg. Alfred Lau" and cited as "F.H. Brandt no. 72/a"], type herbaria (HEID).

*Parodia cardenasii* F. Ritter, *Succulenta* 43(4): 58 (1964). T.: BO, Tarija, O'Connor, Angosto de Villamontes, Ritter 914 (U).

*Parodia chaetocarpa* F. Ritter, *Succulenta* 43: 58 (1964). T.: BO, Potosi, Salinas, 1963, Ritter 1135.

*Parodia chirimoyarana* F.W. Brandt, *Cact. Succ. J.* (Los Angeles) 50(1): 16–17 (1978), (BO). T.: Brandt 45a, holo.(HEID).

*Parodia pachysa* F.H. Brandt, *Frankf. Kakt.-Freund* 5(4): 5–6 (1978), (BO).

*Parodia parvula* F.H. Brandt, *Kaktus* (Odense) 10(1): 6 (1975), (AR).

*Parodia purpureoaura* F. Ritter, *Succulenta* 43: 57 (1964). T.: BO, Tarija, O'Connor, Serere, 1963, Ritter 1134.

*Parodia pusilla* F.H. Brandt, *Cact. Succ. J.* (Los Angeles) 49(3): 120, Figs. (1977), (BO). T.: A.B. Lau Rubens, holo. Herb. Brandt 74/a 74.

*Parodia setispina* F. Ritter, *Succulenta* 43: 57 (1964). T.: BO, Cañada, Province O'Connor, 1963, Ritter 1153.

*Parodia tillii* Weskamp, *Succulenta* 67(10): 210–211, Fig. (1988). T.: BO, Chuquisaca, Till 96, holo.(W).

*Parodia winbergii* Weskamp, *Kakt. and. Sukk.* 47(7): 157–159, Fig. (1996). T.: AR, Jujuy, between Valle Grande and San Francisco, 1500m, 1988, Winberg (formerly Nilsson) 157 (ZSS).

**Description:** Habit solitary, stem globose, rarely short cylindrical, 3–8cm diameter, light green. Ribs 13–26, more or less dissolved into spiraled low tubercles. Central spines 1–12, needle-like, straight, <0.3–2.5cm long, reddish brown. Radial spines 8–30, like the centrals, all white or brown-tipped, <0.3–1.2cm long. Flower 1.6–4cm high × 3.5–4.5cm diameter, sulfur yellow. Fruit globose, 0.8cm diameter. Seeds brownish.

**Etymology:** From Latin *formosus*, beautiful, well done.

**Habitat & Distribution:** Seasonally dry inter-Andean valleys, in rocky outcrops within the forests, 900–1600m.

**Ecological regions:** Transitional areas between the Southern Andean Yungas and the Dry Chaco.

**Biomes:** Transitional areas between the Tropical and Subtropical Moist Broadleaf Forests and the



**Figure 21.** *Parodia formosa*. Bolivia, Tarija, west of Palos Blancos, 1070m. GC864.05.

Photograph: Graham Charles

Tropical and Subtropical Dry Broadleaf Forests.

**Occurrence:** AR(JY,TM);BO(SC,TR). Map 4.

**Comment:** Considered by Kiesling & Ferrari (1990a (62)4: 196) as a synonym of *Parodia microsperma* (F.A.C. Weber) Speg., to be merely a variant with clear spines, in the north-east of the distribution area of the taxon (Kiesling 2005, personal comment). Unfortunately we were not able to reach the populations of the taxon in habitat. Evidence provided by other researchers, (mainly Mats Winberg), seems sufficient to recognize *Parodia formosa* F. Ritter, at the specific level.

**18. *Parodia fusca*** (F. Ritter) Hofacker & P.J. Braun, *Cactaceae Consensus Init.* 6: 10 (1998). Basionym: *Notocactus fuscus* F. Ritter.

## Homotypic Synonyms

*Notocactus fuscus* F. Ritter, *Kakteen Südamerika* 1: 178, Fig. 121 (1979). T.: BR, Rio Grande do Sul, 15km W. of São Francisco de Assis, Mar 1965, Horst in Ritter 1379.

*Peronocactus fuscus* (F. Ritter) Doweld, *Sukkulenty* 2(3): 21 (1999), incorrect name (Art. 11.4).

*Ritterocactus fuscus* (F. Ritter) Doweld, *Sukkulenty* 3(1–2): 60 (2000).

## Heterotypic Synonym

*Notocactus gerloffii* Havlíček, *Kaktusz Vilag* 18(4): 77 (1989), replaced synonym: *Notocactus fuscus* var. *longispinus* F. Ritter, *Kakteen Südamerika* 1: 179, Fig. (1979). T.: Ritter 1379a, holo. (U).

**Description:** Habit solitary [or clustering], stem globose [to short cylindrical with age], [10.5–15.8]cm high × 4–[10.3]cm diameter. Ribs [18]–26, 0.3–0.5cm high. Spines needle-like, [straight or slightly curved]. Central spines [usually 4, forming a cross, matt greyish red or matt violet red, the lower <2cm long]. Radial spines 12–[19], 0.5–1.2cm long,



**Figure 22.** *Parodia fusca*. Brazil, Rio Grande do Sul, São Francisco de Assis, N. of the town, 19 Oct. 2011, A&M 779.



**Figure 24.** *Parodia gibbulosa*. Bolivia, Chuquisaca, near the Rio Pilcomayo.

Photograph: Martin Lowry

[pale or reddish yellow]. Flower [2]–3cm high × [3]cm diameter, [tepals, anthers, stamens and style lemon yellow, stigma lobes 13, purple red]. Fruit olive green at first, later reddish, 1.8–2.5cm long. Seeds dull black, finely tuberculate.



**Figure 23.** *Parodia gaucha*. Brazil, Rio Grande do Sul, Encruzilhada do Sul, SW of Encruzilhada, 17 Feb. 2016, 105m, A&M 1343.

**Etymology:** From Latin *fuscus*, sombre, black, dark, brown; for the colour of the hairs enveloping the flower base.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Southern Brazil, up to 300m.

**Ecological regions:** Humid and Semi-arid Pampas of Argentina, Uruguay and Southern Brazil.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands.

**Occurrence:** BR(RS). Map 9.

**Comment:** *Parodia fusca* (F. Ritter) Hofacker & P.J. Braun represents, on the territory, the weak external vicariant of an even weaker taxon, i.e. *Parodia nothorauschii* D.R. Hunt. This case would seem to be an exception to our hypothesis for which the first species to be discovered, described and published are usually the most visible in the habitats. Actually, the contradiction is only apparent, because neither of the two species represents a dominant, and both, with the few populations consisting of a few individuals (especially in the case of *P. nothorauschii*), and a severely fragmented distribution, can be defined as genetically weak taxa (it must be remembered that in the same places, and under the same conditions, *P. ottonis* lives in excellent health). Certainly, the anthropic intervention (*Eucalyptus* plantations, general decline of the quality of habitat due to various human activity near the small rocky outcrops where the species lives, and illegal collection (the latter especially in the case of *P. nothorauschii*), helped the genetical weakness. Also Gerloff & Neduchal (2004, 25 (2): 89), in their review of *Notocactus* s.l., point out the close relationship between the two taxa, considering *Notocactus fuscus* F. Ritter = *P. fusca*, a variety of *Notocactus rauschii* Vliet = *P. nothorauschii*. We worked on *P. fusca*, in one of the elective areas of the taxon, around the little town of São Francisco de Assis, RS (BR), where the species lives on flat sandstone slabs on the pampas' grassy slopes.

**19. *Parodia gaucha*** M. Machado & Larocca, *Novon* 18(2): 215, (214–219; Figs. 1–2) (2008). T.: BR, Rio Grande do Sul, Mun. Encruzilhada do Sul, 90m, 27 Oct 2006, Machado 865, holo. (ZSS), ISO. (HASU, HUEFS, MO).

#### Homotypic Synonym

*Notocactus gauch* (M. Machado & Larocca) N. Gerloff & H. Henssen, *Internoto* 29 (4): 75–81 (2008).

**Description:** Habit solitary [or clustering], stoloniferous, stolons 2–[2.4]cm high × 1–[2]cm diameter. Stem [globose] to clavate to short-cylindric, [5.2–12.2]cm high × [3.5]–8cm diameter, bright green. Ribs 18–22, straight, well defined, slightly tuberculate. Spines spreading, acicular, straight, almost bristly, 0.5–0.8[–1.15]cm long × 0.01–0.03cm wide. Central spines [4]–6, [the lower <1.15cm long], golden yellow to reddish orange, hardly distinguished from the radials. Radial spines [16]–26, pale yellow. Flower shortly funnelform, <4cm high × 5cm diameter, yellowish green with purplish red throat, stamens numerous (hundreds), sensitive and closing around the style when touched, filaments purplish-red on the lower part, yellow above, style yellow, stigma lobes 10–12, dark red. Fruit 1–1.4cm high × 0.8–1cm diameter, greenish-yellow, dehiscent by one or more longitudinal slits. Seeds helmet-shaped, dark reddish brown to black, shiny.

**Etymology:** The specific epithet is derived from the Portuguese vernacular term ‘gaúcho’ (feminine form: ‘gaúcha’), which in Brazil designates the natives from the state of Rio Grande do Sul.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Southern Brazil, 80–850m.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands.

**Occurrence:** BR(RS). Map 7.

**Comment:** The discovery of *Parodia gaucha* M. Machado & Larocca which dated from October 27, 2006, is the most recent to be found within the genus *Parodia* Spegazzini. The species, near to *Parodia muricata* (Otto ex Pfeiff.) Hofacker, produces stolons at the base, a character that relates it to the *P. ottonis* group, within which it represents a weak external vicariant. The extreme weakness is due to the very small number of individuals constituting the only known population, that mainly lives on a single rocky wall, at the margin of a road between grassy rounded hills with rocky outcrops, in the Camaquã river area, in the southwest of the municipality of Encruzilhada do Sul, RS (BR). We studied the taxon in February 2016, when during two distinct surveys we counted 57 individuals in total at the type locality, where it lives in sympatry with *P. ottonis*. We reached the population thanks to the

instructions of Norbert Gerloff, without which it would have been very difficult to find because of the extreme dislocation and rarity of the taxon. We think that the known population represents the last fragment of a species that is otherwise extinct in habitat, and this is probably the reason for its late discovery in such an exploited and explored area as is the current Rio Grande do Sul.

**20. *Parodia gibbulosa*** F. Ritter, *Kakteen Südamerika* 2: 545–546, Fig. 421 (1980). T.: BO, Chuquisaca, Azurduy, Capadala, Jul 1958, Ritter 736.

#### Heterotypic Synonym

*Parodia gibbulosoides* F.H. Brandt, *Stachelpost* 7(36): 414–415, illus. (1971). T: BO. N.E. of Sucre?, hort. Brandt 12/a? (no material preserved).

**Description:** Habit solitary, stem globose, 7cm high × 7cm diameter, tuberculate, pale green. Tubercles small, in c. 26 spirals. Central spines 1, <0.5cm long, red-brown. Radial spines c. 9, 0.4–1cm long, white tipped brown. Flower 1cm diameter, pale yellow. Fruit c. 0.2cm diameter.

**Etymology:** From Latin *gibbus*, hump, protuberance; probably due to the humped tubercles.

**Habitat & Distribution:** Seasonally dry inter-Andean valleys, on steep rocky slopes, along the river Pilcomayo, between the Chuquisaca and Potosí borders, 1800–2500m.

**Ecological regions:** Bolivian Montane Dry Forest.

**Biomes:** Montane Grasslands and Shrublands.

**Occurrence:** BO(CQ,PO). Map 3.

**Comment:** With *P. formosa*, this is the other species of the genus that we could not see in the habitat. Our search failed in March 2014, near the village of Turuchipa, Potosí (BO), because of a flood of the homonymous river. Anyway, even if some researchers consider the taxon one of the synonyms for *Parodia ocampoi* Cárdenas (Anderson, 2001; Anderson & Eggli, 2011), the available documentary evidence shows that *Parodia gibbulosa* F. Ritter is a highly characterized taxon which does not reveal any particular connection to other members of the genus, and is also far from *P. ocampoi*, a taxon related to *P. columnaris* (see above), as already stated.

**21. *Parodia haselbergii*** (Haage ex Rümpler) F.H. Brandt, *Kakteen Orch. Rundschau* 7(4):67 (1982). Basionym: *Echinocactus haselbergii* Haage ex Rümpler.

#### Homotypic Synonyms

*Acanthocephala haselbergii* (Haage ex Rümpler) Guiggi, *Cactology* 3: 6 (2012).

*Brasilicactus haselbergii* (Haage ex Rümpler) Backeb., *Beitr. Sukkulantenk. Sukkulantenp-*



**Figure 25.** *Parodia haselbergii*. Brazil, Rio Grande do Sul, Caxias do Sul, 16 Nov. 2011, A&M 820.

*flege* 1942: 38 (1942), incorrect name (Art. 11.4?).

*Echinocactus haselbergii* Haage ex Rümpler, *Handb. d. Cacteenk.* ed. II: 563 (1886). T.: XC, hort Haselberg, Stralsund.

*Malacocarpus haselbergii* (Haage ex Rümpler) Britton & Rose, *Cactaceae* 3: 201 (1922), incorrect name (Art. 11.4).

*Notocactus haselbergii* (Haage ex Rümpler) A. Berger, *Kakteen*: 208, 343 (1929).

*Sericocactus haselbergii* (Haage ex Rümpler) Y. Itô, *Explan. Diagr. Austroechinocactinae*: 223 (1957).

#### Heterotypic Synonyms

*Parodia elachisantha* (F.A.C. Weber) F.H. Brandt, *Kakteen Orch. Rundschau* 7(4): 67 (1982). Basionym: *Echinocactus elachisanthus* F.A.C. Weber.

*Brasilicactus elachisanthus* (F.A.C. Weber) Backeb., *Cactaceae* 3: 1578 (1959), incorrect name (Art. 11.4?) Basionym: *Echinocactus elachisanthus* F.A.C. Weber.

*Echinocactus elachisanthus* F.A.C. Weber, *Bull. Mus. Hist. Nat. (Paris)* 10: 387 (1904).

*Acanthocephala graessneri* (K. Schum.) Guiggi, *Cactology* 3(Suppl. III): 1 (2012). Basionym: *Echinocactus graessneri* K. Schum.

*Brasilicactus graessneri* (K. Schum.) Backeb., *Jahrb. Deutsch. Kakteen-Ges.* 1941, pt. 2: 36 (1942), incorrect name (Art. 11.4?). Basionym: *Echinocactus graessneri* K. Schum.

*Dactylanthocactus graessneri* (K. Schum.) Y. Itô, *Explan. Diagr. Austroechinocactinae*: 225 (1957), incorrect name (Art. 11.4). Basionym: *Echinocactus graessneri* K. Schum.

*Echinocactus graessneri* K. Schum., *Monatsschr. Kakteenk.* 13: 130 (1903). T.:BR, Rio Grande do Sul, Aug 1903, *Graessner* fil. s.n. (B†).

*Malacocarpus graessneri* (K. Schum.) Britton &

Rose, *The Cactaceae* 3: 205 (1922), incorrect name (Art. 11.4). Basionym: *Echinocactus graessneri* K. Schum.

*Notocactus graessneri* (K. Schum.) A. Berger, *Kakteen*: 208–209, 343 (1929). Basionym: *Echinocactus graessneri* K. Schum.

*Parodia graessneri* (K. Schum.) F.H. Brandt, *Kakteen Orch. Rundschau* 7(4): 53, 66 (1982). Basionym: *Echinocactus graessneri* K. Schum.

*Parodia haselbergii* ssp. *graessneri* (K. Schum.) Hoffacker & P.J. Braun, *Cactaceae Consensus Init.* 6: 10 (1998). Basionym: *Echinocactus graessneri* K. Schum.

**Description:** Habit solitary [or clustering], stem depressed globose to globose, [ $<14.8$ ]cm high  $\times$  4–15cm diameter, apex depressed and sometimes distorted or slanted in old plants. Ribs 30–60 or more, indistinct, dissolved into small tubercles. Central spines 3–5, [needle like, porrected, protruding from the body of the plant, golden yellow],  $<1.5$  cm. Radial spines [(14–)]20–60 or more, [like hairs, adpressed to the stem, sometimes wrapping it on both sides, bright light yellow] or glassy-white, [ $<4.4$  cm]. Flower rather variable in size and form, c. 1.5cm high  $\times$  0.9–1.1(–2.5)cm diameter, orange-red, yellowish-red or yellowish-green. Fruit small, spherical, slowly ripening, first light-green, becoming darker when mature. Seeds oblong, cap-shaped, c. 0.1cm long, shiny black.

**Etymology:** Named to honour Dr. F. von Haselberg of Stralsund, a cultivator of cacti.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops, and canyons of the Serra Geral formation, surrounded by humid subtropical forest, in Southern Brazil, 200–1500m.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil, and the Alto Paraná Atlantic forests (Mata Atlântica & Selva Misionera), in eastern Argentina, southern Brazil and eastern Paraguay.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands, and the Tropical and Subtropical Moist Broadleaf Forests.

**Occurrence:** BR(RS,SC). Map 10.

**Comment:** The NCL treatment (Hunt *et al.* 2006) still distinguishes *Parodia graessneri* (K. Schum.) F.H. Brandt, at the level of ssp. from *Parodia haselbergii* (Haage ex Rümpler) F.H. Brandt, for the colour of the flower: yellow-green in the first taxon vs. orange, bright red, rarely orange-yellow in the second. Also for the structure/habit of the tepals: half-erect, somewhat spreading, but none closely surrounding style, with the stamens visible in *P. graessneri*, vs. internal tepals remaining erect, closely surrounding the style and hiding the stamens at first, with the outer tepals spreading in *P. haselbergii*. Anderson (2001: 543) highlights only the difference in the colouring of the flower, and a greater number of radial spines in *P. graessneri* (60 vs.



**Figure 26.** *Parodia hausteiniana*. Bolivia, Cochabamba, Mizque, W. of Mizque, Rio Uyuchama, 2163m, 30 Mar. 2014, A&M 1105.

20), which also in this case is distinguished at the subspecific level. Backeberg (1977: 84–85) confirms that his genus *Brasilicactus* Backeberg, substantially constituted by *Brasilicactus graessneri* (K. Schumann) Backeberg and *Brasilicactus haselbergii* (F. Haage ex Rümpler) Backeberg, is distinguished from *Notocactus* (K. Schum.) Frič and other South American globular cacti, by the short floral tubes and the small spiny spherical fruits. For the characters distinguishing the two species, he reports the colour of the flower, green for *B. graessneri*, vs. from flame-coloured with orange margins to scarlet, for *B. haselbergii*, but does not mention the different structure/habit of the tepals in the two species. With regard to the radial spines of *B. haselbergii*, Backeberg reports that they can be 20 or more. In our experience, the two taxa in habitat are quite similar. In Rio Grande do Sul (BR), the populations of *P. graessneri* appear to be the northeast continuation of the populations of *P. haselbergii*. Furthermore, while it is certainly noticeable, as shown in Hunt *et al.*, that there is a diversity in the structure/habit of the tepals, we also know from the recent molecular analysis (Nyffeler and Eggli, 2010; Schlumpberger & Renner, 2012: 1347–1348), that the characters of the flowers and the different pollination syndromes, are not indicators of proximity or distance of two evolutionary lines. In this regard, the growth forms of the two taxa are practically indistinguishable. In addition, we observed that in all populations, indifferently, individuals that have greater exposure to the sun develop a greater number of radial spines compared to those that are living in the shadow of rocks and bushes. The greater or lesser shielding of the taxon seems to be a protection from the sun, rather than the low temperatures reached in the cold subtropical climate of the Serra Gaucha (Mata Atlântica forest). For these reasons we prefer to consider *P. graessneri* as a synonym for *P. haselbergii*. Genetically, the taxon appears to be next to *P. alacri-*

*portana* (Nyffeler & Eggli, 2010; Barcenás *et al.*, 2011: 475), and in the habitats it represents a non-dominant species with fragmented distribution. We detected *P. haselbergii* several times in habitat within the Serra Geral formation. On rocky outcrops in the area of Caxias do Sul, and on walls difficult to access, in the spectacular canyons within Protected Areas, in the Parque da Ferradura, Canela [where the taxon lives in sympatry with *Parodia leninghausii* (K. Schum.) F.H. Brandt] and in the P. N. da Serra Geral (Cânion da Fortaleza), Cambará do Sul, RS (BR).

**22. *Parodia hausteiniana*** Rausch, *Kakt. and. Sukk.* 21: 45, Fig. (1970). T.: BO, Cochabamba, nr Mizque, 2200m, Rausch 192 (W).

#### Homotypic Synonym

*Bolivicactus hausteinianus* (Rausch) Doweld, *Sukkulenty* 3(1–2): 62 (2000).

#### Heterotypic Synonym

*Parodia laui* F.H. Brandt, *Kakt. and. Sukk.* 24(11): 244–245 (1973), as ‘*lauii*’. T.: BO, Cochabamba, Campero?, “in the mountains along the road from Mizque to Mina Asientos, mountains above the Río Caine”, 2700m, s.a., *Lau* 322 [type cited as “Brandt 18/a” with the additional data “found by Alfred B. Lau”], holo. (HEID)[ex cult. F. H. Brandt].

**Description:** Habit solitary [or clustering], stem globose to short cylindrical, [4–22.5]cm high × 5[–9]cm diameter. Ribs 13[–15], [slightly spiraled or spiraled, with rounded tubercles]. Spines flexible. Central spines 4, forming a cross, [all hooked in the crown, then only the lower remain hooked, first yellow, then grey; or straight the higher central, and the lower three hooked, the lower one <1.55cm]. Radial spines [15]–30, [thinner than centrals, needle like or hairs like], <0.8cm long, [white] or yellow becoming white. Flower 1–[1.2]cm high × [0.9]–1cm diameter, [canary yellow]. Fruit ovate, 0.3–0.4cm long, olive green. Seeds finely tuberculate, dark brown.

**Etymology:** For Prof. Dr. Erik Haustein, German botanist at the University Erlangen, 1949–1968 editor of the German periodical *Kakteen und andere Sukkulente*.

**Habitat & Distribution:** Arid inter-Andean rocky valleys, 2100–2500m.

**Ecological regions:** Bolivian Montane Dry Forest.

**Biomes:** Montane Grasslands and Shrublands.

**Occurrence:** BO(CB). Map 3.

**Conservation status:** Least concern, LC

**Comment:** In our opinion, this is not particularly related to other species of the genus, *Parodia hausteiniana* Rausch appears to be a relatively dominant species within the restricted colonized area.



In fact, our judgement about the conservation status resulting from our surveys is different from Lowry's judgement (2013. *Parodia hausteiniana*. The IUCN Red List of Threatened Species 2013. Downloaded on 30 September 2017). The author proposes an Endangered status, EN, adducing only three known populations, with no more than 100 individuals in total, with at most 20 of them in each population, in addition to a probable danger due to goats grazing. The surveys we carried out west of Mizque, only in the Rio Uyuchama valley, highlighted 3 distinct populations in a single day of research. The taxon is quite evident in the vicinity of the little town, where the species is numerous even on the vertical walls of the surrounding mountains, with populations that are definitely bigger than 20 adult individuals. The only population that can suffer from goats grazing is the one that is easier to access, on a stony hill, along the road across the river, close to some "ranchos", where grazing goats were visible. Even this population showed plenty of individuals, both adults and others. A Least Concern risk assessment, LC, seems to be closer to what we found in the habitat.

**23. *Parodia hegeri*** Diers, Krahn & Beckert, *Kakt. and. Sukk.* **56**(5): 127–130, Figs. 1–8 (2005). T.: BO, Dept. Potosi, Prov. Linares, c. 20km south of Duraznos, 3100–3600m, s.a., *Krahn* 960, holo. (B)(ex KOELN), iso. (LPB).

**Description:** [Habit solitary or clustering, stem globose to short cylindrical, 4–16.5cm high × 6.2–12.7cm diameter. Ribs 13–15, low, very spiraled. Spines conical, flexible, from white with orange tip to white grey. Central spines 4, forming a cross, the lower <2.35 cm. Radial spines 5–11. Flower orange-yellow].

**Etymology:** Named to honour E. Heger, the first who imported the seeds.

**Habitat & Distribution:** Puna rocky outcrops, 3100–4000m.

**Ecological regions:** Central Andean Puna.

**Biomes:** Montane Grasslands and Shrublands.

**Occurrence:** BO(PO). Map 4.

**Conservation status:** Data Deficient, DD

**Comment:** Not included in the *NCL* treatment (Hunt *et al.*, 2006), in 2005, after 20 years of observation and comparison, Diers, Krahn and Beckert published the description of this taxon, found during trips in Bolivia in the province of Linares, Dept. Potosi, c. 20km south of Duraznos, 3100–3600m. The seeds were imported for the first time by E. Heger. *Parodia hegeri* Diers, Krahn & Beckert is said to be close to *Parodia otaviana* Cárdenas. Not mentioned in the re-edition of the *NCL's* Atlas, renamed *The New Cactus Lexicon Illustrations* (Hunt, 2013), in *CCC3* (Hunt, 2016: 108), the taxon appeared as an accepted species [but related to *P. otaviana*, in square brackets]. We detected *P.*

*hegeri* in 2014, in the Puna rocky outcrops after Pampa de Vara-Vara, at 3700m, on the Sijlani – Turuchipa road, Dept. Potosi (BO), (= LM0759). In our opinion the taxon is not morphologically related to the *Parodia maassii* (Heese) A. Berger group, and shows a sufficient autonomy of characters compared with other members of the genus to be recognized as a species to itself.

**24. *Parodia herteri*** (Werderm.) N.P. Taylor, *Bradleya* **5**: 93 (1987). Basionym: *Echinocactus herteri* Werderm.

#### Homotypic Synonyms

*Echinocactus herteri* Werderm., *Revista Sudamer. Bot.* **3**: 143, t. 3 (1936). T.: UY, Rivera, Cerro Galgo, c. 300m., Dec 1933, *Herter*, cult. Montevideo and Berlin (B†). LT: Hunt *et al.* 2006, text: 220: if no material is extant, the plate cited.

*Notocactus herteri* (Werderm.) Buining & Kreuz., *Succulenta* **29**: 17 (1950).

*Ritterocactus herteri* (Werderm.) Doweld, *Sukkulenty* **2**(3): 22 (1999).

#### Heterotypic Synonyms

*Notocactus pseudoherteri* Buining, *Natl. Cact. Succ. J.* **26**(1): 2, Figs. (1971). T.: UY, Horst, Buining (collectors), holo. (U).

*Notocactus rubriflorus* Kolischer ex Backeb. & Knuth, *Kreuzinger Verzeichnis amerikanischer und anderer Sukkulanten* (1935); Backeb. & F.M. Knuth, *Kaktus-ABC*: 254 (1935), nom. inval. (Art. 36.1).

**Description:** Habit usually solitary, stem globose to short cylindrical, [c. 10–20]cm high × 10–15cm diameter. Ribs [19]–30, high and straight, distinctly tuberculate and notched. Central spines 4(–6), [when 4 forming a cross], subulate, <2cm, reddish brown, [or first reddish with whitish irregular bands, then whitish with reddish base]. Radial spines c. 8–17, acicular, 1.2–2cm long, white, white with brownish tips, [or whitish]. Flower 4cm high × 5cm diameter, shocking pink with pale to almost white throat. Fruit spherical, <2cm diameter, reddish. Seeds, from more or less spherical to cap shaped, matt black.

**Etymology:** For Dr. Wilhelm (Guillermo) Herter, German botanist and physician, 1907 emigrating to Uruguay and later director of the Montevideo Botanical Garden, later returning to Hamburg, Germany.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Southern Brazil and Uruguay, 100–300m.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands.



**Figure 27.** *Parodia hegeri*. Bolivia, Potosí, between Sijlani and Turuchipa, after Pampa de Vara-Vara, 26 Mar. 2014, 3700m, A&M 1094.

**Occurrence:** BR(RS);UY(AR,RV,TA). Map 9.

**Comment:** Not particularly related to other members of the genus, *Parodia herteri* (Werderm.) N.P. Taylor appears as a very localized, non-dominant species, with fragmented distribution. The cause of the restricted extent of occurrence of the taxon, i.e. 4500 km<sup>2</sup> (data gathered from: Larocca, J., Machado, M. & Duarte, W. 2013. *Parodia herteri*. The IUCN Red List of Threatened Species 2013. Downloaded on 01 October 2017), the scarcity and fragmentation of the populations, containing a low number of individuals, is related to the general decline of quality of habitat due to various human activity near the small rocky outcrops where the species lives. We detected the taxon on some occasions on outcrops and rocky walls in the pampas next to Santana do Livramento, RS (BR).

**25. *Parodia horrida*** F. Brandt, *Cactus* (Wijnegem) **11**(8): 113–115 (1979). T.: AR, Salta, mts. nr. Cafayate, *Brandt 62/a* (HEID).

#### Homotypic Synonym

*Parodia microsperma* ssp. *horrida* (F.H. Brandt) R. Kiesling & O. Ferrari, *Cact. Succ. J.* (Los Angeles) **62**(4): 198 (1990).

#### Heterotypic Synonyms

*Parodia atroviridis* Backeb., *Descr. Cact. Nov.* **3**: 10 (1963), (AR), nom. inval. (Art. 8.4).

*Parodia cachiana* Weskamp, *Die Gattung Parodia* **2**: 131, 134–135 (1992), [a re-description of *Parodia kilianana* Backeberg 1963]. T.: AR, Salta, “near Cachi Adentro”, 2200–2400m, s.a., *Herzog 104*, type herbaria (WU) [ex cult. W. Weskamp (see *Weskamp, Gatt. Parodia* II: 132, for details on the typification)].

*Parodia dextrohamata* Backeb., *Descr. Cact. Nov.* **3**: 10 (1963), (N Arg.), nom. inval. (Art. 8.4).

*Parodia dichroacantha* F.H. Brandt & Weskamp,



**Figure 28.** *Parodia herteri*. Brazil, Rio Grande do Sul, Santana do Livramento, 7 Nov. 2008, A&M 274.



**Figure 29.** *Parodia horrida*. Argentina, Salta, Angastaco, R.N.40, 9 Mar. 2007, A&M 154.

*Kakt. and. Sukk.* **18**(5): 87–88, ill. (1967). T.: AR, Salta, “somewhat N. of frontier Tucuman – Salta, partly in rock crevices, partly in red soil”, 1000m, s.a., *Fechser s.n.*, type herbaria: (B), (ZSS), [status ?], [ex cult. hort. Weskamp, 8.7.1967].

*Parodia heteracantha* F. Ritter ex Weskamp, *Kakteen Sukk.* (Dresden) **21**(4): 83–84, 116, Fig. (1986), (AR, Salta, Cachi to Molinos). T.: F. Ritter 926, holo. (DR).

*Parodia kilianana* Backeb., *Descr. Cact. Nov.* **3**: 11 (1963), (AR, Salta), nom. inval. (Art. 8.4).

*Parodia lohaniana* A.B. Lau & Weskamp, *Kakt. and. Sukk.* **30**(6): 137–138, Fig. (1979). T.: AR, Salta, “between Payogasta and Potrero”, 2600m, 1971, *Lau 457*, holo. (B) [ex cult. hort. Weskamp, March 1979].



**Figure 30.** *Parodia horstii*. Brazil, Rio Grande do Sul, Agudo, Morro Agudo, 345m, 7 Dec. 2006, A&M 91.



**Figure 32.** *Parodia ibicuiensis*. Brazil, Rio Grande do Sul, Alegrete, W. of Alegrete, BR 290, 17 May 2016, 138m, A&M 1355.

*Parodia piltziorum* Weskamp, *Kakt. and. Sukk.* **31**(7): 203, Fig. (1980), (AR, Salta, Rio Calchaquí). T.: B. Piltz, J. Piltz s. n., holo. (KOELN).

*Parodia pluricentralis* Backeb. ex F.H. Brandt, *Stachelpost* **7**(34): 365–367 (1971), (AR, Salta, Amblayo), nom. inval. (Art. 8.4).

*Parodia rigida* Backeb., *Descr. Cact. Nov.* **3**: 11 (1963), (AR, Salta, Tolombòn), nom. inval. (Art. 8.4).



**Figure 31.** *Parodia ibicuiensis*. Brazil, Rio Grande do Sul, Alegrete, W. of Alegrete, BR 290, 17 May 2016, 138m, A&M 1355.

*Parodia superba* F.H. Brandt, *Kakt. and. Sukk.* **21**(1): 15, Fig. (1970), (AR).

*Parodia tolimbona* Weskamp, *Die Gattung Parodia* **2**: 131, 134 (1992), (AR, Salta).

**Description:** Habit usually solitary, occasionally forming small clumps, stem globose to short cylindrical, [<25cm high × 7cm diameter], reddish grey. Ribs c. 15–21, usually spiraling, tuberculate. Central spines 3–4, subulate, strong, straight or hooked, [from pinkish or light brown, with dark tips, to reddish, dark red or black]. Radial spines 7–20(–30), thinner than the centrals, rigid, [interlacing, covering the stem surface], dull, [mainly white, sometimes whitish]. Flower usually yellow. Fruit nearly globose.

**Etymology:** From Latin *horridus* horrible; probably for the fierce and strong spination that characterizes the taxon.

**Habitat & Distribution:** Arid ‘Pre-cordillera’ valleys and ‘quebradas’, 1600–3000m.

**Ecological regions:** High Monte.

**Biomes:** Montane Grasslands and Shrublands.

**Occurrence:** AR(CT,SA). Map 2

**Conservation status:** Least Concern, LC

**Comment:** Although the *NCL* treatment (Hunt *et al.* 2006) considers it a subspecies of *Parodia microserma* (F.A.C. Weber) Speg., we consider it sufficiently different due to the fierce and strong

spination, and the generally north-western habitat, justifying its recognition as a distinct species among the 62 synonyms that in our synopsis characterize the dominant *P. microsperma*. *Parodia horrida* F.Brandt represents in fact the only external vicariant of the population system composing *P. microsperma*. The vicariant is strong because it consists of numerous populations, endowed with numerous individuals. We studied the populations of the taxon, that lives in more xerophytic areas and higher elevations compared to *P. microsperma*, in some “Quebradas” in the High Monte Ecological region, in the Argentine provinces of Catamarca (Quebrada de Jujuy, Santa Maria de Catamarca), and Salta (Quebrada de Las Conchas, Cafayate, and rocky areas northeast of Angastaco).

**26. *Parodia horstii*** (F. Ritter) N.P. Taylor, *Bradleya* **5**: 93 (1987). Basionym: *Notocactus horstii* F. Ritter.

#### Homotypic Synonyms

*Notocactus horstii* F. Ritter *Succulenta* **45**(1): 3–4 (1966). T.: BR, Rio Grande do Sul, S side of Serra Geral, 18 Mar 1964, Horst & Ritter in Ritter 1269.

*Peronocactus horstii* (F. Ritter) Doweld, *Sukkulenty* **2**(3): 21 (1999).

*Wigginsia nothohorstii* (F. Ritter) Doweld, *Sukkulenty* **3**(1–2): 62 (2000).

#### Heterotypic Synonyms

*Notocactus katharinae* Vliet, *Succulenta* **81**(5): 200–204, photos., Fig. (2002). T.: VanVliet 140, holo. (IAC).

*Notocactus muegelianus* hort., *sine anno* (without year), nom inval. (Art. 29.1).

*Notocactus purpureus* F. Ritter, *Succulenta* **49**(7): 109 (1970). T.: BR, Rio Grande do Sul, south of Serra Geral, F. Ritter & L. Horst, March 1964, Ritter 1268.

**Description:** Habit solitary or clustering, stem globose to short cylindrical, 30cm high × 14cm diameter. Ribs 12–19, well defined, 0.7–2cm high. Central spines 1–6, needle-like, straight, curved or twisted, 0.8–3cm long, yellow to [reddish] brown. Radial spines 10–15, finer, straight or curved, 0.6–3cm long, white to pale brown. Flower 3–3.5cm high × 3cm diameter, yellowish orange, reddish or purplish. Fruit globose to barrel shaped, 0.7–1cm high × 0.6–0.8cm diameter, woolly, dry and dehiscent at maturity. Seeds tuberculate, dull black.

**Etymology:** Named to honour Leopoldo Horst, Brazilian of German origin, cactus explorer, collector and exporter, in Rio Grande do Sul, Brazil.

**Habitat & Distribution:** Rocky walls in semi-deciduous forest, in Southern Brazil, 200–800m.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands.

**Occurrence:** BR(RS). Map 9.

**Comment:** Although this is another taxon of the distribution area linked to the pampas, *Parodia horstii* (F. Ritter) N.P. Taylor does not live on flat rocky outcrops, as do the majority of the members of the genus in this area. The taxon is rather located on the almost vertical rocky walls of some “morros”, surrounded by semi-deciduous forest. The species, that can be identified as a non-dominant with fragmented distribution composed of abundant populations on the colonized walls, does not show any particular relationship with other members of *Parodia* s.l., apart from the typology of habitat and the unusual characters of some individuals (bristly spines, showy apical woolliness), which brings them closer to some ex-members of *Eriocactus*. We reached the taxon (climbing down with ropes) on the Morro Agudo’s walls, Agudo, RS (BR).

**27. *Parodia ibicuiensis*** (Prestlé) Anceschi & Magli **comb. nov.** Basionym: *Notocactus ibicuiensis* Prestlé, *Internoto* **6**(4): 103 (1985). T.: Estancia Nova, in the river area of the Rio Ibicui, Dept.Itaquí, Rio Grande Do Sul, Brazil, found in December 1981 by F. Stockinger and A. Gutierrez, *Stockinger* 116, deposited in the Botanical Herbarium University of Utrecht/Netherlands (U).

#### Homotypic Synonym

*Notocactus ibicuiensis* Prestlé, *Internoto* **6**(4): 103 (1985). T.: Estancia Nova, in the river area of the Rio Ibicui, Dept.Itaquí, Rio Grande Do Sul, Brazil, found in December 1981 by F. Stockinger and A. Gutierrez, *Stockinger* 116, deposited in the Botanical Herbarium University of Utrecht/Netherlands (U).

**Description:** Habit solitary or clustering, [stem club shaped or diamond shaped, the stem is short cylindrical since youth, 4.4–14cm high × 2.95–7.15] (–10)cm diameter, olive green to [dark] lilac green. [Ribs 11–15 <1.55cm wide in the centre of the rib, relatively sharp at the top, with nose-like tubercles. Spines thin but rigid, flexible. Central spines 1–3(–4), when 4 forming a cross, red, or reddish variegated yellow, <1.8 cm. Radial spines 9–13, <1.1 cm, yellow or light yellow]. Flower funnel-shaped, 5cm high × 6cm diameter, metallic golden yellow, stamens golden yellow. Fruit oval, 1cm high × 0.5cm diameter, olive green, with light brown wool and dark brown bristles, REM persistent, dehiscent laterally and disintegrating after drying. Seeds bell-shaped, black.

**Etymology:** In Latin *-ensis* (m., f.) means “coming from”; *ibicuiensis* for the occurrence of the species in the river area of the Rio Ibicui, in the Brazilian state of Rio Grande do Sul.



**Figure 33.** *Parodia ibicuiensis*. Brazil, Rio Grande do Sul, W. of Unistalda, 14 Oct. 2011, A&M 765.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Southern Brazil, 140–250m.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands.

**Occurrence:** BR(RS). Map 7.

**Conservation status:** Endangered, EN B1ab(iii)+2ab(iii) Justification: this species is listed as Endangered because the extent of occurrence is estimated to be c. 3440km<sup>2</sup>, the area of occupancy is much less than 500km<sup>2</sup>, population size is severely fragmented and the quality of the habitat is constantly declining due to the proximity of the small rocky outcrops where the species lives to lands destined for agriculture.

**Comment:** Long considered to be a synonym for *Parodia oxycostata* ssp. *gracilis* (F. Ritter) Hofacker (Hunt *et al.*, 2006; Anderson & Egli, 2011), *Notocactus ibicuiensis* Prestlé proves instead to be, within the dominant *P. ottonis*, a distinct linking element between the populations of the latter, known as *Parodia glaucina* (F. Ritter) Hofacker & M.Machado (internal vicariant) and those of *Parodia stockingeri* (Prestlé) Hofacker & P.J. Braun (external vicariant). Also *Parodia oxycostata* ssp. *gracilis* proves to be a misunderstood taxon. In fact, as already pointed out in our redefinition of the concept of *Parodia oxycostata* (Buining & Brederoo) Hofacker (Anceschi & Magli, 2013: 76–78; see also *Comment on P. oxycostata*), the taxon can be considered as one of the many populations composing *P. ottonis*. Going back to *N. ibicuiensis*, in October 2011, we carried out some surveys west of Unistalda, RS (BR), on what we thought to be a *P. stockingeri* population. The publication of a selection of materials (A&M 763 & A&M 765) on cactusinhabitat.org, gave rise to a debate with Norbert Gerloff, which led us to a better understanding of a group of taxa, belonging to the *P. ottonis* complex.



**Figure 34.** *Parodia langsдорфii*. Brazil, Rio Grande do Sul, Caçapava do Sul, Pedra do Leão, 27 Oct. 2011, A&M 80.

According to Gerloff the two A&M numbers contained more than one taxon (substantially *P. glaucinus* & *P. ibicuiensis*), but not *P. stockingeri*. As a matter of fact, *N. ibicuiensis* showed characters near to those of the detected populations, but distinct from those of *P. ottonis* (of which we think *N. glaucinus* is part), so distinct that, because *P. stockingeri* and *N. ibicuiensis* are little-known taxa and with some common characters, and having never studied them in habitat, we probably mistook them. The situation required further examinations in habitat, studying the taxa involved. A series of further investigations held in 2016 in the Alegrete and Unistalda's areas, RS (BR), highlighted the following: a) In 2011 we had “missed” the *P. stockingeri* population by just 600m. The taxon is actually limited to a few square meters in this area, and is morphologically distinguishable in the *P. ottonis* complex both from *P. glaucina* (internal vicariant), and from *N. ibicuiensis* and *Parodia tenuicylindrica* (F. Ritter) D.R. Hunt (external vicariants). b) The surveys carried out in the municipality of Alegrete (one of the known areas for *N. ibicuiensis*), and again west of Unistalda, show *N. ibicuiensis* as a distinct taxon between *P. ottonis* (*glaucina* population) and *P. stockingeri*. Morphologically, *Parodia ibicuiensis* (Prestlé) Anceschi & Magli differs from the two previous taxa because it is short cylindrical since being juvenile, while some individuals of *P. glaucina* can become like that only in adulthood. The distinction is also evident in the descriptions of the two taxa: while Ritter (1979: 168) describes the body of *N. glaucinus* as globose, Prestlé (1985: 103) characterizes *N. ibicuiensis* as pear-shaped, we would define it more specifically “diamond-shaped”, as this is the other identifying character of the taxon. *P. ibicuiensis* reveals itself as a weak external vicariant, with fragmented distribution (see also *Conservation status*), in the range of the dominant *P. ottonis*.

**28. *Parodia langsdorffii*** (Lehm) Hunt, *Cactaceae Consensus Init.* 4: 6 (1997). Basionym: *Cactus langsdorffii* Lehm.

#### Homotypic Synonyms

- Cactus langsdorffii* Lehm., *Ind. Sem. Hort. Hamb.* 17 (1826). T.: XC, hort. bot. Hamburg, nd.  
*Malacocarpus langsdorffii* (Lehm.) Britton & Rose, *The Cactaceae* 3: 199–200, Fig. 217 (1922), incorrect name (Art. 11.4).  
*Notocactus langsdorffii* (Lehm.) Krainz, *Kakt. and. Sukk.* 17: 195 (1966).  
*Ritterocactus langsdorffii* (Lehm.) Doweld, *Sukkulenty* 3(1–2): 60 (2000).  
*Wigginsia langsdorffii* (Lehm.) D.M. Porter, *Taxon* 13: 211 (1964).

#### Heterotypic Synonyms

- Notocactus leprosorum* (F. Ritter) Havlíček, *Kaktusy* (Brno) 17(1): 8 (1981). Basionym: *Wigginsia leprosorum* F. Ritter.  
*Wigginsia leprosorum* F. Ritter, *Kakteen Südamerika* 1: 194–195, Figs. 146, 147, (1979). T.: BR, Rio Grande do Sul, South-east of Porto Alegre, Ritter 1272, holo. (U).  
*Wigginsia longispina* F. Ritter, *Kakteen Südamerika* 1: 198–199, Fig. 241 (1979). T.: BR, Rio Grande do Sul, Lavras, found by Leopold Horst, Ritter 1403a, holo. (U).  
*Notocactus longispinus* (F. Ritter) Havlíček, *Kaktusy* (Brno) 17(1): 8 (1981). Basionym: *Wigginsia longispina* F. Ritter.  
*Parodia langsdorffii* ssp. *multiceps* Hofacker & K. Herm, *Kakt. and. Sukk.* 50(3): 61–66, Figs. 1–9 (1999). T.: UY, Dpt. Lavalleja, Polanco, 29 Nov 1990, Hofacker 169, holo. (ZSS), iso. (MVM).  
*Ritterocactus langsdorffii* ssp. *multiceps* (Hofacker & K.Herm) Doweld, *Sukkulenty* 3(1–2): 60 (2000). Basionym: *Parodia langsdorffii* ssp. *multiceps*.  
*Wigginsia langsdorffii* ssp. *multiceps* (Hofacker & K. Herm) Doweld, *Sukkulenty* 2(3): 25 (1999). Basionym: *Parodia langsdorffii* ssp. *multiceps*.  
*Wigginsia polyacantha* (Link & Otto) F. Ritter, *Kakteen Südamerika* 1: 193–194, Fig. 145 (1979). Basionym: *Echinocactus polyacanthus* (*poliakanthus*) Link & Otto.  
*Echinocactus polyacanthus* (*poliakanthus*) Link & Otto, in *Verh. Preuss. Gartenb. Ver.* iii: 422 (1827).  
*Malacocarpus polyacanthus* (Link & Otto) Salm-Dyck, *Cact. Hort. Dyck.* ed. II: 25. (1850). Basionym: *Echinocactus polyacanthus* (*poliakanthus*) Link & Otto.  
*Notocactus polyacanthus* (Link & Otto) S. Theun., *Succulenta* 60(6): 141 (1981). Basionym: *Echinocactus polyacanthus* (*poliakanthus*) Link & Otto.  
*Wigginsia prolifera* F. Ritter, *Kakteen Südamerika* 1: 199, Fig. 149 (1979). T.: BR, Rio Grande do

Sul, Cazapava, found by Leopold Horst, Ritter 1403, holo. (U).

*Notocactus prolifera* (F. Ritter) S. Theun., *Succulenta* 60(6): 142 (1981). Basionym: *Wigginsia prolifera* F. Ritter.

**Description:** Habit solitary or forming clumps, stem globose to short cylindrical, 10–40cm high × 4–10cm diameter, densely woolly apically. Ribs [12]–17, obtuse, distinctly tuberculate. [Central spines 4, forming a cross, conical, thick, straight, one porrect, the lower three pointing downwards, <2.5 cm, brown or dark brown at apex, then grey with dark tip. Radial spines 5–10, curved on the stem surface, conspicuous, but thinner than the centrals], 1.2–2cm long, [grey with dark tip]. Flower 2.5cm high × 2.5cm diameter, yellow, stigma lobes purple. Fruit barrel shaped, pale green, never red, 0.7cm high × 0.3–0.4cm diameter, trained in white wool. Seeds bell-shaped, matt black.

**Etymology:** Named to honour Georg H. von Langsdorff, German-Russian naturalist and explorer, as well as a Russian diplomat and a respected physician. In 1813 he was nominated Russian consul in Brazil. He collected plants, animals and minerals.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Uruguay and Southern Brazil, up to 300m.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands.

**Occurrence:** BR(RS);UY(CL,LA,TT). Map 9.

**Comment:** *Parodia langsdorffii* (Lehm.) Hunt turns out to be, like the majority of the taxa in *Parodia* of the pampas, a non-dominant species with fragmented distribution, because of the anthropic intervention (mainly *Eucalyptus* plantations and grazing). As already pointed out (see *P. erinacea*), we transferred the populations of *Notocactus pulvinatus* Vliet, considered by Hunt *et al.* (2006, text: 309, 359) to be a synonym of *P. langsdorffii* (Lehm) Hunt, to those of *P. erinacea*. The latter taxon also appears to be the genetically closest relative to *P. langsdorffii* (Nyffeler & Eggli, 2010). We detected the species in various municipalities of the Rio Grande do Sul (Caçapava do Sul, Encruzilhada do Sul). Only the population living at the top of the Pedra do Leão, in the Galpão de Pedra property (Caçapava) which we visited several times, appears to be protected against the mentioned risks.

**29. *Parodia leninghausii*** (K. Schum.) F.H. Brandt, *Kakteen Orch. Rundschau* 7(4): 61 (1982). Basionym: *Echinocactus leninghausii* K. Schum.

#### Homotypic Synonym

*Echinocactus leninghausii* K. Schum., *Monatsschr. Kakteenk.* 10: 134 (1900). *Pilocereus leninghausii*



**Figure 35.** *Parodia leninghausii*. Brazil, Rio Grande do Sul, Caxias do Sul, Rio Mulada, 16 Nov. 2011, A&M 823.

*sii* Haage Cat. **25** (1897), nom. nud., illus. ('lenninghausii'). T.: BR, 'South of Brazils', cult. Haage, np. LT.: D.R. Hunt & N.P. Taylor *Cactaceae Syst. Init.* **21**: 9 (2006): the illus. cited.

*Eriocactus leninghausii* (K. Schum.) Backeb., *Beitr. Sukkulantenk. Sukkulantenpflege* **1942**: 38 (1942).

*Eriocephala leninghausii* (K. Schum.) Heinrich, *Kakteenkunde* **1940**(1): 1 (1940), 'as *Leninghausii*'.

*Malacocarpus leninghausii* (K. Schum.) Britton & Rose, *The Cactaceae* **3**: 204 (1922), incorrect name (Art. 11.4).

*Notocactus leninghausii* (K. Schum.) A. Berger, *Kakteen*: 209, 343 (1929).

#### Heterotypic Synonym

*Pilocereus leninghausii* F. Haage, [see above, *Echinocactus leninghausii* K. Schum.].

*Pilocereus lenninghausii* F. Haage, *Verzeichniss über Blumenwiebeln* **73**: 14 (1896). T.: LT.: Eggli & Hofacker, *Novon* **20**(1): 31 (2010): *Verzeichniss über Blumenwiebeln* **73**: 14, right-hand column, figure labelled "Lenninghausii Haage jr." (1896).

*Parodia lenninghausii* (F. Haage) F.H. Brandt ex Eggli & Hofacker, *Novon* **20**(1): 31 (2010). Basionym: *Pilocereus lenninghausii* F. Haage. LT.: Eggli & Hofacker, *Novon* **20**(1): 31 (2010):

F. Haage, 1986: 14, right-hand column figure labelled "Lenninghausii Haage jr." [the authors state that the lectotype previously selected by Hunt & Taylor (1986), is not validly published under Art. 7.11, see above, *Echinocactus leninghausii* K. Schum.].

*Eriocephala lenninghausii* ssp. *minor* (F. Ritter) Guiggi, *Cactology* **3**: 6 (2012). Basionym: *Eriocactus lenninghausii* "leninghausii" var. *minor* F. Ritter.

*Eriocactus leninghausii* var. *minor* F. Ritter, *Kakteen Südamerika* **1**: 156 (1979), nom. *incorr.* (Art. 11.3). T.: BR, Rio Grande do Sul, "Klein's mountain", south of Montenegro, sandstone rock walls, No. Ritter 1274a.

**Description:** Habit sometimes solitary usually forming clumps, stem cylindrical, 60cm or more high × 7–10cm diameter, slanted apically. Ribs 30–35, straight, low, obtuse. Areoles close-set. Spines hairlike, straight to slightly curved, pale to deep yellow to brown. Central spines 3–4, 2–5cm long. Radial spines 15–20 or more, 0.5–1cm long. Flower 5–6cm high × 5–6cm diameter, lemon yellow, flower areoles with dense brown wool and bristles. Fruit globose, c. 2cm high. Seeds bell shaped, brownish red.

**Etymology:** For Guillermo Leninghaus, cactus collector of German descent in Porto Alegre, Rio Grande do Sul, Brazil.

**Habitat & Distribution:** Basaltic rocky walls on the rivers basins of the Serra Geral formation (Caí and das Antas rivers), gradient close to 90°, surrounded by humid subtropical forest, 300–1300m.

**Ecological regions:** Alto Paraná Atlantic forests (Mata Atlântica & Selva Misionera), in eastern Argentina, southern Brazil and eastern Paraguay.

**Biomes:** Tropical and Subtropical Moist Broadleaf Forests.

**Occurrence:** BR(RS). Map 10.

**Comment:** The taxon, as all the ex-*Eriocactus* members, presents itself as a non-dominant species with fragmented distribution, whose habitats represent a real threatened ecological niche (see also *P. claviceps*). It is in most cases very difficult to approach *Parodia leninghausii* (K. Schum.) F.H. Brandt in its natural habitats. We could see it from a few meters away with the help of Franco Celli Marchetti, on a wall on the Rio Mulada (a tributary of the Rio das Antas), in the area of Caxias do Sul, RS (BR). Otherwise the taxon is detectable only from afar on other vertical basalt walls, belonging to the Serra Geral formation. The location in the Parque da Ferradura, Canela, RS (BR), where the taxon lives in sympatry with *P. haselbergii* is really spectacular.

**30. *Parodia linkii*** (Lehm.) R. Kiesling, *Cact. Succ. J.* (Los Angeles) **67**(1): 22 (1995). Basionym: *Cactus linkii* Lehm.



**Figure 36.** *Parodia leninghausii*. Brazil, Rio Grande do Sul, Canela, Parque da Ferradura, 19 Nov. 2011, A&M 61.

#### Homotypic Synonyms

*Cactus linkii* Lehm., *Index Sem.* (Hamburg) **16** (1827). T.: XC, hort. Hamburg, nd.; AR, Corrientes, Dept. Ituzaingo, 10km from Colonia Liebig, road to Playadito, in rocky fields, 11 Nov. 1978, C.L. Cristobal 1815, iso. (CORR), neo. (SI).

*Echinocactus linkii* (Lehm.) Pfeiff., *Enum. Diagn. Cact.*: 48 (1837).

*Malacocarpus linkii* (Lehm.) Britton & Rose, *The Cactaceae* **3**: 195, Fig. 208 (1922), incorrect name (Art. 11.4).

*Notocactus linkii* (Lehm.) Herter, *Cactus* (Paris) **42**: 120 (1954).

*Peronocactus linkii* (Lehm.) Doweld, *Sukkulenty* **2**(3): 21 (1999), incorrect name (Art. 11.4).

#### Heterotypic Synonyms

*Echinocactus megapotamicus* Osten, *Anales Mus. Nac. Montevideo* ser. 2, **5**: 72, tab. 63, 64 (1941). T.: Ritter 1380 (Brazil), epi.: deposited in the Herbarium of the Palmengarten Frankfurt am Main / D.

*Notocactus megapotamicus* Osten ex Herter, *Revista Sudamer. Bot.* **7**: 73 (1942). Basionym: *Echinocactus megapotamicus* Osten.



**Figure 37.** *Parodia linkii*. Brazil, Rio Grande do Sul, Caxias do Sul, Ana Rech, 16 Nov. 2011, A&M 822.





**Figure 38.** *Parodia maassii*. Bolivia, Tarija, Iscayachi, 29 Jun. 2011, A&M 556.

**Description:** Habit solitary [or clustering], stem [depressed globose to] globose, [3–4.6]–10cm high × [4.65–8.5]cm diameter. Ribs [10]–15, 0.6–1.2cm high, obtuse. Central spines 3–[5], straight, curved or a little twisted, dark red, red, or reddish grey with dark red base], <1.5cm long. Radial spines, finer, [8–14, just curved or twisted, whitish, light yellow, sometimes reddish at base, or all grey], [0.9]–1.5cm long. Flower 2.5cm high × 4–5cm diameter, yellow, stigma [with 12 lobes], yellow, pale [or dark red]. Fruit spherical, dark green. Seeds cap-shaped, black, almost matt.

**Etymology:** Named to honour Prof. Dr. Johann H.F. Link, German botanist. In 1815, successor of Carl Ludwig Willdenow, he became professor of natural history, curator of the herbarium and director of the botanic garden in Berlin.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Argentina, Uruguay and Southern Brazil, and the ex-Mata Atlantica area in eastern Paraguay, 20–1500m.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil, and the Alto Paraná Atlantic forests (Mata Atlantica & Selva Misionera), in eastern Argentina, southern Brazil and eastern Paraguay.

**Biomes:** Tropical and Subtropical Moist Broadleaf Forests, and the Tropical and Subtropical Grasslands, Savannas, and Shrublands.

**Occurrence:** AR(CN,MN);BR(PR,RS,SC);PY(IT,PG);UY(RV,TA). Map 7.

**Comment:** *Parodia linkii* (Lehm.) R. Kiesling represents the strongest external vicariant in the *P. ottonis* system. In fact, the territorial extension is vast, the populations are numerous as well as the individuals within them, and the genetic potential of the taxon appears to be second only to that of the dominant *P. ottonis*. We noted that under the same conditions *P. linkii* survives to “genetically more fragile” taxa, the case of *Parodia rechensis* (Buning) F.H. Brandt with which the taxon lives in



**Figure 39.** *Parodia maassii*. Bolivia, Tarija, Iscayachi, 29 Jun. 2011, A&M 556.

sympatry is an example (see Anceschi & Magli, 2012: 30–34). We met the taxon on several occasions on rocky outcrops in southern Brazil’s pampas (RS), often in sympatry with *P. ottonis*. The species also adapted itself to live in extremely wet conditions in transitional areas between the pampas and the Mata Atlantica in southern Brazil, as well as in habitats that were extremely deteriorated by deforestation in the ex-Mata Atlantica’s area in southern Paraguay.

**31. *Parodia maassii*** (Heese) A. Berger, *Kakteen*: 204, 344 (1929). Basionym: *Echinocactus maassii* Heese

#### Homotypic Synonyms

*Boliviacactus maassii* (Heese) Doweld, *Sukkulenty* 3(1–2): 62 (2000). Basionym: *Echinocactus maassii* Heese

*Echinocactus maassii* Heese, *Gartenflora* 56: 410, Fig. 50 (1907). **T.:** BO, cult. Berlin, np. **LT.:** D.R. Hunt & N.P. Taylor *Cactaceae Syst. Init.* 21: 9 (2006); *Gartenflora* 56: 410, Fig. 50 (1907).

*Malacocarpus maassii* (Heese) Britton & Rose, *The Cactaceae* 3: 202 (1922), incorrect name (Art. 11.4).

#### Heterotypic Synonyms

*Parodia obtusa* ssp. *atochana* F.H. Brandt, *Kakteen Orch. Rundschau* 13(1): 1 (1988), nom. inval. (Art. 37.1).

*Parodia bermejoensis* F.H. Brandt, *Kakteen Orch. Rundschau* 4(3): 33 (1979), (BO).

*Echinocactus escayachensis* Vaupel, *Monatsschr. Kakteenk.* 26: 125 (1916). **T.:** Botanische Staatssammlung München (M), M0145816, BO, Escayache near Tarija, 3600m, *Fiebrig, K.A.G.*, #3199, stored under name, *Malacocarpus escayachensis* (Vaupel) Britton & Rose, type of *Echinocactus escayachensis* Vaupel.

- Malacocarpus escayachensis* (Vaupel) Britton & Rose (1922), incorrect name (Art. 11.4). Basionym: *Echinocactus escayachensis* Vaupel.
- Parodia escayachensis* (Vaupel) Backeb., *Die Cactaceae* III: 1612 (1959). Basionym: *Echinocactus escayachensis* Vaupel.
- Parodia haageana* F.H. Brandt, *Kakteen Orch. Rundschau* 2(4): 53–55 (1977), (BO, Tarija).
- Parodia knizei* F.H. Brandt, *Kakteen Orch. Rundschau* 9: 1–3, Figs. (1984). T.: Brandt 85/b, holo. (HEID).
- Parodia koehresiana* F.H. Brandt, *Stachelpost* 8: 113–115 (1972).
- Parodia lamprospina* F.H. Brandt, *Frankfurter Kakteenf.* 4(2): 6–7 (1977), (BO, Chuquisaca, Sud Cinti).
- Parodia mendeziana* F.H. Brandt, *Cactus* (Wijnegem) 8(6): 93–96 (1976), (BO, Tarija, Mendez), as 'mendezana'.
- Parodia suprema* F. Ritter, *Cactus* (Paris) 17(76): 51–52, Fig. (1962). T: BO, Tarija, Mendez, San Antonio, 3500m. Dec 1958, Ritter 912, type herbaria: (U 117907B), (SGO) [status ?], (ZSS).
- Parodia thieleana* F.H. Brandt, *Kakteen Orch. Rundschau* 1(6): 81 (1976), (BO).

**Description:** Habit usually solitary, occasionally forming clumps, stem globose to elongate, 10–50cm high × 7–25cm diameter, yellowish green. Ribs 10–21, [2cm high], well defined, straight or spiralled. Spines, [mainly yellow or golden brown at the apex, light grey in the center of the stem, dark grey at the bottom]. Central spines (1–)4(–6), [when 4 forming a cross, conical], the lowermost longest and stoutest, [curved] to strongly curved or hooked at apex, <7cm long, [usually golden brown]. Radial spines, 6–18, needle-like, straight to slightly curved, 1–4cm long, paler than the centrals. Flower 3–4.5cm high × 1.5cm diameter, yellow to orange to red, [style light yellow, stigma lobes yellow, stamens and anthers yellow]. Flowering areoles woolly, only the uppermost with bristles. Fruit depressed globose to slightly elongate, 2–6cm high × 0.5–1cm diameter. Seeds black, tuberculate.

**Etymology:** Named to honour Mr. W. Maass, German cactus enthusiast at Zehlendorf near Berlin, 1907 secretary of the Deutsche Kakteen-Gesellschaft.

**Habitat & Distribution:** Puna rocky outcrops, 3000–4200m.

**Ecological regions:** Central Andean Puna.

**Biomes:** Montane Grasslands and Shrublands

**Occurrence:** AR(JY,SA);BO(CQ,OR,PO,TR). Map 1.

**Comment:** *Parodia maassii* (Heese) A. Berger is one of the two dominant species (the other is *Parodia microsperma* (F.A.C. Weber) Speg.), within the Andean center of diversity of *Parodia* s.l.. The complex of taxa related to *P. maassii* show, as external vicariants, the following species: *P. aureicentra*, *P.*

*commutans*, *P. otaviana*, *Parodia subterranea* F. Ritter, and *Parodia tuberculata* Cárdenas. All of the external vicariants are considered strong, considering that all components are constituted by numerous populations, in turn composed of numerous individuals. The only exception is *P. aureicentra*, whose population appears to be relatively strong (see Comment). The habitats colonized by the *P. maassii* complex include pre-Puna rocky slopes, Puna rocky outcrops, and arid inter-Andean rocky valleys, 2000–4200m. The ecological regions involved are Bolivian Montane Dry Forest, and the Central Andean Puna. The biome of reference is the Montane Grasslands and Shrublands. The extension of the geographical distribution of the complex goes from the area of Cachi Adentro, Salta (AR), extreme southwest of the range (*P. aureicentra*), to the areas north of Presto, Chuquisaca (BO) (*P. tuberculata*) and around the Poopó Lake, Oruro (BO) (*P. maassii*): respectively northeast and northwest ends of the distribution range. As we already pointed out, we do not consider *P. hegeri* (see Comment) to be part of the *P. maassii* complex. We detected *P. maassii* on several occasions among the pre-Puna and Puna rocky outcrops in Argentina and Bolivia.

**32. *Parodia magnifica*** (F. Ritter) F.H. Brandt, *Kakteen Orch. Rundschau* 7(4): 62 (1982). Basionym: *Eriocactus magnificus* F. Ritter.

#### Homotypic Synonyms

*Eriocactus magnificus* F. Ritter, *Succulenta* 45(4): 50, Fig. (1966), incorrect name (Art. 11.4). T.: BR, Rio Grande do Sul, Serra Geral, 19 Mar 1964, Horst & Ritter in Ritter 1270.

*Erioccephala magnifica* (F. Ritter) Guiggi, *Cactology* 3: 6 (2012).

*Notocactus magnificus* (F. Ritter) Krainz, *Kakt. and. Sukk.* 17: 195 (1966).

**Description:** Habit solitary [or forming large clumps], stem globose, becoming short cylindrical with age, 7–15cm [or more] in diameter, oblique apically, blue-green, glaucous. Ribs 11–15, straight, acute. Areoles close set or almost contiguous. Spines 12–15 or more, [hair like], 0.8–2cm long, [indistinct between centrals and radials], golden yellow apically, [then brownish yellow to grey with age]. Flower 4.5–5.5cm high × 4.5–5.5cm diameter, sulfur yellow. Fruit globose, <1cm diameter, pink. Seeds obovoid to club-shaped, spiny tuberculate, reddish brown.

**Etymology:** From Latin *magnificus*, magnificent, splendid.

**Habitat & Distribution:** Basaltic rocky walls on the rivers basins of the Serra Geral formation (Toropi and Toropi Mirim rivers), gradient close to 90°, surrounded by humid subtropical forest, 300–800m.

**Ecological regions:** Alto Paranà Atlantic forests



**Figure 40.** *Parodia magnifica*. Brazil, Rio Grande do Sul, Toropí, Rio Toropí basin, 28 Oct. 2008, A&M 256.



**Figure 41.** *Parodia mairanana*. Bolivia, Santa Cruz, Ruta 4, near Mataral, 1253m, 14 Apr. 2014, A&M 1135.

(Mata Atlántica & Selva Misionera), in eastern Argentina, southern Brazil and eastern Paraguay.

**Biomes:** Tropical and Subtropical Moist Broadleaf Forests.

**Occurrence:** BR(RS). Map 10.

**Comment:** Probably the best known taxon among the *Eriocactus* ex-members for its beauty, also *Parodia magnifica* (F. Ritter) F.H. Brandt, highlights itself in the restricted colonized habitats as a non-dominant species with fragmented distribution. This is because of the small area occupied, i.e. 2600 km<sup>2</sup>, and of the few known populations, in large



**Figure 42.** *Parodia mairanana*. Bolivia, Santa Cruz, Ruta 4, near Los Negros, 1253m, 14 Apr. 2014, A&M 1134.

part (60%) threatened by the forthcoming construction of a dam (data gathered from Larocca, J. & Machado, M., 2013. *Parodia magnifica*. The IUCN Red List of Threatened Species 2013. Downloaded on 04 October 2017). We believe that in the past the most accessible populations of the taxon were stolen by merchants and collectors. Currently, the remaining populations live on vertical walls difficult to access. In 2008, accompanied by João Larocca, we were able to detect at close range *P. magnifica* in habitat, on one of these walls in the Rio Toropí basin.

**33. *Parodia mairanana*** Cárdenas, *Natl. Cact. Succ. J.* 12(4): 84–85, Fig. (1957). T.: BO, Santa Cruz, Florida, nr. Mairana, above Agua Clara, 1500m, Dec 1955, Cárdenas 5085, (LIL 531593; US).

#### Homotypic Synonym

*Boliviacactus mairananus* (Cárdenas) Doweld, *Sukkulenty* 3(1–2): 62 (2000).

#### Heterotypic Synonyms

*Parodia neglecta* F.H. Brandt, *Kakt. and. Sukk.* 24(3): 49–51, Fig. (1973). T.: BO, "appendum Chulón a Rio Mizque septentrionalis", 1000m, type in coll. Brandt. 11/a, holo. (HEID).

*Parodia neglectoides* F.H. Brandt, *Stachelpost* 9(47): 129–131, Figs. (1973). T.: holo. in Herb.. Brandt 15/a.

**Description:** Habit solitary or clustering, stem [globose to short cylindrical], (4–)[6.5–17.5]cm high × (4–)[4.8–8]cm diameter, dark green. Ribs 13–[15], [strongly tuberculate, ribs divided into narrow grooved tubercles, <0.85cm high, or spiraled, divided by evident rounded tubercles]. Spines [flexible, dark purple-red or dark red grey in the crown,

ochre yellow with dark spots immediately below the crown. Central spines 1–4, when 4 forming a cross, thicker than the radial spines, straight or slightly curved, the lower hooked, <1.3 cm, pinkish with dark tips or grey with yellow base, later grey]. Radial spines 8–14, needle-like, [slightly curved, curved, or some curved on the stem surface, or even twisted], [0.8]–1.2 cm, [whitish, greyish white with yellow base, or light yellow then grey]. Flower 1–3.5 cm high × 2–3.5 cm diameter, orange-yellow with dark orange red tip, anthers yellow, stigma lobes 8, yellow. Fruit ellipsoid, <0.8 cm.

**Etymology:** Referring to the place of its first discovery, above Agua Clara, near the small town of Mairana, Prov. Florida, Dept. Santa Cruz, Bolivia.

**Habitat & Distribution:** Semi-deciduous thorn forest, up to 1800 m.

**Ecological regions:** Bolivian Montane Dry Forest.

**Biomes:** Montane Grasslands and Shrublands.

**Occurrence:** BO(SC). Map 3.

**Conservation status:** Least Concern, LC

**Comment:** The current understanding of *Parodia mairanana* Cárdenas is generally rather confused. This misunderstanding stems from considering the taxon among the synonyms for *Parodia comarapana* Cárdenas (Hunt *et al.*, 2006; Anderson & Egli, 2011; Hunt, 2016). As already pointed out by Lowry (2012: 26–27), the two taxa are easily distinguishable in habitat. For the evidence that emphasizes the autonomy of the two taxa, and the consequent acceptance of *P. mairanana* in our synopsis, we refer to the Comment on *P. comarapana*.

**34. *Parodia maldonadensis*** (Herter) Hofacker, *Cact. Explor.* 4: 32 (2012) [e-published]. Basionym: *Echinocactus maldonadensis* Herter.

#### Homotypic Synonyms

*Echinocactus maldonadensis* Herter, *Estud. Bot. Reg. Uruguay* 4: 90 (1930). T.: NT.: Hofacker *Cact. Explor.* 4: 32 (2012): Heinz Ruoff 107 (FRP).

*Notocactus maldonadensis* (Herter) Herter, *Revista Sudamer. Bot.* 7: 216 (1943).

#### Heterotypic Synonyms

*Wigginsia arechavaletae* (Speg.) D.M. Porter, *Taxon* 13: 211 (1964). Basionym: *Echinocactus acuatus* var. *arechavaletae* Speg.

*Echinocactus acuatus* var. *arechavaletae* Speg., *Anales Mus. Nac. Buenos Aires* (ser. 3) 4: 494 (1905). T.: UY, nd.

*Notocactus neoarechavaletae* Havlíček, *Kakt. Vilag* 18(4): 79, nom. nov. (1989), as ‘neoarechavaletai’, incorrect name (Art. 52.1). Replaced synonym: *Echinocactus acuatus* var. *arechavaletae* Speg., not *Notocactus arechavaletae* (Speg.) Hert.

*Parodia neoarechavaletae* (Havlíček) D.R. Hunt,



**Figure 43** *Parodia maldonadensis*. Uruguay, Rocha, P. N. Santa Teresa, 19 Dec. 2006, A&M 97

*Cactaceae Consensus Init.* 4: 6 (1997), incorrect name (Art. 11.4). Basionym: *Notocactus neoarechavaletae* Havlíček [ NT.:? (Havl. l.c.): UY, Maldonado, Ruoff 107 (FRP).].

**Description:** Habit usually solitary, [rarely forming clumps], stem globose [to short cylindrical, 4–13.5 cm high × 7–11 cm diameter], with woolly apex, dark green. Ribs 13–21, more or less obtuse. [Spines grey with reddish base and dark tip]. Central spines (1–)[3–4, the lower dagger-like, <1.8](–3) cm long. Radial spines 5–9, thinner, 1–1.5 cm long. Flower 3–4 cm long × 3–4 cm diameter, yellow, stigma lobes purplish-red. Fruit <2 cm high, white.

**Etymology:** In Latin *-ensis* (m., f.) means “coming from”; ‘maldonadensis’ with reference to the region of its first discovery, the department of Maldonado, Uruguay.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Uruguay (Southeast coastal area) and Southern Brazil, up to 250 m.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands.

**Occurrence:** BR(RS);UY(MA,RO). Map 6.

**Comment:** In the article “Some notes on *Wigginsia corynodes*”, Andreas Hofacker (2012: 26–34) discusses some errors in the work of Albesiano and Kiesling (2009), concerning the rehabilitation of *Wigginsia* D.M. Porter as a genus distinct from *Parodia* Spegazzini. One of the major implications for the genus *Parodia*, in Hofacker’s dissertation, consists of the observation, already highlighted by Albesiano and Kiesling, that *Notocactus neoarechavaletae* Havlíček, under ICBN Art 52.1 and *Parodia neoarechavaletae* (Havlíček) D.R. Hunt, are incorrect under ICBN Art 11.4 because the oldest name available at the same rank to indicate the taxon in question is *Echinocactus maldonadensis* Herter. To fill the void in *Parodia*, Hofacker (2012:32) publishes *Parodia maldona-*



**Figure 44** *Parodia maldonadensis*. Uruguay, Rocha, P. N. Santa Teresa, 19 Dec. 2006, A&M 97

*densis* (Herter) Hofacker, designating a neotype: *Heinz Ruoff* 107 (FRP). In accordance with Hofacker's reasoning we accept *P. maldonadensis*, instead of the perhaps better known *P. neoarechavaletae*. As already highlighted in our work on the complex of populations related to *Parodia mammulosa* (Lem.) N.P. Taylor (Anceschi & Magli, 2014: 60–73), we consider *P. maldonadensis* an external vicariant of the first taxon, the latter appearing like a *mammulosa* with a very woolly stem apex. At the molecular level, the close relationship between *Notocactus* s.s. and *Wigginsia* is pointed out in Nyffeler & Eggli (2010) and Anderson & Eggli (2011: 495), finally, the holomorphological proximity (i.e. morphological, ecological, chorological and genetical) (Hennig, 1966: 32), between the two taxa is in our opinion evidence of genetic proximity. The vicariant is weak because of the extreme localization and fragmentation of the taxon's populations. We detected the species on rocky outcrops and "cerros" in the south-eastern coastal area of Uruguay (Dpts. Maldonado and Rocha), where the majority of the populations live. Sometimes we noticed sympatry with *P. concinna*. We report the presence of the taxon within the Protected Area P. N. Santa Teresa in the Dpt. of Rocha.(UY).

**35. *Parodia mammulosa*** (Lem.) N.P. Taylor, *Bradleya* **5**: 93 (1987). Basionym: *Echinocactus mammulosus* Lem.

#### Homotypic Synonyms

*Echinocactus mammulosus* Lem., *Cact. Aliq. Nov. Desc.*: 40 (1838). **T.**: (Lem. l.c. 1839): 'le Cerro', cult. Monville, np. **NT.**: D.R. Hunt & N.P. Taylor *Cactaceae Syst. Init.* **21**: 9 (2006): *Illus., Ann. Fl. Pom.* 1839: 288.

*Malacocarpus mammulosus* (Lem.) Britton & Rose, *Cactaceae* **3**: 200, pl. 22 (1922), incorrect name (Art. 11.4).

*Notocactus mammulosus* (Lem.) A. Berger, *Kakteen*: 212, 343 (1929).

*Ritterocactus mammulosus* (Lem.) Doweld, *Sukkulenty* **2**(3): 22 (1999).

#### Heterotypic Synonyms

*Notocactus albigenmatus* N. Gerloff, *Internoto* **31**(4): 120, ill. (2010), nom. inval. (Art. 36.1, 37.1). [Provisional name, used in caption to illustration only].

*Parodia brasiliensis* Speg., *Anales Soc. Ci. Argent.* **99**: 128, Fig. (1925), (BR, Santos).

*Parodia mammulosa* ssp. *brasiliensis* (Havlíček)



**Figure 45.** *Parodia mammulosa* ('mammulosa' population). Uruguay, Rivera, Tranqueras, Valle del Lunarejo, 21 Nov. 2006, A&M 72.

Hofacker, *Cactaceae Consensus Init.* **6**: 11 (1998). Basionym: *Notocactus mammulosus* var. *brasiliensis* Havlíček.

*Notocactus mammulosus* ssp. *brasiliensis* (Speg.) Lodé, *Cact.-Avent. Int.* **98**(Suppl.): 7 (2013). Basionym: *Parodia brasiliensis* Speg.

*Ritterocactus mammulosus* ssp. *brasiliensis* (Havlíček) Doweld, *Sukkulenty* **2**(3): 22 (1999). Basionym: *Notocactus mammulosus* var. *brasiliensis* Havlíček.

*Notocactus mammulosus* var. *brasiliensis* Havlíček, *Kaktusy* (Brno) **16**(1): 5–7 (1980). T.: BR, holo. deposited by Havlíček, in the Herbarium of the Med. Faculty of the University of Plzeň /CZ.

*Parodia mammulosa* ssp. *erythracantha* (H. Schloss. & Brederoo) Hofacker, *Cactaceae Consensus Init.* **6**: 11 (1998). Basionym: *Notocactus erythracanthus* H. Schloss. & Brederoo.

*Notocactus erythracanthus* H. Schloss. & Brederoo, *Kakt. and. Sukk.* **36**(9): 189 (1985). T.: UY, Tacuarembò, halfway between Tacuarembò and Salto, 1973, *Schlosser* 165 (MVM).

*Notocactus mammulosus* ssp. *erythracanthus* (H. Schloss. & Brederoo) Lodé, *Cact.-Avent. Int.* **98**(Suppl.): 7 (2013). Basionym: *Notocactus erythracanthus* H. Schloss. & Brederoo.

*Ritterocactus mammulosus* ssp. *erythracanthus* (H. Schloss. & Brederoo) Doweld, *Sukkulenty* **2**(3):



**Figure 46.** *Parodia mammulosa* ('submammulosa' population) Argentina, Córdoba, N.W. of Salacate, 1200m, 1 Dec. 2015, A&M 1256).



**Figure 47.** *Parodia mammulosa* ('turecekiana' population). Uruguay, Río Negro, Nuevo Berlín, 24m, 27 Jan. 2014, A&M 966.

22 (1999). Basionym: *Notocactus erythracanthus* H. Schloss. & Brederoo.

*Notocactus euvelenovskiyi* Z. Fleisch. & Schütz, in *Friciana* **51**: 24–25, 36, 45 (1976), nom. inval. (Art. 36.1, 37.1). T.: A.V. Frič 1920, holo. (SCK).

*Echinocactus floricomus* Arechav., *Anales Mus. Nac. Montevideo* **5**: 183 (1905).

*Notocactus floricomus* (Arechav.) A. Berger, *Kakteen*: 211, 343 (1929). Basionym: *Echinocactus floricomus* Arechav.

*Echinocactus hypocrateriformis* Otto & A. Dietr., *Allg. Gartenzeit.* **vi**: 169 (1838).

*Notocactus hypocrateriformis* (Otto & A. Dietr.) Herter, *Revista Sudamer. Bot.* **7**: 216 (1943). Basionym: *Echinocactus hypocrateriformis* Otto & A. Dietr.

*Notocactus macambarensis* Prestlé, *Internoto* **7**(3): 72 (1986). T.: Prestlé 425 (Brazil), holo.: deposited in the Herbarium of the Utrecht National University (U).

*Notocactus megalanthus* H. Schloss. & Brederoo, *Kakt. and. Sukk.* **32**(7): 157, Fig. (1981). T.: H.S.

- Schlosser* 163 (Uruguay), holo.: Deposited in the herbarium of the botanical department of the Museo Nacional de Historia Natural in Montevideo/Uruguay (MVD).
- Ritterocactus megalanthus* (H. Schloss. & Brederoo) Doweld, *Sukkulentny* 2(3): 22 (1999). Basionym: *Notocactus megalanthus* H. Schloss. & Brederoo.
- Parodia submammulosa* ssp. *minor* R. Kiesling, *Cact. Succ. J.* (Los Angeles) 67(1): 16 (1995). T.: AR, Catamarca, Dept. Ancasti, west of Ancasti, Nov. 1983, *Kiesling* 4704, holo. (SI).
- Notocactus submammulosus* ssp. *minor* (Kiesling) Abraham, *Internoto* 16: 82–86 (1995). Basionym: *Parodia submammulosa* ssp. *minor* R. Kiesling.
- Notocactus mueller-moelleri* Frič ex Z. Fleisch. & Schütz, in *Friciana* 8, 50: 24–26, 36,45 (1976). T.: *Schlosser* 151 (Uruguay), holo.: deposited by R. Havlíček in the Herbarium of the University of Plzeň/CZ.
- Echinocactus pampeanus* Speg., *Contr. Fl. Sierra Vent.*: 27 (1896) (AR).
- Notocactus pampeanus* (Speg.) A. Berger, *Kakteen*: 212, 343 (1929). Basionym: *Echinocactus pampeanus* Speg.
- Notocactus paulus* H. Schloss. & Brederoo, *Kakt. and. Sukk.* 31(4): 116, Fig. (1980). T.: *Schlosser* 161 (Uruguay), holo.: deposited in the herbarium of the botanical department of the Museo Nacional de Historia Natural in Montevideo/Uruguay (MVM).
- Notocactus ritterianus* Lisal & Kolarik, *Internoto* 7(1): 5 (1986). T.: L. Horst & W. Uebelmann HU338 p.p. (Brazil), deposited in the Herbarium of the Arboretum of the Silesian Museum in Opava/CZ.
- Notocactus roseoluteus* Vliet, *Succulenta* 52(6): 108, Fig. (1973). T.: *D.J. van Vliet* 75/3 (Uruguay), holo.: deposited in the Herbarium of the University of Utrecht (U).
- Notocactus herteri* ssp. *roseoluteus* (Vliet) Lodé, *Cact.-Avent. Int.* 98(Suppl.): 7 (2013). Basionym: *Notocactus roseoluteus* Vliet.
- Parodia submammulosa* (Lem.) R. Kiesling, *Cact. Succ. J.* (Los Angeles) 67(1): 14 (1995). Basionym: *Echinocactus submammulosus* Lem.
- Parodia mammulosa* ssp. *submammulosa* (Lem.) Hofacker, *Cactaceae Consensus Init.* 6: 11 (1998). Basionym: *Echinocactus submammulosus* Lem.
- Echinocactus submammulosus* Lem., *Cact. Gen. Sp. Nov.*: 20 (1839). T.: AR, Buenos Aires, Partido Tornquist, Sierra de La Ventana, Dec. 1936, A. Castellanos s.n.; NT.: BA 19232, in spirit.
- Notocactus submammulosus* (Lem.) Backeb., *Kakteen-ABC*: 255 (1936). Basionym: *Echinocactus submammulosus* Lem.
- Ritterocactus mammulosus* ssp. *submammulosus* (Lem.) Doweld, *Sukkulentny* 2(3): 22. 1999. Basionym: *Echinocactus submammulosus* Lem.
- Parodia turecekiana* R. Kiesling, *Cact. Succ. J.* (Los Angeles) 67(1): 17–19, Figs. 1–5 (1995). T.: AR, Entre Rios, Dept. Gualaguachù, north of Gualaguachù, Oct. 1985, R. Kiesling et al. 5933, holo. (SI, flower added Dec. 17, 1985).
- Notocactus tureckianus* (R. Kiesling) W.R. Abraham, *Internoto* 16(3): 82–86 (1995). Basionym: *Parodia turecekiana* R. Kiesling.
- Notocactus mammulosus* ssp. *tureckianus* (R. Kiesling) Prestlé (1977), nom. inval. (Art. 33.3).

**Description:** Habit solitary [or clustering], stem [depressed globose to] globose to short cylindrical, [3–23]cm high × 5–13cm diameter, shiny light green to dark green. Ribs 13–25, vertical, well defined, with large, distinct, chin-like tubercles between the areoles. Central spines 1–4, straight, stout, usually one strongly flattened, [or sometimes awl shaped, <2.6cm, rather than, 2 more evident and flattened, papyraceous, the lower <3.85 cm], brown, to white to grey. Radial spines [4–]6–30, usually needle-like, 0.5–1cm long, whitish to brownish. Flower 3.5–5.5cm high, light to golden yellow, rarely light pink, pericarpel plus hypanthium short and broad, flower areoles with dense pale wool and few dark bristles. Fruit globose, elongating at maturity, [1.3cm high × 1.2cm diameter], thin walled, [dark reddish-green, with little scales with white hairs and red bristles at the top, REM persistent, with red bristles]. Seeds bell to helmet shaped, finely tuberculate, matt brown.

**Etymology:** From Latin *mammulosus*, diminutive of Latin *mamma*, breast; i.e. full of small tubercles breast-shaped; for the tuberculate body of the taxon.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Argentina, Uruguay and Southern Brazil, the monte desert in Argentina, and the wooded savanna of the Rio Uruguay in Argentina and Uruguay, up to 1500m.

**Ecological regions:** Humid and Semi-arid Pampas of Argentina, Uruguay and Southern Brazil, the Low Monte, and the Paraná flooded savanna.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands, the Temperate Grasslands, Savannas, and Shrublands, and the Flooded Grasslands and Savannas.

**Occurrence:** AR(BA,CT,CH,CB,ER,LP,MZ,RN,SL);BR(RS);UY. Map 6.

**Comment:** *Parodia mammulosa* (Lem.) N.P. Taylor is one of the three dominant species (together with *P. erinacea* and *P. ottonis*), within the center of diversity of *Parodia* s.l., in the lowland pampas regions of northeastern Argentina, southern Brazil, and Uruguay. As already pointed out in the work on the complex of populations related to *P. mammulosa* (Anceschi & Magli, 2014: 60–73), the taxon is characterized by two internal vicariants

(the *submammulosa* and *turecekiana* populations) and three external vicariants: *P. curvispina* (added to the group in this synopsis), *P. maldonadensis*, and *Parodia mueller-melchersii* (Frič ex Backeb.) N.P. Taylor. While *Parodia submammulosa* (Lem.) R. Kiesling appears to be a strong internal vicariant, since even its populations like those of *P. mammulosa* are widespread and not subject to any risks of extinction, *Parodia turecekiana* R. Kiesling proves to be a rather weak linking point, with severely fragmented populations located in rather specific areas (i.e. the “Blanqueales” with allomorphic soil, in the wooded savanna of the Rio Uruguay, in Uruguay and the “Mesopotamia” in Argentina). These populations are located among those of *P. submammulosa* of the Argentinian Sierras Pampeanas, to the west of the range, and those of *P. mammulosa* of the rocky outcrops of Uruguay and southern Brazil subtropical pampas, to the east. Concerning *P. turecekiana*, still considered among the accepted species in *NCL* (Hunt *et al.*, 2006, text: 224) and *CCC3* (Hunt, 2016: 110), the inclusion of the taxon among the synonyms for *P. mammulosa* in our synopsis is due to the fact that the distinctive semaphoront (see materials and methods) of the taxon, i.e. the 2 central spines, longer and flattened, is evident in *P. turecekiana* especially in the juvenile phase and early adulthood, while older plants look like *P. submammulosa*. It should be added, moreover, that the phases where the evidence of central spines is more relevant can also be found in semaphoronts of *P. submammulosa* (Anceschi & Magli, 2014: 64). With regard to the peculiarities of the habitat, another distinguishing element of *P. turecekiana*, we think that one of the characteristics of a dominant species is to expand itself, conquering new territories and adapting itself (if successful) to new environmental conditions (*ibid.*). The set of external vicariants proves to be weak, because all the components are constituted by extremely localized species, with fragmented populations. The habitats colonized by the *P. mammulosa* complex include pampa grasslands with rocky outcrops and wooded savanna of the Rio Uruguay, 100–1500m. The ecological regions involved are the Humid and Semi-arid Pampas of Argentina, Uruguay and Southern Brazil, the Low Monte, and the Paraná flooded savanna. The biomes of reference are the Tropical and Subtropical Grasslands, Savannas, and Shrublands, the Temperate Grasslands, Savannas, and Shrublands, and the Flooded Grasslands and Savannas. The extension of the geographical distribution of the complex goes from the Sierras de Lihuel Calel (Pr. La Pampa) and Sierra de La Ventana (Pr. Buenos Aires) areas, in southern Argentina (*submammulosa* population), to the Sierra de Ancasti, Pr. Catamarca, Argentina (*submammulosa* population), and Santo Cristo, Rio Grande do Sul, Brazil (*mammulosa* population), respectively northwest

and northeast ends of the range. We detected the internal vicariants of the taxon in various occasions, among the Sierras of Argentina, the Cuchillas of Uruguay and the Sierras and Coxilhas of the Rio Grande do Sul. The search for *P. turecekiana* was the reason for various excursions in the “Blanqueales” area of Uruguay, in Uruguay and Argentina.

**36. *Parodia microsperma*** (F.A.C. Weber) Speng., *Anales Soc. Ci. Argent.* **96**: 70 (1923). Basionym: *Echinocactus microspermus* F.A.C. Weber

#### Homotypic Synonyms

*Hickenia microsperma* (F.A.C. Weber) Britton & Rose, *Cactaceae* **3**: 207, pl. 23 (1922), incorrect name (Art. 11.4).

*Echinocactus microspermus* F.A.C. Weber in Bois, *Dict. Hort.* [Bois] **1**: 469 (1896). T.: AR, Catamarca, Tucumán, nd.

#### Heterotypic Synonyms

*Parodia aconquijaensis* Weskamp, *Kakt. and Sukk.* **42**(4): 90, Fig. (1991). T.: AR, Catamarca, D. Herzog 123, holo. (WU).

*Parodia albofasciata* F.H. Brandt, *Kakteen Orch. Rundschau* **2**(3): 22–25 (1977), as ‘albo-fasciata’, (AR, Salta, Cafayate).

*Parodia amblayensis* F.H. Brandt, in *Letzeb. Cacteeffren* **2**(4): 1 (1981), nom. inval (Art. 36.1).

*Parodia argerichiana* Weskamp, *Kakt. and Sukk.* **36**(1): 9, Fig. (1985). T.: AR, Salta, N. Cafayate, D. Herzog 1981, holo. (B).

*Parodia aureispina* Backeb., *Blätt. Kakteenf.* **1934**(7): [6] genus 68, sp. 2 (Fig.) (1934), (AR, Salta).

*Parodia belenensis* Weskamp, *Die Gattung Parodia* **2**: 132, 137 (1992), (AR Northwest, Catamarca).

*Parodia betaniana* F. Ritter, *Kakteen Südamerika* **2**: 426–427, Fig. (1980). T.: AR, Salta, Betania, discovered by Ritter in 1931, rediscovered in 1959, Ritter 920.

*Parodia cabracorralensis* Piens, *Tijdschr. Liefhebb. Cact. Vetpl. Kamerpl.* **6**(4): 56–58 (1993), (AR, Salta, 1100m.), nom. inval. (Art. 36.1).

*Parodia campestris* F.H. Brandt, *Kaktus* **10**(3): 61 (1975), as *campestrae*, (AR, Salta, Rosario de la Frontera).

*Parodia capillitaensis* F.H. Brandt, *Kaktus Vilag* **4**: 50–52 (1977), (*fide Lit. Kakt.* **2**(4): 244–246, 1978), AR, Catamarca, Capillitas).

*Parodia catamarcensis* Backeb., *Kaktus-ABC*: 269, 416 (1936), (AR, Catamarca).

*Parodia cebilarensis* Weskamp, *Die Gattung Parodia* **2**: 131, 136 (1992), (AR Northwest, Salta).

*Parodia chlorocarpa* F. Ritter, *Kakteen Südamerika* **2**: 427, Figs. 286, 287 (1980). T.: AR, Salta, Mojotoro, 1959, Ritter 921, holo. (U).

*Parodia elegans* Fehser ex Backeb. *Cactus Lexicon*: 388 (1966), nom. inval. (Art. 36.1, 37.1).





**Figure 48.** *Parodia microsperma*. Argentina, Catamarca, El Rodeo, Rio Los Nogales, 13 Nov. 2013, A&M 855.

- Parodia erythrantha* (Speg.) Backeb. & F.M. Knuth, *Kaktus-ABC*: 269 (1936). Basionym: *Echinocactus microspermus* var. *erythranthus* Speg.
- Echinocactus microspermus* var. *erythranthus* Speg., *Anales Mus. Nac. Buenos Aires* 4: 498 (1905), (N. Arg.).
- Parodia fechseri* Backeb., *Descr. Cact. Nov.* 3: 11 (1963), (AR, La Rioja, Olta), nom. inval. (Art. 8.4).
- Parodia fuscatoriviridis* Backeb. *Descr. Cact. Nov.* 3: 11 (1963), as “*fuscato-viridis*”, nom. inval. (Art. 8.4).
- Parodia glischrocarpa* F. Ritter, *Kakteen Südamerika* 2: 427–428, Fig. (1980). T.: AR, Salta, Alemania, 1959, *Ritter* 923, holo. (U).
- Parodia grandiflora* Veverka, *Kaktusy* (Brno) 28(6): 130 (1992), (AR Northwest, Catamarca), nom. inval. (Art. 8.4, 36.1).
- Parodia guachipasana* Weskamp, *Die Gattung Parodia* 2: 153, 151 (1992), (AR Northwest, Salta).
- Parodia herzogii* Rausch, *Kakt. and. Sukk.* 32(2): 31, Figs. (1981). T.: AR, Salta, N Cafayate, *Rausch* 707a, holo. (ZSS).
- Parodia microsperma* ssp. *herzogii* (Rausch) Janeba, *CactusWorld* 31(2): 116, illus. (p. 114) (2013). Basionym: *Parodia herzogii* Rausch.
- Parodia heyeriana* Weskamp, *Die Gattung Parodia* 2: 155–161, Fig. 9 (1992). T.: AR, Salta, “in the neighbourhood of the village La Viña”, s.a., *Herzog* 101, type herbaria (WU) [ex cult. W. Weskamp].
- Parodia hummeliiana* A.B. Lau & Weskamp, *Kakt. and. Sukk.* 29(10): 226–227, ill. (1978). T.: AR, Salta, “c. 6km E. of the village of Amblayo, in a gorge on slopes of red standstone”, 3200m, 1972, *Lau* 567, holo. (B) [ex cult. hort. Weskamp, 21.6.1978].
- Parodia malyana* ssp. *igneiflora* F.H. Brandt, *Kakteen Orch. Rundschau* 13(1): 1 (1988).
- Parodia lembckeii* Weskamp, *Die Gattung Parodia* 2: 131, 135 (1992), (AR, Northwest, Catamarca).
- Parodia macrancistra* (K. Schum.) Y. Ito ex Weskamp, *Die Gattung Parodia*: 424 (1987). Basionym: *Echinocactus microspermus* var. *macrancistrus* K. Schum.
- Echinocactus microspermus* var. *macrancistrus* K. Schum., *Monatsschr. Kakteenk.* 12: 157 (1902), (AR).
- Parodia malyana* Rausch, *Kakt. and. Sukk.* 20: 8 (1969), (AR, Catamarca, Ancasti).
- Parodia matthesiana* Heinrich, *Kakt. Sukk.*, Dresden 3, 37–38 (1968), nom. inval. (Art. 8.4, 36.1).
- Parodia mercedesiana* Weskamp, *Kakt. and. Sukk.* 35(3): 56–57, Fig. (1984). T.: AR, Salta, “N.W. of Las Curtiembres on a slope of reddish sandstone with grass tussocks”, 1800m, 1980, *Herzog* 116, holo. (B) [ex cult. hort. Weskamp, 9.3.1984].
- Parodia mesebrina* F.H. Brandt, *Kakteen Orch. Rundschau* 2(3): 33–36 (1977), (AR, La Rioja, Malanzan).
- Parodia microthele* Backeb., *Kaktus-ABC*: 266, 415 (1936), (N. Arg.).
- Parodia minima* Rausch, *Succulenta* 64: 178, Fig. (1986), nom. illeg. (Art. 53.1). T.: *Rausch* 757, holo. (ZSS).
- Parodia minuscula* Rausch, *Succulenta* 64(11): 230 (1985), (AR, Catamarca).
- Parodia mutabilis* Backeb., *Blätt. Kakteenf. genus* 68, sp. 4, 7 (1934). T.: AR, Salta, 2800m, nd.
- Parodia nana* Weskamp, *Kakt. and. Sukk.* 41(9): 187 (1990). T.: AR, Catamarca, *D. Herzog* 133, holo. (WU).
- Parodia papagayana* F.H. Brandt, *Kaktus* 11(4): 88 (1976), (AR, San Juan, Serra de la Huerta).
- Parodia rigidispina* Krainz, *Swiss Gart.* 15(10): 281–282, Fig. (1945) (AR). T.: holo., spirit specimen (ZSS).
- Parodia riojensis* F. Ritter & Weskamp ex Weskamp, *Die Gatt. Parodia*: 474–476, Fig. 75 (1987). T.: AR, Catamarca/La Rioja, “frontier region of the provinces of Catamarca and La Rioja, near the village Mazan, at the S. margin of the Pipanaco depression”, 1000–1100m, 1958, *Ritter* 917 loc. 1, type herbaria: (DR), (SGO) [status ?].
- Parodia rubelliamata* Backeb., *Descr. Cact. Nov.* 3: 11 (1963), (AR, LA Rioja, Sanagasta), nom. inval. (Art. 8.4).
- Parodia rubriflora* Backeb., *Descr. Cact. Nov.* 3: 12 (1963), (N Arg.), nom. inval. (Art. 8.4).
- Parodia rubristaminea* F. Ritter, *Kakteen Südamerika* 2: 428, Fig.290 (1980). T.: AR, Salta, SW of Alemania, 1959, *Ritter* 924, holo. (U).
- Parodia sanguiniflora* Backeb., *Blätt. Kakteenf. genus* 68, sp. 6, 12 (1934), (AR, Salta, 2000m, scree).

- Parodia scopoides* Backeb. *Kaktus-ABC*: 272, 416 (1936), (AR, Salta).
- Parodia setifera* Backeb., *Blätt. Kakteenf. genus* 68, sp. 3, 7 (1934), (AR, Salta), as “*P. setifer*”.
- Parodia spanisa* F.H. Brandt, *Hazai Kaktusz Tukor* 1977: 22–24 (1977), (AR, Tucumán, Amaicha del Valle).
- Parodia spegazziniana* F.H. Brandt, *Stachelpost* 7: 367–368 (1971), (AR, Catamarca, 2800m).
- Parodia tafiensis* Backeb., *Descr. Cact. Nov.* 3: 12 (1963), (AR, Tucumán, Tafi del Valle), nom. inval. (Art. 8.4).
- Parodia talaensis* F.H. Brandt, *Cactus* (Wijnegem) 8(4): 57–60 (1976), (AR, S. Salta, El Tala).
- Parodia thionantha* F.H. Brandt, *Kakt. and. Sukk.* 20(2): 156 (1969), (AR, Salta).
- Echinocactus microspermus* var. *thionanthus* Speg., *Anales Mus. Nac. Buenos Aires* (ser. 3) 4: 498, (1905), (AR).
- Parodia tuberculosi-costata* Backeb., *Kakteenlexikon*: 351 (1966), (AR, Salta), nom. inval. (Art. 8.4).
- Parodia tucumanensis* Weskamp, *Succulenta* 69(6): 137 (1990). T.: AR, W.Weskamp, holo. (WU).
- Parodia uebelmanniana* F. Ritter, *Kakteen Südamerika* 2: 425–426, Fig. 282 (1980). T.: AR, Salta, Lumbreras, Feb 1959, *Ritter* 919, type herbaria: (U) [not found], (SGO), (ZSS) [seeds only, status ?] [type cited for U in Ritter, *Kakt. Südamer.* 1: iii. 1979].
- Parodia wagneriana* Weskamp, *Kakt. Sukk.* (Dresden) 22(3): 70–71 (1987), (AR, Catamarca, E. of Andalgalá).
- Parodia weberiana* F.H. Brandt, *Kakt. and. Sukk.* 11: 206 (1969), (N. Arg.), as “*weberana*”.
- Parodia weberoides* F.H. Brandt, in *Letzeb. Cacteeffrenn* 5(2): 29–34 (1984).
- Parodia weskampiana* Krasucka & Spanowsky, *Kakt. Sukk.* (Dresden) 3: 45 (1968), (fide Hummel, U., *Kakt. and. Sukk.*: 37, 1978; AR, Salta?).

**Description:** Habit usually solitary, occasionally forming small clumps, depressed globose to globose to short cylindrical, 5–20cm high × 5–10cm diameter. Ribs 15–21, more or less dissolved into spiralled tubercles. Central spines 3–4, 0.5–2(–5)cm long, the lower-most hooked at apex, brown, red [or dark red with black tip]. Radial spines 7–20(–30), bristle-like, 0.4–0.8cm long, white. Flower 3–3.5cm high × 4–5cm diameter, yellow, orange or red, flower areoles with wool and bristles. Fruit nearly globose, 0.4–0.5cm diameter. Seeds with large white strophiole, <0.05cm long, smooth, glossy brown.

**Etymology:** Greek *microspermus*, from Greek *mikros*, small, and Greek *sperma*, seed; for the seeds dimensions.

**Habitat & Distribution:** Arid ‘Precordillera’ valleys and ‘quebradas’ in Argentina, 500–2800m.

**Ecological regions:** High Monte, and the Dry Chaco.

**Biomes:** Montane Grasslands and Shrublands, and the Tropical and Subtropical Dry Broadleaf Forests.

**Occurrence:** AR(CT,JY,LR,SA,SE,SJ,TM). Map 2.

**Comment:** Along with *P. maassii*, *Parodia microsperma* (F.A.C. Weber) Speg. represents the other dominant species within the Andean center of diversity of *Parodia* s.l.. The only external vicariant of the taxon is represented by *P. horrida* (see *Comment*), which can be defined as strong, being composed of numerous populations, with many individuals. The habitats that are colonized by the two species, which overlap in the area of Cafayate, Salta (AR), are represented by arid ‘Precordillera’ valleys and ‘quebradas’, 500–3000m, and the ecological regions involved are the High Monte, and the Dry Chaco. The biomes of reference are the Montane Grasslands and Shrublands, and the Tropical and Subtropical Dry Broadleaf Forests. The extension of the group’s geographical distribution goes from the provinces of San Juan (northeast) and La Rioja, in Argentina, in the south (*P. microsperma*), to the south-east of the province of Jujuy, always in Argentina, in the north (*P. microsperma*). We detected the dominant on many occasions, between the provinces of La Rioja (Olta, Dique), in the south, and that of Salta (‘quebradas’ of Rio Colorado and Rio Yacochuya, near Cafayate), in the north.

**37. *Parodia mueller-melchersii*** (Frič ex Backeb.) N.P. Taylor, *Bradleya* 5: 93 (1987). Basionym: *Notocactus mueller-melchersii* Frič ex Backeb.

#### Homotypic Synonyms

*Notocactus mueller-melchersii* Frič ex Backeb., *Kaktus-ABC*: 254, 415 (1936). T.: UY, nr. Montevideo, nd.

*Ritterocactus mueller-melchersii* (Frič ex Backeb.) Doweld, *Sukkulenty* 2(3): 22 (1999).

#### Heterotypic Synonyms

*Notocactus eugeniae* Vliet, *Succulenta* 55(2): 24, Fig. (1976). T.: UY, Tacuarembó, *Vliet* 41.9, (U).

*Parodia mammulosa* ssp. *eugeniae* (Vliet) Hoffacker, *Cactaceae Consensus Init.* 6: 11 (1998). Basionym: *Notocactus eugeniae* Vliet.

*Notocactus mammulosus* ssp. *eugeniae* (Vliet) Lodé, *Cact.-Avent. Int.* 98(Suppl.): 7 (2013). Basionym: *Notocactus eugeniae* Vliet.

*Ritterocactus mammulosus* ssp. *eugeniae* (Vliet) Doweld, *Sukkulenty* 2(3): 22 (1999). Basionym: *Notocactus eugeniae* Vliet.

*Notocactus gutierrezii* W.R. Abraham, *Kakt. and. Sukk.* 39(7): 152 (1988). T.: BR, Rio Grande do Sul, Uruguaiiana, 200m, *Abraham* 253 (KOELN).

*Notocactus mueller-melchersii* ssp. *gutierrezii* (W.R. Abraham) Lodé, *Cact.-Avent. Int.* 98(Suppl.): 8



**Figure 49.** *Parodia mueller-melchersii*. Uruguay, Tacuarembó, Tambores, 22 Nov. 2008, A&M 284.



**Figure 50.** *Parodia mueller-melchersii*. Uruguay, Rivera, Tranqueras, Valle del Lunarejo, 21 Nov. 2006, A&M 73.

(2013). Basionym: *Notocactus gutierrezii* W.R. Abraham.

*Parodia mueller-melchersii* ssp. *gutierrezii* (W.R. Abraham) Hofacker, *Cactaceae Consensus Init.* **6**: 11 (1998). Basionym: *Notocactus gutierrezii* W.R. Abraham.

*Ritterocactus mueller-melchersii* ssp. *gutierrezii* (W.R. Abraham) Doweld, *Sukkulenty* **2**(3): 22 (1999). Basionym: *Notocactus gutierrezii* W.R. Abraham.

*Parodia permutata* (F. Ritter) Hofacker, *Cactaceae Consensus Init.* **6**: 12 (1998). Basionym: *Notocactus permutatus* F. Ritter.

*Notocactus permutatus* F. Ritter, *Kakteen Südamerika* **1**: 188–189, Fig. 142 (1979). T.: BR, Rio Grande do Sul, São Gabriel, *Büneker* in Ritter 1455.

*Notocactus roseiflorus* H. Schloss. & Brederoo, *Kakt. and. Sukk.* **29**(12): 277 (1978). T.: UY, Schlosser 150, holo. (MVM).

*Notocactus rutilans* Däniker & Krainz, *Sukkulentenkunde* **2**: 19, Fig. (1948). T.: UY, Cerro Largo, border with BR, 'Nr. 724, lebend', SSZ.

*Parodia rutilans* (Däniker & Krainz) N.P. Taylor, *Bradleya* **5**: 93 (1987). Basionym: *Notocactus rutilans* Däniker & Krainz.

*Ritterocactus rutilans* (Däniker & Krainz) Doweld, *Sukkulenty* **2**(3): 23 (1999). Basionym: *Notocac-*

*tus rutilans* Däniker & Krainz.

*Parodia rutilans* ssp. *veeniana* (Vliet) Hofacker, *Cactaceae Consensus Init.* **6**: 12 (1998). Basionym: *Notocactus veenianus* Vliet.

*Notocactus veenianus* Vliet, *Succulenta* **53**: 171–173, Fig. (1974). T.: UY, Tacuarembó, Vliet 40.7 (U).

*Notocactus rutilans* ssp. *veenianus* (Vliet) Lodé, *Cact.-Avent. Int.* **98**(Suppl.): 8 (2013). Basionym: *Notocactus veenianus* Vliet.

*Ritterocactus rutilans* ssp. *veenianus* (Vliet) Doweld, *Sukkulenty* **2**(3): 23 (1999). Basionym: *Notocactus veenianus* Vliet.

*Notocactus winkleri* Vliet, *Succulenta* **54**(7): 136 (1975). T.: UY, Tacuarembó, 300m, Vliet 33.11 (U).

*Notocactus mueller-melchersii* ssp. *winkleri* (Vliet) Lodé, *Cact.-Avent. Int.* **98**(Suppl.): 8 (2013). Basionym: *Notocactus winkleri* Vliet.

*Parodia mueller-melchersii* ssp. *winkleri* (Vliet) Hofacker, *Cactaceae Consensus Init.* **6**: 11 (1998). Basionym: *Notocactus winkleri* Vliet.

*Ritterocactus mueller-melchersii* ssp. *winkleri* (Vliet) Doweld, *Sukkulenty* **2**(3): 23 (1999). Basionym: *Notocactus winkleri* Vliet.

**Description:** Habit solitary, stem globose to short cylindrical, 8[–22]cm high × 6[–9]cm diameter. Ribs

[17–]20–24, low, with small rounded tubercles. Central spines 1(–3), straight, awl shaped [or flattened, <2.3cm long, whitish] or pale yellow, darker or [dark red] at base and apex. Radial spines [10]–18, slender, <0.8cm long, whitish, [or whitish with dark red base and apex]. Flower 3cm high × 4.5–5cm diameter, pale golden-yellow, citron-yellow or reddish. Fruit elongating, 2(–3)cm high × [1.8]cm diameter, [dry, felted white, with reddish bristles], thin-walled, green.

**Etymology:** Named to honour Mr. Müller-Melchers, cactus collector of German descent living in Montevideo, Uruguay, supplying the Haage nursery with South American cacti.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Uruguay and Southern Brazil, 150–300m.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands.

**Occurrence:** BR(RS);UY(AR,MA,PA,RV,SA,TA). Map 6.

**Comment:** Our taxonomic understanding of *Parodia mueller-melchersii* (Frič ex Backeb.) N.P. Taylor, matches with that of *NCL* (Hunt *et al.*, 2006), that considers synonyms for the taxon to be *Notocactus winkleri* Vliet = *Parodia mueller-melchersii* ssp. *winkleri* (Vliet) Hofacker, and *Notocactus veenianus* Vliet = *Parodia rutilans* ssp. *veeniana* (Vliet) Hofacker. As already pointed out in a comment on the topic in our first booklet (Anceschi & Magli, 2010: 26–28), we consider the two taxa to be identifiers of different ontogenetic stages (semaphoronts) of *P. mueller-melchersii*. In this regard, we also noted how Backeberg's description (1936) which is almost unchanged with respect to the sizes in Hunt *et al.* (2006) and describes a taxon of about 8cm in height, 6cm in diameter, with a pale yellow central spine with dark edges, should be expanded to include the populations of the two mentioned taxa, with specimens reaching 20cm and more in height, specimens with a completely red central spine, and other specimens showing both characters (see description). In the same comment (*ibid.*), we stressed that populations of *P. mueller-melchersii* sometimes live in sympatry with those of *P. mammulosa* like, for instance, in Uruguay, Dpt. Tacuarembó, in the area between Valle Edén and Tambores. We also found that some forms of the two taxa are very similar to each other, so that in these forms the differences that should identify *P. mueller-melchersii* from *P. mammulosa*, i.e. the larger number of ribs of the first taxon (21–24 vs. 13–21), in addition to the not flattened central spines and the thinner radial spines, cannot always be considered distinctive elements. In our studies on the relationship within the complex of taxa next to *P. mammulosa* (Anceschi & Magli, 2014: 60–73), we propose *P. mueller-melchersii* as

an external vicariant of the first taxon, because apart from the alleged points of contact, a genetic autonomy is inferred by the fact that some semaphoronts which are identifiers of the taxon are not found in *P. mammulosa* (i.e. the *winkleri* and *veeniana* forms of *P. mueller-melchersii*). We worked on the taxon's populations in the north of Uruguay, in the areas of Cuchilla Negra (Dpt. Rivera), and in the south of the Cuchilla de Haedo (Dpt. Tacuarembó).

**38. *Parodia muricata*** (Otto ex Pfeiff.) Hofacker, *Cactaceae Consensus Init.* **6:** 12 (1998). Basionym: *Echinocactus muricatus* Otto ex Pfeiff.

#### Homotypic Synonyms

*Echinocactus muricatus* Otto ex Pfeiff., *Enum.*

*Diagn. Cact.:* 49 (1837). **T.:** BR, cult. hort. Berlin, nd.

*Malacocarpus muricatus* (Otto ex Pfeiff.) Britton & Rose, *Cactaceae* **3:** 194, Fig. 207 (1922), incorrect name (Art. 11.4).

*Notocactus muricatus* (Otto ex Pfeiff.) A. Berger, *Kakteen:* 210, 343 (1929).

*Peronocactus muricatus* (Otto ex Pfeiff.) Doweld, *Sukkulenty* **2(3):** 21 (1999), incorrect name (Art. 11.4).

#### Heterotypic Synonym

*Notocactus laetivirens* F. Ritter, *Kakteen Südamerika* **1,** 167–168, Figs. 105, 106 (1979). **T.:** BR, Rio Grande do Sul, Taquarichin, 1964, *Ritter* 1266, holo. (U).

**Description:** Habit solitary or clustering, [groups <39.5cm length × 36.5cm height], stem globose to short cylindrical, [6.5–9.5](–20)cm high × 7[–9]cm diameter, glaucous bright green. Ribs [15–17](–20), obtuse, [with a little hump below the areoles, sometimes] with wavy margins. Spines bristly, [sometimes needle-like or twisted on the same plant]. Central spines 3–4[–6, red or reddish, 0.6–]1.3cm long. Radial spines [11]–20, hairlike, <0.8 cm, white, [light yellowish or white with some reddish or yellowish]. Flower 3[–5]cm high × [5.3cm diameter, tepals long and narrow, 3.4cm high × 0.4cm width, yellow, style, stamens and anthers yellow, stigma lobes 11, purple red]. Fruit barrel-shaped, <1cm high, olive green when ripe.

**Etymology:** From Latin *muricatus*, muricate, having a surface roughened by numerous short points like the shell of Murex (a marine gastropod mollusc); for the rough surface of the central spines.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Southern Brazil, 300–700m.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands.

**Occurrence:** BR(RS). Map 7.



**Figure 51.** *Parodia muricata*. Brazil, Rio Grande do Sul, Nova Esperança do Sul, 16 Oct. 2011, A&M 770.

**Comment:** *Parodia muricata* (Otto ex Pfeiff.) Hoffacker represents a weak external vicariant in the complex of the constituents of the dominant *P. ottonis*. The weakness of the populations is due to the fact that the area of occupancy is less than 2000 km<sup>2</sup>, populations are few, the number of individuals in each population is not abundant, and the quality of habitat is constantly declining, due to grazing, agriculture and plantation of exotic species. The nearest taxon seems to be *P. gaucha*, another weak external vicariant of *P. ottonis*, which lives c. 275km south-east of the *P. muricata* area. We detected the species in the area of Nova Esperança do Sul, RS (BR), where the taxon lives in a zone of sandstone rocks among bushes, in sympatry with *P. oxycostata*.

**39. *Parodia neobuenekeri*** (F. Ritter)ANCESCHI & MAGLI, *Cactusinhabitat S. Amer.* 2005/2010: 33 (2010). Basionym: *Notocactus neobuenekeri* F. Ritter.

#### Homotypic Synonyms

*Notocactus neobuenekeri* F. Ritter, *Kakteen Südamerika* 1: 181–182, Fig. 126 (1979). T.: BR, Rio Grande do Sul, Camaquã, Feb 1965, *Büneker et al.* in Ritter 1397.

*Notocactus scopa* ssp. *neobuenekeri* (F. Ritter) Doweld, *Sukkulenty* 3(1–2): 55 (2000).

*Parodia scopa* ssp. *neobuenekeri* (F. Ritter) Hoffacker & P.J. Braun, *Cactaceae Consensus Init.* 6: 10 (1998).

*Peronocactus scopa* ssp. *neobuenekeri* (F. Ritter) Doweld, *Sukkulenty* 2(3): 21 (1999).

**Description:** Habit caespitose, [forming compact clumps, <87cm length × 41cm height, stem globose to briefly cylindrical, 9–12cm high × 5.5–6.3cm diameter]. Ribs 18–21, low, finely tuberculate. Central spines [1–4], strong, [golden yellow, the lower <2.5



**Figure 52.** *Parodia neobuenekeri*. Brazil, Rio Grande do Sul, Santana da Boa Vista, 30 Oct. 2011, A&M 796.

cm]. Radial spines 30–40, needle-like, <1cm long, [whitish] to yellowish. Flower 3.6cm high × 4cm diameter, pale yellow, stamens and anthers yellow, style purple, stigma lobes 10, dark purple. Fruit spherical, very small. Seeds slightly bell shaped, matt black.

**Etymology:** In Greek *neos* means “new”; to avoid a homonym vs. *Parodia buenekeri* (a synonym of *Parodia alacriportana*); named to honour Rudolf Heinrich Büneker, cactus collector of German descent in Rio Grande do Sul, Brazil, brother-in-law of Leopoldo Horst (see *P. horstii*), and father of Rudi W. Büneker.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Southern Brazil, up to 280m.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands.

**Occurrence:** BR(RS). Map 9.

**Conservation status:** Endangered, EN B1ab(ii,iii)+2ab(ii,iii) Justification: this species is listed as Endangered because the extent of occurrence is estimated to be less than 5000km<sup>2</sup>, the area of occupancy is much less than 500km<sup>2</sup>, population size is severely fragmented and the quality of the habitat is constantly declining due to the proximity of the few rocky outcrops where the species lives to lands destined for agriculture or grazing, with consequently human activity.

**Comment:** In the *NCL* treatment (Hunt *et al.*, 2006, text: 223, 310), among the recognized taxa at the intraspecific level as parts of *Parodia scopa* (Sprengel) N.P. Taylor, *Parodia neobuenekeri* (F. Ritter) ANCESCHI & MAGLI is the only taxon that deserves separate recognition at the specific level (ANCESCHI & MAGLI, 2010: 28, 33; 2013: 80), representing the ssp. *marchesii* and *succinea*, just mere variants with lighter spines within the range of the type species (*ibid.*, 2013: 78–80). As already ex-



**Figure 53.** *Parodia neobuenekeri*. Brazil, Rio Grande do Sul, Santana da Boa Vista, 30 Oct. 2011, A&M 796.

pressed, *P. neobuenekeri* clearly shows that it does not belong to the phyletic line of *P. scopa* because of the distinct form of growth, i.e. smaller stems and more compact with each other, forming large groups. The taxon lives in a very restricted area, between Minas de Camaquã and Santana da Boa Vista, RS (BR). Due to the limited extent of occurrence and area of occupancy, the severe fragmentation of the population, and the progressive habitat degradation (see *Conservation status*), the species represents a non-dominant, with a very fragmented distribution, within a restricted area of territory. We detected the taxon several times in its reference area, which in some cases shows sympatry with *Parodia neohorstii* (S. Theun.) N.P. Taylor.

**40. *Parodia neohorstii*** (S. Theun.) N.P. Taylor, *Bradleya* 5: 93 (1987). Basionym: *Notocactus neohorstii* S. Theun.

#### Homotypic Synonyms

*Notocactus neohorstii* S. Theun., *Succulenta* 60(6): 142 (1981), replaced synonym: *Wigginsia horstii* F. Ritter, *Kakteen Südamerika* 1: 199–200, Fig. 150 (1979). T.: BR, Rio Grande do Sul, Mine Camaquã [Minas de Camaquã], 1965, Rit-

ter 1402a, holo.(U).

*Peronocactus neohorstii* (S. Theun.) Doweld, *Sukkulenty* 2(3): 21 (1999), incorrect name (Art. 11.4). Basionym: *Notocactus neohorstii* S.Theun.

*Ritterocactus horstii* (F. Ritter) Doweld, *Sukkulenty* 3(1–2): 60 (2000). Basionym: *Wigginsia horstii* F. Ritter

*Wigginsia horstii* F. Ritter, *Kakteen Südamerika* 1: 199–200, Fig. 150 (1979). T.: BR, Rio Grande do Sul, Mine Camaquã [Minas de Camaquã], 1965, Ritter 1402a, holo.(U).

**Description:** Habit solitary, stem globose to briefly cylindrical, [6–11]cm high × 5–9cm diameter. Ribs 18–26, obtuse. Spines [pale below, dark red in the upper part, at apex, then whitish to greyish with dark tip]. Central spines [2, then 1], awl-shaped, straight, 1–3cm long. Radial spines 14–24, 0.3–[0.8]cm long, more slender, adpressed. Flower 2.5–4cm high × 2.5–3.5cm diameter, shiny to golden yellow,. Fruit 0,8cm high × 0.4cm diameter, hidden in the wool of the stem-apex. Seeds black, almost smooth.

**Etymology:** In Greek *neos* means “new”; to avoid a homonym vs. *Parodia horstii*; named to honour Leopoldo Horst, Brazilian of German origin, cactus



**Figure 54.** *Parodia neohorstii*. Brazil, Rio Grande do Sul, Caçapava do Sul, Minas do Camaquã, 31 Oct. 2008, A&M 262.



**Figure 56.** *Parodia nigrispina*. Paraguay, Dept. Cordillera, Tobatí, Cerro Tobatí, 14 Sep. 2011, A&M 751.

explorer, collector and exporter, in Rio Grande do Sul, Brazil.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Southern Brazil, up to 300m.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands.

**Occurrence:** BR(RS). Map 9.

**Comment:** Due to the limited extension of occurrence, the fragmentation of the populations and the small number of components within them, *Parodia neohorstii* (S. Theun.) N.P. Taylor, appears to be a non-dominant species with very fragmented distribution, within a restricted area of territory. The taxon, apart for the apical woolliness of the ex-



**Figure 55.** *Parodia nigrispina*. Paraguay, Dept. Cordillera, Tobatí, Cerro Tobatí, 11 Sep. 2011, A&M 249.

members of *Wigginsia*, does not show particular signs of proximity to other members of the genus, if not in adulthood, to some semaphoronts (see materials and methods) of *P. mueller-melchersii*. We studied the species on several occasions in the Minas de Camaquã area, RS (BR), where the scattered groups of the taxon sometimes live in sympatry with *P. neobuenekeri*.

**41. *Parodia nigrispina*** (K. Schum.) F.H. Brandt, *Kakteen Orch. Rundschau* 7(4): 61 (1982). Basionym: *Echinocactus nigrispinus* K. Schum.

#### Homotypic Synonyms

*Erioccephala nigrispina* (K. Schum.) Lodé, *Cact.-Avent. Int.* 99: 25, illus. (2013).

*Erioccephala schumanniana* ssp. *nigrispina* (K. Schum.) Guiggi, *Cactology* 3(Suppl. III): 1 (2012). [First used invalidly (Art. 35.1) by Guiggi in l.c. 3: 6, 2012.]

*Echinocactus nigrispinus* K. Schum., *Monatsschr. Kakteenk.* 9: 45 (1899). T.: PY, nr Paraguari, between Carepe-gua and Aca-ay, 160–220m, *Grosse* s.n. (B?†).

*Eriocactus nigrispinus* (K. Schum.) F. Ritter, *Kakteen Südamerika* 1: 256 (1979), incorrect name (Art. 11.4).

*Malacocarpus nigrispinus* (K. Schum.) Britton & Rose, *Cactaceae* 3: 190 (1922), incorrect name (Art. 11.4).

*Notocactus nigrispinus* (K. Schum.) Buining, *Succulenta* 49: 179 (1970).

*Notocactus schumannianus* ssp. *nigrispinus* (K. Schum.) T. Engel (1990), nom. inval. (Art. 33.3).

**Description:** Habit solitary or caespitose, stem initially globose becoming elongate, [6–30]–(40)cm high × [3.4]–16cm diameter. Ribs [16–25]. Spines [bristle-like, flexible, sometimes twisted, grey or white with dark tip, yellowish at the top. In old

plants, spines only at apex, bare (inactive) areoles in the lower part of the stem. Central spines 0–4(–5), when 4 forming a cross, <4.5 cm. Radial spines 2–7, 1–5cm long, the lower is the longest]. Flower funnellform, 6.5cm high × 7cm diameter, yellow. Fruit 2.5cm high × 1.5cm diameter, shiny brown. Seeds cap-shaped, matt black.

**Etymology:** From Latin *niger*, *nigra*, *nigrum*, black, and Latin *spina*, spine; refers to the colour of the spines [despite its name, *P. nigrispina* in habitat often has pale grey-coloured spines and not dark grey or black].

**Habitat & Distribution:** Sandstone rocky outcrops on the ex-Mata Atlantica area in South-East Paraguay, 100–400m.

**Ecological regions:** Alto Paraná Atlantic forests (Mata Atlantica & Selva Misionera), in eastern Argentina, southern Brazil and eastern Paraguay.

**Biomes:** Tropical and Subtropical Moist Broadleaf Forests.

**Occurrence:** PY(CR). Map 10.

**Conservation status:** Critically Endangered, CR B1ab(iii,v)+2ab(iii,v);C2a(i) Justification: this species is listed as Critically Endangered because the extent of occurrence is estimated to be less than 100 km<sup>2</sup>, and the area of occupancy is estimated to be much less than 10km<sup>2</sup>; the population is severely fragmented (from 2007 to 2011 we've encountered only two small populations in the zones comprised between Piribebuy, Caacupé, Tobatí and Atyrá), and quality of habitat due to deforestation (in this area, the Mata Atlantica forest is only a memory), and number of mature individuals due to collection for commerce, are in continuing decline. No subpopulation is estimated to contain more than 50 mature individuals (in September 2011 the total of the two subpopulations known, was approximately of 40 individuals in total). The taxon is almost extinct in the wild in Paraguay.

**Comment:** The taxon, historically related to (and perhaps not distinct from) *P. schumanniana*, is not *P. claviceps* (considered a ssp. of the first taxon in Hunt *et al.*, 2006), but *P. nigrispina*, as Gerloff *et al.* (1995: 142) have already suggested. In the first vague description of *Echinocactus nigrispinus* K. Schumann (1899: 45), the type is reported “between Carepe-gua and Aca-ay”, but in fact no population of *P. nigrispina*, as currently conceived, has ever been found in these areas, where instead only *P. schumanniana* lives. The current concept of *P. nigrispina* was fixed by Buining (1970: 179). In Schumann's description, he identified the populations in Dept. Cordillera (PY) above the location of Cholólo. These populations have their centre between the sandstone outcrops of the Silurian, sandstone of Caacupé (Esser, 1982:57–59), between Caacupé, Tobatí and the Yhaguy Guazu river, as was also reported by Gerloff *et al.* (1995: 142). The conditions for the survival of the taxon

are quite critical, as we have already stressed (Anceschi & Magli, 2010: 40; 2013a: 7, 38; 2013b: 105–106; see also *Conservation status*). Besides the geographical location north of the Dpts. Paraguari and Guairá, there are various distinctions listed by Buining to separate his *Notocactus nigrispinus* (K. Schumann) Buining from *Notocactus schumannianus* (Nicolai) A. Berger: the first shows a tendency to form groups compared to the second which has usually a simple growth; the first has shorter stems (<40cm compared with <180cm; the first also has stronger and less bristly spines, from dark grey to yellow compared with the second's bristly, thin spines, brown to yellowish (when young), then brown. Based on our studies in habitat the distinctions proposed by Buining are usually verifiable (even if it is now difficult for adult individuals to form groups). We have to add that, despite its name, *P. nigrispina* often has pale grey-coloured, not dark grey spines. In spite of this, the two taxa are very similar. The main reasons why we still distinguish *P. nigrispina* are the distinct distribution areas. The two species are parapatric: we have not yet found any area where the two intergrade. *P. nigrispina* can thus be described as a non-dominant species, with a very fragmented distribution, living within a restricted geographic area. From 2007 to 2011 we monitored two populations of the taxon, in the areas included between Piribebuy, Caacupé, Tobatí and Atyrá. During the last surveys (2011), we counted 40 individuals in total, versus the 27 counted in 2007 at the beginning of our monitoring. Despite the small improvement, mainly due to the fact that a population is difficult to access and the other is protected by one of the owners of the area, we think that the taxon is doomed to extinction in the wild.

**42. *Parodia nivosa*** Frič ex Backeb., *Blätt. Kakteenf. genus* 68, sp. 5, 12, Figs. 18–19 (1934). T.: AR, Salta, 2000m, screens, nd.

#### Heterotypic Synonyms

*Parodia crucinigriventra* Frič ex Subík, *Sukkulentenkunde* 4: 31, Fig. (1951), nom. inval. (Art. 32.1).

*Parodia faustiana* Backeb., *Kaktus-ABC*: 266, 415 (1936). T.: AR, Salta, nd.

*Parodia penicillata* Fehser & Steeg, *Succulenta* 1960: 77–78, ill. (1960). T.: AR, Salta, Cafayate, 1951, Fehser (L).

*Parodia uhligiana* Backeb., *Descr. Cact. Nov.* iii: 12 (1963), nom. inval. (Art. 8.4).

**Description:** Habit solitary [or clustering], stem initially globose becoming elongate, 15–30(–70)cm high × 7–12cm diameter. Ribs 17–20, dissolved in spiralled tubercles. Central spines 1–4, straight,





**Figure 57.** *Parodia nivosa*. Argentina, Salta, Quebrada del Toro, 14 Mar. 2007, A&M 157.



**Figure 58.** *Parodia nivosa*. Argentina, Salta, Cafayate, Quebrada del Rio Yacochuya, 6 Mar. 2007, A&M 149.



**Figure 59.** *Parodia nothorauschi*. Brazil, Rio Grande do Sul, Santana do Livramento, between BR 293 and Cerros Verdes, 11 Nov. 2011, A&M 819.

[needle-like, rarely flattened], 2–2.5(–5)cm long, almost white, pale yellow or rarely pale brown. Radial spines 18–40 or more, bristle-like, finer and shorter, 1.5–1.8cm long, white to glassy white. Flower 3–5cm high × 2.5–5cm diameter, orange yellow, blood-red, or bright red. Fruit spherical to elongated, 0.3–0.5(–0.7)cm diameter, first pink to reddish, then olive brown to grey when ripe. Seeds

0.05–0.06cm long, glossy brown to glossy dark brown, smooth or slightly structured.

**Etymology:** From Latin *nivosus*, full of snow; for the white spines of the taxon.

**Habitat & Distribution:** Arid 'Precordillera' valleys and 'quebradas', and pre-Puna rocky slopes, 1800–2000m.

**Ecological regions:** High Monte, and Central Andean Puna.

**Biomes:** Montane Grasslands and Shrublands.

**Occurrence:** AR(SA). Map 4.

**Conservation status:** Endangered, EN B1ab(ii,iii,v) Justification: this species is listed as Endangered because the extent of occurrence is estimated to be less than 5000 km<sup>2</sup>, the occupancy is known to exist at only four locations, area of occupancy, quality of habitat, and number of mature individuals are in continuing decline due to road construction and commercialization (Quebrada del Toro and Santa Rosa de Tastil areas), wild and indiscriminate commercialization by the only cactus nursery in Cafayate (Chuscha, Colorado and Yacochuya quebradas areas).

**Comment:** The last taxonomic change we faced in our synopsis of *Parodia* s.l. was the inclusion of the populations of *Parodia penicillata* Fechsner & Steeg among the synonyms for *Parodia nivosa* Frič ex Backeb. In fact, even if *NCL* (Hunt *et al.*,

2006, text: 222, 310), *NCL2* “illustration” (Hunt, 2013: xxvii), and *CCC3* (Hunt, 2016: 109) consider the first taxon as a distinct species, by comparing the two taxa in the habitats, there is no good reason to keep them separate. Doubts had already been expressed by Kiesling & Ferrari in these terms: “We decided, after considerable hesitation, to keep this species [*P. penicillata*] separate from *P. nivosa* for the morphological difference mentioned in the key, and for the differing flowering times. (1990b: 250). In fact, the two taxa are equal. Even the ‘characteristic’ tufts of spines, which should characterize *P. penicillata* (etymology: from Latin *penicillatus*, like an artist’s brush; for the arrangement of the spines on the areoles at the apex of the plant), are also found in *P. nivosa*. While including in the taxon the populations of *P. penicillata*, based on the justifications presented in the *Conservation status* (see above) we consider *P. nivosa* a seriously endangered non-dominant species with fragmented distribution. We extensively studied the taxon (*P. penicillata*) during our long stays in Cafayate, Salta (AR), in the Chuscha, Colorado and Yacochuya ‘Quebradas’, north of the small town. The populations of the type species were detected in several points of the Quebrada del Toro, Salta (AR).

**43. *Parodia nothorauschii*** D.R. Hunt, *Cactaceae Consensus Init.* 4: 6 (1997), replaced synonym: *Notocactus rauschii* Vliet, *Succulenta* 48: 3 (1969). T.: UY, Rivera, Cuchilla Negra, *Rausch* in *Vliet* 34 (U).

#### Homotypic Synonyms

*Notocactus rauschii* Vliet, *Succulenta* 48: 3 (1969). T.: UY, Rivera, Cuchilla Negra, *Rausch* in *Vliet* 34 (U).

*Ritterocactus rauschii* (Vliet) Doweld, *Sukkulenty* 2(3): 23 (1999).

#### Heterotypic Synonym

*Notocactus spinibarbis* F. Ritter, *Kakteen Südamerika* 1: 186–187 (1979). T.: Br, Rio Grande do Sul, about 12 or 15km north of Livramento, 1965, *Ritter* 1379b, holo. (U).

**Description:** Habit solitary [or rarely clustering], stem globose to short cylindrical, [10–]21cm high × [7.8–]16cm diameter. Ribs 20–28, with chin-like tubercles. Spines flexible. Central spines 4, [the lower flattened], <2.2 cm, [purplish pink]. Radial spines [14–]15, [thinner than centrals, and just curved than the centrals], <0.8cm long, [dirty white] to pale rose. Flower 3.5cm high × 5cm diameter, lemon yellow. Fruit elongate, thin walled, green, dehiscent, covered with white wool. Seeds bell shaped, black.

**Etymology:** In Greek *notho-* means “false, wrong”; to avoid a homonym vs. *Parodia rauschii* (a sy-

nonym of *Parodia aureicentra*).

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Northern Uruguay and Southern Brazil.

**Ecological regions:** Humid and Semi-arid Pampas of Argentina, Uruguay and Southern Brazil.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands.

**Occurrence:** BR(RS);UY(RV). Map 9.

**Comment:** About *Parodia nothorauschii* D.R. Hunt, we have already underlined the close affinity with *P. fusca* in the *Comment* to the latter taxon, to which we refer. As already expressed, *P. fusca* appears to be a weak external vicariant of a weaker taxon, precisely *P. nothorauschii*. We met the taxon only once in habitat, on flat rocky outcrops in the pampas northwest of Santana do Livramento, RS (BR).

**44. *Parodia ocampo*** Cárdenas, *Kakt. and. Sukk.* 6(1): 101, Fig. (1955). T.: BO, Cochabamba, Campero, nr Puente Arce, 1700m, Aug. 1952, *Cárdenas* 5044 (LIL, not found).

#### Homotypic Synonym

*Boliviacactus ocampo* (Cárdenas) Doweld, *Sukkulenty* 3(1–2): 62 (2000).

#### Heterotypic Synonyms

*Parodia augustinii* Weskamp, *Die Gattung Parodia* 3: 196 (1997). T.: BO, Dept. Cochabamba, Prov. Campero, Lagar Pampa, Heinz Swoboda & Karl Augustin (collectors), holo. AX 17800/B 17799 (ZSS).

*Parodia compressa* F. Ritter, *Cactus* (Paris) 17 (73/74): 9–10 (1962). T.: BO, Chuquisaca, Oropeza, Rio Chico, Dec. 1954, *Ritter* 385.

*Parodia copavilquensis* Weskamp, *Die Gattung Parodia* 3: 194, 193 (1997). T.: BO, Dept. Cochabamba, Prov. Oropeza, Copavilque, Heinz Swoboda & Karl Augustin (collectors), holo. AX 17777/B 17778 (ZSS).

*Parodia elachista* F.H. Brandt, *Kakteen Orch. Rundschau* 6(1): 2 (1981), (BO).

*Parodia zecheri* ssp. *elachista* (F.H. Brandt) F.H. Brandt, *Kakteen Orch. Rundschau* 13(1): 1 (1988), nom. inval. (Art. 33.3). Basionym: *Parodia elachista* F.H. Brandt.

*Parodia exquisita* F.H. Brandt, *Kakteen Orch. Rundschau* 3(2): 44–46 (1978), (BO).

*Parodia minuta* F. Ritter, *Kakteen Südamerika* 2: 546 (1980). T.: on the way from Marqueza to Sta. Ana, Prov. Vallegrande, 1958, *Ritter* 737, holo, (U).

**Description:** Habit sometimes solitary usually clustering, stem [club shaped to cylindrical], 7–[31]cm high × 6–11cm diameter. Ribs 13–[19], straight, well defined. Spines [awl shaped], reddish



**Figure 60.** *Parodia ocampoi*. Bolivia, Chuquisaca, Ruta 5, S. of Puente Arce, 22 Mar. 2014, A&M 1083.

to light brown becoming grey with age. Central spines 1, usually shorter than radials, 0.4–0.5(–2.5)cm long. Radial spines 8–9, radiating, 0.4–1(–2.5)cm long. Flower 3cm high × 5cm diameter, golden yellow. Fruit globular, c. 0.4cm diameter, whitish to slightly pink. Seeds glazing black-brown to red-black.

**Etymology:** The epithet *ocampoi* means “from the Ocampo site”, named to honour E. Ocampo, the first to discover the species, in September 1951, near Puente Arce, Prov. Campero, Dept. Cochabamba, Bolivia.

**Habitat & Distribution:** Arid inter-Andean rocky valleys, 1700–1900m.

**Ecological regions:** Bolivian Montane Dry Forest.

**Biomes:** Montane Grasslands and Shrublands.

**Occurrence:** BO(CB,CQ). Map 3.

**Comment:** As already noted in the *Comment to P. columnaris*, *Parodia ocampoi* Cárdenas appears to be a strong external vicariant of the first taxon. In fact, the populations are compact and composed by numerous individuals, albeit in a restricted area of territory. Although at first sight the two taxa in habitat appear similar, *P. ocampoi* is distinguished by the higher number of ribs, <19 vs. 12–17, and the different pattern of the spines, mainly awl-shaped in *P. ocampoi* vs. curved in *P. columnaris*. We carried out several surveys on the taxon in the Rio Grande area north of Sucre, between the provinces of Chuquisaca and Cochabamba.

**45. *Parodia otaviana*** Cárdenas, *Cactus* (Paris) 18(78): 94–95, illus. (1963). T.: BO, Potosi, Linares, Pampa de Otavi, 3400m, Apr. 1958, Cárdenas 5561 (LIL, not found).

#### Homotypic Synonym

*Boliviacactus otavianus* (Cárdenas) Lodé, *Cact.-Avent. Int.* 101: 14 (2014).



**Figure 61.** *Parodia otaviana*. Bolivia, Chuquisaca, Tacaquira, 1 Jul. 2011, A&M 595.

**Description:** Habit usually solitary, stem globose [to elongated globose, 9.5–17cm high × 7.5–19cm diameter], grey-green. Ribs [12–]13, acute, [spiralled]. Spines, mainly straight and acicular, [flexible], white [or white with orange tips, orange the young spines at the apex. Central spines 1–4, the lower <4cm long. Radial spines 9–13, the lower slightly curved, <3.1 cm]. Flower tubular or urceolate, 3cm long, yellow-orange.

**Etymology:** Referring to the place of its first discovery, Pampa de Otavi, Prov. Linares, Dept. Potosi, Bolivia

**Habitat & Distribution:** Pre-Puna rocky slopes, 3100–3400m.

**Ecological regions:** Central Andean Puna.

**Biomes:** Montane Grasslands and Shrublands.

**Occurrence:** BO(CQ,PO). Map 1.

**Comment:** Strong external vicariant in the complex of the dominant *P. maassii*, *P. otaviana* is constituted by numerous populations, in turn composed of numerous individuals. Given the proximity of the holomorphologies of the two taxa, we cannot exclude the hypothesis that the latter can be interpreted as an internal vicariant of the group (see Anderson, 2001: 545; Anderson & Egli, 2011: 503), but having not detected cases of possible genetic flow between the two, we note that the white spination is certainly a constant and distinctive character in the populations of *P. otaviana*. We detected the taxon on different occasions in the Tacaquira area, Chuquisaca (BO), sometimes in sympatry with *Parodia ritteri* Buining.

**46. *Parodia ottonis*** (Lehmann) N.P. Taylor, *Bradleya* 5: 93 (1987). Basionym: *Cactus ottonis* Lehm.

#### Homotypic Synonyms

*Cactus ottonis* Lehm., *Index Sem.* (Hamburg) 16. (1827). T.: XC, hort. bot. Hamburg, 1827, np.



**Figure 62.** *Parodia ottonis*. Brazil, Rio Grande do Sul, Santana da Boa Vista, 30 Oct. 2011, A&M 798.

- Echinocactus ottonis* (Lehm.) Link & Otto, *Icon. Pl. Rar.*: 31, t. 16, (1828).  
*Malacocarpus ottonis* (Lehm.) Britton & Rose, *The Cactaceae* 3: 195, pl. 20, (1922), incorrect name (Art. 11.4).  
*Notocactus ottonis* (Lehm.) A. Berger, *Kakteen*: 212, 343 (1929).  
*Peronocactus ottonis* (Lehm.) Doweld, *Sukkulenty* 2(3): 20 (1999), incorrect name (Art. 11.4).

#### Heterotypic Synonyms

- Echinocactus arechavaletae* Speg., *Anales Mus. Nac. Buenos Aires ser.* 3, 4: 496 (1905), (AR), as “*Arechavaletai*”.  
*Malacocarpus arechavaletae* (Speg.) A. Berger, *Kakteen*: 207, 342 (1929), incorrect name (Art. 11.4). Basionym: *Echinocactus arechavaletae* Speg.  
*Notocactus arechavaletae* (Speg.) Herter, *Revista Sudamer. Bot.* 7: 216 (1943), as “*Arechavaletai*”. Basionym: *Echinocactus arechavaletae* Speg.  
*Notocactus campestris* F. Ritter, *Kakteen Südamerika* 1: 177, Fig. 119 (1979). T.: BR, Rio Grande do Sul, Campestre, 1964, *Ritter* 1398, holo. (U).  
*Notocactus eurypleurus* Prestlé, *Minimus* 1991(1–3): 43–46 (1991), non. inval. (Art. 36.1, 37.1).  
*Parodia glaucina* (F. Ritter) Hofacker & M. Machado, *Kakt. and. Sukk.* 63(2): 44 (2012). Basionym: *Notocactus glaucinus* F. Ritter.  
*Notocactus glaucinus* F. Ritter, *Kakteen Südamerika* 1: 168, Fig. 107 (1979). T.: BR, Rio Grande do Sul, Santiago, 1965, *Ritter* 1376, holo. (U).  
*Notocactus globularis* F. Ritter *Kakteen Südamerika* 1: 167, Fig. 104 (1979). T.: UY, Riveras [Rivera], next to the Brazilian border, grows also on the Brazilian side near the border, 1965, *Ritter* 1388, holo. (U).  
*Notocactus gracilis* Gemmrich, *Internoto* 17(3): 98 (1996), (BR, Rio Grande do Sul), non. inval. (Art. 34.1b).  
*Parodia oxycostata* ssp. *gracilis* (F. Ritter) Hofacker, *Cactaceae Consensus Init.* 6: 12 (1998). Basionym: *Notocactus glaucinus* var. *gracilis* F. Ritter.  
*Notocactus oxycostatus* ssp. *gracilis* (F. Ritter) Doweld, *Sukkulenty* 3(1–2): 54 (2000). Basionym: *Notocactus glaucinus* var. *gracilis* F. Ritter.  
*Peronocactus oxycostatus* ssp. *gracilis* (F. Ritter) Doweld *Sukkulenty* 2(3): 21 (1999), incorrect name (Art. 11.4). Basionym: *Notocactus glaucinus* var. *gracilis* F. Ritter.  
*Notocactus glaucinus* var. *gracilis* F. Ritter, *Kakteen Südamerika* 1: 168–169, Fig. 108 (1979). T.: BR, Rio Grande do Sul, São Francisco de Assis, 1965, Horst & Ritter in *Ritter* 1378, holo. (U).  
*Notocactus grandiensis* Bergner *Internoto* 10(2): 43 (1989), (BR), nom. inval. (Art. 36.1, 37.1).  
*Parodia nothominuscula* ssp. *gravior* Hofacker, *Kakt. and. Sukk.* 51(9): 234–236, Figs. 1–8, tab. 1 (2000), (BR, Rio Grande do Sul, Near Torrinhas). T.: Hofacker 380, holo. (PACA), iso. (ZSS).  
*Notocactus harmonianus* F. Ritter, *Kakteen Südamerika* 1: 176–177, Fig. 118 (1979). T.: BR, Rio Grande do Sul, west of Harmonia, 1965, *Ritter* 1414, holo. (U).  
*Parodia ottonis* ssp. *horstii* (F. Ritter) Hofacker *Cactaceae Consensus Init.* 6: 12 (1998). Basionym: *Notocactus arechavaletae* var. *horstii* F. Ritter  
*Notocactus ottonis* ssp. *horstii* (F. Ritter) Doweld, *Sukkulenty* 3(1–2): 55 (2000). Basionym: *Notocactus arechavaletae* var. *horstii* F. Ritter.  
*Peronocactus ottonis* ssp. *horstii* (F. Ritter) Doweld, *Sukkulenty* 2(3): 21 (1999), incorrect name (Art. 11.4). Basionym: *Notocactus arechavaletae* var. *horstii* F. Ritter.  
*Notocactus arechavaletae* var. *horstii* F. Ritter, *Kakteen Südamerika* 1: 166, Fig. 101 (1979). T.: BR, Rio Grande do Sul, Três pontes, Horst in *Ritter* 1027c, holo. (U).  
*Notocactus incomptus* N. Gerloff, *Internoto* 11(2–3): 37–41 (1990), (BR, Rio Grande do Sul). T.: Horst & Uebelmann 96, holo.: deposited in the herbarium of the Succulent collection, Zurich/CH.  
*Notocactus miniatispinus* (F. Ritter) Havlíček, *Kakt. Vilag* 18(4): 73 (1989). Basionym: *Notocactus securituberculatus* var. *miniatispinus* F. Ritter.  
*Notocactus securituberculatus* var. *miniatispinus* F. Ritter, *Kakteen Südamerika* 1: 169, Fig. 111, (1979). T.: BR, Rio Grande do Sul, 1965, *Ritter* 1375, holo. (U).  
*Notocactus minusculus* Hofacker & K. Herm, *Internoto* 17(3): 75–79 (1996). T.: BR, Rio Grande

do Sul, W. of Santana da Boa Vista, 20 Nov 1990, *Hofacker* 71, holo. (ZSS), iso. (PACA).

*Peronocactus minusculus* (Hofacker & K. Herm) Doweld, *Sukkulenty* 2(3): 21 (1999), incorrect name (Art. 11.4). Basionym: *Notocactus minusculus* Hofacker & K. Herm.

*Parodia nothominuscula* Hofacker, *Cactaceae Consensus Init.* 6: 11 (1998), replaced synonym: *Notocactus minusculus* Hofacker & K. Herm, *Internoto* 17(3): 75–79 (1996). T.: BR, Rio Grande do Sul, W. of Santana da Boa Vista, 20 Nov 1990, *Hofacker* 71, holo. (ZSS), iso. (PACA).

*Notocactus ottoianus* Y. Itô, *Explan. Diagn. Austroechinocactinae*: 247 (1957), nom. illeg. (Art. 52.1).

*Parodia paraguayensis* Speg., *Anales Soc. Ci. Argent.* 96: 70 (1923). T.: PY, Sierra de Amambay, “ad fissuras rupium in Sierra de Amambay”, Sept. 1833, lg. Karl von Guelich, holo. Flower, illus. (LP).

*Notocactus ruoffii* N. Gerloff, *Internoto* 15(4): 115–119 (1993), (UY). T.: *H. Ruoff* 88, holo.: deposited in the herbarium of the National Museum of Natural History Stuttgart/D.

*Notocactus securituberculatus* F. Ritter, *Kakteen Südamerika* 1: 169, Fig. 110 (1979). T.: BR, Rio Grande do Sul, Quevedos, 1965, *Ritter* 1377a, holo. (U).

*Echinocactus tenuispinus* Link & Otto, in *Verh. Preuss. Gartenb. Ver.* iii: 421, tab. 19, Fig. 1 (1827), (“Habitat in Brasiliae provincia Rio Grande. Sellow.”). T.: tab. 19, Fig. 1.

*Notocactus tenuispinus* (Link & Otto) Herter, *Cactus* (Paris) 10(44), 177 (1955). Basionym: *Echinocactus tenuispinus* Link & Otto.

*Echinocactus tortuosus* Link & Otto, *Icon. Pl. Rar.*: 29, t. 15. (1828).

*Notocactus uruguayus* (Arechav.) Herter, *Revista Sudamer. Bot.* 7: 217 (1943). Basionym: *Echinocactus ottonis* var. *uruguayus* Arechav.

*Echinocactus ottonis* var. *uruguayus* Arechav., *Anales Mus. Nac. Montevideo* 5: 213, tab. 13. (1905), (UY).

**Description:** Habit solitary at first, later clustering, stem [depressed globose to] globose [to short cylindrical], [sometimes] tapered at base, [2.5–20.5cm high × 2.2–11](–15)cm diameter. Ribs 6–16, well-defined, rounded or acute. Spines [thin, rigid], straight, curved, or twisted, [pale yellow with reddish base or tip] reddish brown, light to dark brown, [or dark red]. Central spines [0]–4(–6), [when 4 forming a cross], 0.8–4cm long, [sometimes darker than the radials]. Radial spines (4–)[7–20], 0.5–3cm long. Flower 5–6cm high × [5.4–7.1]cm diameter, yellow or rarely orange-red, stigma lobes usually red or purple, rarely orange to yellow, flowering areoles with brownish wool and bristles. Fruit ovoid to short cylindrical, 0.9–1.2cm diameter, thick-walled, dehiscent, pulp white. Seeds bell

-shaped, strongly tuberculate, glossy black.

**Etymology:** Named to honour Christoph Friedrich Otto, German botanist and horticulturist, 1805–1843 inspector of the Botanical Garden in Berlin.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Argentina, Uruguay, and Southern Brazil, and on the ex-Mata Atlantica area in South-east Paraguay, up to 1000m.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil, and Alto Paraná Atlantic forests (Mata Atlantica & Selva Misionera), in eastern Argentina, southern Brazil and eastern Paraguay.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands, and the Tropical and Subtropical Moist Broadleaf Forests.

**Occurrence:** AR(CN,ER,MN);BR(RS);PY;UY. Map 7.

**Comment:** With *P. erinacea* and *P. mammulosa*, *Parodia ottonis* (Lehmann) N.P. Taylor represents the third dominant species within the center of diversity of *Parodia* s.l., in the lowland pampas regions of north-eastern Argentina, southern Brazil, and Uruguay, and in the ex-Mata Atlantica region in southern Paraguay. The taxon highlights a strong vicariant, represented by *P. linkii*: a species with a large extension of occurrence, numerous populations with numerous individuals within them, and a genetic potential that appears second only to that of the dominant. The *P. ottonis* complex, besides *P. linkii*, includes seven weak external vicariants, namely: *P. carambeiensis*, *P. gaucha*, *P. ibicuiensis*, *P. muricata*, *P. oxycostata*, *P. stockingeri* and *P. tenuicylindrica*. This extended group of external vicariants is considered weak, since more or less all members have limited areas both of extension and occupancy, scarce and fragmented populations, mostly composed of a low number of individuals (see comments to the relevant taxa). A possible hypothesis to justify the considerable number of the *P. ottonis*' external vicariants, and the precariousness almost all of them show, would lead us to consider the idea of an occurred “radiation” in Hennig’s sense (1966: 216–217), i.e. an accumulation of dichotomous cleavage in a relatively short period of time, with not always successful evolutionary results, as in the cases of *P. ottonis* and *P. linkii*. The hypothesis is also in line with the results of the molecular data relating to three of the taxa within the complex, i.e. *P. ottonis*, *P. tenuicylindrica* and *P. linkii* (Nyffeler & Eggli, 2010). The habitat colonized by the *P. ottonis* complex is rather homogeneous, and consists essentially of pampa grasslands with rocky outcrops in Argentina, Uruguay, and Southern Brazil, 50–1000m, pampas grasslands with rocky outcrops at the border with the Araucaria moist forests ecoregion in Southern Brazil, 900–1000m (*P. carambeiensis*), and the ex-Mata Atlantica area in South-east Paraguay (*P. ottonis*). The ecological regions involved are Humid

and Semi-arid Pampas of Argentina, Uruguay and Southern Brazil, and the Alto Paraná Atlantic forests (Mata Atlântica & Selva Misionera), in eastern Argentina, southern Brazil and eastern Paraguay. The biomes of reference are the Tropical and Subtropical Grasslands, Savannas, and Shrublands, and the Tropical and Subtropical Moist Broadleaf Forests. The extension of the geographical distribution of the complex goes from the area of Piriapolis and Punta Ballena, Dpt. Maldonado (UY), in the south (*P. ottonis*), to the areas of Eusebio Ayala, Itacurubí, Piribebuy, and Valenzuela, all in the Dpt. Cordillera (PY), in the north (*P. ottonis*). We found *P. ottonis* on manifold occasions, in all the colonized habitats in Argentina, Brazil, Paraguay and Uruguay. Despite the smaller extension of occurrence with respect to the other two dominants of *Parodia* in the pampas area (*P. erinacea* and *P. mammulosa*), *P. ottonis* is certainly the species with the largest area of occupancy. In the State of Rio Grande do Sul (BR), however anthropized and deteriorated habitats can appear, on the surviving rocky outcrops (maybe even a few rocks on the edge of inhabited centres), there are often some specimens of the taxon waiting for you.

**47. *Parodia oxycostata*** (Buining & Brederoo) Hofacker, *Cactaceae Consensus Init.* 6: 12 (1998). Basionym: *Notocactus oxycostatus* Buining & Brederoo.

#### Homotypic Synonyms

*Notocactus oxycostatus* Buining & Brederoo, *Die Kakteen* [Lieferungen] 50–51: [unpag.], illus. (1972). T.: BR, Rio Grande do Sul, E. of São Gabriel, 300m, *Horst & Uebelmann* 229 (U).

*Peronocactus oxycostatus* (Buining & Brederoo) Doweld, *Sukkulenty* 2(3): 21 (1999), incorrect name (Art. 11.4).

#### Heterotypic Synonym

*Notocactus acutus* F. Ritter, *Kakteen Südamerika* 1: 169–170, Fig. 235 (1979). T.: BR, Rio Grande do Sul, Quevedos, 1965, *Ritter* 1377, holo. (U).

**Description:** Habit solitary, rarely offsetting, stem depressed globose to globose, [3.5–7.5](–9)cm high × [7–8](–9)cm diameter. Ribs [6–9](–10), very sharp, deep, wide at the base, 2–2.2cm high × 3.5–4cm width. Spines curved or twisted, [reddish yellow, reddish brown, red or dark red]. Central spines 1[–3], [1.5–]2cm long. Radial spines [7–11], [1.5]–2.5cm long. Flower bell to funnel shaped, 5cm high × 4.5cm diameter, tepals 0.9cm high, yellow, stigma lobes c. 12, red. Fruits 2.5–2.7cm high × 1–1.2cm diameter. Seeds helmet-shaped, shiny black.

**Etymology:** From Greek *oxys*, sharp, acute, and Latin *costatus*, ribbed; referring to the acute angles of the ribs, i.e. very sharp, wide at the base and deep.



**Figure 63.** *Parodia oxycostata*. Brazil, Rio Grande do Sul, Santiago, between Santiago and Nova Esperança do Sul, 16 Oct. 2011, A&M 768.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Southern Brazil, up to 500m.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands.

**Occurrence:** BR(RS). Map 7.

**Conservation status:** Endangered, EN B2ab(ii,iii)+2ab(ii,iii);C2a(i) Justification: this species is listed as Endangered because the area of occupancy is estimated to be much less than 500 km<sup>2</sup>, subpopulations are severely fragmented, the area of occupancy and quality of habitat is constantly declining due to the proximity of the small rocky outcrops where the species lives to land destined for agriculture, with consequent human activity. Population size is estimated to number fewer than 2,500 mature individuals, no subpopulation is estimated to contain more than 250 mature individuals.

**Comment:** As already pointed out in our booklet of 2013 (Anceschi & Magli, 2013: 76–78), the characters that distinguish *Parodia oxycostata* (Buining & Brederoo) Hofacker from all other members of the group of *Parodia ottonis* (Lehmann) N.P. Taylor, in the description of *Notocactus oxycostatus* Buining & Brederoo (1972: 50–51), are the low number of ribs (6–7) with acute angles; i.e. very sharp, wide at the base (3.5–4 cm) and deep (2–2.2 cm). Without these precise characteristics, *P. oxycostata* cannot be recognized. On the contrary, as described in *NCL* (Hunt *et al.*, 2006, text: 222, 310; atlas: 314, tabs. 314.1, 314.2, 314.3), *P. oxycostata* appears to be a taxon with uncertain limits and poorly understood. The boundaries that should divide some populations of the taxon conceived are easily labile (the ssp. *gracilis*), from the variable and dominant *P. ottonis*. The most tangible example of this confusion are the images that illustrate the taxon in *NCL* (*ibid.*). If we compare the two



**Figure 64.** *Parodia prestoensis*. Bolivia, Chuquisaca, S.E. Tarabuco, road to Icla, 13 Mar. 2014, A&M 1041



**Figure 65.** *Parodia prestoensis*. Bolivia, Chuquisaca, between Tarabuco and Sucre, 3224m, 15 Mar. 2014, A&M 1068



**Figure 66.** *Parodia prestoensis*. Bolivia, Chuquisaca, Icla, N. of Icla, 2587m, 13 Mar. 2014, A&M 1056

photos illustrating *P. ottonis* (ibid.: 313, tabs. 313.3, 313.4) with Fig. 314.3 *Parodia oxycostata* ssp. *gracilis*, we note that these three plants, in habitat, could be part of the same natural population. All carry at least 11 ribs, and none of them show the sharp and deep ribs of *P. oxycostata*. Also Fig. 314.1 *Parodia oxycostata* ssp. *oxycostata* (*P. nothominuscula*), is nothing more but one of the possible variant forms of *P. ottonis*, so much so that the ribs show exact opposite characteristics from what is required by the description of *P. oxycostata*. The taxon is finally illustrated in Fig 314.2, *Parodia oxycostata* ssp. *oxycostata*: a specimen with a few (8), sharp and deep ribs. The confusion arose from

the idea of expanding the concept of one species, which is infrequently encountered in habitat, and whose populations (or better, groups) are composed of a small number of individuals, spreading over a relatively large portion of territory. This expanded concept now includes in *P. oxycostata*, groups of taxa with quite heterogeneous characters, the most part published by Ritter in *Kakteen in Südamerika* 1 (1979). They are: *Notocactus glaucinus* Ritter, *Notocactus glaucinus* var. *gracilis* Ritter, *Notocactus glaucinus* var. *depressus* Ritter, *Notocactus securituberculatus* Ritter, *Notocactus securituberculatus* var. *miniatispinus* Ritter, *Notocactus acutus* Ritter, *Notocactus harmonianus* Ritter, and finally *Notocactus campestris* Ritter. The taxa in question, as just pointed out, are mutual bearers of rather heterogeneous characters ranging in fact from *N. glaucinus* with 9–12 ribs, straight, in triangular section, 1–2cm high, up to *N. harmonianus* with 15 ribs, obtuse, 0.5–0.7cm high. Probably this confused idea on the definition of the taxon was born with Hofacker's publication (1998: 12) of one of the Ritter's taxa (*N. glaucinus* var. *gracilis*), as a subspecies of *P. oxycostata*, with the name *Parodia oxycostata* ssp. *gracilis* (F. Ritter) Hofacker. Now if *N. glaucinus* has little to do with *P. oxycostata*, except the height of the ribs, its var. *gracilis* has even less. Ritter tells us only that the overall body is smaller, and that the ribs are lower and less deeply dentate (Ritter, 1979: 168–169), therefore even further from the characteristics of *P. oxycostata*. All the taxa mentioned show less sharp ribs, and in greater numbers than in the description of *N. oxycostatus*, or rather, all except one. The only taxon that seems to be seriously morphologically related to *P. oxycostata* is *N. acutus*. The description of *N. acutus*, seems to be a natural extension of the description, maybe too restrictive, of *N. oxycostatus*. The ribs are in fact acute at the apex and sharp, as shown in the photo of the taxon in Ritter (1979:

355, Fig. 235), and the number of ribs goes from 6–7, 3.5–4cm wide (in *P. oxycostata*), to 7–9, 3cm wide (in *N. acutus*). We believe that the concept of *P. oxycostata* (for having a distinctive meaning, within the *P. ottonis* complex, and at the same time being close to the description of *N. oxycostatus*) could at most include *N. acutus*, the only taxon that seems to be really conspecific. This is a concept already highlighted by Gerloff *et al.* (1995: 64), even if these authors also included in *N. oxycostatus* the forms of *N. securituberculatus*. We believe that all the other taxa assigned by Hunt *et al.* (2006, text: 310) to *P. oxycostata*, with the exclusion of *Notocactus ibicuiensis* (see *Comment* to *P. ibicuiensis*), should be attributed to the dominant and variable *P. ottonis*, which can have 6–15 or more, indifferently rounded or acute ribs. For these reasons, *P. oxycostata* appears to be a weak external vicariant with very fragmented distribution, in the complex of *P. ottonis*. We met the taxon on a few occasions in the habitats of the Rio Grande do Sul, between Santiago and Nova Esperanza do Sul, sometimes casually, in groups of few individuals, very distant from each other.

**48. *Parodia prestoensis*** F.H. Brandt, *Kaktus* 11(3): 54, illus. (1976). T.: BO, Chuquisaca, mts. beyond Presto, *Brandt* 33/a (HEID).

#### Heterotypic Synonym

*Parodia sotomayorensis* F. Ritter, *Kakteen Südamerika* 2: 530, Figs. (1980). T.: BO, Chuquisaca, above Sotomayor, at the Rio Pilcomayo, 1958, *Ritter* 734, holo. (U).

**Description:** Habit [usually] simple, stem depressed globose [to globose to cylindrical, with basal offshoots in age, (3.5–)6.7–14.2(–21)cm high × 7–11.5(–13.3)cm diameter. Sometimes the low part of the stem (c. 11cm), completely covered by spines, sometimes apically woolly with orange spines]. Ribs 13[–20, 1(–2.4)cm wide in the high part of the stem], prominent, [straight, spiralled or slightly spiralled, sometimes tuberculated]. Areoles oval, 0.5cm diameter. Spines, [sometimes the highest (centrals and radials) cone-shaped or needle-like, and the lower ones (centrals and radials) subulated and flattened. Central spines 4, forming a cross, straight, the lower <3.6](–8.2) cm, [red, reddish, brown, light brown, brownish or violet light brown, darker than the radials, then grey or light grey]. Radial spines [(7–)10–12](–15), [slightly cone-shaped, or flexible, needle-like, straight, rounded or twisted, <2.35cm, pink, pale pink, light yellowish, grey, light grey, or white]. Flower [1.15cm high × 1.3cm diameter], tepals [yellow to] golden yellow [to orange yellowish, style yellow orange, stigma lobes light yellow, stamens closed to the base of the style, with light yellow anthers, forming a ring around the style]. Fruit 0.4cm high,

brown. Seeds 0.1cm long x 0.08cm diameter, black. **Etymology:** In Latin -ensis (m., f.) means “coming from”; prestoensis referring to the place of its first discovery, near the village of Presto, Chuquisaca, Bolivia.

**Habitat & Distribution:** Arid inter-Andean rocky valleys, and pre-Puna rocky slopes, 2800–3100m.

**Ecological regions:** Bolivian Montane Dry Forest, and the Central Andean Puna.

**Biomes:** Montane Grasslands and Shrublands.

**Occurrence:** BO(CQ). Map 3.

**Comment:** Considered a synonym of *Parodia procera* F. Ritter in Anderson (2001, 551) and in Anderson & Egli (2011, 510), *P. prestoensis* is accepted as a good species in Hunt *et al.* (2006) but defined as 'doubtfully distinct from *P. procera* but with more spines' in the note accompanying the text. In our judgment the two taxa are not particularly related (see also next comment to *P. procera*), in fact, in addition to the 175km between them as the crow flies, on average the populations of *P. prestoensis* show a tuberculated rib, not conspicuous in *P. procera*. A series of surveys carried out by us in 2014, also highlighted the autonomy of the taxon with respect to the *P. maassii* group (see comment on *P. tuberculata*). Following an observation by Lowry (2018, pers. comm.), we preferred to include *P. sotomayorensis* F. Ritter among the synonyms of *P. prestoensis* rather than those of *P. tuberculata* as in Hunt *et al.* (2006). In fact, the taxon photographed by Ritter (1980, Abb. 392) shows a plant with straight spines, more similar to the *P. prestoensis* populations of the Icla Valley than to those of *P. tuberculata*. Although the species occupies a limited portion of territory (about 900km<sup>2</sup>), mainly in the valleys of Presto and Icla and in an area west of Tarabuco, and consists of a limited number of populations, it is present in large and compact groups, dense in individuals. *P. prestoensis* therefore manifests itself as a relatively dominant species in the restricted colonized area. We detected the taxon in pre-Puna rocky slopes to the West of Tarabuco (Umbate and W. of Umbate) and in arid inter-Andean rocky valleys from Tarabuco to Icla in the southeast direction, 2587–3238m.

**49. *Parodia procera*** F. Ritter, *Taxon* 13(3): 117 (1964). T.: BO, Chuquisaca, Sud-Cinti, “region of mouth of Río Challamarca”, s.a., *Ritter* 742, type herbaria: (U 117823B), (SGO), (ZSS, seeds only) [holotype cited, for U in *Taxon* 12(1): 28].

#### Homotypic Synonym

*Boliviacactus procerus* (F. Ritter) Doweld, *Sukkulenty* 3(1–2): 62 (2000).

#### Heterotypic Synonyms

*Parodia andreae* H. Brandt, *Stachelpost* 8: 145–147 (1972).





**Figure 67.** *Parodia procera*. Bolivia, Tarija, N of San Lorenzo, Caraparí valley, m 1724, 22 Feb. 2014, A&M 988.

*Parodia andreaeoides* F.H. Brandt, *Stachelpost* **50**: 38–40, Figs. (1974), (BO). T.: Brandt 27/a, holo. Herb. Brandt.

*Parodia challamarca* F.H. Brandt, *Stachelpost* **8**: 1–4 (1972). T.: BO, Chuquisaca, Sud Cinti 2200m, type herbaria: (sheet specimen) rad, corp, ar, sp, fl (ZSS), herb. ID ZSI 020.159.

*Parodia gracilis* F. Ritter, *Succulenta* **43**: 23 (1964). T.: BO, Tarija, Mendez, Alto España, 1958, Ritter 740, holo. (U).

*Parodia lychnosa* F.H. Brandt, *Kaktus* **10**(2): 42 (1975), (BO).

*Parodia perplexa* F.H. Brandt, *Kakteen Orch. Rundschau* **6**(5): 115 (1981), (BO).

*Parodia pilayensis* L. Diers and K. Beckert, *Kakt. and. Sukk.* **57** (11), photo (2006), (Habitat: BO, Tarija, N-E of Prov. Mendez, slopes to the south of the Rio Pilaya at 1500–1900m, in loamy erosion material from the red sandstone, between inclined plates of rock).

*Parodia pseudoprocera* F.H. Brandt, *Kakt. and. Sukk.* **21**: 122, Figs. 1, 2 (1970), (BO).

*Parodia riograndensis* F.H. Brandt, *Kakteen Orch. Rundschau* **1**(5): 76 (1976), (BO).

*Parodia separata* F.H. Brandt, *Cactus. Antwerp (Cactus Flam. Ausg)* **8** (5): 77–79 (1976).

*Parodia subtiliamata* F. Ritter, *Kakteen Südamerika* **2**: 537, Fig. 574 (and KSA **1**: Fig. 234, 1979) (1980). T.: BO, Chuquisaca, Sud Cinti, Challamarca, 2400m, 1958, Ritter 741, holo. (U) [type cited for U in Ritter, *Kakteen Südamerika* **1**: iii. 1979].

*Parodia tredecimcostata* F. Ritter, *Kakteen Südamerika* **2**: 538, Fig. 400 (1980). T.: BO, Tarija, Mendez, Colpana, Rio Pilaya, 1958, Ritter 739, holo. (U).

**Description:** Habit solitary or clustering, stem globose to short cylindrical, [10.3–21](–30)cm high × (3–)[7–9.4]cm diameter. Ribs 13–[15], high,



**Figure 68.** *Parodia rechensis*. Brazil, Rio Grande do Sul, Caxias do Sul, Ana Rech, 16 Nov. 2011, A&M 821.

[straight or] spiralled, [rarely tuberculate]. Central spines 4, forming a cross, straight or one curved to hooked at apex, [brownish-yellow, pinkish light brown, or dirty white with black tip], [1.3]–2cm long. Radial spines [6–11], white, 0.7–1.5 cm. Flower [1.2–]3cm high × [(1.2–)]2.5–4cm diameter, yellow [to orange-red, stigma lobes, stamens and anthers yellow]. Fruit globose, 0.5–0.8cm high. Seeds dull black.

**Etymology:** From Latin *procerus*, tall, slender; said for the growth habit.

**Habitat & Distribution:** Arid inter-Andean rocky valleys, occasionally in deciduous forest, up to 1810m.

**Ecological regions:** Bolivian Montane Dry Forest.

**Biomes:** Montane Grasslands and Shrublands.

**Occurrence:** BO(CQ,TR). Map 3.

**Comment:** *Parodia procera* F. Ritter is not a well-known taxon, because of the type populations, reached only by Ritter and Lau, live at the mouth of the Río Challamarca (a tributary of the Río Pilaya). This is a very remote area that is only accessible on foot, starting from the village of Estancia Caraparí, Chuquisaca (BO), following a 3 + 3 hours trail on the bank of the Río Pilaya, when this is not flooded. We studied the species in the Caraparí Valley, on the Río Pilaya, where a population of the taxon (also known in this area as *Parodia pilayensis* L. Diers and K. Beckert) is distinguishable by the red-orange flower, compared to the yellow one of the type population. The first individuals are encountered in the forest starting from 1812m, then they form a more or less compact front which is dense with individuals, on the rocks of the valley, up to the bridge over the river which divides the Dpt. of Tarija and Chuquisaca, (BO). The reason why in *NCL* (Hunt *et al.* 2006, text: 222), *Parodia presteensis* F.H. Brandt is related to *P. procera* appears unclear. The two taxa, whose populations

live at a distance of c. 175km as the crow flies, also show a distinct morphology. In fact, while the ribs of *P. prestoensis* are on average tuberculated, those of *P. procera* very rarely show tubercles. In addition to the physical distance between the two taxa, it is to be noted that, while the core populations of *P. prestoensis* occupy two valleys in the north and in the south of Tarabuco (Presto and Icla valleys), a part of the same area as populated by *P. tuberculata*, the populations of *P. procera* live in a very specific ecological niche, i.e. the Rio Pilaya and the Rio Challamarca valleys, between Estancia Caraparí and Challamarca. According to the data in our possession, despite the restricted area occupied, *P. procera* seems to manifest itself as a relatively dominant species in the colonized habitat.

**50. *Parodia rechensis*** (Buining) F.H. Brandt, *Kakteen Orch. Rundschau* 7(4): 65 (1982). Basionym: *Notocactus rechensis* Buining.

#### Homotypic Synonyms

*Brasilicactus rechensis* (Buining) Doweld, *Sukkulenty* 2(3): 24 (1999), incorrect name (Art. 11.4?).

*Brasiliparodia rechensis* (Buining) F. Ritter, *Kakteen Südamerika* 1: 149 (1979).

*Notocactus rechensis* Buining, *Kakt. and. Sukk.* 19(2): 23, Fig. 2 (1968). T.: BR, Rio Grande do Sul, near Ana Rech, 10 Feb 1967, *Büneker et al.* s.n., holo. (U).

**Description:** Habit caespitose, stem globose to short cylindrical, <[7.2]cm high × [3]–5cm diameter. Ribs [17–]18. Central spines [1, darker than radials]. Radial spines, [<17], radiating, 0.6–0.7cm long, [pale yellow, nearly white]. Flower [2.9cm high × 1.8]–3.5cm diameter, stigma lobes creamy white. Fruit [rounded, a truncated cone facing downwards], [0.5]cm high × [0.4]–(0.7)cm diameter, red. Seeds cap shaped.

**Etymology:** In Latin *-ensis* (m., f.) means “coming from”; *rechensis* referring to the place of its first discovery, near the Ana Rech district, Caxias do Sul, Rio Grande do Sul, Brazil.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Southern Brazil, up to 1100m.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands.

**Occurrence:** BR(RS). Map 10.

**Conservation status:** Critically Endangered, CR B1ab(ii,v)+2ab(i,ii,v);C2a(i);E Justification: the extent of occurrence is 8.5km<sup>2</sup>, the only two known populations are very small and during the last 7 years (last update Nov 2011), have decreased with percentages ranging from 65% to 75%, the area of occupancy of the two populations combined is esti-

mated to be a few square metres, the quantitative data shows that there is a 50% probability that the taxon will disappear from its habitat in the next 10 years.

**Comment:** In our article “The last populations of *Parodia rechensis* (Buining) F.H. Brandt” (Ancechi & Magli, 2012: 30–34), we report the results of the research carried out in November 2011 on *P. rechensis*, the taxon which is being eradicated in habitat, and which gave very poor results in the ex-situ cultivation attempts. According to Celli Marchetti (2008: 1–2), we believe that the robberies and the expansion of urbanization and agriculture isolated the favourable areas for the survival of the populations, causing local extinctions and reducing the genetic variability. In addition, we put forward the hypothesis that these factors compromised a species that was already genetically “weak”, as shown in the comparison with the luxuriant population of *Parodia linkii* (Lehmann) R. Kiesling, with which it lives sympatrically. *P. linkii* is a dominant species in the Darwinian sense, that is, the more opportunistic, and the most widespread of the genus *Parodia* Spegazzini, of the 6 living on the rocky outcrops of the municipality of Caxias do Sul (ibid: 44), and which in the same environmental conditions did not show the difficulties of *P. rechensis*. The survey and the information gathered led us to update the risk assessment of *P. rechensis* as per our *Conservation status* (see above). The taxon, which consists of two populations, made up respectively of 10 individuals (Represa do Faxinal / data up to November 3rd, 2009) and 42 individuals (private fazenda/ data up to November 16th, 2011), can more realistically be considered extinct in nature. We studied the species on a flat rocky slab, in the middle of the woods owned by the above mentioned fazenda. Contrary to Ritter (1979: 145–152) and Gerloff & Neduchall (2004: 47–50), we do not consider *P. rechensis* related to the ex-members of *Brasiliparodia* (i.e. *P. alacriportana*).

**51. *Parodia ritteri*** Buining, *Succulenta* 38(2): 17–20, Fig. (1959). T.: BO, Tarija, Mendez, near El Puente, 2500m, 1953, *Ritter* 85, type herbaria: (U) [not found], (SGO), (ZSS) [lecto] [lectotype designated from amongst 2 isotypes by Doweld in *Sukkulenty* 3(1–2): 62 (2000)].

#### Homotypic Synonym

*Boliviacactus ritteri* (Buining) Doweld, *Sukkulenty* 3(1–2): 62 (2000).

#### Heterotypic Synonyms

*Parodia agasta* F.H. Brandt, *Frankfurter Kakteenf.* 3(4): 6–7 (1976).

*Parodia aglaisma* F.H. Brandt, *Kakteen Orch. Rundschau* 1: 50–53 (1976), (BO).



**Figure 69.** *Parodia ritteri*. Bolivia, Chuquisaca, between Camargo and San Pedro, 30 Jun. 2011, A&M 566.

- Parodia belliata* F.H. Brandt, *Kakteen Orch. Rundschau* 6(2): 24 (1981), (BO).
- Parodia camargensis* Buining & F. Ritter, *Succulenta* 41: 18, Fig. 3 (1962). T.: BO, Chuquisaca, Sud Cinti, Camargo, 1953, *Ritter* 86.
- Parodia camblayana* (F. Ritter) F.H. Brandt, *Kakteen Orch. Rundschau* 7(3): 40 (1982), nom. inval. (Art. 33.3). Basionym: *Parodia camargensis* var. *camblayana* F. Ritter.
- Parodia camargensis* var. *camblayana* F. Ritter, *Succulenta* 41(2): 20 (1962). T.: BO, Chuquisaca, Sud-Cinti, Camblaya Chica, May 1958, *Ritter* 724, iso. (ZSS), herb. ID: ZSI 014.363.
- Parodia carrerana* Cárdenas, *Cactus* (Paris) 18 (78): 93–94 (1963). T.: BO, Potosi, Sud Cinti, 3400m, type herbaria: (ZSS), herb. ID ZSI 004.374.
- Parodia castanea* (F. Ritter) F. Ritter, *Kakteen Südamerika* 2: 519–522, Fig. 379 (1980). Basionym: *Parodia camargensis* var. *castanea* F. Ritter.
- Parodia camargensis* var. *castanea* F. Ritter, *Succulenta* 41: 21 (1962). T.: BO, Tarija, Sud Cinti, La Torre, 1958, *Ritter* 726, iso. (ZSS), herb. ID: ZSI 014.365.
- Parodia cintiensis* F. Ritter, *Succulenta* 41(9): 122–123, Fig. 63 (1962). T.: BO, Chuquisaca, Sud Cinti, Impora, 1958, *Ritter* 85a, iso. (ZSS), herb. ID: ZSI 014.216.
- Parodia fulvispina* F. Ritter, *Cactus* (Paris) 17(76): 54–55 (1962). T.: BO, Tarija, Mendez, Carrizal, 1953, *Ritter* 727(=46a), type (*Ritter* 46a) (spirit specimen) corp, ar, sp (ZSS), herb. ID ZSI 003.630.
- Parodia prolifera* (F. Ritter) Weskamp, *Die Gattung Parodia* 3: 159 (1997).
- Parodia camargensis* var. *prolifera* F. Ritter, *Succulenta* 41(2): 20 (1962). T.: BO, Chuquisaca, Sud-Cinti, “Las Carraras”, May 1958, *Ritter* 723, type herbaria: (U) 116988B, (SGO), (ZSS) [seeds only]).

- Parodia roseoalba* F. Ritter, *Succulenta* 43(2): 23–24 (1964). T.: BO, Potosi, Nor Chichas, between Cotagaita and Tupiza, Nov 1962, *Ritter* 728, iso. (ZSS) [seed sample], herb. ID ZSI 014.369.
- Parodia rostrum-sperma* F.H. Brandt, *Stachelpost* 43: 2–4, Fig. (1973), (BO). T.: *Brandt* 56/a, holo. Herb. Brandt.
- Parodia rubida* F. Ritter, *Succulenta* 43(3): 43–44 (1964). T.: BO, Chuquisaca, Sud-Cinti, from La Torre, 1963, *Ritter* 725 (= FR 46b = FR 86a), type herbaria: *Ritter* 725 loc. 2, iso. (ZSS) [seed sample], herb. ID ZSI 014.364; *Ritter* 725 loc 1, [spirit specimen], herb. ID ZSI 010.491.
- Parodia splendens* Cárdenas, *Cact. Succ. J.* (Los Angeles) 33(4): 108, Figs. 59, 60 (1961). T.: BO, Chuquisaca, Sud Cinti, on the way Las Carraras to Chaupi Unu, 2500m, Apr 1958, Cárdenas 5527, holo. (LIL531599).
- Parodia tojoensis* F.H. Brandt, *Kakteen Orch. Rundschau* 10(2): 14 (1985), (BO).

**Description:** Habit solitary [or forming large clumps, to 180cm wide], stem globose to cylindrical, [33]–50cm high × 8–[13.5] cm diameter. Ribs [13]–21. Central spines 1–4, [when alone <5cm long, when 4 forming a cross, the lower slightly curved at apex, <2.5cm long, reddish yellow the lower, yellow the others]. Radial spines [8]–14, more or less erect, [the lower <3cm, straw-yellow] to rose to whitish. Flower 2.5–3.5cm high, brownish red or blood-red. Fruit 0.3–0.7cm high × 0.4–0.8cm diameter, carmine red. Seeds black.

**Etymology:** For Friedrich Ritter, German geologist, traveller, self-taught botanist, who collected and described many species of cacti, [the greatest cactus explorer of all time].

**Habitat & Distribution:** Pre-Puna rocky slopes, 2,300–3,200m.

**Ecological regions:** Central Andean Puna.

**Biomes:** Montane Grasslands and Shrublands.

**Occurrence:** BO(CQ,PO,TR). Map 3.

**Comment:** Composed of compact populations consisting of numerous individuals, *P. ritteri* is a relatively dominant species, with regard to the restricted colonized habitat. The extension of occurrence of the taxon is found between the northern area of Tojo (Tarija) in the south, and the area north of Lecori (Chuquisaca) in the north (*P. roseoalba*). It is interesting to note the morphological proximity between *P. ritteri* and some mature individuals of *P. prestoensis*. In 2014 when we conducted a series of surveys in the valleys that go from Tarabuco to Icla, in the southeast, we found above the village of Icla (precisely north of Icla, 2587m, A&M 1056), a population of the latter taxon with some large and very spiny mature individuals, so similar to *P. ritteri*, so much to confuse us that we initially attributed the population to the species of the Cinti valley. We detected the taxon

on several occasions among the pre-Puna rocky slopes, in an area between El Puente (Tarija) in the south and Tacaquira (Chuquisaca) in the north (where we noticed sympatry with *P. otaviana*).

**52. *Parodia schumanniana*** (Nic.) F.H. Brandt, *Kakteen Orch. Rundschau* 7(4): 62 (1982). Basionym: *Echinocactus schumannianus* Nicolai.

#### Homotypic Synonyms

*Erioccephala schumanniana* (Nicolai) Backeberg ex Guiggi, *Cactology* 3(Suppl. III): 1, (2012). [Name first used invalidly (Art. 34.1c, 33.4) by Backeberg, *Cact. Succ. J. (US)* 23: 85.]

*Echinocactus schumannianus* Nicolai, *Monatsschr. Kakteenk.* 3: 175 (1893). T.: PY, Missiones, Kuntze s.n. cult. ort. Nicolai, Dresden, nx.

*Eriocactus schumannianus* (Nicolai) Backeb., *Cactaceae* (DKG) 1941(2): 37 (1942), incorrect name (Art. 11.4).

*Malacocarpus schumannianus* (Nicolai) Britton & Rose, *The Cactaceae* 3: 189 (1922), incorrect name (Art. 11.4).

*Notocactus schumannianus* (Nicolai) A. Berger, *Kakteen*: 210, 343 (1929).

#### Heterotypic Synonyms

*Parodia ampliostata* (F. Ritter) F.H. Brandt, *Kakteen Orch. Rundschau* 7(4): 61 (1982). Basionym: *Eriocactus ampliostatus* F. Ritter.

*Eriocactus ampliostatus* F. Ritter, *Kakteen Südamerika* 1: 253 (1979), incorrect name (Art. 11.4). T.: PY, Paraguari, Cordillera de Los Altos, Ritter 1182.

*Notocactus ampliostatus* (F. Ritter) S. Theun., *Succulenta* 60(6): 142 (1981). Basionym: *Eriocactus ampliostatus* F. Ritter.

*Echinocactus grossei* K. Schum., *Monatsschr. Kakteenk.* 9: 44, illus. (1899). T.: PY, between Carapegua and Aca-ay, Grosse s.n.

*Eriocactus grossei* (K. Schum.) Backeb., *Beitr. Sukkulenteenk. Sukkulentepflege* 1942: 38 (1942), incorrect name (Art. 11.4). Basionym: *Echinocactus grossei* K. Schum.

*Erioccephala grossei* (K. Schum.) Y. Itô, *Explan. Diagr. Austroechinocactinae*: 252 (1957), nom. inval. (Art. 33.3). Basionym: *Echinocactus grossei* K. Schum.

*Malacocarpus grossei* (K. Schum.) Britton & Rose, *The Cactaceae* 3: 190, Fig. 200 (1922), incorrect name (Art. 11.4). Basionym: *Echinocactus grossei* K. Schum.

*Notocactus grossei* (K. Schum.) A. Berger, *Kakteen*: 210, 343 (1929). Basionym: *Echinocactus grossei* K. Schum.

*Parodia grossei* (K. Schum.) F.H. Brandt, *Kakteen Orch. Rundschau* 7(4): 62 (1982). Basionym: *Echinocactus grossei* K. Schum.



**Figure 70.** *Parodia schumanniana*. Paraguay, Paraguari, Carapeguá, M.N. Macizo Acahay, 480m, 16 Jul. 2007, A&M 243.

**Description:** Habit usually solitary, stem globose then cylindrical, [17–112](–180)cm high × [9–17](–30)cm diameter. Ribs 21–48, straight, acute, well defined. Spines bristle-like, straight or slightly curved, golden yellow, brown or red brown, later grey. Central spines [0–1], <3cm long. Radial spines [5–7, the lower <6.5cm long]. Flower 4–4.5cm high × 4.5–6.5cm diameter, lemon to golden yellow. Pericarpel + hypanthium c. 2–2.5cm high. Flower areoles with dense wool and bristles. Fruit globose to ovoid, 1–1.5cm high × 1.5cm diameter. Seeds bell shaped, shiny reddish brown, nearly smooth.

**Etymology:** Named to honour Dr. Karl M. Schumann German botanist in Berlin with a strong interest in cacti, author of the first important monograph on the family: *Gesamtbeschreibung der Kakteen* (1897–99), in which he recognized 21 genera.

**Habitat & Distribution:** Hills with granitic rock outcrops and sandstone reliefs on the ex-Mata Atlantica area in South-East Paraguay.

**Ecological regions:** Alto Paraná Atlantic forests (Mata Atlantica & Selva Misionera), in eastern Argentina, southern Brazil and eastern Paraguay.

**Biomes:** Tropical and Subtropical Moist Broadleaf Forests.

**Occurrence:** PY(GU,PG). Map 10.



**Figure 71.** *Parodia schwebsiana*. Bolivia, Cochabamba, road to Chuchu Punata, 2812m, 3 Apr. 2014, AM 1109.

**Comment:** The populations of *P. schumanniana* live in south-western Paraguay on the sandstone outcrops of the Silurian, i.e. sandstone of Caacupé (Cordillera de los Altos, Cerro Santo Tomás and Cerro Verá), and on the granitic rocks of the Silurian (Macizo Acahay), in the Dept. of Paraguari. They also live on the sandstone outcrops of the Permian, i.e. Passa Dois series, including in the Independencia-Villa Rica area (Cerro Acatí, Cerro Pelado) in the Dept. of Guairá (Esser, 1982:13). As already expressed in various previous works (Anceschi & Magli, 2010: 25; 2013a: 31–32; 2013b: 72), we emphasize that *P. schumanniana* is an endemic taxon of Paraguay, which has never crossed the great natural barrier formed by the Rio Paraná, whose populations further south (Acatí, Capilla Tuya, Verá) are located between 145 and 160km from the great river. Moreover, contrary to NCL's opinion (Hunt *et al.*, 2006, 223), which treats *P. claviceps* as a ssp. of *P. schumanniana*, it should be noted that the taxon historically related to the latter is *Parodia nigrispina* (K. Schumann) F.H. Brandt, as reported by Gerloff *et al.* (1995: 142). On the relationship between the three taxa, see also *P. claviceps* and *P. nigrispina* in the synopsis. Currently, *P. schumanniana* appears to be a non-dominant species with very fragmented distribution. Although the situation risk of the taxon is not as desperate as that of the sister *P. nigrispina* (see *Comment*), we must point out that at the moment the species lives only on a few rocky outcrops, increasingly undermined by the damage caused by humans (deforestation, fire, theft). The outcrops now stand out against a deforested plain which once was the Mata Atlantica in Paraguay. In 2008, while we were guests in the Reserva Natural del Bosque Mbaracayú, Dpt. Canendiyú (PY), part of the Protected Areas of the Fundacion Moisés Bertoni, we could observe an impressive series of photos taken from the plane, which highlighted the

progressive deforestation over the last decades in the east part of the country. If in the past the Mata Atlantica covered the whole part east of Rio Paraguay, when the last photos were taken it covered only small areas corresponding to some Protected Areas (Mbaracayú, Caaguazú, Ybytyruzú, Ybycuí, and Acahay), which in recent years have continued to be eroded by further deforestation, with the exception of the mentioned Reserva Mbaracayú that is privately managed and still retains 64,405 hectares of Mata Atlantica. We studied the taxon on the rocky outcrops of the Macizo Acahay (Carapeguá) and of the Cerro Verá (La Colmena). In the second location one has to be really reckless to reach the surviving plants between the vertical rock spires detached from the body of the mountain.

**53. *Parodia schwebsiana*** (Werderm.) Backeb., *Blätt. Kakteenf. genus* 68, sp. 7, 3 (1935). Basionym: *Echinocactus schwebsianus* Werderm.

#### Homotypic Synonyms

*Bolivicactus schwebsianus* (Werderm.) Doweld, *Sukkulenty* 3(1–2): 62 (2000).

*Echinocactus schwebsianus* Werderm., *Monatsschr. Deutsch. Kakteen-Ges.* 2: 186–189, Fig. (1930).

T.: BO, Cochabamba, nr city, Steinbach, np.

#### Heterotypic Synonyms

*Parodia applanata* (Hoffm. & Backeb.) F.H. Brandt, *Kakteen Orch. Rundschau* 9(4): 28 (1984), nom. inval. (Art. 8.4). Basionym: *Parodia schwebsiana* var. *applanata* Hoffm. & Backeb.

*Parodia schwebsiana* var. *applanata* Hoffm. & Backeb., *Cactaceae* (Backeberg) 3: 1598, Fig. 1535 (lower). (1959). T.: BO, on road between Cochabamba and Comarapa, cult. hort, *Bkbg*, np.

*Parodia minima* F.H. Brandt, *Frankfurter Kakteenf.* 3(3): 67 (1976).

*Parodia salmonea* F.H. Brandt, *Kakt. and. Sukk.* 24(5): 97–98, Fig. (1973), (BO). T.: 17/a, holo: Herb. Brandt.

**Description:** Habit usually solitary, [sometimes clustering in old plants], stem depressed globose to globose to short cylindrical, [3.5–27.5]cm high × [7.7–9.7]cm diameter, very woolly apically. Ribs [9–21], straight or spiraled, more or less tuberculate. [Spines slightly curved, brownish in the crown, then golden yellow with reddish base, or yellow with base and tip tinged dark or brownish. Central spines 4, forming a cross, more evident than radials, the lower flattened, strongly hooked, <1.9 cm]. Radial spines [3–6](–10). Flower 2–3cm high × 2–2.5cm diameter, dark red to brilliant blood-red. Hypanthium constricted above the pericarpel, flowering areoles woolly, only the uppermost with bristles. Fruit globose, 0.3–0.4cm diameter. Seeds



**Figure 72.** *Parodia scopae* ('scopa' population). Uruguay, Maldonado, Piriapolis, Cerro del Toro, 2 Jan. 2007, A&M 55.

with strophiole, tuberculate, glossy black.

**Etymology:** Named to honour of Willy Schweps, a German cactus horticulturist from near Dresden.

**Habitat & Distribution:** Arid inter-Andean rocky valleys, 2810–3200m.

**Ecological regions:** Bolivian Montane Dry Forest.

**Biomes:** Montane Grasslands and Shrublands.

**Occurrence:** BO(CB). Map 3.

**Comment:** Very distinctive taxon, with uniform characters throughout the colonized area (i.e. the golden yellow spines with reddish base, with the lower central flattened and strongly hooked), *Parodia schwebsiana* (Werderm.) Backeb. represents a relatively dominant species in the reference area (basically rocky outcrops in the surroundings of Cochabamba). In fact, despite the limited area, i.e. 300km<sup>2</sup> (data gathered from Lowry, 2013. *Parodia schwebsiana*. The IUCN Red List of Threatened Species 2013. Downloaded on 13 October 2017), the populations are numerous, as are the individuals within them. We detected the taxon on some occasions in the area south-east of Cochabamba (Cuchu Punata, Arani), between 2812m and 2925m.

54. *Parodia scopae* (Sprengel) N.P. Taylor, *Bradleya* 5: 93 (1987). Basionym: *Cactus scopae* Spreng.

#### Homotypic Synonyms

*Cactus scopae* Spreng., *Syst. Veg.*, ed. 16, 2: 494 (1825). [*Cereus scopae* Salm-Dyck ex DC. *Prodr.* 3: 464 (1828)]. T.: 'Patria?', nd.

*Malacocarpus scopae* (Spreng.) Britton & Rose, *The Cactaceae* 3: 193, (1922), incorrect name (Art. 11.4).

*Notocactus scopae* (Spreng.) A. Berger, *Kakteen*: 209, 343 (1929).

*Peronocactus scopae* (Spreng.) Doweld, *Sukkulenty* 2(3): 21 (1999), incorrect name (Art. 11.4).



**Figure 73.** *Parodia scopae* ('marchesi' population). Uruguay, Treinta y Tres, 11 Dec. 2008, A&M 294.

#### Heterotypic Synonyms

*Parodia rudibuenekeri* ssp. *glomerata* (N. Gerloff) Hofacker, *Cactaceae Consensus Init.* 6: 12 (1998). Basionym: *Notocactus glomeratus* N. Gerloff.

*Notocactus glomeratus* N. Gerloff, *Internoto* 12(1): 3–10 (1991). T.: BR, Rio Grande do Sul, *Stockinger* 249, holo. (ZSS)[(spirit specimen) rad, corp, ar, sp, fl, fr, sem], herb. ID ZSI 003.411; [(sheet specimen) photo], herb. ID, ZSI 003.412].

*Notocactus rudibuenekeri* ssp. *glomeratus* (N. Gerloff) Doweld, *Sukkulenty* 3(1–2): 55 (2000). Basionym: *Notocactus glomeratus* N. Gerloff.

*Peronocactus rudibuenekeri* ssp. *glomeratus* (N. Gerloff) Doweld, *Sukkulenty* 2(2): 21 (1999), incorrect name (Art. 11.4). Basionym: *Notocactus glomeratus* N. Gerloff.

*Parodia scopae* ssp. *marchesii* (W.R. Abraham) Hofacker, *Cactaceae Consensus Init.* 6: 12 (1998). Basionym: *Notocactus scopae* var. *marchesii* W.R. Abraham.

*Peronocactus scopae* ssp. *marchesii* (W.R. Abraham) Doweld, *Sukkulenty* 2(3): 21 (1999), incorrect name (Art. 11.4). Basionym: *Notocactus scopae* var. *marchesii* W.R. Abraham.

*Notocactus scopae* ssp. *marchesii* (W.R. Abraham) Doweld, *Sukkulenty* 3(1–2): 55 (2000). Basionym: *Notocactus scopae* var. *marchesii* W.R. Abraham.

*Notocactus scopae* var. *marchesii* W.R. Abraham, *Kakt. and. Sukk.* 40(7): 174–176 (1989). T.: UY, Treinta y Tres, 1982, Schlosser & Abraham, cult. *Abraham* 34 (KOELN, Succulentarium, preserved?).

*Notocactus rudibuenekeri* W.R. Abraham, *Succulentia* 67(6): 133–138, Fig. (1988). T.: BR, Rio Grande do Sul, E. of São Gabriel, 300m, Bünker in *Abraham* 355 (KOELN).



**Figure 74.** *Parodia scopia* ('succinea' population). Brazil, Rio Grande do Sul, São Gabriel, SE of São Gabriel, 23 Oct. 2011, A&M 787.

*Parodia rudibuenekeri* (W.R. Abraham) Hofacker & P.J. Braun, *Cactaceae Consensus Init.* **6**: 10 (1998). Basionym: *Notocactus rudibuenekeri* W.R. Abraham.

*Peronocactus rudibuenekeri* (W.R. Abraham) Doweld, *Sukkulenty* **2**(3): 21 (1999). Basionym: *Notocactus rudibuenekeri* W.R. Abraham.

*Notocactus soldtianus* Vliet, *Succulenta* **54**(4): 72–75 (1975), (UY, BR).

*Parodia succinea* (F. Ritter) N.P. Taylor, *Bradleya* **5**: 93 (1987). Basionym: *Notocactus succineus* F. Ritter.

*Parodia scopia* ssp. *succinea* (F. Ritter) Hofacker & P.J. Braun, *Cactaceae Consensus Init.* **6**: 10 (1998). Basionym: *Notocactus succineus* F. Ritter.

*Notocactus succineus* F. Ritter, *Succulenta* **49**(7): 109 (1970), as '*sucineus*'. T.: BR, Rio Grande do Sul, São Gabriel, Feb 1965, Büneker *et al.* in Ritter 1399.

*Notocactus scopia* ssp. *succineus* (F. Ritter) Doweld, *Sukkulenty* **3**(1–2): 56 (2000). Basionym: *Notocactus succineus* F. Ritter.

*Peronocactus scopia* ssp. *succineus* (F. Ritter) Doweld, *Sukkulenty* **2**(3): 21 (1999), incorrect name (Art. 11.4). Basionym: *Notocactus succineus* F. Ritter.

**Description:** Habit solitary or forming clumps, stem globose to cylindrical, [(1.8–)]5–50cm high × (2.5–) 6–10cm diameter, [light to] dark green. Ribs 18–40, low, finely tuberculate, [tubercles more or less covered by the radial spines]. Spines needle like or bristly, [flexible, sometimes indistinct between centrals and radials, none is hooked]. Central spines [1–4(–8 at apex), <1.6cm, when 4 forming a cross, red, orange red, dark yellow then pale yellow, optical white, white, or white with dark-brownish base]. Radial spines c. 12–40 or more, [interlacing], 0.5–0.7[–1.5]cm long, [optical white],



**Figure 75.** *Parodia scopia* ('rudibuenekeri' population). Brazil, Rio Grande do Sul, Caçapava do Sul, Pedra da Abelha, 28 Oct. 2011, A&M 793.

white, [dirty white, or pale yellow nearly white]. Flower 2–4cm high × 3–4.5cm diameter, bright [lemon] yellow. Fruit globose, <0.7cm diameter, dehiscent. Seeds tuberculate, dull black.

**Etymology:** From Latin *scopa*, 1)broom, 2)twig; probably said for the spination.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Uruguay and Southern Brazil, up to 300m.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands.

**Occurrence:** BR(RS);UY(CL,LA,MA,RO,TT). Map 8.

**Comment:** *Parodia scopia* (Sprengel) N.P. Taylor is a taxon with numerous and variable populations, but with a rather fragmented distribution. In contrast, the other dominant species of the genus *Parodia* Spegazzini of the pampa grasslands with rocky outcrops in Uruguay and Southern Brazil, i.e. *P. erinacea*, *P. mammulosa* and *P. ottonis*, in addition to populations that are numerous and variable in shape, reveal a certain spatial continuity. About the different spination of the various populations of *P. scopia*, and the substantial uniformity of forms of growth, we have already expressed our position in the study on the *Parodia scopia* ssp. *marchesii* (W.R. Abraham) Hofacker, living in Uruguay, in the “quebradas” of the Treinta y Trés Dpt. (Anceschi & Magli, 2010: 28). A similar situation occurs in Brazil, in the northern part of the range of *P. scopia*, among the rocky outcrops (serras and coxilhas) of the pampas, in the centre-south of the Rio Grande do Sul. Even here, several populations of *P. scopia* occupy the territory distinguishing themselves essentially only by the colour of their spination. Southwest of São Gabriel, populations of *Parodia succinea* (F. Ritter) N.P. Taylor are living,

which easily can be assimilated by the forms with clear spines of *P. scopia*. In fact, all the characters of the first taxon are included, or merged, with those of the second. In addition, the form of growth is the typical form of the type species. But while *P. succinea* is considered, in *NCL* (Hunt *et al.*, 2006, text: 223) to be a subspecies of *P. scopia*, another form with clear spines, i.e. *Parodia rudibuenekeri* (W.R. Abraham) Hofacker & P.J. Braun, was recognized at the rank of species (ibid., text: 223). Reto Nyffeler in "Further referrals of 'limbo' species" in *CCC1* (1997: 9), had already correctly identified *Notocactus rudibuenekeri* W. R. Abraham as a synonym for *P. scopia*, but then Hofacker & Braun (1998: 10) published *P. rudibuenekeri*, distinguishing it from *P. scopia* for "various markings such as spinations and flowers". As per Hofacker's own admission, the two taxa live really very close, in the area of Caçapava do Sul, Rio Grande do Sul (BR), precisely on the rocky outcrops of sandstone conglomerates of the formation Pedra do Segredo. On one of these, the Pedra da Abelha, the population of *P. rudibuenekeri* lives; while on the surrounding outcrops, including the nearby Pedra do Segredo (about 1.5km as the crow flies), there are populations of *P. scopia*. The character that distinguishes the *rudibuenekeri* population from the *scopia* populations is basically the colour of the spines: completely white for the first, with central red-orange for the other. Given the morphological and spatial proximity of the two taxa and, as also Hofacker does not exclude, between the two populations there are points of contact, which we prefer to define as melting points. During the last surveys in the area (2011), we found, in discrete areas of the habitat, populations that show the two forms. At the Pedra do Leão, another of the outcrops of the formation, in the same population coexist: individuals with 4 central variegated in reddish yellow, and all radial white spines; individuals with all white spines; individuals with central orange-red and white radial spines; and groups where individuals with completely white spines and others with red orange centrals coexist side by side. It should be noted that even among the population of the Pedra da Abelha (the site of *P. rudibuenekeri*), can be observed central spines variegated in reddish yellow, as between those of Pedra do Leão. As pointed out for *P. succinea*, also *P. rudibuenekeri* shows the typical growth form of the stems of *P. scopia*. Following the foregoing, as the *marchesi* populations from Uruguay, also *P. succinea* and *P. rudibuenekeri* are to be considered only populations with clear spines, not taxonomically distinguishable in the range of *P. scopia*. We recall that the other taxon connected by *NCL* (Hunt *et al.*, 2006, text: 223) to *P. scopia*, always following Hofacker's proposal (1998: 10), namely *Parodia scopia* ssp. *neobuenekeri* (F. Ritter) Hofacker & P.J. Braun, is instead the only one that clearly shows that it does

not belong to this phyletic line, i.e. because of the distinct form of growth, i.e. smaller stems and more compact with each other, forming large groups. For this reason, we recognized it at the species level *P. neobuenekeri* (Anceschi & Magli, 2010: 33) the taxon living in a restricted area between Minas de Camaquã and Santana da Boavista. We studied the taxon, which manifests itself as an ex-dominant species, now with fragmented distribution, in the sites mentioned, and in other places between the south of the Uruguay (Maldonado Dpt.) and the centre of the Rio Grande do Sul state (BR).

**55. *Parodia stockingeri*** (Prestlé) Hofacker & P.J. Braun, *Cactaceae Consensus Init.* **6**: 10 (1998). Basionym: *Notocactus stockingeri* Prestlé.

#### Homotypic Synonyms

*Notocactus stockingeri* Prestlé, *Succulenta* **64**(11): 226–230, illus. (1985). T.: BR, Rio Grande do Sul, 40km W of São Borja, 1981, *Stockinger* 141 (U).

*Peronocactus stockingeri* (Prestlé) Doweld, *Sukkulenty* **2**(3): 21 (1999), incorrect name (Art. 11.4).

**Description:** Habit [sometimes solitary usually clustering, stoloniferous], stem short cylindrical [to short clavate], [2.4]–9cm high × [1.75–4]cm diameter. Ribs 12–[15], vertical, [nose shaped between the areoles]. Spines [finely needle-like, flexible]. Central spines [1]–[4], [when 4 forming a cross, more erected than radials, <1.55cm long, red, reddish or yellow with red base]. Radial spines [10–13]–[14], [curved on the stem surface or radiating, yellow, some with red base, or light yellow], 0.8–1[–1.2]cm long. Flower short funnellform, 3.5–4cm high × 4–4.5cm diameter, shiny golden yellow. Fruit globose, 0.7cm high × 0.7cm diameter, light green to reddish, dehiscing sideways, REM persistent. Seeds hat-shaped, slightly tuberculate, black.

**Etymology:** For Francisco A. Stockinger, also known as Chico Stockinger, Austrian artist naturalized Brazilian, cactus hobbyist in Rio Grande do Sul, Brazil.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Southern Brazil, 300–400m.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands.

**Occurrence:** BR(RS). Map 7.

**Comment:** *Parodia stockingeri* (Prestlé) Hofacker & P.J. Braun, is a poorly-known taxon. The species represents one of the weak external vicariants in the complex of the dominant *P. ottonis* (see *Comment*). Taxonomically it is intermediate between *P. ibicuiensis*, in the direction of *P. ottonis* (*P. glaucina*), and *P. tenuicylindrica*. More precisely *P. stockingeri*, while globally maintaining a higher





**Figure 76.** *Parodia stockingeri*. Brazil, Rio Grande do Sul, Unistalda, W. of Unistalda, 250m, 26 Jun. 2016, A&M 1363.



**Figure 77.** *Parodia stockingeri*. Brazil, Rio Grande do Sul, Unistalda, W. of Unistalda, 250m, 26 Jun. 2016, A&M 1363.



**Figure 78.** *Parodia stockingeri*. Brazil, Rio Grande do Sul, Unistalda, W. of Unistalda, 250m, 26 Jun. 2016, A&M 1363.



**Figure 79.** *Parodia stockingeri*. Brazil, Rio Grande do Sul, Unistalda, W. of Unistalda, 250m, 26 Jun. 2016, A&M 1363.

apical spinosity, in the intermediate phases of the ontogenesis process shows clavate forms similar to the young semaphoronts (see materials and methods) of *P. ibicuiensis*. In more adults semaphoronts, it stands out instead from *P. tenuicylindrica* for showing, compared with this, longer and more irregular spines. i.e. central spines <1.55cm and radial spines <1.2cm in *P. stockingeri* vs. central spines <0.7 and radial spines <0.3–0.4cm in *P. tenuicylindrica*. We spent a long time studying the taxon, in the type locality, west of Unistalda, RS (BR), where the population lives on a few square meters, on rocky outcrops at the edge of cultivated fields, in sympatry with individuals of *P. linkii* and *P. ibicuiensis*. This latter taxon lives in the area also sympatrically with *P. ottonis* (*P. glaucina*). Despite the limited area of occupancy of *P. stockingeri* and *P. ibicuiensis*, the two taxa are quite variable in habitat, and as already reported,

some semaphoronts tend to overlap (we remember that Werner Uebelmann quoting from Gerloff *et al.*, 1995: 50, defined *N. ibicuiensis* as a “multiforme” species). We do not hide that in the early stages of our research, the exact definition of the taxon in habitat was a true enigma. It took repeated surveys at different times, to figure it out (see also *Comment to P. ibicuiensis*).

**56. *Parodia stuemeri*** (Werderm.) Backeb., *Kaktus-ABC*: 272 (1936). Basionym: *Echinocactus stuemeri* Werderm.

#### Homotypic Synonyms

*Boliviacactus stuemeri* (Werderm.) Doweld, *Sukkulenty* 3(1–2): 63 (2000).

*Echinocactus stuemeri* Werderm., *Monatsschr. Deutsch. Kakteen-Ges.* 3: 122, illus. (1931). T.: AR, Salta, 1000–2000m, *Stümer*, np?

### Heterotypic Synonyms

- Parodia carminata* Backeb., *Kaktus-ABC*: 268, 416 (1936), (AR, Salta).
- Parodia fricana* F.H. Brandt, *Stachelpost* 9(45): 68–71, Figs. (1973), (AR). T.: 53/a, holo. Herb. Brandt.
- Parodia gigantea* Frič ex Krainz, *Sukkulentenkunde* 6: 26–28 (1957), (N. Arg.). T.: holo. (ZSS)[(spirit specimen) corp, ar, sp], herb. ID ZSI 003.693.
- Parodia gokrauseana* Heinrich, *Kakt. Sukkulent.*, Dresden 1967, 25–26 (1967), nom. inval. (Art. 8.4).
- Parodia gutekunstiana* Backeb., *Cactaceae* (Backeberg) 3: 1604 (1959), (AR), nom. inval. (Art. 37.1).
- Parodia jujuyana* Frič ex R.Šubík, *Kaktusy*: 131 (1960), as 'jujuana'.
- Parodia pseudostuemei* Backeb., *Descr. Cact. Nov.* 3: 11 (1963), (AR, Jujuy, Molle Punco), nom. inval. (Art. 8.4).
- Parodia rubricentra* Backeb., *Kaktus-ABC*: 267, 415 (1936), (AR, Salta).
- Parodia rubripina* U.Köhler, *Kakt. and. Sukk.* 18(11): 212, sphalm. 'rubispina'. (1967), nom. inval. (Art. 37.1).
- Parodia schuetziana* Jajó, *Zpravy Ceskosl. Gua. Spolecn.*: 25–26, ill. (1947). T.: AR, Jujuy, Volcán, Ritter 48 (Jajó 1947), type herbaria: (ZSS) [seed sample], herb. ID ZSI 010101.
- Parodia scoparia* F. Ritter, *Kakteen Südamerika* 2: 421–422, Fig. 274 (1980). T.: AR, Jujuy, S. of Humahuaca, 1959, Ritter 915, holo. (U).
- Parodia setosa* Backeb., *Descr. Cact. Nov.* 3: 12 (1963), (AR, Jujuy), nom. inval. (Art. 8.4).
- Boliviacactus tilcarensis* (Werderm. & Backeb.) Doweld, *Sukkulenty* 3(1–2): 63 (2000). Basionym: *Echinocactus stuemei* var. *tilcarensis* Werderm. & Backeb.
- Parodia tilcarensis* (Werderm. & Backeb.) Backeb. *Kakteen-Freunde* 4: 50 (1935). Basionym: *Echinocactus stuemei* var. *tilcarensis* Werderm. & Backeb.
- Echinocactus stuemei* var. *tilcarensis* Werderm. & Backeb., *Neue Kakteen*: 59, 89, Fig. (1931). T.: AR, Jujuy, Tilcara, nd.
- Parodia tumbayana* Weskamp, *Die Gattung Parodia* 2: 132, 136–137 (1992), [a re-description of *Parodia setosa* Backeberg 1963, nom. inval. (Art. 8.4)]. T.: AR, Jujuy, Tumbaya, 2100m, s.a., Piltz 171, type herbaria: (WU) [ex cult. W. Weskamp].

**Description:** Habit usually solitary, occasionally forming small clumps, stem globose to short cylindrical, [11–30]cm high × (7–)[8.5–18.2]cm diameter, [light to] dull green, Ribs 15–22, straight or spiralled, [with a wavy line at base], tuberculate. Central spines 4–[6], [more evident than the radials, the lower is the longest <2.5cm, or hooked



**Figure 80.** *Parodia stuemei*. Argentina, Jujuy, Volcan, 2100m, 19 Mar. 2007, A&M 170.

<1.7cm long], pale yellow, [reddish], brown, violet-grey, or [dark grey]. Radial spines 9–35, <2cm, [bristle like, straight], interlacing, [sometimes covering the stem surface], whitish to [silver-grey]. Flower 2.5–4cm high × 2.5–5cm diameter, red, orange or yellow. Fruit oblong, 1.5cm high × 0.5cm diameter, greenish yellow. Seeds black.

**Etymology:** Named to honour Ernst (Ernesto) Stümer, Argentinian field collector and plant trader.

**Habitat & Distribution:** Pre-Puna rocky slopes, 2300–3100m.

**Ecological regions:** Central Andean Puna.

**Biomes:** Montane Grasslands and Shrublands.

**Occurrence:** AR(JY,SA). Map 3.

**Comment:** *Parodia stuemei* (Werderm.) Backeb. is a relatively dominant species in relation to the restricted colonized habitats; the populations are in fact widespread, numerous, and composed of a good number of individuals. We detected the taxon on several occasions on the rocks of the pre-Puna's arid valleys, between the Quebrada del Toro (Salta) in the south, and the areas of Cuesta de Lipan and the Quebrada de Humahuaca (Jujuy) in the north. In 2005 we hunted for the populations of *Parodia tilcarensis* (Werderm. & Backeb.) Backeb., in the area between Purmamarca and Tilcara. We could not detect the taxon; in all the sites indicated *P. stuemei* continued to appear, which we had already encountered further south. When we came



**Figure 81.** *Parodia subterranea*. Bolivia, Chuquisaca, between Culpina and Incahuasi, 30 Jun. 2011, A&M 588 (BLMT 68.05).



**Figure 82.** *Parodia taratensis*. Bolivia, Cochabamba, Izata, S. of Izata, 3205m, 4 Apr. 2014, A&M 1127.

back from the journey (it was already in 2006), we felt relieved that *NCL* (Hunt *et al.*, 2006, text: 224) listed the first taxon among the synonyms for the second. Similar situations recurred frequently during our travels, even on cases not already resolved by modern literature. This is one of the reason why in 2010 cactusinhabitat.org was born.

**57. *Parodia subterranea*** F. Ritter, *Succulenta* 43: 43 (1964). T.: BO, Chuquisaca, Sud Cinti, La Cueva, Ritter 731, holo. (U).



**Figure 83.** *Parodia tenuicylindrica*. Brazil, Rio Grande do Sul, Santana do Livramento, between BR 293 and Cerros verdes, 11 Nov. 2011, A&M 816.

#### Homotypic Synonym

*Bolivicactus subterraneus* (F. Ritter) Doweld, *Sukkulenty* 3(1–2): 63 (2000).

#### Heterotypic Synonyms

*Parodia culpinensis* F.H. Brandt, *Stachelpost* 9(48): 161–165, Fig. (1973), (BO). T.: 55/a, holo. Herb. Brandt.

*Parodia ladae* Halda & Horáček, *Acta Mus. Richnov., Sect. Nat.* 7(2): 73 (2000). T.: BO, vicinity of Camargo in summo collis, 3100m, 20 Nov 1999, J.J. Halda, L. Horáček JJH&LH9911320, holo. (PR).

*Parodia miranda* F.H. Brandt, *Kakteen Orch. Rundschau* 6(4): 94 (1981), (BO).

*Parodia nigresca* F.H. Brandt, *Letzeb. Cacteeffren* 2(5): 1–6 (1981).

*Parodia occulta* F. Ritter, *Kakteen Südamerika* 2: 528–529, Figs. 390, 571 (1980). T.: BO, Tarija, Mendez, Caña Cruz, Feb 1963, Ritter 1152, holo. (U).

*Parodia pseudosubterranea* F.H. Brandt, *Kakteen Orch. Rundschau* 4(5): 66 (1979), (BO).

*Parodia robustihamata* F. Ritter, *Kakteen Südamerika* 2: 532 (1980), nom. inval. (Art. 36.1). T.: BO, Chuquisaca, Sud-Cinti, Ingahuasi, May 1958, Ritter 731a, type herbaria (ZSS) [seed sample], herb. ID ZSI 014.374.

*Parodia salitrensis* F.H. Brandt, *Letzeb. Cacteeffren* 2(1): 2–5 (1981).

*Parodia slabana* Halda & Horáček, *Cactaceae etc.* 10(3): 76–80 (2000), (BO, 3100 m).

*Parodia zaletaewana* F.H. Brandt, *Stachelpost* 44: 30–33, Fig. (1973).

**Description:** Habit solitary [or clustering], stem flattened globose, [4–6.5]cm high × 6–[9.5]cm diameter, dark to olive green. Ribs 11–13[–16], forming distinct conical tubercles. [Spines black at the

apex]. Central spines 1(–4), strong, [awl-shaped, sometimes slightly curved at the apex, <2cm long, pinkish dark grey]. Radial spines 10, radiating, 0.5–0.8cm long, whitish, yellowish, [but some grey like the centrals]. Flower 2.2–3cm high × 2.5–3.5cm diameter, purple. Fruit [1.3cm high × 0.9cm diameter], red or green, covered with white hairs, dehiscent at the base. Seeds purse-shaped, black.

**Etymology:** From Latin *subterraneus*, subterranean, underground; for the flattened globose stem, partially hidden underground.

**Habitat & Distribution:** Puna rocky outcrops, 2800–3600m.

**Ecological regions:** Central Andean Puna.

**Biomes:** Montane Grasslands and Shrublands.

**Occurrence:** BO(CQ,TR). Map 1.

**Comment:** Despite not all the semaphoronts (see materials and methods) show clear relations between the two taxa, we consider *Parodia subterranea* F. Ritter as belonging to the external vicariants group in the complex of the dominant *P. maassii* (see Comment). Like the other components, it is considered strong, because the populations are numerous, in turn composed by numerous individuals. We found the taxon in the highlands, on the Puna flat hills, where it lives hidden among rocky outcrops.

**58. *Parodia taratensis*** Cárdenas, *Cact. Succ. J.* (Los Angeles) **36**: 24–25, Fig. (1964). **T.:** BO, Cochabamba, Tarata, between Tarata and Rio Caine, 2200m, Feb 1961, Cárdenas 5552 (LIL not found; US).

#### Homotypic Synonym

*Boliviacactus taratensis* (Cárdenas) Doweld, *Sukkulenty* **3**(1–2): 63 (2000).

#### Heterotypic Synonyms

*Parodia bilbaoensis* Cárdenas, *Cact. Succ. J.* (Los Angeles) **38**: 146, Figs. (1966).

*Parodia caineana* F.H. Brandt, *Lëtzebueger Cactéfrénn* **6**(2): 18 (1985), (BO).

*Parodia krahnii* Weskamp, *Kakt. and. Sukk.* **40**(3): 60, Figs. (1989), (BO). **T.:** *Krahn* s.n., holo. (WU).

**Description:** Habit solitary [or forming small clumps], globose [to short cylindrical in age], 3[–8]cm high × 4[–5.8]cm diameter. Ribs [12–]13, slightly spiralled. [Spines orange yellow in the crown, then whitish]. Central spines 4, forming a cross, [thicker than the radials, the lower hooked, <2 cm]. Radial spines [14–]17, 0.3–1.5[–2.1] cm. Flower 3cm high × 1.5cm diameter, golden yellow. Fruit globular, more or less 0.5cm diameter, brown. Seeds matt black.

**Etymology:** For the occurrence of the species in the Tarata province, Dept. Cochabamba, Bolivia, between the city of Tarata and the Rio Caine basin.

**Habitat & Distribution:** Arid inter-Andean rocky valleys, and Puna rocky outcrops, 2500–3200m.

**Ecological regions:** Bolivian Montane Dry Forest, and the Central Andean Puna.

**Biomes:** Montane Grasslands and Shrublands.

**Occurrence:** BO(CB). Map 3.

**Conservation status:** Data Deficient, DD (as in *NCL* 2006, text: 333).

**Comment:** Although Lowry judges the taxon to be common in the colonized area (*Parodia taratensis*. The IUCN Red List of Threatened Species 2013. Downloaded on 14 October 2017), detecting the species, in the area between Tarata and Izata, Cochabamba, Bolivia, was not easy. In 2014, we were able to locate a population of the taxon, by climbing on the steep walls of a canyon, after a few hundred metres walking on the riverbed, just south of Izata, a ghost village south of Tarata. According to the data at our disposal, we relate the population we found to *Rausch* 199a, the only one who detected the taxon in the area. Regarding the proximity between *Parodia taratensis* Cárdenas and *P. schwebsiana* (we remember that *P. taratensis* was initially considered a var. of the second taxon by Cárdenas), we underline that in the extreme homogeneous characters of *P. schwebsiana* (basically the golden yellow spines with reddish base, with the lower central flattened and strongly hooked), the whitish spines that characterize instead *P. taratensis* are not recognizable. Moreover, at least in the visited area, the habitat of *P. taratensis* is moister than the more typically xerophytic habitat of *P. schwebsiana*.

**59. *Parodia tenuicylindrica*** (F. Ritter) D.R. Hunt, *Cactaceae Consensus Init.* **4**: 6 (1997). **Basionym:** *Notocactus tenuicylindricus* F. Ritter.

#### Homotypic Synonym

*Notocactus tenuicylindricus* F. Ritter, *Succulenta* **49**: 108 (1970). **T.:** BR, Rio Grande do Sul, S. of Alegrete, Mar 1965, Horst & Ritter in *Ritter* 1361.

#### Heterotypic Synonyms

*Notocactus minimus* Frič & Kreuz. ex Buining, *Succulenta* **22**(8): 86-90, Fig. (1940), (UY). **T.:** type herbaria: 86a, UY, Rivera (ZSS), herb. ID ZSI 015.329; epi.: *Ruoff* 86a (UY), deposited in the Herbarium of the Palmengarten Frankfurt am Main/D.

*Peronocactus minimus* (Frič & Kreuz. ex Buining) Doweld, *Sukkulenty* **2**(3): 21 (1999), incorrect name (Art. 11.4). **Basionym:** *Notocactus minimus* Frič & Kreuz. ex Buining.

**Description:** Habit solitary, stem short cylindrical [to briefly clavate], 4–8[–9.9]cm high × 2–[3.7]cm diameter. Ribs 13–21. 0.3–0.4cm high, notched, tuberculate. Spines straight, needle-like.



**Figure 84.** *Parodia tuberculata*. Bolivia, Chuquisaca, between Tarabuco and Sucre, Khochi, 2923m, 15 Mar. 2014, A&M 1073.



**Figure 85.** *Parodia tuberculata*. Bolivia, Chuquisaca, between Tarabuco and Sucre, Yamparaez, S. of Yamparaez, 15 Mar. 2014, A&M 1072.



**Figure 86.** *Parodia tuberculata*. Bolivia, Chuquisaca, Zudañez, Cerro Ayrampo, 2543m, 14 Mar. 2014, A&M 1058

Central spines [usually 4 in mature plants, <0.7cm long, 2–3 in young plants (diameter <1.8 cm), 1 or 2 of which can be hooked, red or orange red]. Radial spines 10–[21], 0.3–0.4cm long, pale yellow. Flower <4.2cm high, clear lemon yellow, stigma lobes [purple red]. Fruit greenish-yellow. Seeds oblong, with small tubercles, black.

**Etymology:** From Latin *tenuis*, thin, slender, and Latin *cylindricus*, cylindrical; for the slender, short cylindrical stem.

**Habitat & Distribution:** Pampa grasslands with rocky outcrops in Uruguay and Southern Brazil, 50–200m.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil.



**Figure 87.** *Parodia tuberculata*. Bolivia, Chuquisaca, Presto, N.E. of Presto, 2938m, 11 Mar. 2014, A&M 1023.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands.

**Occurrence:** BR(RS);UY(AR,RV,SA,TA). Map 7.  
**Comment:** *Parodia tenuicylindrica* (F. Ritter) D.R. Hunt is related to *P. stockingeri* by Gerloff & Neduchal (2004: 62–64), who interpret the two taxa as varieties of *Notocactus minimus* Frič & Kreuz. ex Buining. The latter taxon is considered a synonym of *P. tenuicylindrica* in *NCL* (Hunt *et al.*, 2006, text: 359). As already pointed out in the *Comment* about *P. stockingeri*, in our judgment the populations of the two taxa are easily distinguishable, for the longer and less regular spines shown by this species compared with *P. tenuicylindrica*. The species is also part of the extensive group of weak vicariants that distinguishes *P. ottonis* (see *Comment*) and is characterized by a fragmented distribution on a relatively small portion of territory, i.e. 5,000–6,000km<sup>2</sup> (data on the extent of occurrence gathered from Larocca, J., Machado, M. & Duarte, W., 2013. *Parodia tenuicylindrica*. The

IUCN Red List of Threatened Species 2013. Downloaded on 14 October 2017). We detected the taxon on flat rocky outcrops in the pampas north of Santana do Livramento, RS (BR).

**60. *Parodia tuberculata*** Cárdenas, *Cact. Succ. J.* (Los Angeles) **23**: 97, Figs. 51–52 (1951). **T.**: BO, Chuquisaca, Oropeza, c. 5km from Sucre airport, Hacienda Rellini, nr Quebrada de Villa Maria, 2700m, Feb 1949, Cárdenas 4397, (LIL not found; US).

#### Homotypic Synonym

*Boliviacactus tuberculatus* (Cárdenas) Doweld, *Sukkulenty* **3**(1–2): 63 (2000).

#### Heterotypic Synonyms

*Parodia backebergiana* F.H. Brandt, *Kakt. and. Sukk.* **20**: 111 (1969), (BO).

*Parodia candida* F.H. Brandt, *Letzeb. Cacteeffren* **2**(2): 1–5 (1982).

*Parodia firmissima* F.H. Brandt, *Stachelpost* **51**: 65–68, Figs. (1974), (BO). **T.**: 28/a, holo. Herb. Brandt.

*Parodia idiosa* F.H. Brandt, *Frankfurter Kakteenf.* **3**(2): 6–8 (1976), (BO). **T.**: type herbaria: 990 (ZSS)[(sheet specimen) rad, corp, ar, sp, al, fl], herb ID ZSI 022.238.

*Parodia ignorata* F.H. Brandt, *Stachelpost* **8**: 86–87 (1972).

*Parodia krasuckana* F.H. Brandt, *Kakt. and. Sukk.* **23**(7): 179 (1972). **T.**: BO, Chuquisaca, between Tarabuco and Zudanez, Brandt 19a.

*Parodia multicostata* F. Ritter & Jelin. ex F. Ritter, *Kakteen Südamerika* **2**: 529–530, Fig. 391 (1980). **T.**: BO, Chuquisaca, between Yamparaez and Sotomayor, 1958, Ritter 733, holo. (U); iso. (ZSS), herb. ID ZSI 005.048.

*Parodia otuyensis* F. Ritter, *Cactus* (Paris) **17**(76): 52–53 (1962). **T.**: BO, Potosi, Saavedra, Otuyo, Dec 1958, Ritter 913.

*Parodia punae* Cárdenas, *Cact. Succ. J.* (Los Angeles) **42**: 39, Fig. 20, 21 (1970), (BO). **T.**: holo.: Puña - 6311. (herb. Cárdenas).

*Parodia quechua* F.H. Brandt, *Kakteen Orchid. Rundschau* **2**(1): 5 (1977), (BO).

*Parodia rosarioana* Diers, R. Hillmann & Krahn, *Kakt. and. Sukk.* **66**(11): 282–283, illus. (pp. 283–286) (2015). **T.**: BO, Prov. Mendez, Dept. Tarija, N. San Lorenzo, on the way to the Rio Pilaya, 2600–2800m, 25 Oct 2003, holo. Krahn 1035/1 (LPB), iso. Krahn 1035/2 (WU).

*Parodia stereospina* F.H. Brandt, *Kaktusz Vilag* **1977**(1): 10–12 (1977).

*Parodia sucrensis* F.H. Brandt, *Kakteen Orch. Rundschau* **8**(1): 1–4, Figs. (1983), (BO). **T.**: Knize 1980, holo. (HEID).

*Parodia tarabucina* Cárdenas, *Cact. Succ. J.* (Los Angeles) **33**: 108–109, Figs. 61, 62 (1961). **T.**: BO, Chuquisaca, Oropeza, between Sucre and

Tarabuco, 2900m, Feb 1949, Cárdenas 5528 (LIL not found).

*Parodia yamparaezi* Cárdenas, *Cactus* (Paris) **19**(82): 43 (1964), (BO). **T.**: holo. Cárdenas 6127 (herb. Cárdenas), iso. Cárdenas 6127 (US).

*Parodia zecheri* R.Vásquez, *Kakt. and. Sukk.* **29**(3): 49–50, Fig. (1978), (BO). **T.**: R.Vásquez 432, holo. (ZSS).

**Description:** Habit usually solitary, occasionally forming small clumps, stem depressed globose [to globose], [3.7–11]cm high × 5–[12]cm diameter, [light to dark green. Center crown from very spiny and little woolly, to white woolly or hairy, with a tangle of reddish spines]. Ribs 13–[21], spiralled, forming large rounded tubercles, sometimes less tuberculated toward the base. Central spines 1–4[–8], [when 4 forming a cross, conical, sometimes curved, hooked, or twisted, thicker than the radials, sometimes longer than radials, the lower curved or hooked to the tip, sometimes flattened, <2.7cm; light brown, yellowish brown, pinkish white], or grey. Radial spines [5–20], needle like, [some curved other twisted, some just curved to the tip, <2.3cm, whitish or white, then grey, or reddish]. Flower short bell shaped, 1.8–2.7cm high × 3cm diameter, yellow-red to red-orange. Fruit globose [to elongate], [(0.3–)]0.6–0.7[–(0.85)]cm high × [(0.2–)]0.45[–]0.6cm diameter, purple. Seeds finely tuberculate, dull black.

**Etymology:** From Latin *tuberculatus*, tuberculate; with reference to the tuberculated ribs.

**Habitat & Distribution:** Arid inter-Andean rocky valleys, and pre-Puna rocky slopes, 2800–3400m.

**Ecological regions:** Bolivian Montane Dry Forest, and the Central Andean Puna.

**Biomes:** Montane Grasslands and Shrublands.

**Occurrence:** BO(CQ,PO). Map 1.

**Comment:** *Parodia tuberculata* Cárdenas is the most important species in the group of external vicariants of *P. maassii* (see *Comment*). The taxon, in fact, colonizes a relatively large portion of territory in the extreme northeast of the *P. maassii* complex, with frequent populations, some of which with numerous individuals, showing a high variability within them. The core of the taxon populations occupy the valleys that extend in the 4 cardinal points from Tarabuco (i.e. in the direction of Presto in the north, Zudañes in the east, Icla in the south and Sucre in the west). Although in some adult individuals (from the south of Yamparaez) *P. tuberculata* may resemble very closely the habit and spination of *P. maassii*, even in the variety of semaphoronts presented (see materials and methods), the first taxon always maintains a tuberculate appearance that the second does not show. Our previous idea of a possible relationship between *P. tuberculata* and *P. prestoensis* (substantially based on photographic materials collected in the habitat from other researchers), has been



**Figure 88.** *Parodia warasii*. Brazil, Rio Grande do Sul, Barros Cassal, Rio Fão, RP0712.

Photograph: Rodrigo Pinto

investigated by dedicating a week of extensive research to the two taxa in 2014, working on 8 populations of *P. tuberculata* in distinct areas of the range and on seven populations of *P. prestoensis*, mainly in the area southeast of Tarabuco. The research carried out on these populations highlighted that the two taxa are not related (and that *P. prestoensis* is independent from the *P. maassii* complex). The morphological distinctions between the two taxa are substantially based on the curved or hooked central spines and the yellow-red to red-orange flower of the first taxon versus the porrect central spines and golden yellow flower of the second. Lowry's opinions and suggestions (pers. comm.) have been crucial in our comprehension of the taxonomic position of these two taxa.

**61. *Parodia warasii*** (F. Ritter) F.H. Brandt, *Kakteen Orch. Rundschau* 7(4): 62 (1982), as '*warasi*'. Basionym: *Eriocactus warasii* F. Ritter.

#### Homotypic Synonyms

*Eriocactus warasii* F. Ritter, *Bradea* 1(34): 353, Fig. (1973), incorrect name (Art. 11.4). T.: BR,

Rio Grande do Sul, Büneker in Ritter 1400. *Eriocéphala warasii* (F. Ritter) Guiggi, *Cactology* 3: 6 (2012).

*Notocactus warasii* (F. Ritter) T. Hewitt & Donald, *Ashingtonia* 1(11): loose page insert [2] (1975).

**Description:** Habit sometimes solitary, often branching basally to form clumps, [stem twisted with youth, becoming cylindrical elongate with age], <50cm high × 10–15cm diameter, dark grass green. Ribs 15–16, nearly triangular in cross section. Spines 15–20, flexible, [bristle-like], 1–4cm long, not easily distinguishable between centrals and radials, yellowish brown to brown. Flower 5–6cm diameter, golden to lemon yellow. Fruit barrel-shaped, 1.5cm high × 1cm diameter, opening basally with a transverse split. Seeds purse-shaped, black.

**Etymology:** Named to honour Eddie Waras, plant collector from São Paulo, Brazil.

**Habitat & Distribution:** Basaltic rocky walls on the rivers basins of the Serra Geral formation (Fão river), gradient close to 90°, surrounded by humid subtropical forest, 800–1000m.



**Figure 89.** *Parodia werdermanniana*. Uruguay, Tacuarembó, Cerro del Portón, 25 Nov. 2008, A&M 288.

**Ecological regions:** Alto Paraná Atlantic forests (Mata Atlântica & Selva Misionera), in eastern Argentina, southern Brazil and eastern Paraguay.

**Biomes:** Tropical and Subtropical Moist Broadleaf Forests.

**Occurrence:** BR(RS). Map 10.

**Comment:** Like all the ex-*Eriocactus*, *Parodia warasii* (F. Ritter) F.H. Brandt is not easily reachable in the habitat, considering that the taxon lives on basaltic rocky walls on the river basins of the Serra Geral formation (Fão river), gradient close to 90°, surrounded by humid subtropical forest. The few known populations (4), although numerous on site, configure *P. warasii* as a non-dominant species with a very fragmented distribution. The holomorphologically closest relative appears to be *P. magnifica*, and Gerloff & Neduchal, 2004: 42–43 consider *P. warasii* (as *Notocactus magnificus* var. *warasii* (F. Ritter) N. Gerloff & J. Neduchal) a variety of the second taxon. *P. warasii* stands out for having more twisted stems and darker cuticle than *P. magnifica*. We detected the taxon at the base of a wall on the Rio Fão, in the area of Barros Cassal, RS (BR).

**62. *Parodia werdermanniana*** (Herter) N.P. Taylor, *Bradleya* 5: 93 (1987). Basionym: *Notocactus werdermannianus* Herter.

#### Homotypic Synonyms

*Wigginsia werdermanniana* (Herter) Doweld, *Sukkulenty* 3(1–2): 62 (2000).

*Notocactus werdermannianus* Herter, *Revista Sudamer. Bot.* 7: 75, t. 2 (1942). **T.:** UY, Tacuarembó, Cerro Portón, arenisca São Bento, Walther (hb?).

*Peronocactus werdermannianus* (Herter) Doweld, *Sukkulenty* 2(3): 21 (1999), incorrect name (Art. 11.4).

#### Heterotypic Synonyms

*Notocactus ferrugineus* H.Schloss., *Internoto* 3(2): 23–26 (1982). **T.:** Schlosser S211 (Uruguay), holo.: deposited in Herbarium of the botanical department of the Museo Nacional de Historia Natural in Montevideo/Uruguay.

*Notocactus memorialis* Prestlé, *Internoto* 9(1): 7 (1988), (UY).



*Notocactus vanvlietii* Rausch, *Kakt. and. Sukk.* 21(5): 89–90, Figs. (1970). T.: UY, Tacuarembó, Rausch 376, holo. (ZSS) [(spirit specimen) rad, corp, ar, sp], herb. ID ZSI 006.224.

**Description:** Habit solitary [or clustering], [globose to] club shaped, 13[–17]cm high × [6.3–]10cm diameter, yellow-green. Ribs [30–]40, straight, with many [prominent] chin like tubercles. Spines needle to bristle-like. Central spines [1], needle-like, [directed downward, <1.8cm long, straw yellow]. Radial spines [c. 20, prominent], not adpressed, <0.5cm long, yellowish white. Flower [4.8–]6cm high × [5.8–]7cm diameter, inner tepals bright lemon yellow with darker mid stripe, stamens and anthers yellow, style yellow, stigma lobes 9, purple. Pericarpel + hypanthium with brownish bristles. Fruit egg-shaped, dark green, with dark brown felt and hairs. Seeds black.

**Etymology:** Named to honour Prof. Dr. Erich Werdermann, German botanist in Berlin, specialist on cacti, 1927–1934 president of the Deutsche Kakteen-Gesellschaft, and director of the Botanischer Garten und Museum Berlin until 1958.

**Habitat & Distribution:** Sandstone ‘cerros chatos’ (mountain tables), on pampa grasslands in Uruguay, up to 60m.

**Ecological regions:** Humid and Semiarid Pampas of Argentina, Uruguay and Southern Brazil.

**Biomes:** Tropical and Subtropical Grasslands, Savannas, and Shrublands.

**Occurrence:** UY(TA). Map 9.

**Comment:** Despite the similarity pointed out in Hunt *et al.* (2006, text: 225), *Parodia werdermanniana* (Herter) N.P. Taylor is distinct from *Parodia scopae* (Sprengel) N.P. Taylor by the smaller body (13–17 × 6.3–10 cm, compared with 5–50 × 6–10 cm), the colour of the stem (yellow green vs. dark green) and the most prominent chin like tubercles, not hidden by the radial spines, which are less (about 20, vs. 12–40 or more), more prominent and not so close to the plant body as in *P. scopae*. *P. werdermanniana*, that seems to be the only endemic cactus of Uruguay, is configured as a non-dominant species with a very fragmented distribution, considering that the few populations live only on some sandstone ‘cerros chatos’ (flat mountains), south of the city of Tacuarembó. We studied the taxon at the Cerro del Porton, in the type locality, where the species lives in sympatry with *P. erinacea*. At the time of the survey (2008) we struggled to find the “cerro” in question, in the midst of the numerous pines plantations of the area.

#### Acknowledgements

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Special thanks for their input are due to

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Further thanks for providing additional images go to Graham Charles (*P. formosa*), Martin Lowry (*P. gibbulosa*), and Rodrigo Pontes (*P. warasii*).

Finally, without the help of all those friends who supported and helped us in the countries of origin of the plants during our expeditions, this enterprise would never have been possible: muchas gracias, obrigado, thank you.

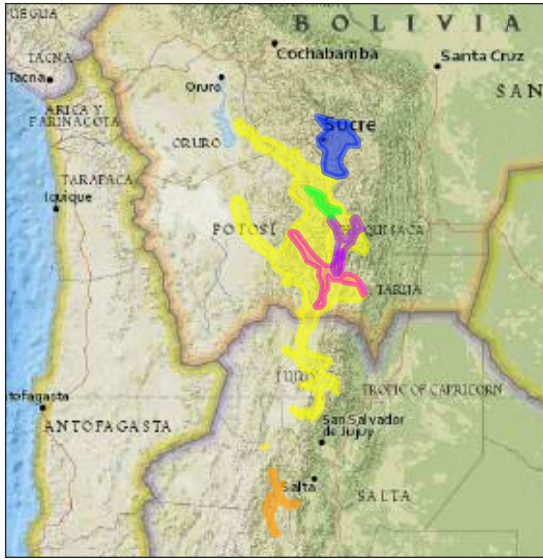
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## Appendix I: Distibution Maps



**Map 1. *P. maassii* complex**, (based on 266 locations in total). Extension of occurrence of: *P. maassii* (163 locations, yellow), *P. aureicentra* (21 locations, orange), *P. commutans* (22 locations, fuchsia), *P. otaviana* (12 locations, green), *P. subterranea* (22 locations, violet), *P. tuberculata* (26 locations, blue).



**Map 2. *P. microsperma* complex**, (based on 176 locations in total). Extension of occurrence of: *P. microsperma* (140 locations, fuchsia), *P. horrida* (36 locations, green).



**Map 3. Relatively dominant species in a restricted area (Andean area)**, (based on 175 locations in total). Extension of occurrence of: *P. ayopayana* (17 locations, yellow), *P. chrysacanthion* (11 locations, orange), ***P. columnaris* complex**: *P. columnaris* (16 locations, fuchsia), *P. ocampoi* (7 locations, grass green), *P. gibbulo* (2 locations, brown), *P. hausteiniana* (7 locations, violet), *P. mairanana* (9 locations, sky-blue), *P. prestonis* (11 locations, blue), *P. procera* (11 locations, ochre yellow), *P. ritteri* (31 locations, red), *P. schwebsiana* (10 locations, dark-blue), *P. stuemeri* (39 locations, dark-green), *P. taratensis* (4 locations, pink).



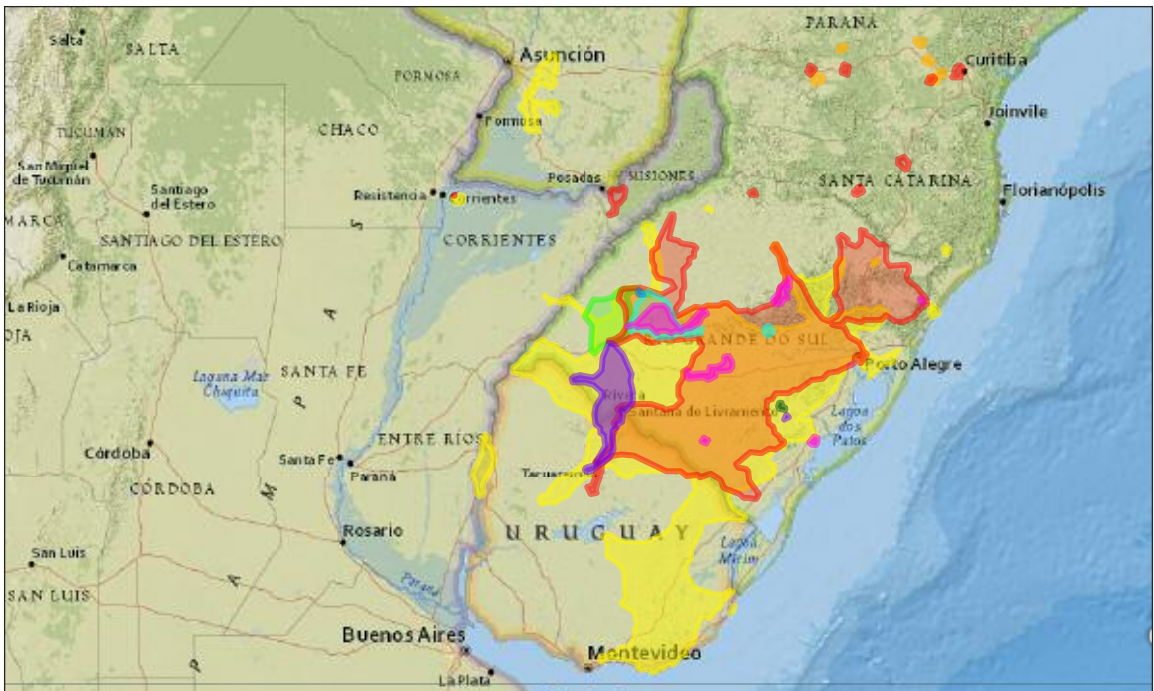
**Map 4. Non dominant species with fragmented or very fragmented distribution (Andean area)**, (based on 58 locations in total). Extension of occurrence of: *P. comarapana* (8 locations, violet), *P. formosa* (18 locations, grass green), *P. hegeri* (7 locations, red), *P. nivosa* (25 locations, sky-blue).



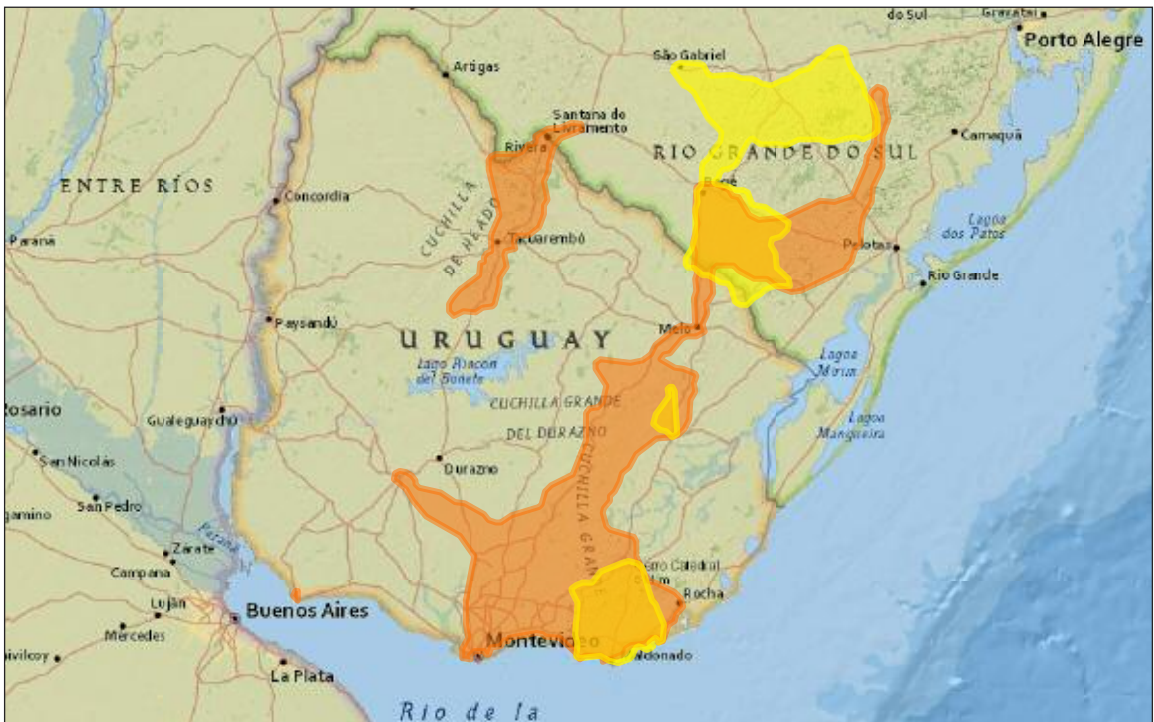
Map 5. *P. erinacea* (based on 126 locations, orange).



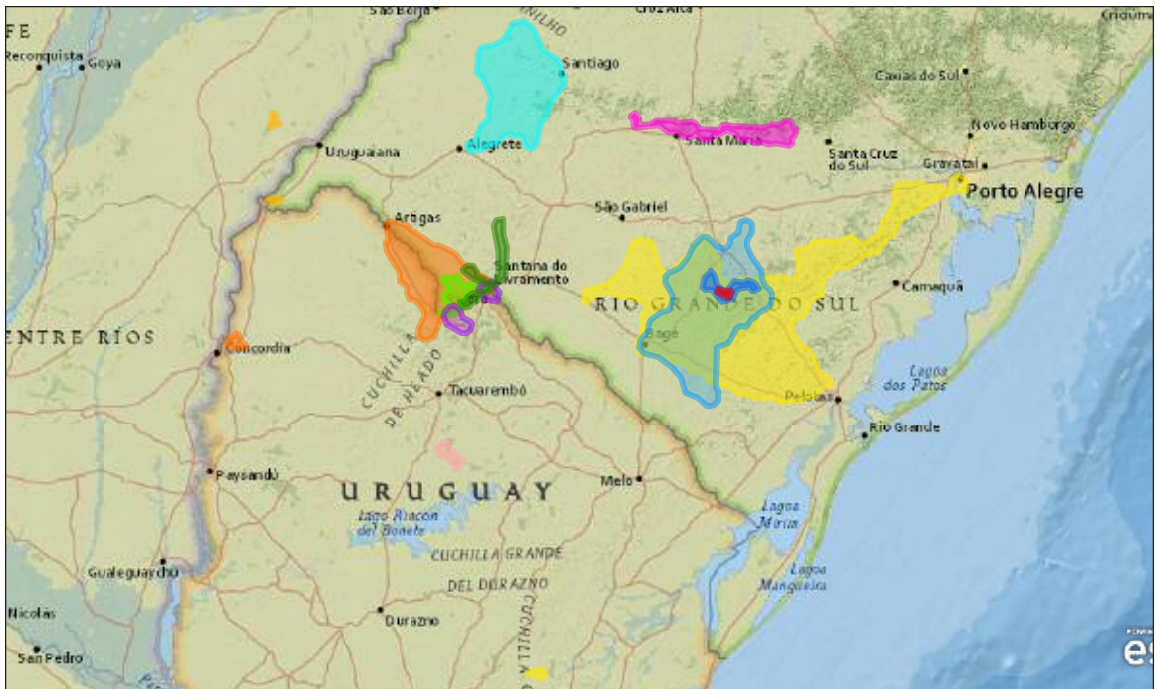
Map 6. *P. mammulosa* complex, (based on 527 locations in total). Extention of occurrence of: *P. mammulosa* (450) 'mammulosa' populations (218 locations, orange), 'submammulosa' populations (222 locations, yellow) and 'tureckiana' populations (10 locations, fuchsia), *P. curvispina* (23 locations, violet), *P. maldonadensis* (17 locations, sky-blue), *P. mueller-melchersii* (37 locations, green).



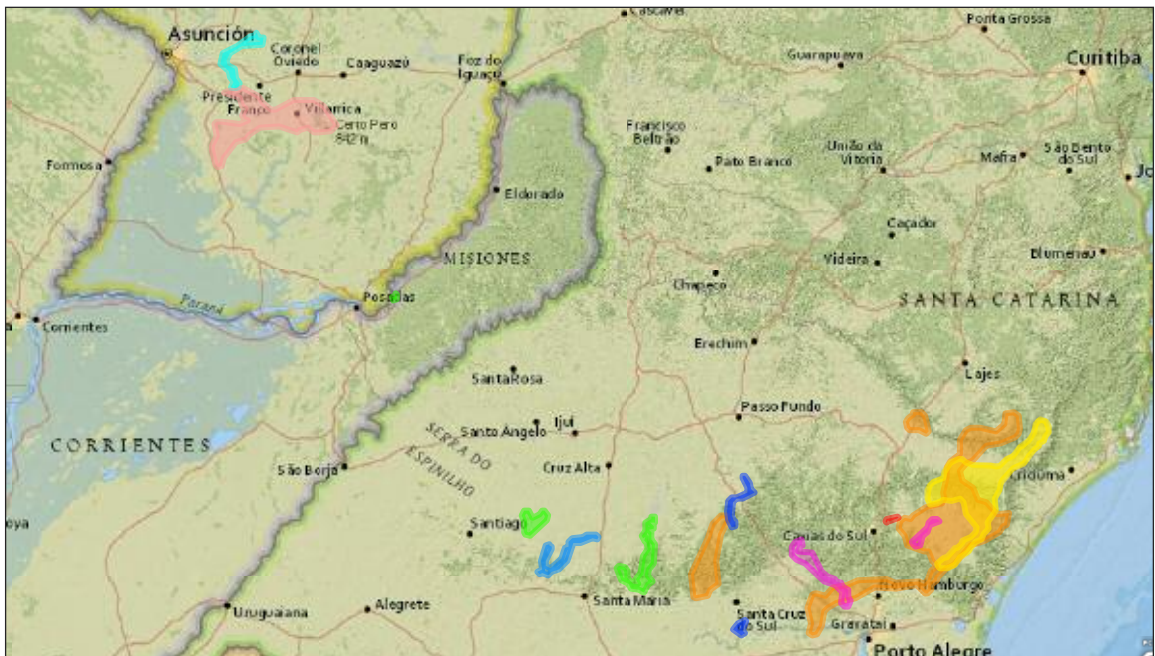
**Map 7. *P. ottonis* complex**, (based on 608 locations in total). Extention of occurrence of: *P. ottonis* (362 locations, yellow), *P. carambeiensis* (7 locations, ocher yellow), *P. gaucha* (1 locations, dark-green), *P. ibicuiensis* (15 locations, grass green), *P. linkii* (152 locations, red), *P. muricata* (18 locations, sky-blue), *P. oxycostata* (26 locations, fuchsia), *P. stockingeri* (1 location, blue), *P. tenuicylindrica* (26 locations, violet).



**Map 8. Ex-dominant species, now with fragmented distribution (Pampas area)**, (based on 138 locations in total). Extention of occurrence of: *P. concinna* (79 locations, orange), *P. scopa* (59 locations, yellow).



**Map 9. Non dominant species with fragmented or very fragmented distribution (Pampas area)**, (based on 161 locations in total). Extension of occurrence of: *P. allosiphon* (4 locations, grass green), *P. buiningii* (13 locations, orange), *P. calvescens* (3 locations, ocher yellow), *P. crassigibba* (31 locations, blue), *P. herteri* (12 locations, violet), *P. horstii* (7 locations, fuchsia), *P. langsdorffii* (44 locations, yellow), *P. neobuenekeri* (3 locations, red), *P. neohorstii* (8 locations, dark-blue), *P. nothorauschii* complex: *P. nothorauschii* (11 locations, dark-green), *P. fusca* (24 locations, sky-blue), *P. werdermanniana* (1 locations, pink).



**Map 10. Ex-Brasilicactus / Brasiliparodia group**, (based on 77 locations in total). Extension of occurrence of: *P. alacriportana* (20 locations, yellow), *P. haselbergii* (20 locations, orange), *P. rechensis* (2 locations, red); **ex-Eriocactus group**: *P. claviceps* (7 locations, grass green), *P. leninghausii* (7 locations, fuchsia), *P. magnifica* (5 locations, blue), *P. nigrispina* (6 locations, sky-blue), *P. schumanniana* (7 locations, pink), *P. warasii* (3 locations, dark-blue).

## Appendix II:

Index of names considered in the synonymy. Genera and accepted species in *Parodia* are in **boldface**. Synonyms are not. Taxa are alphabetically listed in order of their final epithet.

- Parodia**  
*aconquijaensis* → *Parodia microsperma*  
*agasta* → *Parodia ritteri*  
*aglaisma* → *Parodia ritteri*  
*concinna* ssp. *agnetae* → *Parodia concinna*
- alacriportana**  
*albofuscata* → *Parodia microsperma*  
**allosiphon**  
*amblayensis* → *Parodia microsperma*  
*ampliocostata* → *Parodia schumanniana*  
*andreae* → *Parodia procera*  
*andreaeoides* → *Parodia procera*  
*applanata* → *Parodia schwebsiana*  
*schwebsiana* var. *applanata* → *Parodia schwebsiana*  
*argerichiana* → *Parodia microsperma*  
*arnostiana* → *Parodia curvispina*  
*obtusa* ssp. *atochana* → *Parodia maassii*  
*atroviridis* → *Parodia horrida*  
*augustinii* → *Parodia ocampoi*  
**aureicentra**  
*aureispina* → *Parodia microsperma*  
**ayopayana**  
*backebergiana* → *Parodia tuberculata*  
*belenensis* → *Parodia microsperma*  
*bellavistana* → *Parodia formosa*  
*belliata* → *Parodia ritteri*  
*bermejoensis* → *Parodia maassii*  
*betaniana* → *Parodia microsperma*  
*bilbaensis* → *Parodia taratensis*  
*concinna* ssp. *blauuwiana* → *Parodia concinna*  
*tabularis* ssp. *bommeljei* → *Parodia concinna*  
*borealis* → *Parodia ayopayana*  
*brasiliensis* → *Parodia mammulosa*  
*mammulosa* ssp. *brasiliensis* → *Parodia mammulosa*  
*brevihamata* → *Parodia alacriportana*  
*alacriportana* ssp. *brevihamata* → *Parodia alacriportana*  
*buenekeri* → *Parodia alacriportana*  
*alacriportana* ssp. *buenekeri* → *Parodia alacriportana*
- buiningii**  
*buxbaumiana* → *Parodia ayopayana*  
*cabracorralensis* → *Parodia microsperma*  
*cachiana* → *Parodia horrida*  
*caespitosa* → *Parodia concinna*  
*caineana* → *Parodia taratensis*  
**calvescens**  
*turbinata* ssp. *calvescens* → *Parodia calvescens*  
*camargensis* → *Parodia ritteri*  
*camblayana* → *Parodia ritteri*  
*camargensis* var. *camblayana* → *Parodia ritteri*  
*campestris* → *Parodia microsperma*  
*candidata* → *Parodia tuberculata*  
*capillitaensis* → *Parodia microsperma*  
**carambeiensis**  
*carapariana* → *Parodia formosa*  
*cardenasii* → *Parodia formosa*  
*carminata* → *Parodia stuemeri*  
*carrerana* → *Parodia ritteri*  
*castanea* → *Parodia ritteri*  
*camargensis* var. *castanea* → *Parodia ritteri*
- catamarcensis* → *Parodia microsperma*  
*catarinensis* → *Parodia alacriportana*  
*alacriportana* ssp. *catarinensis* → *Parodia alacriportana*  
*cebilarensis* → *Parodia microsperma*  
*chaetocarpa* → *Parodia formosa*  
*challamarcana* → *Parodia procera*  
*chirimoyarana* → *Parodia formosa*  
*chlorocarpa* → *Parodia microsperma*  
**chrysacanthion**  
*cintiensis* → *Parodia ritteri*  
**claviceps**  
*schumanniana* ssp. *claviceps* → *Parodia claviceps*
- columnaris**  
**comarapana**  
**commutans**  
*comosa* → *Parodia ayopayana*  
**concinna**  
*copavilquensis* → *Parodia ocampoi*  
*cotacajensis* → *Parodia ayopayana*  
**crassigibba**  
*crucinigricentra* → *Parodia nivosa*  
*culpinensis* → *Parodia subterranea*  
**curvispina**  
*dextrohamata* → *Parodia horrida*  
*dichroacantha* → *Parodia horrida*  
*echinopsoides* → *Parodia columnaris*  
*echinus* → *Parodia ayopayana*  
*elachisantha* → *Parodia haselbergii*  
*elachista* → *Parodia ocampoi*  
*zecheri* ssp. *elachista* → *Parodia ocampoi*  
*elata* → *Parodia ayopayana*  
*elegans* → *Parodia microsperma*  
**erinacea**  
*mammulosa* ssp. *erythracantha* → *Parodia mammulosa*  
*erythrantha* → *Parodia microsperma*  
*escayachensis* → *Parodia maassii*  
*mammulosa* ssp. *eugeniae* → *Parodia mueller-melchersii*  
*exquisita* → *Parodia ocampoi*  
*faustiana* → *Parodia nivosa*  
*fechseri* → *Parodia microsperma*  
*firmissima* → *Parodia tuberculata*  
**formosa**  
*fricana* → *Parodia stuemeri*  
*fulvispina* → *Parodia ritteri*  
**fusca**  
*fuscatoviridis* → *Parodia microsperma*  
**gaucha**  
**gibbulosa**  
*gibbulosoides* → *Parodia gibbulosa*  
*gigantea* → *Parodia stuemeri*  
*glaucina* → *Parodia ottonis*  
*glischrocarpa* → *Parodia microsperma*  
*rudibuenekeri* ssp. *glomerata* → *Parodia scopa*  
*gokrauseana* → *Parodia stuemeri*  
*gracilis* → *Parodia procera*  
*oxycostata* ssp. *gracilis* → *Parodia ottonis*  
*graessneri* → *Parodia haselbergii*  
*haselbergii* ssp. *graessneri* → *Parodia haselbergii*  
*grandiflora* → *Parodia microsperma*  
*nothominuscula* ssp. *gravior* → *Parodia ottonis*  
*grossei* → *Parodia schumanniana*  
*guachipasana* → *Parodia microsperma*  
*gutkunstiana* → *Parodia stuemeri*
- mueller-melchersii* ssp. *gutierrezii* → *Parodia mueller-melchersii*  
*haageana* → *Parodia maassii*  
**haselbergii**  
**hausteiniana**  
**hegeri**  
**herteri**  
*herzogii* → *Parodia microsperma*  
*microsperma* ssp. *herzogii* → *Parodia microsperma*  
*heteracantha* → *Parodia horrida*  
*heyeriana* → *Parodia microsperma*  
**horrida**  
*microsperma* ssp. *horrida* → *Parodia horrida*
- horstii**  
*ottonis* ssp. *horstii* → *Parodia ottonis*  
*humeliana* → *Parodia microsperma*  
**ibicuiensis**  
*idiosa* → *Parodia tuberculata*  
*malyana* ssp. *igneiflora* → *Parodia microsperma*  
*ignorata* → *Parodia tuberculata*  
*jujuyana* → *Parodia stuemeri*  
*kilianana* → *Parodia horrida*  
*knizei* → *Parodia maassii*  
*koehresiana* → *Parodia maassii*  
*krahni* → *Parodia taratensis*  
*krasuckana* → *Parodia tuberculata*  
*ladae* → *Parodia subterranea*  
*lamprospina* → *Parodia maassii*  
**langsdorfii**  
*lauri* → *Parodia hausteiniana*  
*legitima* → *Parodia columnaris*  
*lembcke* → *Parodia microsperma*  
**leninghausii**  
*leninghausii* → *Parodia leninghausii*  
**linkii**  
*lohaniana* → *Parodia horrida*  
*lychnosa* → *Parodia procera*  
**maassii**  
*macednosa* → *Parodia ayopayana*  
*macrancistra* → *Parodia microsperma*  
**magnifica**  
**mairanana**  
**maldonadensis**  
*malyana* → *Parodia microsperma*  
**mammulosa**  
*scopa* ssp. *marchesii* → *Parodia scopa*  
*matthesiana* → *Parodia microsperma*  
*maxima* → *Parodia commutans*  
*mendeziana* → *Parodia maassii*  
*meonacantha* → *Parodia crassigibba*  
*mercedesiana* → *Parodia microsperma*  
*mesembrina* → *Parodia microsperma*  
**microsperma**  
*microthele* → *Parodia microsperma*  
*miguillensis* → *Parodia ayopayana*  
*minima* → *Parodia microsperma*  
*minima* → *Parodia schwebsiana*  
*submammulosa* subsp. *minor* → *Parodia mammulosa*  
*minuscula* → *Parodia microsperma*  
*minuta* → *Parodia ocampoi*  
*miranda* → *Parodia subterranea*  
**mueller-melchersii**  
*muhrii* → *Parodia aureicentra*  
*langsdorfii* ssp. *multiceps* → *Parodia langsdorfii*  
*multicostata* → *Parodia tuberculata*  
**muricata**  
*mutabilis* → *Parodia microsperma*



nana → *Parodia microsperma*  
 neglecta → *Parodia mairanana*  
 neglectoides → *Parodia mairanana*  
 neoarechavaletae → *Parodia maldonadensis*  
**neobuenekeri**  
 scopa ssp. neobuenekeri → *Parodia neobuenekeri*  
**neohorstii**  
 nigresca → *Parodia subterranea*  
**nigrispina**  
**nivosa**  
 nothominuscula → *Parodia ottonis*  
**nothorauschi**  
 obtusa → *Parodia commutans*  
**ocampo**  
 occulta → *Parodia subterranea*  
**otaviana**  
**ottonis**  
 ottyensis → *Parodia tuberculata*  
**oxycostata**  
 pachysa → *Parodia formosa*  
 papagayana → *Parodia microsperma*  
 paraguayensis → *Parodia ottonis*  
 parvula → *Parodia formosa*  
 penicillata → *Parodia nivosa*  
 permutata → *Parodia mueller-melchersii*  
 perplexa → *Parodia procera*  
 pilayensis → *Parodia procera*  
 piltziorum → *Parodia horrida*  
 wernerii ssp. pleiocephala → *Parodia crassigibba*  
 pluricentralis → *Parodia horrida*  
**prestoensis**  
**procera**  
 prolifera → *Parodia ritteri*  
 camargensis var. prolifera → *Parodia ritteri*  
 pseudoayopayana → *Parodia ayopayana*  
 pseudoprocera → *Parodia procera*  
 pseudostuenteri → *Parodia stuenteri*  
 pseudosubterranea → *Parodia subterranea*  
 punae → *Parodia tuberculata*  
 purpureoaurae → *Parodia formosa*  
 pusilla → *Parodia formosa*  
 quechua → *Parodia tuberculata*  
 rauschii → *Parodia aureicentra*  
**rechensis**  
 rigida → *Parodia horrida*  
 rigidispina → *Parodia microsperma*  
 riograndensis → *Parodia procera*  
 riojensis → *Parodia microsperma*  
**ritteri**  
 robustihamata → *Parodia subterranea*  
 rosarioana → *Parodia tuberculata*  
 rosealba → *Parodia ritteri*  
 rostrum-sperma → *Parodia ritteri*  
 rubelliamata → *Parodia microsperma*  
 rubida → *Parodia ritteri*  
 rubricentra → *Parodia stuenteri*  
 rubriflora → *Parodia microsperma*  
 rubrispina → *Parodia stuenteri*  
 rubristaminea → *Parodia microsperma*  
 rudibuenekeri → *Parodia scopa*  
 rutilans → *Parodia mueller-melchersii*  
 saint-pieana → *Parodia chrysacanthion*  
 salitrensis → *Parodia subterranea*  
 salmonea → *Parodia schwebsiana*  
 sanguiniflora → *Parodia microsperma*  
 schuetziana → *Parodia stuenteri*  
**schumanniana**  
**schwebsiana**

**scopa**  
 scopaooides → *Parodia microsperma*  
 scoparia → *Parodia stuenteri*  
 sellowii → *Parodia erinacea*  
 separata → *Parodia procera*  
 setifera → *Parodia microsperma*  
 setispina → *Parodia formosa*  
 setosa → *Parodia stuenteri*  
 slabana → *Parodia subterranea*  
 sotomayorensis → *Parodia prestoensis*  
 spanisa → *Parodia microsperma*  
 spegazziniana → *Parodia microsperma*  
 splendens → *Parodia ritteri*  
 stereospina → *Parodia tuberculata*  
**stockingeri**  
**stuenteri**  
 submammulosa → *Parodia mammulosa*  
 mammulosa ssp. submammulosa → *Parodia mammulosa*  
**subterranea**  
 subtiliamata → *Parodia procera*  
 succinea → *Parodia scopa*  
 scopa subsp. succinea → *Parodia scopa*  
 suensis → *Parodia tuberculata*  
 superba → *Parodia horrida*  
 suprema → *Parodia maassii*  
 tabularis → *Parodia concinna*  
 tafiensis → *Parodia microsperma*  
 talaensis → *Parodia microsperma*  
 tarabucina → *Parodia tuberculata*  
**taratensis**  
**tenuicylindrica**  
 thieleana → *Parodia maassii*  
 thionantha → *Parodia microsperma*  
 tilcarensis → *Parodia stuenteri*  
 tillii → *Parodia formosa*  
 tojoensis → *Parodia ritteri*  
 tolongona → *Parodia horrida*  
 tredecimcostata → *Parodia procera*  
**tuberculata**  
 tuberculosi-costata → *Parodia microsperma*  
 tucumanensis → *Parodia microsperma*  
 tumbayana → *Parodia stuenteri*  
 turbinata → *Parodia erinacea*  
 turecekiana → *Parodia mammulosa*  
 uebelmanniana → *Parodia microsperma*  
 uhligiana → *Parodia nivosa*  
 variicolor → *Parodia aureicentra*  
 rutilans ssp. veeniana → *Parodia mueller-melchersii*  
 wagneriana → *Parodia microsperma*  
**warasii**  
 weberiana → *Parodia microsperma*  
 weberioides → *Parodia microsperma*  
**werdermanniana**  
 wernerii → *Parodia crassigibba*  
 weskampiana → *Parodia microsperma*  
 winbergii → *Parodia formosa*  
 mueller-melchersii ssp. winkleri → *Parodia mueller-melchersii*  
 yamparaezi → *Parodia tuberculata*  
 zaletaewana → *Parodia subterranea*  
 zecheri → *Parodia tuberculata*  
**Acanthocephala**  
 graessneri → *Parodia haselbergii*  
 haselbergii → *Parodia haselbergii*  
**Boliviacactus**  
 aureicentrus → *Parodia aureicentra*  
 columnaris → *Parodia columnaris*  
 comarapanus → *Parodia comarapana*  
 commutans → *Parodia commutans*  
 hausteianus → *Parodia hausteianiana*

*maassii* → *Parodia maassii*  
*mairananus* → *Parodia mairanana*  
*ocampo* → *Parodia ocampo*  
*otavianus* → *Parodia otaviana*  
*procerus* → *Parodia procera*  
*ritteri* → *Parodia ritteri*  
*saint-pieanus* → *Parodia chrysacanthion*  
*schwebsianus* → *Parodia schwebsiana*  
*stuenteri* → *Parodia stuenteri*  
*subterraneus* → *Parodia subterranea*  
*taratensis* → *Parodia taratensis*  
*tilcarensis* → *Parodia stuenteri*  
*tuberculatus* → *Parodia tuberculata*  
**Brasilicactus**  
**alacriportanus** → *Parodia alacriportana*  
*brevihamatus* → *Parodia alacriportana*  
*buenekeri* → *Parodia alacriportana*  
*catarinensis* → *Parodia alacriportana*  
*elachisanthus* → *Parodia haselbergii*  
*graessneri* → *Parodia haselbergii*  
*haselbergii* → *Parodia haselbergii*  
*rechensis* → *Parodia rechensis*  
**Brasiliparodia**  
*alacriportana* → *Parodia alacriportana*  
*brevihamata* → *Parodia alacriportana*  
*buenekeri* → *Parodia alacriportana*  
*catarinensis* → *Parodia alacriportana*  
*rechensis* → *Parodia rechensis*  
**Cactus**  
*erinaceus* → *Parodia erinacea*  
*langsдорffii* → *Parodia langsdorffii*  
*linkii* → *Parodia linkii*  
*ottonis* → *Parodia ottonis*  
*scopa* → *Parodia scopa*  
**Dactylanthocactus**  
*graessneri* → *Parodia haselbergii*  
**Echinocactus**  
*acuatus* → *Parodia erinacea*  
*apricus* → *Parodia concinna*  
*arechavaletae* → *Parodia ottonis*  
*acuatus* var. *arechavaletae* → *Parodia maldonadensis*  
*caespitosus* → *Parodia concinna*  
*chrysacanthion* → *Parodia chrysacanthion*  
*concinna* → *Parodia concinna*  
*corynodes* → *Parodia erinacea*  
*courantii* → *Parodia erinacea*  
*elachisanthus* → *Parodia haselbergii*  
*microspermus* var. *erythranthus* → *Parodia microsperma*  
*escayachensis* → *Parodia maassii*  
*flicomus* → *Parodia mammulosa*  
*fricii* → *Parodia erinacea*  
*graessneri* → *Parodia haselbergii*  
*grossii* → *Parodia schumanniana*  
*haselbergii* → *Parodia haselbergii*  
*herteri* → *Parodia herteri*  
*hypocrateriformis* → *Parodia mammulosa*  
*joadii* → *Parodia concinna*  
*leninghausii* → *Parodia leninghausii*  
*leucocarpus* → *Parodia erinacea*  
*linkii* → *Parodia linkii*  
*maassii* → *Parodia maassii*  
*microspermus* var. *macrancistrus* → *Parodia microsperma*  
*sellowii* var. *macrogonus* → *Parodia erinacea*

- maldonadensis* → *Parodia maldonadensis*  
*mammulosus* → *Parodia mammulosa*  
*megapotamicus* → *Parodia linkii*  
*microspermus* → *Parodia microsperma*  
*muricatus* → *Parodia muricata*  
*nigrispinus* → *Parodia nigrispina*  
*ottonis* → *Parodia ottonis*  
*pampeanus* → *Parodia mammulosa*  
*pauciareolatus* → *Parodia erinacea*  
*polyacanthus* → *Parodia langsdorfii*  
*schumannianus* → *Parodia schumanniana*  
*schwebsianus* → *Parodia schwebsiana*  
*sellowii* → *Parodia erinacea*  
*sessiliflorus* → *Parodia erinacea*  
*stuemeri* → *Parodia stuemeri*  
*submammulosus* → *Parodia mammulosa*  
*concinna* var. *tabularis* → *Parodia concinna*  
*tenuispinus* → *Parodia ottonis*  
*tephraacanthus* → *Parodia erinacea*  
*tetracanthus* → *Parodia erinacea*  
*microspermus* var. *thionanthus* → *Parodia microsperma*  
*stuemeri* var. *tilcarensis* → *Parodia stuemeri*  
*tortuosus* → *Parodia ottonis*  
*sellowii* var. *turbinatus* → *Parodia erinacea*  
*ottonis* var. *uruguayus* → *Parodia ottonis*  
*vorwerkianus* → *Parodia erinacea*
- Eriocactus**  
*ampliocostatus* → *Parodia schumanniana*  
*claviceps* → *Parodia claviceps*  
*schumannianus* ssp. *claviceps* → *Parodia claviceps*  
*grossei* → *Parodia schumanniana*  
*leninghausii* → *Parodia leninghausii*  
*magnificus* → *Parodia magnifica*  
*leninghausii* var. *minor* → *Parodia leninghausii*  
*nigrispinus* → *Parodia nigrispina*  
*schumannianus* → *Parodia schumanniana*  
*warasii* → *Parodia warasii*
- Eriocephal**  
*claviceps* → *Parodia claviceps*  
*schumanniana* ssp. *claviceps* → *Parodia claviceps*  
*grossei* → *Parodia schumanniana*  
*leninghausii* → *Parodia leninghausii*  
*magnifica* → *Parodia magnifica*  
*leninghausii* ssp. *minor* → *Parodia leninghausii*  
*nigrispina* → *Parodia nigrispina*  
*schumanniana* ssp. *nigrispina* → *Parodia nigrispina*  
*schumanniana* → *Parodia schumanniana*  
*warasii* → *Parodia warasii*
- Frailea**  
*caespitosa* → *Parodia concinna*
- Hickenia**  
*microsperma* → *Parodia microsperma*
- Malacocarpus**  
*acuatus* → *Parodia erinacea*  
*apricus* → *Parodia concinna*
- arechavaletae* → *Parodia ottonis*  
*bezrucii* → *Parodia erinacea*  
*caespitosus* → *Parodia concinna*  
*concinna* → *Parodia concinna*  
*corynodes* → *Parodia erinacea*  
*courantii* → *Parodia erinacea*  
*erinaceus* → *Parodia erinacea*  
*escayachensis* → *Parodia maassii*  
*fricii* → *Parodia erinacea*  
*graessneri* → *Parodia haselbergii*  
*grossei* → *Parodia schumanniana*  
*haselbergii* → *Parodia haselbergii*  
*langsdorfii* → *Parodia langsdorfii*  
*leninghausii* → *Parodia leninghausii*  
*leucocarpus* → *Parodia erinacea*  
*linkii* → *Parodia linkii*  
*maassii* → *Parodia maassii*  
*macrogonus* → *Parodia erinacea*  
*mammulosus* → *Parodia mammulosa*  
*martinii* → *Parodia erinacea*  
*muricatus* → *Parodia muricata*  
*nigrispinus* → *Parodia nigrispina*  
*ottonis* → *Parodia ottonis*  
*pauciareolatus* → *Parodia erinacea*  
*polyacanthus* → *Parodia langsdorfii*  
*rubricostatus* → *Parodia erinacea*  
*schumannianus* → *Parodia schumanniana*  
*scopa* → *Parodia scopa*  
*sellowii* → *Parodia erinacea*  
*sessiliflorus* → *Parodia erinacea*  
*stegmannii* → *Parodia erinacea*  
*tabularis* → *Parodia concinna*  
*tephraacanthus* → *Parodia erinacea*  
*tetracanthus* → *Parodia erinacea*  
*turbinatus* → *Parodia erinacea*  
*vorwerkianus* → *Parodia erinacea*
- Notocactus**  
*acuatus* → *Parodia erinacea*  
*acutus* → *Parodia oxycostata*  
*agnetae* → *Parodia concinna*  
*concinna* ssp. *agnetae* → *Parodia concinna*  
*alacriportanus* → *Parodia alacriportana*  
*albigemmatu* → *Parodia mammulosa*  
*allosiphon* → *Parodia allosiphon*  
*ampliocostatus* → *Parodia schumanniana*  
*apricus* → *Parodia concinna*  
*arachnitis* → *Parodia crassigibba*  
*arechavaletae* → *Parodia ottonis*  
*arnostianus* → *Parodia curvispina*  
*beltranii* → *Parodia erinacea*  
*bezrucii* → *Parodia erinacea*  
*blaauwianus* → *Parodia concinna*  
*bommeljei* → *Parodia concinna*  
*tabularis* ssp. *bommeljei* → *Parodia concinna*  
*mammulosus* ssp. *brasiliensis* → *Parodia mammulosa*  
*mammulosus* var. *brasiliensis* → *Parodia mammulosa*  
*brederooianus* → *Parodia concinna*  
*brevihamatus* → *Parodia alacriportana*  
*buenekeri* → *Parodia alacriportana*  
*buiningii* → *Parodia buiningii*  
*caespitosus* → *Parodia concinna*  
*calvescens* → *Parodia calvescens*  
*campestrensis* → *Parodia ottonis*  
*carambeiensis* → *Parodia carambeiensis*  
*catarinensis* → *Parodia alacriportana*  
*claviceps* → *Parodia claviceps*  
*schumannianus* ssp. *claviceps* → *Parodia claviceps*
- concinnoioides* → *Parodia claviceps*  
*concinna* → *Parodia concinna*  
*corynodes* → *Parodia erinacea*  
*courantii* → *Parodia erinacea*  
*crassigibbus* → *Parodia crassigibba*  
*cristatoides* → *Parodia curvispina*  
*curvispinus* → *Parodia curvispina*  
*eremiticus* → *Parodia concinna*  
*erinaceus* → *Parodia erinacea*  
*erythracanthus* → *Parodia mammulosa*  
*mammulosus* ssp. *erythracanthus* → *Parodia mammulosa*  
*eugeniae* → *Parodia mueller-melchersii*  
*mammulosus* ssp. *eugeniae* → *Parodia mueller-melchersii*  
*eurypleurus* → *Parodia ottonis*  
*euelevnovskyi* → *Parodia mammulosa*  
*ferrugineus* → *Parodia werdermanniana*  
*floricomus* → *Parodia mammulosa*  
*fricii* → *Parodia erinacea*  
*fuscus* → *Parodia fusca*  
*gaucho* → *Parodia gaucha*  
*gerloffii* → *Parodia fusca*  
*gibberulus* → *Parodia concinna*  
*glaucinus* → *Parodia ottonis*  
*globularis* → *Parodia ottonis*  
*glomeratus* → *Parodia scopa*  
*glomeratus* ssp. *glomeratus* → *Parodia scopa*  
*gracilis* → *Parodia ottonis*  
*oxycostatus* ssp. *gracilis* → *Parodia ottonis*  
*glaucinus* var. *gracilis* → *Parodia ottonis*  
*graessneri* → *Parodia haselbergii*  
*grandiense* → *Parodia ottonis*  
*grossei* → *Parodia schumanniana*  
*gutierrezii* → *Parodia mueller-melchersii*  
*mueller-melchersii* ssp. *gutierrezii* → *Parodia mueller-melchersii*  
*harmonianus* → *Parodia ottonis*  
*haselbergii* → *Parodia haselbergii*  
*herteri* → *Parodia herteri*  
*horstii* → *Parodia horstii*  
*ottonis* ssp. *horstii* → *Parodia ottonis*  
*arechavaletae* var. *horstii* → *Parodia ottonis*  
*hypocrateriformis* → *Parodia mammulosa*  
*ibicuiensis* → *Parodia ibicuiensis*  
*incomptus* → *Parodia ottonis*  
*joadii* → *Parodia concinna*  
*katharinae* → *Parodia horstii*  
*laetivirens* → *Parodia muricata*  
*langsdorfii* → *Parodia langsdorfii*  
*leninghausii* → *Parodia leninghausii*  
*leprosorum* → *Parodia langsdorfii*  
*leucocarpus* → *Parodia erinacea*  
*linkii* → *Parodia linkii*  
*longispinus* → *Parodia langsdorfii*  
*macabarensis* → *Parodia mammulosa*  
*macrogonus* → *Parodia erinacea*  
*magnificus* → *Parodia magnifica*  
*maldonadensis* → *Parodia maldonadensis*  
*mammulosus* → *Parodia mammulosa*  
*scopa* ssp. *marchesii* → *Parodia scopa*  
*scopa* var. *marchesii* → *Parodia scopa*  
*megalanthus* → *Parodia mammulosa*  
*megapotamicus* → *Parodia linkii*  
*memoralis* → *Parodia linkii*

*Parodia werdermanniana*  
*meonacanthus* → *Parodia crassigibba*  
*miniatispinus* → *Parodia ottonis*  
*securituberculatus* var. *miniatispinus* →  
*Parodia ottonis*  
*minimus* → *Parodia tenuicylindrica*  
*submammulosus* ssp. *minor* →  
*Parodia mammulosa*  
*minusculus* → *Parodia ottonis*  
*muegelianus* → *Parodia horstii*  
*mueller-melchersii* →  
*Parodia mueller-melchersii*  
*mueller-moelleri* →  
*Parodia mammulosa*  
*multicostatus* → *Parodia concinna*  
*concinna* ssp. *multicostatus* →  
*Parodia concinna*  
*muricatus* → *Parodia muricata*  
*neoarechavaletae* →  
*Parodia maldonadensis*  
*neobuenekeri* → *Parodia neobuenekeri*  
*scopa* ssp. *neobuenekeri* →  
*Parodia neobuenekeri*  
*neohorstii* → *Parodia neohorstii*  
*nigrispinus* → *Parodia nigrispina*  
*schumannianus* ssp. *nigrispinus* →  
*Parodia nigrispina*  
*olimarensis* → *Parodia concinna*  
*ottoianus* → *Parodia ottonis*  
*ottonis* → *Parodia ottonis*  
*oxycostatus* → *Parodia oxycostata*  
*pauciareolatus* → *Parodia erinacea*  
*paulus* → *Parodia mammulosa*  
*permutatus* →  
*Parodia mueller-melchersii*  
*uebelmannianus* ssp. *pleiocephalus* →  
*Parodia crassigibba*  
*uebelmannianus* var. *pleiocephalus* →  
*Parodia crassigibba*  
*polyacanthus* → *Parodia langsdorfii*  
*prolifer* → *Parodia langsdorfii*  
*pseudoherteri* → *Parodia herteri*  
*pulvinatus* → *Parodia erinacea*  
*purpureus* → *Parodia horstii*  
*rauschii* → *Parodia nothorauschi*  
*rechensis* → *Parodia rechensis*  
*ritterianus* → *Parodia mammulosa*  
*roseiflorus* →  
*Parodia mueller-melchersii*  
*roseoluteus* → *Parodia mammulosa*  
*herteri* ssp. *roseoluteus* →  
*Parodia mammulosa*  
*rubricostatus* → *Parodia erinacea*  
*rubriflorus* → *Parodia herteri*  
*rubrigemmatu* → *Parodia concinna*  
*rubropedatus* → *Parodia curvispina*  
*rudibuenekeri* → *Parodia scopa*  
*ruoffii* → *Parodia ottonis*  
*rutilans* → *Parodia mueller-melchersii*  
*schaeferianus* → *Parodia erinacea*  
*schumannianus* →  
*Parodia schumanniana*  
*scopa* → *Parodia scopa*  
*securituberculatus* → *Parodia ottonis*  
*sellowii* → *Parodia erinacea*  
*sessiliflorus* → *Parodia erinacea*  
*soldtianus* → *Parodia scopa*  
*spinibarbis* → *Parodia nothorauschi*  
*stegmannii* → *Parodia erinacea*  
*stockingeri* → *Parodia stockingeri*  
*submammulosus* →  
*Parodia mammulosa*  
*succineus* → *Parodia scopa*  
*scopa* ssp. *succineus* → *Parodia scopa*  
*tabularis* → *Parodia concinna*

*tenuicylindricus* →  
*Parodia tenuicylindrica*  
*tenuispinus* → *Parodia ottonis*  
*tephracanthus* → *Parodia erinacea*  
*tetracanthus* → *Parodia erinacea*  
*turbinatus* → *Parodia erinacea*  
*turecekianus* → *Parodia mammulosa*  
*mammulosus* ssp. *turecekianus* →  
*Parodia mammulosa*  
*uebelmannianus* →  
*Parodia crassigibba*  
*uruguayus* → *Parodia ottonis*  
*vanvlietii* → *Parodia werdermanniana*  
*veenianus* →  
*Parodia mueller-melchersii*  
*rutilans* ssp. *veenianus* →  
*Parodia mueller-melchersii*  
*vilanovensis* → *Parodia curvispina*  
*villa-velhensis* → *Parodia carambeiensis*  
*ottonis* var. *villa-velhensis* →  
*Parodia carambeiensis*  
*vorwerkianus* → *Parodia erinacea*  
*warasii* → *Parodia warasii*  
*werdermannianus* →  
*Parodia werdermanniana*  
*winkleri* → *Parodia mueller-melchersii*  
*mueller-melchersii* ssp. *winkleri* →  
*Parodia mueller-melchersii*  
**Peronocactus**  
*concinna* ssp. *agnetae* →  
*Parodia concinna*  
*carambeiensis* →  
*Parodia carambeiensis*  
*concinna* → *Parodia concinna*  
*fuscus* → *Parodia fusca*  
*rudibuenekeri* ssp. *glomeratus* →  
*Parodia scopa*  
*oxycostatus* ssp. *gracilis* →  
*Parodia ottonis*  
*horstii* → *Parodia horstii*  
*ottonis* ssp. *horstii* → *Parodia ottonis*  
*linkii* → *Parodia linkii*  
*scopa* ssp. *marchesii* → *Parodia scopa*  
*minimus* → *Parodia tenuicylindrica*  
*minusculus* → *Parodia ottonis*  
*concinna* ssp. *multicostatus* →  
*Parodia concinna*  
*muricatus* → *Parodia muricata*  
*scopa* ssp. *neobuenekeri* →  
*Parodia neobuenekeri*  
*neohorstii* → *Parodia neohorstii*  
*ottonis* → *Parodia ottonis*  
*oxycostatus* → *Parodia oxycostata*  
*rudibuenekeri* → *Parodia scopa*  
*scopa* → *Parodia scopa*  
*stockingeri* → *Parodia stockingeri*  
*scopa* ssp. *succineus* → *Parodia scopa*  
*tabularis* → *Parodia concinna*  
*werdermannianus* →  
*Parodia werdermanniana*  
**Pilocereus**  
*leninghausii* → *Parodia leninghausii*  
*leninghausii* → *Parodia leninghausii*  
**Ritterocactus**  
*allosiphon* → *Parodia allosiphon*  
*arnostianus* → *Parodia curvispina*  
*ayopayanus* → *Parodia ayopayana*  
*mammulosus* ssp. *brasiliensis* →  
*Parodia mammulosa*  
*buiningii* → *Parodia buiningii*  
*crassigibbus* → *Parodia crassigibba*  
*curvispinus* → *Parodia curvispina*

*mammulosus* ssp. *erythracanthus* →  
*Parodia mammulosa*  
*mammulosus* ssp. *eugeniae* →  
*Parodia mueller-melchersii*  
*fuscus* → *Parodia fusca*  
*mueller-melchersii* ssp. *gutierrezii* →  
*Parodia mueller-melchersii*  
*herteri* → *Parodia herteri*  
*horstii* → *Parodia neohorstii*  
*langsdorfii* → *Parodia langsdorfii*  
*mammulosus* → *Parodia crassigibba*  
*megalanthus* → *Parodia mammulosa*  
*meonacanthus* → *Parodia crassigibba*  
*miguillensis* → *Parodia ayopayana*  
*mueller-melchersii* →  
*Parodia mueller-melchersii*  
*langsdorfii* ssp. *multiceps* →  
*Parodia langsdorfii*  
*uebelmannianus* ssp. *pleiocephalus* →  
*Parodia crassigibba*  
*rauschii* → *Parodia nothorauschi*  
*rutilans* → *Parodia mueller-melchersii*  
*mammulosus* ssp. *submammulosus* →  
*Parodia mammulosa*  
*uebelmannianus* → *Parodia crassigibba*  
*rutilans* ssp. *veenianus* →  
*Parodia mueller-melchersii*  
*mueller-melchersii* ssp. *winkleri* →  
*Parodia mueller-melchersii*  
**Sericocactus**  
*haselbergii* → *Parodia haselbergii*  
**Wigginsia**  
*acuata* → *Parodia erinacea*  
*arechavaletae* →  
*Parodia maldonadensis*  
*beltranii* → *Parodia erinacea*  
*bezrucii* → *Parodia erinacea*  
*calvescens* → *Parodia calvescens*  
*turbinata* ssp. *calvescens* →  
*Parodia calvescens*  
*corynodes* → *Parodia erinacea*  
*courantii* → *Parodia erinacea*  
*erinacea* → *Parodia erinacea*  
*fricii* → *Parodia erinacea*  
*horstii* → *Parodia neohorstii*  
*langsdorfii* → *Parodia langsdorfii*  
*leprosorum* → *Parodia langsdorfii*  
*leucocarpa* → *Parodia erinacea*  
*longispina* → *Parodia langsdorfii*  
*macrogonia* → *Parodia erinacea*  
*langsdorfii* ssp. *multiceps* →  
*Parodia langsdorfii*  
*nothohorstii* → *Parodia horstii*  
*pauciareolata* → *Parodia erinacea*  
*polyacantha* → *Parodia langsdorfii*  
*prolifera* → *Parodia langsdorfii*  
*rubricostata* → *Parodia erinacea*  
*schaeferiana* → *Parodia erinacea*  
*sellowii* → *Parodia erinacea*  
*sessiliflora* → *Parodia erinacea*  
*stegmannii* → *Parodia erinacea*  
*tephracantha* → *Parodia erinacea*  
*turbinata* → *Parodia erinacea*  
*vorwerkiana* → *Parodia erinacea*  
*werdermanniana* →  
*Parodia werdermanniana*

### Appendix III:

Index of geographical codes contained in the text . Code reference: Hierarchical Administrative Subdivision Codes, HASC.

#### **AR Argentina**

##### *Provinces*

BA Buenos Aires  
CB Córdoba  
CH Chubut  
CN Corrientes  
CT Catamarca  
ER Entre Ríos  
FM Formosa  
JY Jujuy  
LP La Pampa  
LR La Rioja  
MN Misiones  
MZ Mendoza  
RN Río Negro  
SA Salta  
SE Santiago del Estero  
SF Santa Fe  
SJ San Juan  
SL San Luis  
TM Tucumán

#### **BO Bolivia**

##### *Departments*

CB Cochabamba  
CQ Chuquisaca  
LP La Paz  
OR Oruro  
PO Potosí  
SC Santa Cruz  
TR Tarija

#### **BR Brazil**

##### *States*

BA Bahia  
MG Minas Gerais  
MS Mato Grosso do Sul  
PR Paraná  
RS Rio Grande do Sul  
SC Santa Catarina

#### **CL Chile**

##### *Regions*

AN Antofagasta  
AP Arica y Parinacota  
AT Atacama  
BI Bío-Bío

#### **CO Colombia**

##### *Capital district*

DC Bogotá

#### **PE Peru**

##### *Regions*

AP Apurímac  
AR Arequipa  
CS Cusco  
IC Ica  
LR Lima

#### **PY Paraguay**

##### *Departments*

AG Alto Paraguay  
AM Amambay  
BQ Boquerón  
CN Concepción  
CR Cordillera  
GU Guairá  
IT Itapúa  
PG Paraguari  
SP San Pedro

#### **UY Uruguay**

##### *Departments*

AR Artigas  
CA Canelones  
CL Cerro Largo  
CO Colonia  
DU Durazno  
FD Florida  
FS Flores  
LA Lavalleja  
MA Maldonado  
MO Montevideo  
PA Paysandú  
RN Río Negro  
RV Rivera  
RO Rocha  
SA Salto  
SO Soriano  
TA Tacuarembó  
TT Treinta y Tres