cactusinhabitat

South America 2013/2021

Giovanna Anceschi & Alberto Magli

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MODO

cactusinhabitat booklet
South America 2013/2021
Giovanna Anceschi & Alberto Magli
first edition: July 2021
all the photos mentioned are available on cactushabitat.org

published & distributed by: Modo infoshop
via Mascarella 24 b, 40126 Bologna, Italy
phone: 0039-0515871012
e-mail: info@modoinfoshop.com

ISBN: 9788894238822

graphic design: Harun Alikadić
editing: Al Laius
layout: Studio RAM, Bologna

download version available at:
www.cactusinhabitat.org/booklet
www.researchgate.net/profile/Giovanna-Anceschi
www.cactuspro.com/biblio/en:cactusinhabitat

www.cactusinhabitat.org
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dedicated to Norbert Gerloff

00. Introduction

After returning from our sixth South American trip (16 Nov. 2015/2 Aug. 2016), in a cactusinhabitat.org News dated September 2016, we hoped to update the website with the materials of the last two trips (2013-2014, 2015-2016), for the beginning of 2018. In reality, the processing of the huge amount of data collected in the habitats, in addition to the publication of some wide-ranging articles, namely the synopsis of *Parodia* Spegazzini s.l., which appeared in *Bradleya* (2018, 36: 70-161), and the two articles on the genera *Parodia* s.l. and *Echinopsis* s.l., created for the special issue of *CactusWorld* dedicated to South American Cacti (2020, Vol. 38 Special Issue: 1-52), made us postpone the deadlines. With our *synopsis*, the only complete study published to date on the genus *Parodia*, we have replaced the static system based on species and subspecies with a more dynamic vision of the relationships between species in habitats, consisting on the relationships between dominant species in the Darwinian evolutionary sense and their vicariants (internal and external). A transformation that has given rise to a reformulation of the scientific descriptions of the taxa involved, based on the data of real populations existing in nature, rather than on “abstract types”. In this sense, as already expressed in the article dedicated to the dominant species in *Parodia* that appeared in *CactusWorld* (2020, Vol. 38 Special Issue: 25), “We are convinced that this approach to classification has changed firstly in substance, and then in numerical data, the information that existed before for these species.”. An approach to classification that has substantiated the definitions of all taxa recognized as species in cactusinhabitat.org. The present publication brings to 347 the accepted taxa at the specific level and to 46 those at the generic level, compared to 252 and 40 respectively considered in the previous 2013 edition. Through the molecular outcomes we are aware (Nyffeler & Eggli 2010; Barcenas et al. 2011; Schlumpberger & Renner 2012), that most of the genera still recognized within the family Cactaceae de Jussieu simply do not exist in phylogenetic terms, as the morphological differences still used to distinguish them do not correspond to real differences at the genetic level (Nyffeler & Eggli 2010). In this sense, to the cases of *Echinopsis* s.l., *Parodia* s.l., *Eriosyce* s.l., already treated in the previous booklets

(Anceschi & Magli 2010, 2013), based on the evidences of Franco et al. (2017) we now also add *Cereus* s.l. to the macrogenera considered, with the already suspected inclusion of *Cipocereus* F. Ritter and *Praecereus* Buxbaum, the second already assimilated by us in *Cereus* in 2013.

The 608 new surveys conducted during the last two trips are documented by 6300 photos, which together with the previous 6500, bring the total images illustrating the taxa in cactusinhabitat.org to 12800.

In the main text of the booklet, Taxonomy (part III), we trace some guidelines which, retracing the milestones of Western philosophical and scientific thought, lead to the current propensity of human mind, in its definitions about something approximately true in nature, to a predisposition to proceed always and only through inductive methods aimed at dissecting the real, and not to the understanding of a totality of the same reality through a deductive and unifying method. We emphasize that the division of the world of specialists in the approach to the definition of the surrounding reality in the basic categories of “splitters” and “lumpers” it is only hypothetical, being now the second only imaginary figures whose sole function is to substantiate in the facts the existence of the former. When in our article appeared in the ICSG bulletin, Cactaceae Systematics Initiatives, relating to the monophyly of *Echinopsis* Zuccarini (Anceschi & Magli 2013, 31: 24-27), we took a stand against the indiscriminate approach to division for the division, supported by the ICSG members of the time, approach that contradicted the very principles of the theory in use (the principles of monophyly and paraphyly sensu Hennig 1966), we were aware of our counter current navigation. The results of this widespread mode of approach have led, for example, in the understanding of the last Hunt (2013, xiii; 2016, 11-12), to taxa with “alternative names”, i.e. taxa that identify the same object as belonging to different totalities within the same reality.

Returning to the cultural background that justifies a propensity for “inductive method and division’’ vs. “deductive method and unification’’, we remember that this approach comes from afar. Precisely by the Fathers of Western culture, philosophical, scientific, poetic, ethical, political, etc: the ancient Greeks. Especially with Plato’s and Aristotle’s approach to knowledge, who, although aware of what the deductive method was, were both “spitters” in their understanding of the world. That is, the sensible being (in Plato and

Aristotle) and the intelligible Being (in Plato), were constituted (albeit in a different way in the two doctrines), by a “many”. While Parmenides and Plotinus, with their most integral and univocal visions of Being, were the progenitors of a more unifying although anti-phenomenal approach to reality. Through the transition from the Aristotelian qualitative science, to the quantitative one, sustained in the early 1600s by Descartes, Mersenne, and of course Galileo and exemplified by the Baconian principle of the “*dissectio naturae*”, that “it is better to dissect than to abstract nature” [melius autem est natura secare, quam abstrahere] (Bacon 1620, book 1, section 51), we tried to retrace the achievements gained by this interpretation of reality. Namely the Newton’s physics first, and then the achievements of the men of quantum mechanics, remembering that the two great contemporary technological revolutions, that of the transistor (1948) and the laser (1950 c.), they are both progeny of the second. Continuing, we also point out the current “impasse” due to the exclusive use of this approach, highlighting also its subsequent defeats (the string theory, “a theory of everything”, the wandering for an inclusion of human mind as part of the measuring apparatus in quantum measurement etc.), and the “divertissements” (such as the search for “exoplanets”, for example), sustaining the intelligence fundamental unifying value in the approach to knowledge.

Returning to taxonomic science, and to the paradigms that regulate its current use, we point out the limit constituted by the predilection given to the sense of sight in the understanding of the sensible reality that surrounds us, emphasizing that this predilection often leads us to surface interpretations.

The long journeys conducted through the most arid and semi-arid ecosystems on the planet, have made us aware that species are not interested in maintaining an identity through reproductive barriers, but they simply want to continue to exist or to be, transforming to each other in space and time through reproduction and crossing. On the basis of genetic arguments, we underline how a taxonomic science with a more universal vision, can help us to overcome together with many useless names that reassure us so much, also as many useless barriers, in the direction of a more empathic and ethical understanding of the world.

Coming back to what we would like, it should be the approach to knowledge, ontological in general and scientific in particular, we believe that true science is based on the intuition of the principles and not on inductive methods, probabilities supported by "solid" mathematical quantities, opinion and relative consensus, i.e. the paradigms dear to contemporary epistemology. To substantiate our hypothesis, we bring the testimonies of three great men: Aristotele (Aristotle, Posterior Analytics, II, 19, 100 b), Albert Einstein (Einstein 1936) and Willi Hennig (Hennig 1966, 128-129), convinced supporters of the fundamental value of intuition as the "principle of principle" (Aristotle, ibidem), of the scientific procedure.

In the conclusions we formulate as a proposal for a preparation for a new method of approach to scientific knowledge, a return to a way of proceeding that favours theoretical-speculative thinking as the basis for understanding reality. An invitation to grasp the visible through reasoning, and the invisible through intuition. For this purpose, a re-reading of the Classics of Western philosophy, also by scientists, physicists included, would probably be a good starting point.

01. Taxonomy (part III)

Towards a taxonomy with a more universal understanding of the living world around us, for a new vision of the world in philosophical, ethical and scientific terms. More generally, the stimulus for a new approach to scientific knowledge, which favors at the base the intuition of the principles

I. The two approaches

According to Kitcher (1984, 309), “the species category is heterogeneous”, there are in fact two main approaches for the demarcation of specific taxa. One consists is to group organisms on the basis of structural similarities, the other is to consists in grouping them according to their phylogenetic relationships. This choice, in the approach to classification, obviously also stands out for all other taxa above the specific rank. As far as we are concerned, and as already explained in our penultimate booklet (Anceschi & Magli 2013a, 13) in accordance with modern systematics, for the interpretation of taxa within our taxonomic system, we opt for to use of phylogenetic criteria to achieve a genealogical classification according to Darwin (1859), or a natural classification according to Hennig (1966), expressed through the Linnaean hierarchical system (1753). For the understanding of the phylogenetic relationships between taxa, we then highlighted our choice about the use of the two distinct theoretical tools devised by Hennig (1966), for the definition of higher taxa on the one hand and the species on the other. Namely: 1) with regard to supraspecific taxa, the identification of synapomorphies (characters that are inherited by all members of the group, or clade, from a recent common ancestor), in the recognition of monophyletic taxa (or natural taxa), vs. para and polyphyletics taxa (non-natural in Hennig’s sense) (Anceschi & Magli 2013a, 15). 2) For the definition of the species, instead, the use of the comparative holomorphology (or holomorphy) between semaphoronts (ibidem, 34), reminding that Hennig (1966, 65) considers the semaphoront figure the fundamental building block which is the basis of the biological system, identifying it as “... (the character bearer) ... the individual in a certain, theoretically infinitely small, time span of its life, during which it can be considered unchangeable.”

II. Synapomorphies in the molecular analysis

As already reported (Anceschi & Magli 2018, 36: 74), since Wallace's study (1995, 13: 1-12), over the last decades, changes at the genericus level and the higher taxa in the family Cactaceae, have almost always been followed by new evidence emerging from molecular analysis. Examples are Nyffeler (1999); Nyffeler & Eggli (2010); Schlumpberger & Renner (2012); Schlumpberger (2012); Charles (2012); Anceschi & Magli (2013a, 2013b); Hunt (2013); Lodé (2015). 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. The contraposition of the principle of monophyly to that of paraphyly, automatically implies the recognition of the theoretical system conceived by Hennig (1966), being the concept of paraphyly, a new concept proposed by this author. Prior to Hennig, systematists generally recognized two kinds of groups relating to phylogeny, monophyletic and polyphyletic groups, with the exception of Naef, 1919 (Wiley & Liebermann, 2011). As mentioned above, for the definition of monophyletic taxa at the supraspecific level within Hennig's system (1966), it is necessary to be able to distinguish them through the recognition of synapomorphies. Now, the recognition of real synapomorphies at the molecular level it is not an easy thing, as the qualitative criteria that identify Hennig's groups, i.e. monophyletic based on synapomorphy (see above), paraphyletic based on symplesiomorphy (i.e. like the first, homologous characters inherited from the common stem species) and polyphyletic if similarity is due to convergence (i.e. due to analogous characters, not derived from a common ancestor) (1966, 146), they are often not easily identifiable. Some researchers, for example Nyffeler & Eggli (2010), identify in their analysis the deletion of 23 nucleotides highlighted in the representatives of *Parodia* s.l., a derived character (sinapomorphy), and the presence of these in the other two groups under investigation, a primitive character (simplesiomorphy). As already expressed (Anceschi & Magli 2018, 36: 74-75) "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." Basically, Nelson's approach helps in the definition of monophyletic groups, giving the qualitative criteria designed by Hennig also a more understandable quantitative aspect than that provided by the latter in his historical diagram (1966, 148, fig. 45). A more usable way, especially in the choice of options resulting from the results provided by molecular data, where it is not always easy to qualitatively distinguish real synapomorphies deriving from a recent common ancestor, compared to the "background noise" created by the symplesiomorphies inherited from the groups under analysis from the common stem species. Returning to modern systematics, regarding the use of Hennig's phylogenetic principles (1966) and his successors, i.e. Nelson (1971), Farris (1974), Wiley & Liebermann (2011), we would like to emphasize that the sharing of these principles by the majority of current researchers often remains within the scope of an acceptance at the theoretical level, whereas in practice there is still a clear propensity to recognize taxa on the basis of structural similarities.

III. The new monophyletic macrogenus *Echinopsis*

When in 2013, following the publication of the results of the molecular analysis relating to the phylogeny of *Echinopsis* and related genera (Schlumpberger & Renner 2012, 99 (8): 1335-1349), we decided to opt for the macrogenus *Echinopsis* highlighted by the results of the analysis as the most convincing hypothesis in phylogenetic terms, it was not an easy choice. We were aware of the beginning of an our navigation counter current, with respect to the current approach the way of doing science supported by most of the scientific community. As expressed in our booklet at the time (Anceschi & Magli 2013a, 22-29) and then confirmed on Cactaceae Systematics Initiatives (2013b, 31: 24-27), the analysis highlighted a genus *Echinopsis*, as conceived at the time, polyphyletic. Two possible options were outlined in order to interpret the examined taxa as natural clades (or monophyletic in Hennig's sense). The first consisted of the assimilation in *Echinopis* s.l. of 15 other genera never included before; this solution was sustained by the maximum support (100% bootstrap support). The second again divided *Echinopsis* into a dozen clades, with the resurrection of old generic names and transfers of species epithets. The first identified in a simple way the genera of the Trichocereeae/Trichocereinae involved in the analysis to be assimilated into the new macrogenus as "*Echinopsis* groups with floral characters and/or pollination syndromes modified" (Anceschi & Magli 2013b, 31: 25). The second was the one then partially adopted by Schlumpberger (2012, 28: 29-31), as it did not resolve the internal relationships of the clades *Cleistocactus* sens. str. and *Oreocereus* in a natural way in Hennig's sense, in addition to creating confusion, because the new proposed clades were not characteristically definable and therefore identifiable (Anceschi & Magli 2013a, 25-27; 2013b, 24-25). We would like to recall that the tool of synapomorphy instrument was designed by Hennig (1966) to define higher taxa, in his work: families, suborders, orders, subclasses, classes, i.e. large groups of species, such as to show quantitative and qualitative characters, in order to be interpreted as ancestral or derived, and thus to draw reliable phylogenetic conclusions on the analyzed taxa. As already stated (Anceschi & Magli 2018, 36: 74), "… 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." (Hennig 1966, 132). What we are saying is that basing phylogeny by invoking the principle of monophyly on groups consisting of a low number of species, is a contradiction in Hennigians terms. Returning to the phylogenetic hypothesis adopted by Schlumpberger (2012, 28: 29-31), in line with Hennig's theory (1966), the first option was so crystal clear compared to the opacity of the second, that as researchers and scientists we felt embarrassed in the face of yet another disavowal of the evidence by a science always intent on proceeding only inductively, without ever having an overview of the results of its demonstrations, based on the principles that should govern it.

IV. Which lumpers?

In our first booklet (Anceschi & Magli 2010, 9), regarding the names to be given to plants, we argued about the possible "schools of thought" adopted by specialists in relation to the classification of living beings, basically "… that of the "splitters" (those who divide, and mainly capture differences), and that of the "lumpers" (those who merge, and mainly capture similarities)." We would like to underline that with regards to the family Cactaceae A. L. de Jussieu, from the first important monograph on the family i.e. Gesamtbeschreibung der Kakteen (Monografia Cactacearum) by Karl Schumann (1897-99), in which the author recognizes 21 genera, from 1920 onwards, i.e. since the publication of the work of the two American botanists Nathaniel Lord Britton & Joseph Nelson Rose, that in their four volumes The Cactaceae (1919-23) divide the 21 Schumann's genera of into 124, all subsequent specialists never fell below the number they recognized. It is noteworthy to point out that according to Benson's understanding (1982), his compatriots Britton & Rose were essentially considered to be the first splitters in the history of these plants. In the history of the approach to classification of the genera of the Cactaceae, after the 124 genera of Britton & Rose, we move on to the 233 recognized by the German collector Curt Backeberg in Kakteen Lexicon (1966), whose methods certainly lead to the apex in the splitting up of the genera and species within the family, to then return to a more traditional approach (with substantially similar understandings to those of 1920), with Ted Anderson recognizing 125 genera in his The Cactus Family (2001), Hunt et al., with 124 genera in The New Cactus Lexicon (2006), Nyffeler & Eggli, who recognize 128 taxa, at the genus level (Schumannia 2010, 6: 109-149), as 128 genera are still accepted by Eggli, as author of the latest German edition of Anderson's book, Das Grosse Kakteen Lexikon (2011). A return to a greater fragmentation in the comprehension of the genera of the Cactaceae it is represented instead by the work of the Frenchman J. Lodé, who in Taxonomy of the Cactaceae (2015) again raises the number of the recognized genera to 177. Now, even taking into account that since the monograph of Hunt et al. (2006), included, all subsequent studies have made use in some way of the molecular outcomes, it is a fact that the majority of specialists recognize more or less the same number of genera recognized by Britton & Rose (1920), whose too "liberal" influence was already pointed out by Benson (Hunt et al. 2006, Text: 3). It is clear that after the Backeberg era, any other approach to the taxonomy of the family would have seemed more conservative, but in practice, from Schumann's 21 genera (1897-99), with the only exception of Benson precisely, whose monograph however applies only, to the cacti of the United States and Canada (1982), no lumper appeared on the horizon. As already expressed (Anceschi & Magli 2018, 36: 74), in relation to Anderson's work (2001), "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.”.

V. Backeberg’s imprinting

The “collecting” approach, given to the knowledge of the Cactaceae family by Curt Backeberg (1958, 1966), has helped to create a strong propensity for division in the specialists of his time or immediately following (i.e. Ritter, Buining, Rausch, etc.). This approach, then enthusiastically supported by enthusiasts from all over the world (it must be considered that even today these plants are basically studied in greenhouses, while little time is dedicated to their study in natural habitats), has left an indelible mark on the scholars of subsequent generations, collectors and professional taxonomists included. In Hunt’s words (1991, 152 quoted from Anderson 2001, 98), “… [Backeberg] named 78 more genera and named or renamed 1200 species without, so far as I know, ever making (or citing) an herbarium specimen. He left a six-volume monograph of the family [Die Cactaceae] running to 4000 pages and a trail of nomenclatural chaos that will probably vex cactus taxonomists for centuries.”. Backeberg’s imprinting appears to be so natural and durable in some researchers, that they proceed under his influence even in the age of molecular analysis. In “Two old men wandering in Northern Argentina”, Kiesling & Schweich (2019, 24: 33-47), states: “ We do not use “this” or “that” nomenclature, either old or recent, either based on modern concepts like DNA or old ones like the flower structure; we use “familiar names” that are “valid”. Names change periodically, the plants do not, and the article is focused on plants not names!”. Given that Western thought is aware at least since the time of Heraclitus’ flux theory (Diels & Kranz 1903-1952, Herakleitos 22 A 6, 22 B 12, 22 B 49a, 22 B 91), that everything changes (including plants), and at least from Plato’s Cratylus (Plato, Cratylus 384d-384e), that one of the possible meanings of the names with which we identify things is purely of a technical-conventional kind (i.e. dependent on a prior agreement between speakers about a choice between distinct possibilities), we would like to emphasize that the “valid names” or “familiar” proudly used by the two authors in their article, are those accepted by

Backeberg's nomenclature and his successors, not others, with the use of the relative floral characters to distinguish the genera (*Chamaecereus*, *Lobivia*, *Trichocereus*, *Soehrensia*, etc.), the species and the varieties. This forgetting that since a long time, molecular analysis show that floral characters and related pollination syndromes are no longer suitable to distinguish taxa at a genus level (Ritz et al. 2007; Lendel et al. umpubl. data & Nyffeler et al. umpubl. data in Nyffeler & Eggli 2010; Schlumpberger & Renner 2012; Anceschi & Magli 2013a, 2013b). Molecular evidence also shows just as clearly that the most part of the genera of the Trichocereeae/Trichocereinae (Schlumpberger & Renner 2012; Anceschi & Magli 2013a, 2013b), are part of a well-supported monophyletic macrogenus *Echinopsis* s.l. (i.e. 100% bootstrap support). According to Nyffeler & Eggli (2010), both the molecular data, and the widespread occurrence of intergeneric hybrids (see Rowley 1994, 2004a, 2004b for listing), indicate that Trichocereinae has a relatively recent evolutionarily origin [i.e. about 7.5-6.5 Ma according to Arakaki et al. (2011, 8380)], and that the genetic divergence between the various taxa is far lower than the difference shown by the same in morphological and floral characters. To sum up, while we are aware that criticising now Backeberg's methods is anachronistic, we also stress that refusing to consider new and relevant evidence is not scientific.

VI. "Alternative" names

Despite the initial good intentions (Hunt & Taylor eds. 1986), in the direction of a more conservative approach to the classification of the genera of the Cactaceae, Hunt himself (2013, xiii), attracted by the proposals made by Schlumpberger (2012, 28: 29-31) and initially accepted by the NCL "team" (2012, 26: 7-8; 2012, 28: 3-4), proposals that we refuted on the basis of a correct interpretation of the molecular evidence and of the concept of paraphyly sensu Hennig (Anceschi & Magli 2013a, 2013b); in an attempt to solve the problem of polyphyly in *Echinopsis* s.l. has dusted off in his words, the "old favorites" (and now paraphyletics) *Echinopsis*, *Lobivia* and *Trichocereus*, together with the genera proposed by Schlumpberger. But accepting these second taxa as "alternative" names. Conscious in fact of the phylogenetic lability we underlined in Schlumpberger's solution (Hunt 2014, 32: 3), the last Hunt has proposed in his works (2013, xiii; 2016, 11-12), taxa identifiable by more than one name. For example *Echinopsis walteri* [SO] (2016, 52), can also indifferently assume the role of *Soehrensia walteri* ≡ *Echinopsis walteri* (ibidem, 126). In the author's latest publications (2013, 2016) there are well 9 genera of the Trichocereeae/Trichocereinae (i.e. *Acanthocalycium*, *Chamaecereus*, *Leucostele*, *Lobivia*, *Reicheocactus*, *Setiechinopsis*, *Soehrensia*, *Trichocereus*, *Vatricania*), living in this strange reality to say the least, where they share an identity suspended between *Echinopsis* and the generic name proposed by Schlumpberger. According to Hennig (1966, 4) "… it is not basically a scientific task to combine several systems so created, because one and the same object cannot be presented and understood at the same time in its position as a member of different totalities.".

VII. Only one direction: inductive method and division

As already highlighted in our synopsis on *Parodia* s.l. (Anceschi & Magli 2018, 36: 75), recent molecular analysis, in one of the most comprehensive studies of molecular biology on the family Cactaceae so far appeared, Bárcenas et al. (2011) they clearly highlighted 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). While underlining this evidence, the authors attempt to overcome what from their point of view represents to be a problem (i.e. not being aligned with the understanding of the genera of the Cactaceae as interpreted by current systematics i.e. Anderson (2001), Hunt et al. (2006), Anderson & Eggli (2011), Hunt (2013, 2016), propose the following solution: " 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." (Bárcenas et al. 2011: 488). As we have pointed out (Anceschi & Magli 2018, 36: 75), we cannot agree with this way of doing science (i.e. continuing to mystify the results of the analysis). Similar interpretations of the molecular results are provided by Franco et al. (2017), to keep the genera *Cipocereus* F. Ritter and *Praecereus* Buxbaum separate, despite the analysis clearly demonstrating that they are both imbedded among the species of *Cereus*, in a single well-supported monophyletic clade, i.e. posterior probabilities 0.93 (>0.85) (ibidem, 203) (see our comment on the matter on page 43-44). Much of contemporary science suffers from the same kind of propensity to divide for the sake of division, where since in the results of any molecular or non-molecular analysis, in order to come closer in its solutions to something approximately true in nature, it is always more willing to proceed through inductive methods capable of dissecting reality, while it is never willing to understand the totality of the same reality through a deductive method.

VIII. An approach that comes from afar

It would be a lack of historical retrospective to make only contemporary scientific specialists responsible for this type of approach to scientific truth, and in fact, the predilection for division was born a long time ago. It is not our intention to carry out in a few sentences the history of Western thought in its philosophical and scientific approach to the reality that surrounds us, but we will try to draw up in a nutshell some guidelines that lead us to the current state of things. The Fathers of Western culture, philosophical, scientific, poetic, ethical, political, etc., are the Ancient Greeks, in particular, for the vastness of the works that have come down to us, Plato and Aristotle. Classical philologists and exegetes of all ages will forgive us, but both of these great men were essentially "splitters" in their worldview, despite knowing very clearly (contrary to contemporary scientists), what the deductive method was. Plato in the Phaedo (Plato, Phaedo 79a), distinguished being into: sensible being, i.e. the one in becoming, visible, caught by the senses, constituted by the plurality of sensible things, from the intelligible Being, i.e. what it always is, invisible, transcendent the sensible, grasped by the intellect, composed this from the Ideas (we recall that Idea in Plato constitutes a figure of an ontological and metaphysical character and not a gnoseological one as in modern philosophy). Underlining that even "the Ideas" still represented a plurality, both beings grasped by Plato were therefore "a many". In turn, Aristotle (Aristotle, Physics V, 1, 225b5 and Metaphysics V, 7, 1017a25), divided the sensible being into 8 categories with as many meanings (i.e. according to essence or substance, quality, quantity, relation, activity, passivity, where and when), categories that became 10 (adding having and being in a position) in the treatises on logic (Aristotle, Metaphysics. Reale, G. 2000, XXII). Other visions of being, more integral and univocal, where reality is only as we think of it with the λόγος (intended as reason), or even beyond thought, and not as we experience it with the senses, they saw as their “paladins”, Parmenides in his Poem on Nature (Diels-Kranz 1903-1951, Parmenides 28 A 7, 28 A 8, 28 A 21, 28 A 22, 28 A 24, 28 A 25, 28 A 28, 28 A 34, 28 B 1, 28 B 8) and Plotinus (Plotinus, Enneads V, 3, 13, V, 6, 6, VI, 8, 8, VI, 9, 4), the great “lumpers” of our past. In their respective doctrines, the latter two philosophers intended Being: as a one, whole, all at once, a continuous one, not divisible, immovable, uncreated, imperishable and incorruptible, the former. It is the One is One, austere, isolated, which has no relationship with being, later attributed to Parmenides by Plato in the homonymous dialogue (Plato, Parmenides 137c4-142a8). Or as a One beyond thought, unknowable, ineffable, which is not (apophatic), and therefore not related to the other parts of being, but reachable only through intuition, the second. The distancing from the phenomenal world and the denial of the experience that attests it has meant that the ontologies of these thinkers were not the winning ones in our common understanding of reality, although they remain unsurpassed in the field of philosophical thought on Being within human knowledge. As we said, although “splitters” in their distinct conceptions of Being/being, Plato and Aristotle were aware that no scientific truth, both physical and metaphysical, i.e. in Aristotle, through the idea of the “Unmoved mover” (which moves without being moved), the two realities are continuous (Aristotle, Physics II, 7, 198b3-198b9, VIII, 5, 257b22-257b24, VIII, 6, 258b10-258b15, VIII, 10, 267b18-267b25), can be reached based solely on inductive reasoning and demonstrations, without first having a deductive understanding based on the intuition of their principles. Fundamental in this sense is the understanding of science (Dialectic in that case), understood as synopsis, from the Greek σύνοψις (i.e. overview of the subject matter), elaborated by Plato in the Republic (Plato, Republic VII, 533b-533e, 537b-537c) and in the Sophist (Plato, Sophist 253d1-253e2). This vision is obtained by overcoming the initial hypotheses, until reaching the principle that regulates the science in question, understanding that allows then to descend through a process of division (διαίρεσις) to the particular, in order to subsequently carry out the operation in the opposite direction through the method (μέϑοδος), now with the awareness of knowing exactly how to evaluate the relationships of proximity and/or diversity among the components of the scale of values thus obtained. In our opinion, a rare example this, of an “antelitteram” theoretical understanding of the scientific method as it should also currently be conceived. Who among contemporary epistemologists (Gottlieb, P. & Sober, E. 2017 (7): 252), tends to reduce Plato's scientific thought to just the Timaeus' demiurge, should read (or reread) the Sophist. Aristotelian physics, of a qualitative type, travelled throughout antiquity, the Middle Ages and the Renaissance up to the early 1600s, where a new generation of thinkers i.e. Descartes, Mersenne, and of course Galileo, have "ferried" the parts of philosophy previously dedicated to the logical, physical and mathematical sciences, to science as currently conceived; through a shift of centre of gravity from a deductive method to a purely inductive one, namely to a quantitative science. The Baconian principle of the "*dissectio naturae*", that "it is better to dissect than to abstract nature" [melius autem est natura secare, quam abstrahere] (Bacon 1620, book 1, section 51), it exemplifies the passage of understanding between the two conceptions of the world. The Lord Chancellor's declaration that "without dissecting and anatomizing the world must diligently" we cannot "found a real model of the world in the understanding, such as it is found to be, not such as man's reason [i.e. the Aristotelian approach] has distorted" (ibidem, section 124, quoted from Jammer, M. 1974, 199), became one of the most important and most successful guiding principles of the method of modern science. According to Jammer (ibidem), "Descartes' second "Rule of investigation" (Descartes, R. 1637, Second Part) and Galileo's "metodo resolutivo" reverberate this maxim, and once it was combined with the appropriate mathematics, as in the hands of Newton, it led science to its greatest achievements. More than any other subject, atomic physics owed its development [with the exception of Bohr's adoption of a relational and holistic conception of the state of a physical system], to a systematic application of Bacon's "principle of dissection". ". It would be untrue to just praise the achievements of humankind, due to this interpretation of real, without even mentioning the latest defeats. The same approach that led physics, "the most fundamental" of our sciences, the first on the Nobel scale, to the results above, mathematics is not really a science at all, if a science is understood to be a discipline devoted to the description of nature and its laws (Gell-Mann 1994, 107-109), it has also led in recent decades to the repeated failures of the String Theory (Smolin 2006). Where, in an attempt to reach a unifying theory, string theorists have come to hypothesize the existence of eleven dimensions through “the eleven-dimensional supermembrane theory”. In the author’s synthesis “… if you take one of the eleven dimensions to be a circle, then you can wrap one dimension of a membrane around that circle. ... This leaves the other dimension of the membrane free to move in the remaining nine dimensions of space. This is a one-dimensional object moving in a nine-dimensional space. It looks just like a string! … This is so pretty that it’s hard not to believe in the existence of the eleven-dimensional unifying theory. The only problem left open was to discover it.” [sic!] (ibidem, 135-136). Physical science as conceived from 1600 onwards must predict observable results, i.e. verifiable theories at an experimental level, not “elegant” as well as indemonstrable theories. In this regard, always in Smolin’s words “In the two string revolutions [1984-1996], observation played almost no rule.” (ibidem 149). A physics (better astrophysics in this case), that currently delights itself in the discovery of “exoplanets” (Peebles, J., Mayor, M. & Queloz, D. Nobel Prizes for physics in 2019), by now having in practice only at heart the construction of computers that communicate faster and faster with each other. It now seems very far from the enthusiasm of Richard Feynman’s time (Nobel Prize in Physics in 1965, with Tomonaga, S-I. & Schwinger, J.). Enthusiasm due to the results achieved in the physical field also thanks to his contribution to QED (Feynman 1985), when the technologies of the transistor (1948) and the laser (1950 c.), both technological progeny of quantum mechanics, revolutionized our understanding of the world, giving rise to the birth of the information age, the first, and the possibility of the huge increase in the flow of information in telecommunications through laser light and optical fibres, the second (Aspect, A. in Bell, J. S. 2004, XX-XXI). Above all, they appear now very far the times in which Feynman himself felt he could mock Spinoza’s philosophy with these words “There were all these Attributes, and Substances, all this meaningless chewing around, and we [with his son] started to laugh. Now, how could we do that? Here’s this great Dutch philosopher, and we’re laughing at him. It’s because there was no excuse for it! In that same period there was Newton, there was Harvey studying the circulation of the blood, there were people with methods of analysis by which progress was being made! You can take every one of Spinoza’s propositions, and take the contrary propositions, and look at the world-and you can’t tell which is right.” (Feynman 1999, 195). The great physicist went on, generally mocking the depth of philosophical reasoning “There’s a tendency to pomposity in all this, to make it all deep and profound. … instead, they [the philosophers] seize on the possibility that there may not be any ultimate fundamental particle, and say that you should stop work and ponder with great profundity.” (ibidem), convinced that the physics that started from Newton could investigate every human question about the reality that surrounds us, without any more help from philosophy. On the contrary, today we are aware that we are very far from reaching “a unique theory of nature” [i.e. a unique theory that gave unique predictions for experiments], envisioned by the latest physics (Smolin 2006, 159), just as we are equally aware that we cannot include human consciousness among the data of the macroscopic world (i.e. the measuring apparatus), for a greater completeness of quantum measurement (Bell 2004, 25-27). We will continue to love brilliant (and profound) thinking, regardless of whether a philosopher rather than a physicist is the bearer of it. On the other hand, intelligence is so rare that we cannot afford to discriminate when we meet it, and also in this case we are always careful to grasp the connections rather than the divisions, certain that the components of the reality that surrounds us, material and immaterial (such as intelligence precisely), are linked together rather than separate. In this sense, Aristotle’s philosophy would not have existed if it had not been nourished for twenty years (367/366 BC - 347 BC), at the Platonic Academy, or even before, that of Plato, if he had not been able to learn from the doctrines of Heraclitus, Pythagoras, Parmenides, Socrates (his teacher from 408-407 BC to 399 BC) and Anaxagoras. Just as Beethoven’s 9 Symphonies would not have existed if they had not been preceded by Mozart’s 41 symphonies and above all by Haydn’s 104, the latter at the end of the eighteenth century, in Vienna, teacher and inspirer of both, etc.

IX. Return to taxonomic science. The “limit” of sight

Assuming that our brief history has been of some use in the understanding of why, in the background of the human mind, inductive process and division are now more understandable than deductive process and assimilation, we would like to return with some brief remarks to the science we are dealing with in this text, taxonomy, specifically in relation to the family Cactaceae. We said above, that the evidence from an increasing number of molecular analysis (Nyffeler & Eggli 2010; Bárcenas et al. 2011;

Schlumpberger & Renner 2012), clearly demonstrate that most of the genera of the Cactaceae as currently conceived, i.e. Anderson (2001), Hunt et al. (2006), Anderson & Eggli (2011), Hunt (2013, 2016), simply do not exist, and that the differences detected by the human eye at the morphological level and still used in their distinction, do not correspond to differences at the genetic level (Nyffeler & Eggli 2010). Despite this evidences at the generic level, at a lower level of the genetic scale, i.e. at the specific level, a world of researchers is at work to search for increasingly variable markers that can somehow justify differences between taxa (Shaw et al. 2007; Franck et al. 2012; etc.). Now what appears paradoxical, is that molecular analysis at the specific level, may support differences between taxa that have already been refuted for the same at a higher level of the scale, i.e. the generic one. This is the case with the revealed sequence variation among two closely related species of *Harrisia* from the Caribbean region (*H. earlei* and *H. fragrans* Small ex Britton & Rose), highlighted by Franck, A. R. et al. (2012, e406), through the use of three newly characterized markers (isi1, nhx1, and ycf1), for their possible application at low taxonomic levels, within a genus, *Harrisia* Britton precisely, not distinguished at the genetic level from *Echinopsis* Zuccarini according to the latest molecular evidences (Schlumpberger & Renner 2012, 1336, 1341). Now, within the same reference system, what is particular cannot deny what is more general, on pain of losing the credibility of the system itself. We would also point out that not always to every difference always corresponds to a real diversity (genetic in this case). In this regard, there is, in our opinion, a considerable disparity in approach between, for example, compared to what botanists and zoologists of our time recognize as species and subspecies within their taxonomic systems, and those what are the genetic relationships currently recognized between the populations that make up *Homo sapiens* Linnaeus. Using the paradigms employed by these specialists, probably the Lapps (Sami) of Northern Europe, the Masai living between Kenya and Tanzania, the Pygmies (BaMbuti, Baka, Batwa) of equatorial Africa, etc., would all be recognized as distinct species within the human race, but we well know that at the genetic level things are not exactly like that. We would point out that the list of human populations with morphological differences far greater than those that divide many species and genera of Cactaceae could be very long. Again in this case, the predilection of the sense of sight to discriminate the objects of reality comes from afar. Aristotle begins the Metaphysics (Aristotle, Metaphysics I, 980a) by emphasizing that men prefer sight among all the sense, as it is by sight that, by grasping numerous differences between things, allows us to know more than by using the other sense. Things haven't changed much since that time. Scrolling through the papers on biological conservation, it is interesting for example to note that, despite several phylogenies of Ursidae, based on mitochondrial and nuclear DNA, increasingly suggests that polar bears (*Ursus maritimus*) and brown bears (*Ursus arctos*) are not mutually monophyletic (Talbot and Shields, 1996a, 1996b; Waits et al., 1999, quoted from W. R. Morrison III et al. 2009, 142: 3204), nonetheless after a 3-year long review, the USFWS made its final ruling in 2008 that the polar bear is a threatened species (Schliebe and Johnson, 2008, ibidem), where no judgment of threath was expressed for *U. arctos*. And again in a similar vein, in 1999, a molecular study indicated no significant distinction between the green turtle (*Chelonia mydas*) and the black turtle (*Chelonia agassizii*; Karl and Bowen, 1999), and as a result *Chelonia mydas* and *C. agassizii* are now treated as a single species (NMFS and USFWS, 2007). However, a monitoring program for the green turtle was started in Mozambique in 2004 by the WWF Homeland Foundation-USA and represents an investment of $210,000 USD (www.wwf.org.mz). (quoted from W. R. Morrison III et al. 2009, 142: 3204). Now it is not our intention to erase distinctions that can somehow save parts of biological populations, as already pointed out (Anceschi & Magli 2020, 38 Special Issue: 7), "… we should not only make an effort to protect living things solely because of their IUCN conservation status, but we should respect the habitats of all taxa. Today's dominant species may be tomorrow's endangered species. ". What interests us here is to highlight, that we can distinguish and we will continue to distinguish the sensible reality that surrounds us, preferring our visual experience, regardless of what the latest available contemporary tools show us. Often during our study trips, crossing the most arid and semi-arid ecosystems of the planet such as the Chilean Atacama, the coastal desert of Peru and the Argentinian Monte Desert (Rundel et al. 1991; Rundel et al. 2007), we have realized that frequently the species living these extreme habitats, are not particularly interested in maintaining an identity through reproductive barriers, rather to survive by any means possible, even by crossing with each other. The many infrageneric hybrids within the

Trichocereeae/Trichocereinae are a striking example. In this sense, species can be defined as biological processes whose goals are, in the Darwinian sense, adaptation and survival, or more philosophically, continue to be, transforming each other in space and time, and not the maintenance of an identity. Reproduction and crossing only serve, for this purpose, to continue to exist or to be. The plant populations that interact with each other they do not see, they feel, and the desire to distinguish phylogenies on the basis of morphological criteria grasped through our eyes is a typically human attitude. Over a fairly dilated space-time, speaking of species in the sense commonly attributed to the term appears to be quite meaningless.

X. A taxonomy that considers a more universal approach to reality: a possible tool for a better understanding of the world

Each human science has a specific taxonomy to identify and deal with principles, demonstrations and the results, in a word the objects of its research. In this sense we like to see taxonomic science as a tool that, like mathematics in the physical sciences in other respects, can help us in defining a better and probably more realistic understanding of the world around us. On the basis of the adopted taxonomy, it can change our perception and evaluation of the world, not only on a purely taxonomic level, but also at a philosophical, scientific and ethical one. According to Sober (2000, 212-213) “It is not implausible to think that many of our current ethical beliefs are confused. I am inclined to think that morality is one of the last frontiers that human knowledge can aspire to cross. Even harder than the problem of understanding the secrets of the atom, of cosmology and of genetics is the question of how we ought to lead our lives. This question is harder for us to come to grips with because it is clouded with self-deception: We have a powerful interest in not staring moral issue squarely in the face. No wonder it is taken humanity so long to traverse so modest a distance. Moral beliefs generated by superstition and prejudice probably *are* untrue. Moral beliefs with this sort of pedigree deserve to be undermined by genetic arguments”. We believe in fact that very often useless distinctions aimed at separating parts of the same reality, derive from an our prejudice towards things, which capable of creates harmful distinctions in our ethical understanding of the world. Precisely on the basis of the “genetic arguments” invoked by the author, we should, for example, definitively take note, that if there are distinctions within *H. sapiens* they are certainly not at the genetic level (if anything at an individual level, but this is not the place for an in-depth study), and that a more correct understanding of the rest of the living world that surrounds us, in the same direction, i.e. avoiding a redundancy that only creates useless names, would probably help us to have a greater sense of empathy towards the other living things on the planet. The mental approach of dividing for the sake of dividing, without ever having any overview of the whole (synopsis), it serves to always create ever new, useless barriers, not to break them down for a new ethical understanding of the world.

XI. True science is based on the intuition of the principles, not on inductive methods, probabilities supported by "solid" mathematical quantities, opinion and related consensus

Criticizing the approach to knowledge of contemporary science is not difficult, but perhaps more complex is trying to trace some guidelines in an attempt to give new impetus to our scientific thought. Following Aristotle (Aristote, Du Ciel, II, 12, 291b24 - 291b28), we believe that it deserves to be qualified as modesty, rather than audacity, the ardour of those who, thirsty for the desire to know, is happy to provide clarification, however limited, on the topics on which the greatest difficulties are encountered. We argue that true science, the real one, is based on the intuition of the principles not on inductive methods, probabilities, "solid" mathematical quantities, opinion and related consensus, paradigms very dear to contemporary epistemology. As already extensively discussed above, to proceed only through induction, a method by its nature fragmentary and limited, as not capable of grasping the totality or overview (synopsis) of the science in question, which can only lead us: a) to have only mere opinions on the objects that make up the sensible reality that surrounds us. We remember in fact that the opinion (δόξα), if not supported by the knowledge of the cause, is fallacious by its nature. Consequently, b) in order for our demonstrations to reach truthful results, we must know the causes, or rather the principles. Now, contemporary science substantiates its opinions through the evaluation of probabilities of competing hypotheses using likelihood models, but we well know that probabilities have nothing to do with truth, since, quoting

Sober (2000, 64-65), “One might take the view that probability talk is always simply a way to describe our ignorance; it describes the degree of belief we have in the face of incomplete information. According to this idea, we talk about what *probably* will happen only because we do not have enough information to predict what certainly will occur.” In tune with Aristotle (Aristotle, Posterior Analytics, II, 19, 100 b), it is true that principles are indemonstrable, but as many true is that they can be grasped intuitively, i. e. through our intellect (νοῦς) and its action, the intellection, or, to clearly separate this process from scientific knowledge based on reasoning (διάνοια), from intuition (ibidem). For those who prefer to use the Latin mens (mind), instead of the greek term νοῦς (intellect), often identifying the latter in classical Greek culture, the highest part of the rational soul, the option is possible. We will now bring as witnesses in support of our thesis, namely that the knowledge of principles, ontological in general and scientific in particular, is based on intuition: I) Aristotle (philosopher), II) Albert Einstein (physicist) and III) Willi Hennig (biologist, entomologist).

I) In agreement with Barnes (Barnes, J. in Mignucci, M. 2007, IX, XI, XIII), Aristotle in his two main works of logic (Prior and Posterior Analytics), divides the truths that constitute science into two groups: those proven and those that are not. The term currently used by the philosopher for the latter is “principle” (ἀρχή), i.e. the axioms of contemporary philosophy, while he uses for the former, without further specification, “proven thing”, i.e. what contemporary philosophers call “theorems”. In current terms, in the Aristotelian logical scheme, theorems are proved through syllogisms (logical demonstrations) starting from axioms. As primary or primitive (i.e. there is nothing prior to them), and necessary premises of the demonstrations, the principles cannot be grasped demonstratively but through the νοῦς, a term translated with “intuition” in the first Mignucci’s interpretation (1970, 131-132), while with “intellection” in the second (Mignucci 2007, 141). As indicated above, we prefer the author’s first translation. In the aforementioned final chapter of the Posterior Analytics, the treatise dedicated to non-demonstrative knowledge of principles (it is in the Prior Analytics that the Philosopher deals with the logic of demonstrations, through the scientific syllogism), in our opinion in one of the most enlightening pages in the history of human knowledge Aristotle (Aristotle, Posterior Analytics, II, 19, 100b), begins by saying that of the thinking states by which we grasp truth, some are unfailingly true, while others admit of error. The first are scientific knowing and intuition, the second are opinion and calculation or reasoning [it is immediately evident that just the latter are those set by current scientific methodology to certify the truthfulness of our knowledge]. The Philosopher emphasizes that of the first two, intuition is even more exact than scientific knowledge. He then affirms in rapid succession, that principles are better known than demonstrations [since the first are the necessary premises of the second], and that since all scientific knowledge is discursive, there can be no scientific knowledge of principles [as they are intuitively grasped through the νοῦς, not through the reasoning, this latter applied instead in the following demonstration]. Since there is nothing truer than scientific knowledge except intuition, it will be intuition that apprehends the principles. A result which also follows from the fact that demonstration cannot be the originative principle of demonstration, nor, consequently, scientific knowledge of scientific knowledge. Ascertained that we have no other kind of true knowledge besides science [if not intuition], intuition will be the principle of science. Aristotle concludes by stating that intuition can then be considered principle of the principle, while science as a whole is in the same relationship with the totality of things it has as its object. Concluding our Philosopher establishes this brilliant proportion:

intuition: the principle = scientific knowledge: the research objects of the distinct sciences

II) A few centuries later Albert Einstein (1936) expressed himself against the inductive method in science, replacing the concept of “intuition” with that of “free invention”, arguing that physics constitutes a logical evolving thought system, whose bases cannot be obtained by a distillation of lived experiences by any inductive method, but exclusively through free invention.

III) Finally, we want to substantiate our opinion about the fundamental importance of intuition in science, with a passage already highlighted in our previous booklet (Anceschi & Magli 2013, 16), in the expression of Willi Hennig, the man who more than any other tried to give a modern face, i.e. scientific, to taxonomic science. Indeed, according to Hennig's opinion: "... there is no simple and absolutely dependable criterion for deciding whether corresponding characters in different species are based on synapomorphy. Rather it is a very complex process of conclusions by which in each individual case, 'synapomorphy' is shown to be the most probable assumption" (1966, 128). Furthermore, "... the attempt to reconstruct the phylogeny, and thereby the phylogenetic relationships of species, from the present conditions of individual characters and the presumed preconditions of these characters has the nature of an integration problem. In mathematics, the most exact science, according to Michaelis (1927), 'integration ... is an art ... since one is often faced with the problem of combining, from the numerous possible manipulations, those that make possible the solution of the problem.' " (ibid., 128-129). Hennig adds that the solution to a particular problem depends on capabilities that do not lie in the realm of the learnable (what we would call intuition), quoting the words of the mathematician Gauss: "I have the result, but I don't know yet how I got it" (ibid., 129).

In summary, in an attempt to formulate a proposal that can prepare us for a new method of approach to scientific knowledge, we would say that a return to a way of proceeding that favours theoretical-speculative thinking as the basis for the understanding of the real (this thinking is part of it), would help to prepare researchers who know how to interpret the visible through reasoning, and the invisible through intuition. To this end, a re-reading of the Classics of Western philosophy, even by scientists, physicists included, would be a good starting point. In the recent article "Why science needs philosophy" (Laplane et al. 2019), the authors report all the benefits deriving of a scientific approach that includes a philosophical basis, and particularly because we would point out that, it is from Thales times (b. perhaps 624 or 623 BC - d. between 548 and 545 BC), that we know it is the former that arises as part of the latter, not vice versa. The above article (ibidem, 3948) opens once again with Albert Einstein's enlightening words: "A knowledge of the historic and philosophical background gives that kind of independence from prejudices of his generation from which most scientists are suffering. This independence created by philosophical insight is—in my opinion—the mark of distinction between a mere artisan or specialist and a real seeker after truth." (1944, Letter to Robert Thornton). If the contemporary scientific community wants to avoid the risk of Academies becoming only the receptacle of a form of specialized and self-referential knowledge, these must go back to being what the Platonic idea of Academy was born for, i.e. a place where knowledge can meet, not divide.

02. Nomenclatural novelties

New names and combinations in *Echinopsis* Zuccarini

As already extensively outlined in our previous booklet (Anceschi & Magli 2013a, 22-29) and underlined in Cactaceae Systematics Initiatives (Anceschi & Magli 2013b, 31: 24-27), the most consistent phylogenetic solution to solve the problem of polyphyly in *Echinopsis* s.l., highlighted by molecular evidence (Schlumpberger & Renner 2012, 99 (8): 1335-1349), and thus to obtain a well-supported monophyletic genus *Echinopsis* in accordance with Hennig's theory (1966), consists in the further inclusion in *Echinopsis* s.l. of the genera of the Trichocereeae/Trichocereinae as indicated by the analysis (ibidem: 1336, 1341).

Recalling that:

a) the solution proposed by Schlumpberger (2012, 28: 29-31), does not solve the internal relationships of the clades *Cleistocactus* sens. str. and *Oreocereus* in a natural way in Hennig' sense, in addition to creating confusion, because the new proposed clades were not characteristically definable and therefore identifiable (Anceschi & Magli 2013a, 25-27; 2013b, 24-25).

b) Hunt's subsequent interpretation (2013, xiii; 2016, 11-12), consisting of dusting off in his words, the "old favourites" (and now paraphyletic) *Echinopsis*, *Lobivia* and *Trichocereus*, together with the genera proposed by Schlumpberger, but accepting the latter as "alternative" names, only adds confusion to confusion. Conscious in fact of the phylogenetic lability we underlined in the Schlumpberger solution (Hunt 2014, 32: 3), the last Hunt proposed (2013, xiii; 2016, 11-12) taxa identifiable with more than one name.

There are in fact well 9 genera of the Trichocereeae/Trichocereinae (i.e. *Acanthocalycium*, *Chamaecereus*, *Leucostele*, *Lobivia*, *Reicheocactus*, *Setiechinopsis*, *Soehrensia*, *Trichocereu*s, *Vatricania*), wandering in this strange reality, to say the least, where they share an identity suspended between *Echinopsis* and the generic name proposed by Schlumpberger.

We then proceed with the assimilation in *Echinopsis* s.l. of the genera indicated by the analysis for the species implicated in cactusinhabitat.org, continuing the work of revision in *Echinopsis* Zuccarini already begun in the 2013 booklet (Anceschi & Magli 2013a, 37-40). Here follow the new names and combinations required in *Echinopsis* for this edition.

Echinopsis acrantha (K. Schumann ex Vaupel) Anceschi & Magli **comb. nov. Basionym:** *Cereus acranthus* K. Schumann ex Vaupel, Bot. Jahrb. Syst. 50 (2-3, Beibl. 111): 14 (1913). **Type:** PE, Lima, nr. Santa Clara, on railway Lima-Oroya, 400-600 m, 26 Oct 1902, Weberbauer 1679 (B, alc.).

Echinopsis glaziovii (K. Schumann) Anceschi & Magli **comb. nov. Basionym:** *Cereus glaziovii* K. Schumann, Fl. Bras. (Martius) 4(2): 200, t. 39 (1890). **Type:** BR, Minas Gerais, Pico d'Itabira do Campo, 20 Dec 1888, Glaziou s.n. (B; K, SPF, photos ex B).

Echinopsis hennigiana Anceschi & Magli **nom. nov. Replaced synonym:** *Weberbauerocereus cuzcoensis* Knize, Biota 7(57): 256 (1969), non *Echinopsis cuzcoensis* (Britton & Rose) H. Friedrich & G. D. Rowley, I.O.S. Bull. 3(3): 95 (1974). **Type:** PE, Apurímac, Río Pampas valley, c. 2000 m, Soukup 6311 (SMF 6102). **Etymology:** named to honour Willi Hennig, German biologist, entomologist, father of phylogenetic systematics (the modern cladistic school).

Echinopsis hystrix (Rauh & Backeberg) Anceschi & Magli **comb. nov. Basionym:** *Loxanthocereus hystrix* Rauh & Backeberg, Descr. Cact. Nov. 15 (1957). **Type:** PE, Nazca-Lucanas, 3300 m, rock crevices, 1956, Rauh K 112, np?

Echinopsis laniceps (K. Schumann) Anceschi & Magli **comb. nov. Basionym:** *Cereus laniceps* K. Schumann, Gesamtbeschr. Kakt. 93 (1897). **Type:** BO, nr Tunari, 1300 m, Kuntze (not extant?).

Echinopsis martinii (Labouret) Anceschi & Magli **comb. nov. Basionym:** *Cereus martinii* Labouret, Ann. Soc. Hort. Haute-Garonne 1: 182-184 (1854). **Neotype:** (Kiesling, Darw. 34 (1-4): AR, Entre Ríos, Colón, 6 Feb 1985, Kiesling 5069 (SI).

Echinopsis micropetala (F. Ritter) Anceschi & Magli **comb. nov. Basionym:** *Cleistocactus micropetalus* F. Ritter, Kakteen Südamerika 2: 675, figs. 653, 656 (1980). **Type:** BO, Tarija, Avilez, Concepción, 1958, Ritter 830.

Echinopsis rondoniana (Backeberg & Voll) Anceschi & Magli **comb. nov. Basionym:** *Arthrocereus rondonianus* Backeberg & Voll, Kakteenkunde 1943(3): 62, illus. (1943). **Lectotype:** N. P. Taylor & Zappi, Cacti of Eastern Brazil**,** 439 (2004): Backeberg, Blätter für Kakteenforschung 1935(4): [unpag] (1935), illus. as **'***Arthrocereus rondonianus* Bckbg. et Voll n. sp.'.

Echinopsis smaragdiflora (F. A. C. Weber) Anceschi & Magli **comb. nov. Basionym:** *Cereus smaragdiflorus* F. A. C. Weber, Dict. Hort. [Bois] 1: 281 (1894). **Type:** AR, Tucumán, Schickendantz 154, [P [Status?]].

Echinopsis strausii (Heese) Anceschi & Magli **comb. nov. Basionym:** *Pilocereus strausii* Heese, Gartenflora 56: 410, fig. 49 (1907). **Lectotype:** D. R. Hunt & N. P. Taylor, Cactaceae Syst. Init. 21: 6 (2006): Gartenflora 1907: fig. 49.
Note: the new combination replaces the illegitimate *Echinopsis nothostrausii* Anceschi & Magli, published in Cactusinhabitat South America 2011/2013, 39 (2013). See Eggli & Nyffeler, Repertorium Plantarum Succulentarum LXIV (2013): 13 (August 2014).

New combinations in other genera

Arrojadoa Britton & Rose

Arrojadoa leucostele (Gürke) Anceschi & Magli **comb. nov. Basionym:** *Cereus leucostele* Gürke, Monatsschr. Kakteenk. 18: 53 (1908). **Type:** BR, Bahia, Maracás, 'Calderão', Ule 2 (B). **Synonym:** *Stephanocereus leucostele* (Gürke) A. Berger, Entwicklungslin. Kakt. 59, 97 (1926).
Note: The taxon known as *Stephanocereus leucostele* (Gürke) A. Berger, is actually morphologically and molecularly more related to the components of *Arrojadoa* Britton

& Rose, than to *Stephanocereus luetzelburgii* (Vaupel) N. P. Taylor & Eggli, the other member of the genus *Stephanocereus* A. Berger as currently conceived on the basis of Taylor & Eggli (1991). In fact:
a) Morphologically *S. leucostele* in its ontogenetic process can be assimilated into a "giant *Arrojadoa*" (evident are the common ringlike cephalia on the stem tips, a character that only rarely appears on some old individuals of *S. luetzelburgii*). Furthermore, the semaphoronts (Hennig 1966, 6-7, 32-33, 63, 65-67), globular at first, then with the characteristic elongated bottle-neck shape of *S. luetzelburgii*, make this taxon unique in the Cactaceae family.
b) Molecularly preliminary study of gene sequences in tribe Cereeae, conducted at Kew by Patricia Soffiatti (unpubl. Data in Taylor 2002, 14: 28), show that *S. luetzelburgii* is separated from *S. leucostele*, being the first basal to a range of more derived cereoids, while the second is immediately basal to *Arrojadoa* Britton & Rose. For a more extensive discussion on the subject, see the comment on page 72-73 of this booklet.

Cereus Miller

Based on the evidence of the molecular data (Franco et al. 2017, 203), which clearly show *Cipocereus* and *Praecereus* embedded among the species of *Cereus*, in a single well-supported monophyletic clade, i.e. posterior probabilities 0.93 (>0.85) (ibidem), and in the direction of a monophyletic genus *Cereus* s.l. (Hennig 1966; Anceschi & Magli 2018, 36: 74-75), after the inclusion of *Praecereus* in *Cereus* (Anceschi & Magli 2013a, 44), we now transfer to *Cereus* the species of *Cipocereus* previously attributed to *Pilosocereus* in cactusinhabitat.org (Anceschi & Magli 2010, 18, 31-33; 2013a, 84-85, 101-102), i.e. *Pilosocereus crassisepalus, Pilosocereus laniflorus, Pilosocerus minensis*, together with *Cipocereus bradei* (Backeberg & Voll) Zappi & N. P. Taylor, taxon subject of our latest research and not yet present in the 2013 publication. For a more extensive discussion on the subject, see the comment on page 43-44 of this booklet. The two new combinations needed in *Cereus* s.l., are published here.

Cereus bradei (Backeberg & Voll) Anceschi & Magli **comb. nov. Basionym:** *Pilocereus bradei* Backeberg & Voll, Cactaceae. Jahrbücher der Deutschen Kakteen-Gesellschaft e. V. Berlin 1941: 78 (1942). **Lectotype:** N. P. Taylor & Zappi, Cacti of Eastern Brazil**,** 286 (2004): Backeberg & Voll, Blätter für Kakteenforschung 1935(1): [p. 3] (1935), photograph.

Cereus laniflorus (N. P. Taylor & Zappi) Anceschi & Magli **comb. nov. Basionym:** *Cipocereus laniflorus* N. P. Taylor & Zappi, Cactaceae Systematics Initiatives 3: 7 (1997). **Type:** BR, Minas Gerais, mpio Santa Bárbara, Serra do Caraça, quartzitic outcrops in campo rupestre, 11 Sep 1990, Zappi et al. 240 (SPF, holo.; HRCB, BHCB, iso.).

03. Comments on species*

Cereus

Recent molecular analysis (Franco et al. 2017) confirms the non-existence of the genera *Cipocereus* F. Ritter and *Praecereus* Buxbaum as taxa separate from *Cereus* Miller

In our first two booklets (Anceschi & Magli 2010, 18, 31-33; 2013a, 84-85), we have amply highlighted the inconsistency of the genus *Cipocereus* F. Ritter, distinct from *Pilosocereus* Byles & G. D. Rowley, on the sole basis of "indehiscent fruits with colourless, watery pulp", a character that according to Taylor (Taylor in Hunt & Taylor 1990, 8: 98-99), would distinguish the first taxon from the second. However, in recent years, preliminary molecular evidence has led to the inclusion of *Cipocereus* and *Praecereus* Buxbaum in *Cereus* Miller (Machado et al., 2006; Hunt 2013, xì-xìì; Taylor in Hunt 2017, 37: 21). Pending confirmation of this at the molecular level, we had attested to the provisional inclusion of *Cipocereus* in *Pilosocereus* (Anceschi & Magli 2013a, 85), and had already considered *Praecereus* as part of *Cereus* (Anceschi & Magli 2013a, 44). The awaited molecular analysis on *Cereus* and closely allied genera (i.e. *Cipocereus* and *Praecereus*), obtained from the plastid trnS-trnG intergenic spacer, have been published in a biogeographical study by Franco et al. (2017, 199-210). The analysis confirms that *Cipocereus* and *Praecereus* are embedded among the species of *Cereus*, in a single well-supported monophyletic clade, i.e. posterior probabilities 0.93 (>0.85) (ibidem, 203). However, the result is summarized as follows in the authors's words: "The main results of our phylogenetic analyses are as follows. First, it is likely that *Cereus* is not monophyletic, as *Cipocereus* (clade D1) and *Praecereus* (clade D2) were placed among *Cereus* spp." (Ibidem, 202). Now, it is clear to us that to make *Cereus* monophyletic, the simplest and most realistic phylogenetic solution to adopt, as well as being consistent with Hennig's theory (Hennig 1966; Anceschi & Magli 2018, 36: 74-75), would be to include in *Cereus* the two groups that the analysis clearly indicates as part of the monophyletic group thus constituted. However, in order to maintain the monophyly of

Cipocereus and *Praecereus* as advocated by the authors, the first taxon should include the subgenus *Mirabella* (*Cereus albicaulis* and *Cereus mirabella*) and the second should include part of the subgenus *Ebneria* (in the analysis *Cereus saddianus* and *Cereus kroenleinii*). This will leave the rest of the genus *Cereus* composed of the current subgenus *Cereus*, *Oblongicarpi* and part of *Ebneria* (in the analysis *Cereus aethiops* and *Cereus spegazzini*), sustained from a lower support (posterior probabilities 0.82) compared to that of the phylogenetic hypothesis adopted by us (posterior probabilities 0.93) (ibidem 203). Therefore, based on the evidence of the molecular data and in aiming for a monophyletic genus *Cereus* s.l. (Hennig 1966; Anceschi & Magli 2018, 36: 74-75), we propose to transfer to *Cereus* the species of *Cipocereus* previously attributed to *Pilosocereus* in cactusinhabitat.org (i.e. *Pilosocereus crassisepalus, Pilosocereus laniflorus, Pilosocerus minensis*), together with *Cipocereus bradei* (Backeberg & Voll) Zappi & N. P. Taylor, a taxon that is the subject of our latest research and not yet present in the 2013 publication. The two new combinations needed in *Cereus* s.l., are published on page 41 of this booklet (i.e. *Cereus bradei* (Backeberg & Voll) Anceschi & Magli, *Cereus laniflorus* (N. P. Taylor & Zappi) Anceschi & Magli).

Cereus jamacaru ssp. *calcirupicola* (F. Ritter) N. P. Taylor & Zappi, the part of *Cereus jamacaru* De Candolle adapted to the rocky outcrops of the Caatinga ecoregion

During our 2015-2016 study tour, we spent the months of June and July making surveys in the states of Minas Gerais and Bahia, Brazil. One of the species of interest was the dominant *Cereus jamacaru* De Candolle, a taxon which is distributed in 7 Brazilian states (i.e. Alagoas, Bahia, Goiás, Maranhão, Minas Gerais, Pernambuco, Sergipe), at heights between 50 and 1200 m asl. (data gathered from: Braun, P., Machado, M. & Taylor, N. P. 2017. *Cereus jamacaru* (amended version of 2013 assessment). The IUCN Red List of Threatened Species 2017. Downloaded on 11 January 2020). Travelling in a north-eastern direction through the Caatinga ecoregion, a part of the Tropical & Subtropical Dry Broadleaf Forest Biome (Olson, D. M. et al. 2001), we came across various populations of the taxon in an area between Montes Claros (north Minas Gerais) in the south (A&M 1381), and Ituaçu (central-south Bahia), in the north (A&M 1440).

Regarding the taxonomic understanding of this species, Hunt et al. (2006, text: 40), divided the taxon into two ssp., recognizing in addition to ssp. *jamacaru*, the ssp. *calcirupicola*; having young plants (c.10-100 cm in high) of the first taxon with only 3-7 ribs versus 5-8 ribs present in the second, on specimens of the same height. Our surveys show that, if it is true that young specimens of *calcirupicola* populations, in the above-mentioned height range, they can show 4-8 ribs at the base versus an average of 7 in the *jamacaru* populations; it must be considered that in the upper part of the stem (i.e. c. 100 cm in high), in both taxa the rib count becomes 4-5. See A&M 1381 (*calcirupicola* populations), photos 11-16; A&M 1385 (*calcirupicola* populations), photos 21-24 and A&M 1395 (*jamacaru* populations), photos 39-40; in addition to A&M 1396 (*jamacaru* populations), photos 48-49. We find it difficult to distinguish taxa solely on the basis of these differences, within dominant species of such a geographical extent. The only discernible difference within the species is constituted by the fact that, while *jamacaru* populations tend to grow in the flatter part of the Caatinga, the plant we call *calcirupicola* has populations growing on the rocky outcrops of this ecoregion. We would like to recall that occupying distinct habitats is part of the normal expansion process of a dominant species in the Darwinian evolutionary sense (Darwin, 1859), with the slight morphological variations that this entails. In this sense we consider *Cereus calcirupicola* (F. Ritter) Rizzini and *Cereus jamacaru* ssp. *calcirupicola* (F. Ritter) N. P. Taylor & Zappi synonymous with *C. jamacaru*. Anderson & Eggli (2011, 107-108), distinguish within C. jamacaru, also Cereus jamacaru ssp. goiasensis (F. Ritter) P. J. Braun & Esteves, always for a labile distinction based on the number of ribs (i.e. 5-7, at the base of the young plants (<100 cm in height). But based on Taylor & Zappi (2018, 36: 9), who consider the last taxon (as Piptanthocereus goiasensis) synonymous with Cereus hexagonus (Linné) Miller, we prefer to exclude C. jamacaru ssp. goiasensis from the synonymy of C. jamacaru.

Corryocactus

Corryocactus brachypetalus **(Vaupel) Britton & Rose, a synonym of *Corryocactus brevistylus* (K. Schumann) Britton & Rose**

As already expressed in Hunt et al. (2006, text: 57), probably *Corryocactus brachypetalus* (Vaupel) Britton & Rose is probably only a lowland form of *Corryocactus brevistylus* (K. Schumann) Britton & Rose. To confirm this hypothesis, we emphasize that the dimensional elements of the first taxon are included in the second (see Anderson 2001, 183-184; Hunt et al. 2006, text: 57), apart from the deep orange flower in *C. brachypetalus*, versus yellow in *C. brevistylus* (ibidem). However, we are aware of the fallability of using floral characters to distinguish taxa, even at a specific level (Ritz et al. 2007; Lendel et al. unpubl. data; Nyffeler et al. unpubl. data, Nyffeler & Eggli 2010, Schlumpberger & Renner 2012, Anceschi & Magli 2013a). The character constituted by the fastigiate branches (i.e. having erect and parallel branches), which should identify *C. brachypetalus* (Hunt et al. 2006, text: 57), is not always present (see the surveys of Atiquipa, A&M 1155, A&M 1159, A&M 1164), and moreover it is also found among the populations of *C. brevistylus* (see the populations of Cabanaconde, A&M 216). For the comparison of the semaphoronts (Hennig 1966, 6-7, 32-33, 63, 65-67) between the two taxa, see:

a) fastigiate branches - A&M 216, (*C. brevistylus*), Peru, Arequipa, Cabanaconde, Cañon del Colca (photos 1-2), with A&M 1140 (*C. brachypetalus*), Peru, Arequipa, north-east of Matarani, 511 m (photos 6-8, 10, 20, 22);
b) detail of the ribs - A&M 216, (*C. brevistylus*), Peru, Arequipa, Cabanaconde, Cañon del Colca (photo 3), with A&M 1140 (*C. brachypetalus*), Peru, Arequipa, north-east of Matarani, 511 m (photo 21).

Furthermore, the difference between the green-yellow fruit of *C. brachypetalus* versus the olive-green of *C. brevistylus* highlighted in Hunt et al. (2006, text: 57), is not a distinctive enough diagnostic feature of the two taxa, and in fact *C. brachypetalus* can bear both green-yellow fruit (A&M 1155, photo 29), and olive-green as *C. brevistylus* (A&M 1140, photo 09). Based on the above, we believe it is correct to attribute the populations of *C. brachypetalus* to *C. brevistylus*.

Echinopsis

Monophyly of *Echinopsis* Zuccarini s.l.

In August 2013, following publication of our 2011/2013 booklet (June 2013), we published an article relating to the discussed monophyly of *Echinopsis* Zuccarini s.l. in Cactaceae Systematics Initiatives (2013b, 31: 24-27). That article summarized and underlined the position we have taken in the booklet in relation to the phylogenetic hypothesis to be adopted regarding the classification of the genera related to *Echinopsis* s. l., within the tribe Trichocereeae, or subtribe Trichocereinae (Nyffeler 2002, 317, 319; Lendel et al. 2006, unpubl. data in Nyffeler & Eggli 2010), between the two shown by the results from the molecular analysis carried out by Schlumpberger & Renner (2012: 1335-1349). According to them, to avoid the polyphyly of *Echinopsis* s.l. as conceived at the time (Anderson 2001, 2005, 2011; Hunt et al., 2006; Nyffeler & Eggli 2010), there were two possible solutions:
I) A new division of *Echinopsis* s.l. in at least 7 old genera (*Acanthocalycium, Chamaecereus, Leucostele, Lobivia, Reicheocactus, Soehrensia* and *Setiechinopsis*). This is the option adopted by Schlumpberger, which led to the 48 new combinations presented by him in CSI (28: 29-31). This was a solution devoid of internal coherence, as it did not naturally resolve the internal relationships of the clades *Cleistocactus* sens. str. and *Oreocereus* (Schlumpberger & Renner 2012: 1342; Anceschi & Magli 2013b, 31: 25).
II) The other solution was constituted by the inclusion of 15 genera hitherto never incorporated before in *Echinopsis* s.l., as indicated by the analysis (Schlumpberger & Renner 2012: 1336, 1341), to make the genus monophyletic in Hennig's sense. The latter, as we know, is the hypothesis we supported (Anceschi & Magli 2013a, 22-29; 2013b, 31: 24-27). Referring to the aforementioned booklet and to the article in CSI for all the insights related to the matter treated at that time, we now update what is known, with the following notes:

I) Of the 15 genera often cited to be assimilated in *Echinopsis* s.l., for the constitution of a monophyletic macrogenus *Echinopsis*, actually just 6 of these are monotypic genera (i.e. composed of only one species): *Denmoza, Mila, Rauhocereus, Samaipaticereus,* *Vatricania, Yungasocereus*; and according to Hunt (2003, 15: 3) "The monotypic genus is a contradiction in terms. Logically (or at least etymologically) the term *genus* implies a *class* or *group* of things of a lower order (in botany, species etc.), i.e. a collection of things with common attributes. ". Not to mention that 2 of the genera in question (*Oroya* and *Pygmaeocereus*), are composed of only two species. It is therefore evident that the aforementioned transfer to *Echinopsis* involves in reality far fewer natural taxa than those which would seem to be initially implicated.

II) it is striking that of the 17 naturally-occurring intergeneric hybrids reported by Hunt et al. (2006, text: 321) and taken from Hunt (2015, 33: 16) for the family Cactaceae, as many as 11 concern the alleged genera within the tribe Trichocereeae, or subtribe Trichocereinae, i.e. 1) xCleistocana (Cleistocactus x Matucana), 2) xEchinomoza (Echinopsis x Denmoza), 3) xEspocana (Espostoa x Matucana), 4) xEspostingia (Espostoa x Rahuocereus), 5) xEspostocactus (Espostoa x Cleistocactus), 6) xHaagespostoa (Haageocereus x Espostoa), 7) xMaturoya (Matucana x Oroya), 8) xOreocana (*Oreocereus* x Matucana), 9) xOreonopsis (Oreocereus x Echinopsis), 10) xWeberbostoa (Weberbauerocereus x Espostoa), 11) xYungastocactus (Yungasocereus x Cleistocactus). We would like to remember, assuming that the term genus still has some meaning in biology and classification, that two genera that are such, that by definition cannot cross with each other, and if not, they are not two distinct genera.

III) Regarding the 'judgment' repeatedly expressed by Hunt (2013, xiii; 2018, 39: 5, 11), "This radical option has been espoused by Anceschi & Magli (2013) but seems unlikely to gain many supporters", related to our taxonomic approach to the solution of the *Echinopsis* classification problem, a judgment which has already been denied by Molinari-Novoa (2015, 13: 18-21) and by Mayta & Molinari-Novoa (2015, 14: 13-20), we wonder: since when being "radical" would compromise the use of a solution in science, if this is the one that best represents the correct interpretation of the theory in use?

IV) As already stated in our synopsis of the genus *Parodia* Spegazzini s.l. (Anceschi & Magli 2018, 36: 75), recent molecular analysis (Barcenas et al. 2011, 27: 470-489), have clearly highlighted that most of the genera of the Cactaceae as currently understood are not monophyletic in Hennig's sense (i.e. not sufficiently extended and not supported by a sufficient number of synapomorphies (see Anceschi & Magli 2018, 36: 74-75), or as in the authors' words "… 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." (ibidem, 488). Regarding this way of operating, we think that the science of classification has reached a crossroads:

a) correctly apply the available theories to the evidence that science shows us through the techniques and tools currently in use (in this case the principle of monophyly in Hennig's sense (1966), having regard to the opposition that is made of the mentioned principle with the concepts of polyphyly and paraphyly, being the second a new concept proposed by this author (see Anceschi & Magli 2018, 36: 74-75).

b) continue to use the paradigms of collecting to distinguish taxa or, if preferred, with the contemporary tools at hand, the use of the 'cynical' species concept, which is, summarized in Kitcher's words as follows: "Species [and genera] are those groups of organisms which are recognized as species [or genera] by competent taxonomists. Competent taxonomists, of course, are those who can recognize the true species [or genera]." (1984 (51) 2: 308). We think that Hunt's solution (2013, xiii), to solve the problem in *Echinopsis*, to dust off, in his words, the "old favorites" (and now paraphyletics) *Echinopsis*, *Lobivia* and *Trichocereus*, together with the above mentioned genera of Schlumpberger, in addition to adding confusion to confusion, fall under the second hypothesis.

Enlargement of the synonymy in *Echinopsis acanthura* (Vaupel) Molinari

Hunt et al. (2006, text: 44; atlas: 208-209), divided *Cleistocactus acanthurus* (Vaupel) D. R. Hunt into 3 ssp. namely *acanthurus*, *faustianus* and *pullatus*. The three taxa are then transferred by Hunt to *Borzicactus* Riccobono (2013, atlas: xii, xix, 208-209; 2016, 23, 161), following Charles' adaptation (2012, 26:14), of the molecular outcomes (Schlumpberger & Renner 2012 (99), 1342). In this regard, we underline that the genus

Borzicactus as proposed by Charles is polyphyletic, i.e. according to Nelson's redefinition (1971: 472) of the concepts of paraphyly and polyphyly sensu Hennig, and 8 groups are missing in order for it to be considered monophyletic, while 7 are missing in the less restrictive concept of Wiley & Liebermann (2011, 82). To be truly monophyletic, as indicated by the aforementioned analysis "the *Oreocereus* clade (99% bootstrap) or, given the results of the analysis, *Borzicactus* (according to Kimmach), should include: *Borzicactus* (or *Oreocereus*), *Espostoa*, *Haageocereus*, *Matucana*, *Mila*, *Oroya*, *Pygmaeocereus* and *Rauhocereus*" (ibidem; Anceschi & Magli 2013a, 25), and not only *Borzicactus* as proposed by Charles. Returning to the ssp. of *C. acanthurus*, the same is also recognized by Anderson (2001, 153-154) and Anderson & Eggli (2011, 115-116). In our opinion, the differences shown to somehow distinguish the taxa in question are irrelevant in the context of a biological species. The same comment by Hunt at the conclusion of the entries relating to the 2 ssp. on NCL (2006, text: 44), leaves some doubt about their actual existence: "Of numerous named variants from dept. Lima, the above may perhaps merit recognition as subspecies." We also point out that the photos that should distinguish the three taxa in the same Lexicon, show individuals that could be part of the same natural population (ibidem, atlas: 208, photos 208.3, 208.4, 209, photo 209.1). Finally, E. A. Molinari-Novoa in his updated list of the Cactaceae of the Lima basin (2015, 13: 18-21), follows the phylogenetic option chosen by us of a monophyletic macrogenus *Echinopsis* based on molecular outcomes (Anceschi & Magli 2013a, 22-29; 2013b, 31: 24-27), and has erected *Echinopsis acanthura* (Vaupel) Molinari, and has made the new combinations of ssp. *canetensis* and ssp. *pullata*. Referring to the above for ssp. *pullata*, according to Hunt et al. (2006, text: 285) and with Anderson & Eggli (2011, 116), we consider *Loxanthocereus canetensis* Rauh & Backeberg to be synonymous with *C. acanthurus* ssp. *acanthurus* = *E. acanthura.* Together with ssp. *canetensis*, we also assimilate into the synonymy of *E. acanthura*, ssp. *faustiana*, subsequently added by Mayta, L. & Molinari-Novoa, E. A. (2015, 14:19).

The populations of *Echinopsis acrantha* (K. Schumann ex Vaupel) Anceschi & Magli, of the Peruvian coastal desert

Our surveys carried out in 2014 in the coastal desert of Peru also considered the populations of *Echinopsis acrantha* (K. Schumann ex Vaupel) Anceschi & Magli (A&M 1213, A&M

1219), a taxon better known as *Haageocereus acranthus* (Vaupel) Backeberg. In this regard, for the phylogenetic hypothesis adopted for the assimilation of *Haageocereus* Backeberg in *Echinopsis* Zuccarini see Anceschi & Magli (2013a, 22-29; 2013b, 31: 24-27). The ssp. *olowinskianus* of *H. acranthus*, is distinguished by having a stem <1m, vs. <2m for the ssp. *acranthus*, and a distribution area south of Lima (Anderson 2001, 365). The same distinctions are confirmed in Anderson & Eggli (2011, 331-332). In Hunt et al. (2006, text: 135), the longer central spine, <6 cm, vs. 2 cm of the type species, is added as a distinctive element. As for the major distinctive element (i.e. the height of the stem), we have encountered individuals of 121cm in height among the *olowinskianus* populations of Omas, Lima, Peru. Regarding the greater length of one of the central spines, if it is true that in photographic documentation the *olowinskianus* populations seem to have the lower central spine longer than those of the type species, during the measuring phase this appearance is not confirmed. In fact, we measured <3.1cm for the lower central among the *olowinskianus* populations, while <3.9cm and <2.4cm, respectively for the upper and lower central in the *acranthus* populations. Actually the spination (like the rest of the holomorphology of the 2 taxa) is very similar. Compare the *olowinskianus* populations, A&M 1213, Peru, Lima, noth-east of Omas (photos 9-11), with those of the *acranthus* populations, A&M 1219, Peru, Lima, Lima, north-east of Lima (photos 19, 23). As for the distribution area, the olowinskianus populations represent a natural continuation of the species to the south. In relation to the taxonomic interpretation given by E. A. Molinari-Novoa (2015, 13:19), which assimilates *H. acranthus* and *Haageocereus olowinskianus* Backeberg in *Echinopsis limensis* (Salm-Dyck) Molinari, basionym *Cereus limensis* Salm-Dyck (1845), synonym *Haageocereus limensis* (Salm-Dyck) F. Ritter, it is considered that in Hunt et al. (2006, text: 136, 323) *Haageocereus limensis*, basionym *Cereus limensis*, is considered an outlawed name, and a similar evaluation is made in Anderson & Eggli (2011, 331, 667, 694), where *C. limensis* and *H. limensis* are identified as *Haageocereus* sp. On the basis of these considerations, we prefer the name *E. acrantha* to identify the populations in question. Together with the epithet *olowinskianus*, for similar reasons, we consider to include in the synonymy of *E. acrantha* both *Haageocereus acranthus* ssp. *backebergii* N. Calderón and *Haageocereus acranthus* ssp. *zonatus* (Rauh & Backeberg) Ostolaza, which were both absent in Hunt et al. (2006), and in Hunt (2013), but reinstated by Hunt in CCC3 (2016, 67, 162). Consequently *Echinopsis limensis* ssp. *backebergii* (N. Calderón) Molinari & Mayta (Molinari & Mayta 2015, 14: 20) is included in the synonymy.

Echinopsis ayopayana F. Ritter & Rausch, a conceivable extension of the morphological standard of *Echinopsis bridgesii* Salm-Dyck

Anderson (2001, 263), considers *Echinopsis ayopayana* F. Ritter & Rausch synonymous with *Echinopsis comarapana* Cárdenas; the same position is maintained in Anderson & Eggli (2011, 226). Otherwise, Hunt et al. (2006), included *E. comarapana* among the synonyms of *E. bridgesii* ssp*. vallegrandensis* (Cárdenas) M. Lowry (ibidem, text: 94, 292), recognizing *E. ayopayana* among the accepted taxa, noting “Doubtfully distinct from *E. bridgesii*, though mature br become decumbent and > 1m long, a growth habit not seen in *E. bridgesii.*”. Actually in different populations of the dominant and variable *E. bridgesii* we studied in habitat, individuals showing decumbent and elongated habits coexist with others, conforming to the standard dimensions of the species. See for example A&M 1107, Bolivia, Cochabamba, south-east of Cochabamba, La Angostura, photos 86-88 for semaphoronts (Hennig 1966, 6-7, 32-33, 63, 65-67) of the first type, and photos 93, 95, and 97 for those of the second. It is also worth noting as well as in areas close to the type locality of *E. ayopayana* (i.e. BO, Cochabamba, Ayopaya, between Indipendencia and Tiquirpaya), the populations show many individuals in the dimensional range of *E. bridgesii* (i.e. with non-decumbent stems, <1m long), see A&M 1129, Bolivia, Cochabamba, Ayopaya, below Yayani, 2090 m (photos 127-156). For the above reasons we add *E. ayopayana* to the synonymy of *E. bridgesii*.

Lobivia krahn-juckeri Diers, one of the many manifestations of *Echinopsis bridgesii* Salm-Dyck

It should be noted that before the publication of *Lobivia krahn-juckeri* Diers (Kakteen And. Sukk. 60 (8): 216 (215-223; figs. 1-19) (2009), in the Turuchipa area, Potosi, Bolivia, previous researchers (BB 1124.02 (2001), RH 350 (1989) identified this species with *Echinopsis huotii* (Cels) Lobouret, a taxon now referred by Hunt et al. (2006, text: 96) to *Echinopsis bridgesii* ssp. *vallegrandensis* (Cárdenas) M. Lowry (in cactusinhabitat.org both taxa are considered synonyms of *Echinopsis bridgesii* Salm-Dyck, see Anceschi & Magli 2013a, 45-46), or simply as *E. bridgesii*. Only after Prof. Diers publication in 2009, subsequent researchers (VOS 11-1077 (2011), LB 4055, LB 4057 (2011) began to search for it and identify it as *Echinopsis krahn-juckeri* nomen nudum, although some (MU 493.2 (2011), continued to identify it as *E. huotii*. Also Lowry & Winberg, in their article "Two to Turuchipa" (2013, 8: 44), regarding *L. krahn-juckeri* point out that "mature plants are almost indistinguishable from *Echinopsis bridgesii* ssp. *vallegrandensis*", but that the protologue describes the taxon with short or long flower tubes and white, magenta, red or yellow flowers. In this regard, we are all aware of the fallability of the value of floral characters in defining taxa, following the recent molecular evidence (Ritz et al. 2007; Lendel et al. umpubl. data; Nyffeler et al. umpubl. data; Nyffeler & Eggli 2010; Schlumpberger & Renner 2012; Anceschi & Magli 2013a). Despite Lowry's change of opinion (2018, 22: 26-32) of now willing to recognize the rank of species of the *Echinopsis* from Turuchipa as *Echinopsis krahn-juckeri* (Diers) M. Lowry, on the basis of the surveys carried out by us in habitat (A&M 1097, A&M 1100 and A&M 1101), we are in line with its previous interpretation, and consider the populations of *E. krahn-juckeri* as one of the many manifestations of the dominant *E. bridgesii.*

Echinopsis oligotricha **(Cárdenas) M. Lowry, a thinner spined form of** ***Echinopsis cinnabarina*** **(Hooker) Labouret, detectable also among the populations of the dominant taxon**

In agreement with Anderson's position (2001, 263), confirmed again in Anderson & Eggli (2011, 225), *Lobivia oligotricha* Cárdenas is to be considered a synonym of the dominant *Echinopsis cinnabarina* (Hooker) Labouret. Lowry (2005, 19: 12), proposes a distinction of the first taxon from the second, electing *Echinopsis oligotricha* (Cárdenas) M. Lowry, with these arguments "... amply distinct through its smaller pale-throated flowers which arise laterally and its rough, dull brown seeds with an oblique hilum.". Given that for years, through the results of molecular analysis, we are aware of the fallability of the use of floral characters to distinguish taxa (Ritz et al. 2007; Lendel et al. umpubl. data; Nyffeler et al. umpubl. data; Nyffeler & Eggli 2010; Schlumpberger & Renner 2012; Anceschi & Magli 2013a), what about the marginality of distinctions, such as the color of the seed or the oblique hilum, to distinguish taxa within a dominant natural species such as *E. cinnabarin*a. Also what would seem to be the other distinctive element of *E.*

oligotricha, namely the thinner spines (Hunt et al. 2006, text: 98), is also found within the populations of *E. cinnabarina*.
In this regard, compare:

-A&M 1120, (*E. oligotricha*), Bolivia, Cochabamba, Arani, south-east of Arani, 3084 m (photo 126), with A&M 999 (*E. cinnabarina*), Bolivia, Chuquisaca, Tarabuco, 3363 m (photo 03);

-A&M 1120, (*E. oligotricha*), Bolivia, Cochabamba, Arani, south-east of Arani, 3084 m (photo 121), with A&M 999 (*E. cinnabarina*), Bolivia, Chuquisaca, Tarabuco, 3363 m (photo 34);

-A&M 1120, (*E. oligotricha*), Bolivia, Cochabamba, Arani, south-east of Arani, 3084 m (photo 140), with A&M 1001, Bolivia, Chuquisaca, Tarabuco, 3363 m (photo 47);

-A&M 1120, (*E. oligotricha*), Bolivia, Cochabamba, Arani, south-east of Arani, 3084 m (photo 129), with A&M 1001, Bolivia, Chuquisaca, Tarabuco, 3363 m (photo 54).

It should be noted as in the above comparisons, that the individuals chosen for the two taxa could pass indifferently from one population to another (see photos of the A&M of reference), without distinguishing themselves in any way from the other components of the population. As further confirmation of what has already been highlighted, we also bring the example of A&M 1313, Bolivia, Cochabamba, between Cochabamba and Santiváñez, 2900 m, where the “distinctive” semaphoronts of *E. oligotricha* (photo 145) and *E. cinnabarina* (photos 148-149), coexist in the same population together with the relative transitional phases in the two directions (photos 144, 142, respectively).

***Echinopsis pugionacantha* ssp. *rossii* (Bödeker) G. Navarro, a spiny form in the morphological and geographical range of the dominant *Echinopsis cinnabarina* (Hooker) Labouret**

In Backeberg (1966, trs. Glass, L. 1977, 240), *Lobivia pugionacantha* (Rose & Bödeker ex Bödeker) Backeberg and *Lobivia rossii* (Bödeker) Backeberg, are treated as two separate species. The rib character of *L. rossii* is that of being divided into oblique tubercles, hatchet-shaped (ibidem), a distinctive semaphoront of the taxon (Hennig 1966, 6-7, 32-33, 63, 65-67), but this is not so for *L. pugionacantha*. In Anderson (2001, 278), *L. rossii* is considered a ssp. of *Echinopsis pugionacantha* Rose & Bödeker, as *Echinopsis pugionacantha* ssp. *rossii* (Bödeker) G. Navarro. The distinctions between the two ssp. are in the flower color and the distribution, that is: color reddish yellow with distribution in Argentina and Bolivia for ssp. *pugionacantha*, color from orange to reddish, distribution Bolivia for ssp. *rossii*. The distinctive character of *L. rossii*, constituted by the division of the rib into hatchet-shaped tubercles, is also reported in Hunt et al. (2006, text: 99), where the taxon is always considered a ssp. of *E. pugionacantha,* which however, in the same publication is divided into three ssp., with the addition of *Echinopsis pugionacantha* ssp. *haemantha* (Rausch) M. Lowry, which has red flowers. The semaphoront identifying ssp. *rossii* always remains a distinctive element, compared to the other two ssp. in which it is absent (i.e., these show at all stages of the ontogenetic process straight or wavy ribs, not divided into oblique tubercles). In confirmation, see the photos illustrating the three taxa in Hunt et al. (ibidem, atlas: 252, 252.2 (*E. pugionacantha* ssp. *haemantha*); 252, 252.3, 252.4 (*E. pugionacantha* ssp. *pugionacantha*); 252, 252.5 (*E. pugionacantha* ssp. *rossii*). The same position of Anderson (2001) is maintained by Eggli in DGKL (2011, 240-241). There is another taxon that clearly shows the semaphoront characterized by ribs with oblique tubercles hatchet-shaped or, if you prefer, irregular and oblique ribs, divided into acute tubercles, with red or scarlet flowers, recognized by all the authors mentioned above (Anderson 2001, 263; Hunt et al. 2006, text: 94; Anderson & Eggli 2011, 225), whose distributional range, i.e. Chuquisca, Cochabamba, Potosí (Hunt et al. 2006, text: 94; Anderson & Eggli 2011, 225), also includes that of *L. rossii*. We are talking about the dominant *Echinopsis cinnabarina* (Hooker) Labouret. Even Lowry & Winberg (2013, 8: 44), and recognizing the close proximity between these two taxa, pointing out that sometimes they grow together, adding however “but usually it is quite easy to tell them apart since *L. cinnabarina* grows applanate and has red flowers, whereas *L. rossii* is more spherical and has yellow/orange flowers.” Obviously, it is demonstrable that, both in the dominant *E. cinnabarina*, spherical individuals can be encountered, as well as the fact that among the populations attributed to *L. rossii* there are flattened individuals.

As for *E. cinnabarina* with a spherical habit, see the A&M list that follows:

A&M 999, Bolivia, Chuquisaca, Tarabuco, 3363 m (photos 14, 20, 32);
A&M 1020, Bolivia, Chuquisaca, Zudáñez, south-east of Zudáñez (photos 60, 66);
A&M 1038, Bolivia, Chuquisaca, south-east of Tarabuco, 3044 m (photo 70, spherical-elongated habit);
A&M 1045, Bolivia, Chuquisaca, south-east of Tarabuco, 2970 m (photo 71);
A&M 1092, Bolivia, Potosí, Sijlani-Turuchipa, 3500 m (photo 94);

Regarding individuals with flattened habit in *L. rossii* see:

A&M 1093 (BLMT 916), Bolivia, Potosí, Sijlani-Turuchipa, 3727 m (photo 110);
A&M 1095, Bolivia, Potosí, Sijlani-Turuchipa, 3700 m (photo 114)

Regarding the distinction of the flower colour mentioned above, immediately after, the same authors conclude: “At this place they both had red flowers [Figs. 8 & 9]” (Ibidem). The captions with which Lowry & Winberg describe the photos of the two taxa in their article, further underline how weak the distinctions they made about the effectivness of discriminating the two taxa in habitat are; we include them here: “Fig. 8 *Lobivia rossii*, or is it just a spiny *L. cinnabarina*?“ and again “Fig. 9 *Lobivia cinnabarina*, or is it just a flat *L. rossii*?“ (Ibidem, 43). Indeed it is difficult to distinguish the two taxa, with *L. rossii* being a spinier form in the morphological and geographical range of the dominant *E. cinnabarina*. As we will demonstrate, individuals with more spines, assimilable to the idea of *L. rossii* or *E. pugionacanth*a ssp. *rossii*, are found in the common populations of *E. cinnabarina*. Compare for example:

A&M 999, (*E. cinnabarina*), Bolivia, Chuquisaca, Tarabuco, 3363 m (photo 43, spherical semaphoront, with long spines), with A&M 1095 (*L. rossii*), Bolivia, Potosí, Sijlani-Turuchipa, 3700 m (photo 112);

A&M 1045, (*E. cinnabarina*), Bolivia, Chuquisaca, south-east of Tarabuco, 2970 m (photo

71, spherical-elongated semaphoront, with long spines), with A&M 1093 (BLMT 916), (*L. rossii*), Bolivia, Potosí, Sijlani-Turuchipa, 3727 m (photo 97, flattened specimen);

A&M 1067, (*E. cinnabarina*), Bolivia, Chuquisaca, west of Tarabuco, Umbate, 3238 m (photos 75-76, spherical semaphoront, with long spines), with A&M 1093 (BLMT 916), (*L. rossii*), Bolivia, Potosí, Sijlani-Turuchipa, 3727 m (photo 106);

A&M 1091, (*E. cinnabarina*), Bolivia, Potosí, Sijlani-Turuchipa, 3460 m, (photos 88-89, spherical semaphoronts with long spines), and compare again with A&M 1093 (BLMT 916), (*L. rossii*), Bolivia, Potosí, Sijlani-Turuchipa, 3727 m (photo 106).

Based on the evidence found in habitats, it seems correct to assimilate *L. rossii*-*E. pugionacantha* ssp. *rossii* into the synonymy of *E. cinnabarina*.

Echinopsis jajoana **(Backeberg) Blossfeld; molecular analysis confirms it in the synonymy of** ***Echinopsis marsoneri*** **Werdermann**

In the comment accompanying *Echinopsis jajoana* (Backeberg) Blossfeld, Hunt et al. (2006, text: 96) recognize that the taxon is difficult to distinguish both vegetatively and florally from *Echinopsis marsoneri* Werdermann, nevertheless they keep the two taxa separate by reporting morphological differences relative to the seed. This strong proximity is confirmed at the molecular level in the study on *Echinopsis* conducted by Schlumpberger & Renner (2012, 99 (8): 1342), where the two taxa clearly appear to constitute a strongly supported monophyletic clade (ML bootstrap support 100%). For the reasons espoused, we assimilate *E. jajoana* among the synonyms of *E. marsoneri*, as already considered in Anderson (2001, 273) and in Anderson & Eggli (2011, 236), with the name *Lobivia jajoana* Backeberg.

Harrisia regelii **(Weingart) Borg is not distinguishable from** ***Harrisia martinii*** **(Labouret) Britton & Rose; is now** ***Echinopsis martinii*** **(Labouret) Anceschi & Magli**

In May 2016, carrying out surveys in the Province of Corrientes (Argentina) searching for populations of *Gymnocalycium mesopotamicum* R. Kiesling (see A&M 1353), among the encountered taxa, we also detected scattered populations of a species of *Harrisia* Britton, a genus now included in *Echinopsis* Zuccarini (Anceschi & Magli 2013a, 22-29; 2013b, 31: 24-27), on the basis of a coherent interpretation (see Anceschi & Magli 2018, 36: 74-75) of Hennig's theory (1966) of the molecular results (Nyffeler 2002, 317- 319; Lendel et al. 2006, unpubl. data in Nyffeler & Eggli 2010; Schlumpberger & Renner 2012). The characters of the species in question were intermediate between two morphologically closely related taxa, i.e., *Harrisia regelii* (Weingart) Borg and *Harrisia martinii* (Labouret) Britton & Rose. Regarding the recent taxonomic understanding of the two taxa, in Anderson (2001, 373), *H. regelii*, with smaller stems and fewer spines, is considered a subspecies of the dominant *Harrisia pomanensis* (F. A. C. Weber ex K. Schumann) Britton & Rose = *Echinopsis pomanensis* (F. A. C. Weber ex K. Schumann) Anceschi & Magli, in its new circumscription in *Echinopsis* (Anceschi & Magli 2013a, 39). The same position is maintained in Anderson & Eggli (2011, 340). Hunt et al. (2006, text: 138), instead consider *H. regelii* as a distinct taxon, close to *H. martinii* rather than to *H. pomanensis*, underlining that the state is uncertain, as the taxon is probably only a variant of *H. martinii*. Indeed, the two descriptions are rather close (ibidem: 137-138), like the photos that illustrate the two taxa (ibidem, atlas: 227, 227.5, 228, 228.3). In his "Monograph of *Harrisia*", Franck (2016, 85: 1-159), in recognizing both taxa, distinguishes morphologically *H. martinii* from *H. regelii*, by the ribs of the first taxon "separated by a distinct line at sulcus" (ibidem: 20) vs. "not separated by conspicuous line at sulcus" for the second (ibidem: 22). It should be noted that this distinction is contradicted by the photos that the same author uses to illustrate the two taxa in the article in question, in fact *H. martinii* can show an almost irrelevant sulcus at the base of the rib (ibidem, 80, fig. 31b), while *H. regelii*, can highlight a rather marked one (ibidem, 92, fig. 43b). Confirming the difficult distinction between the two taxa, we also highlight that in Hunt et al. (2006), the images chosen to illustrate the two taxa show characters exactly opposite to those which, for the previous author, should be the element of recognition between the two, i.e. *H. martinii* shows less evident sulci (ibidem, atlas: 227, 227.5), compared to *H. regelii* (ibidem; 228, 228.3). Based on the evident confusion of the alleged dividing line between the two taxa, we consider it correct to assimilate *H. regelii* into *Echinopsis martinii* (Labouret) Anceschi & Magli.

Mila caespitosa **ssp.** ***pugionifera*** **(Rauh & Backeberg) D. R. Hunt is not distinguished from** ***Mila caespitosa*** **Britton & Rose, now** ***Echinopsis maytana*** **Molinari**

Contrary to Hunt et al. (2006, text: 192) who distinguished *Mila pugionifera* Rauh & Backeberg (as *Mila caespitosa* ssp. *pugionifera* (Rauh & Backeberg) D. R. Hunt), from *Mila caespitosa* Britton & Rose, and in agreement with Anderson (2001, 470) and Anderson & Eggli (2011, 435), we believe the first epithet to be synonymous with the second. Indeed, in the habitats of the species we have found that some of the “distinctive” elements of ssp. *pugionifera*, i.e. taller with more ribs, 4 central spines (ibidem), are also found in the populations of ssp. *caespitosa* (see A&M 1207 & A&M 1208, Peru, Ica, Chincha, east of Chincha). We want to remember that following the assimilation of *Mila* Britton & Rose in *Echinopsis* Zuccarini, in the direction of a monophyletic macrogenus *Echinopsis* (Anceschi & Magli 2013a, 22-29; 2013b, 31: 24-27), supported by a long series of molecular outcomes (Nyffeler 2002, 317-319; Lendel et al. 2006, unpubl. data in Nyffeler & Eggli 2010; Schlumpberger & Renner 2012), and a phylogenetic hypothesis subsequently followed by other researchers in their updated lists of the Cactaceae of the Departments of Lima and Arequipa, Peru (Molinari-Novoa, E. A. 2015, 13: 18-21; Mayta, L. & Molinari-Novoa, E. A. 2015, 14: 13-20), the current name of the taxon appears to be *Echinopsis maytana* Molinari.

Echinopsis micropetala **(Ritter) Anceschi & Magli and** ***Echinopsis tominensis*** **(Weingart) Anceschi & Magli, two distinct species**

The surveys we conducted in habitat in 2014, in the Chuquisaca and Tarija Departments of Bolivia, have shown that there is no clear correspondence between the natural populations of *Echinopsis micropetala* (Ritter) Anceschi & Magli (A&M 981, A&M 995, A&M 1050), and *Echinopsis tominensis* (Weingart) Anceschi & Magli (A&M 1013, A&M 1018), with the descriptions and images of the two taxa reported by Hunt et al. (2006), (as *Cleistocactus tominensis* (Weingart) Backeberg and *Cleistocactus tominensis* ssp. *micropetalus* (F. Ritter) Mottram). They describe for *C. tominensis* (ibidem, text: 49) a taxon with more ribs, 18-22, <5 cm in diameter and more spines, 8-9, compared to ssp. *micropetalus*, with 16-18 ribs, 6-8 cm in diameter, and fewer spines, i.e. 1 central and 5-6 radial (ibidem). The descriptions show the first taxon with denser ribs on the stem vs. the second with more spaced ribs. The images representing the two taxa in question (ibidem, atlas: 207) and also unchanged in the subsequent edition of the atlas (2013, 207), show specimens with characters exactly opposite to their relative descriptions. Assuming that there must be a relationship between what has been detected in the originally described habitats of the two taxa, and what has been described and represented in the lexicons, then for a correct definition of the species in question, we believe the two images have been reversed. We then consider the image with more ribs and more spines (Hunt et al. 2006, atlas: 207, fig. 207.2), to be *E. tominensis* and the one with less ribs and less spines (ibidem, fig. 207.3), to be *E. micropetala*. According to Lowry (2016, 34: 165), precisely because of the distinct characters shown in relation to ribs and spines, we prefer to consider the two taxa as separate species.

Espostoa melanostele ssp. _nana_ (F. Ritter) G. J. Charles cannot exceed 1.5m in height, while in _Espostoa melanostele_ (Vaupel) Borg a height between 1.5 and 2m is recommended!

Hunt et al. (2006, text 116; atlas: 191) recognized *Espostoa melanostele* ssp. *nana* (F. Ritter) G. J. Charles within the populations of *Espostoa melanostele* (Vaupel) Borg, now *Echinopsis melanostele* (Vaupel) Molinari (E. A. Molinari-Novoa 2015, 13: 19), since the first taxon is said to be <1.5 m in height vs. >1,5 and <2 m for the second (actually we found specimens of *E. melanostele* <2.42 m in height, see A&M 1212, photo 01), as well as pale yellow rather than yellow-brown for the cephalium. Other authors (Anderson 2001, 319; Anderson & Eggli 2011, 282-283), considered the first taxon at the rank of species, as *Espostoa nana* F. Ritter. In our understanding of a natural species it seems unrealistic to discriminate taxa on the basis of the above-mentioned distinctions, especially within a dominant species such as *E. melanostele*, which spreads from the north of the Ica Department to the south, to the south of the Lambayeque Department to the north, passing seamlessly through the Departments of Lima, Ancash and La Libertad. For the reasons explained, we include *Espostoa melanostele* ssp. *nana* and *Espostoa nana* within the synonymy of *Echinopsis melanostele.*

Overlap of the semaphoronts of *Echinopsis oxygona* (Link & Otto) Pfeiffer & Otto and *Echinopsis rhodotricha* K. Schumann in the distinctive distribution areas of the two taxa

In January 2014 we were in the Nuevo Berlin area, in the Department of Rio Negro, Uruguay, searching for populations of *Parodia turecekiana* R. Kiesling, in relation to the study work on the relationships between this taxon and the other populations composing the *Parodia mammulosa* complex (Lamaire) N. P. Taylor (Anceschi & Magli 2014, 13: 60-73; 2018, 36: 116-117). In the areas of wooded savanna with allomorphic soil, near the Rio Uruguay, known as “blanqueales”, among the forests mainly consisting of “algarrobos”, “quebrachos” and the palm “Caranday” (for more informations on the physicochemical composition and the phytogeographic components of the “blanqueales” see Anceschi & Magli 2014, 13: 62), we encountered different populations of *Echinopsis oxygona* (Link & Otto) Pfeiffer (A&M 967, A&M 972). Again, as on other previous occasions we have faced the perplexing situation of having to see that within the same population there were present semaphoronts (Hennig 1966, 6-7, 32-33, 63, 65-67), attributable to *E. oxygona* (see A&M 967, photos 77-85, 87-89), and others more attributable to *Echinopsis rhodotricha* K. Schumann (always see A&M 967, photo 86). And again, see A&M 972 (photos 92-95) for individuals closest to the first taxon, and in the same population of A&M 972 (photos 90-91), for those closest to the characters of the second. Considering that also in other populations found within the “blanqueales” of the Rio Uruguay, we had observed an overlap of the elements that should characterize the two taxa (see below). An example is the population of Young, Rio Negro, Uruguay, A&M 277 (photos 11-17), which shows intermediate characters (in habit and spination), and we had thought that the two species could cross just in the “blanqueales” which, as already highlighted (Marchesi 2013, quoted from Anceschi & Magli 2014, 13: 62), represents an extension of the Humid Chaco ecoregion. We know that *E. rhodotricha* (including *Echinopsis chacoana* Schütz, see Anceschi & Magli 2013a, 50), is recognized as an endemic dominant species of the Chaco, while *E. oxygona* in turn lives on a large extension of territory, in habitats mostly consisting of Pampa grasslands with rocky outcrops in Argentina, Uruguay and Southern Brazil, in the Humid and Semi-arid Pampas of Argentina, Uruguay and Southern Brazil Ecological region, but also detectable in the “blanqueales”, part of the Paranà flooded savanna Ecological region. In fact it is known that the two taxa are sympatric in this area (data gathered from: Larocca, J., Machado, M., Kiesling, R., Oakley, L. & Pin, A. 2017. *Echinopsis oxygona* [geographic range], (amended version of 2013 assessment). The IUCN Red List of Threatened Species 2017. Downloaded on 07 December 2019) & Oakley, L., Duarte, W. & Pin, A. 2017. *Echinopsis rhodotrich*a [geographic range], (amended version of 2013 assessment). The IUCN Red List of Threatened Species 2017. Downloaded on 05 December 2019). But re-evaluating all the populations of these two dominant species that we visited on many occasions in the vastness of their distribution areas, we realized that the overlapping of the distinctive semaphoronts wasn't related only to the "blanqueales", where it is known that the two species overlap, but also in other "not suspected" areas, far from the recognized areas of sympatry. See for example the populations of *E. rhodotricha*, which we detected in 2011 in Bolivia, Santa Cruz, Santiago de Chiquitos, Valle de Tucavaca, in the northernmost distribution area of the taxon, very far from what is recognized to be the distribution range of *E. oxygona*, where many individuals show the traits belonging to the second taxon (A&M 705, photos 04, 07, 14-15, 22). On the other hand, consider that it is not difficult to encounter what should be the distinctive characters of *E. rhodotricha*, in the pampas of southern Brazil, in the state of Rio Grande do Sul, or in the north of Uruguay, areas which should be the prerogative of *E. oxygona*. In this regard, see our A&M 86 (photo 03), A&M 260 (photo 08), A&M 283 (photo 18), A&M 286 (photo 23), A&M 767 (photo 26), A&M 777 (photos 30-31). However, if within the same natural population, two distinct semaphoronts are elected, indicating distinct phases in the ontogenesis process of the taxon, as representative instead of two distinct taxa, it will give rise to the creation of non-existent species. This is what happens for example on the IUCN website (ibidem, see Pierre Braun's photos), where for *E. oxygona* a semaphoront representing a globular plant is chosen, with evident felted and protruding areolas, without or with small inconspicuous spines; and for *E. rhodotricha* a more elongated semaphoront, with a strong spination. More or less the same selection of images was done by Hunt et al. (2006, atlas: 243-244). As already highlighted, it is demonstrable that the two taxa in the "distinct areas of election" show both semaphoronts. Based on what has been revealed, we have assimilated *E. rhodotricha* into the synonymy of *E. oxygona* in cactusinhabitat.org. Thus *E. oxygona* assumes the range of an even wider dominant species, which from the Tucavaca Valley, Santa Cruz, Bolivia, located at the extreme north of the taxon's distribution, populating the Dry Chaco, the Humid Chaco, the Humid and Semi-arid Pampas of Argentina, Uruguay and Southern Brazil, and the Paranà flooded savanna ecological regions, reaches to the south the areas west of the city of Buenos Aires.

Echinopsis pseudomelanostele (Werdermann & Backeberg) Anceschi & Magli, a dominant species divided into not very significant ssp.

Hunt et al. (2006, text: 136), divide *Haageocereus pseudomelanostele* (Werdermann & Backeberg) Backeberg into 5 ssp., recognizing in addition to the type ssp., the following ssp. *acanthocladus*, *aureispinus*, *chryseus* and *turbidus*. The same ssp. are also recognized in Anderson & Eggli (2011, 334-335), with the exclusion of ssp. *acanthocladus*, which is believed to be synonymous with *H. pseudomelanostele*, and the addition of ssp. *carminiflorus*, considered synonymous with ssp. *pseudomelanostele* by the first authors (Hunt et al. 2006, text: 136). The surveys we carried out in 2014 in the coastal desert of Peru, on the populations of *Echinopsis pseudomelanostele* (Werdermann & Backeberg) Anceschi & Magli, in the Nazca-Huallhua valley, corresponding to ssp. *turbidus*, and in the Lima-Matucana valley (Rio Rimac valley), corresponding to ssp. *pseudomelanostele*, have highlighted that the only distinctive element for the first, are the more evident spines (thicker and whitish) on the majority of the individuals, see A&M 1171, Peru, Ica, north-east of Nazca, 862m (photo 5); although there is no lack of semaphoronts (Hennig 1966, 6-7, 32-33, 63, 65-67) young (photo 8), or adults, see A&M 1176, ibidem, 1147 m (photos 41-42), bearing thinner spines, golden or brown yellow colored, and are perfectly in line with their correspondents of the Lima Valley (Rimac Valley), see A&M 1218, Peru, Lima, Lima, north-east of Lima (photos 51-52, for adults semaphoronts, and photos 55-56 for both young and adults semaphoronts). Even the concise descriptions of ssp. *acanthocladus*, *aureispinus*, and *chryseus* in Hunt et al. (2006, text: 136), do not highlight any differences worthy of note, compared to the type species, if not the name. The poor distinction between the taxa in question is also highlighted by the photos chosen by the authors to represent them (ibidem, atlas: 185-186). This little distinction is confirmed also by the photo that identifies *Haageocereus chryseus* F. Ritter (the ssp. *Chryseus*), in Ritter (1981, 4: 1520, fig. 38), substantially the same for spination and colors as a specimen of *H. pseudomelanostele.* For the above reasons, the additional taxa proposed by Hunt et al. are not justifiably distinct to split up the populations of the dominant *E. pseudomelanostele*; and we consider them redundant, and that they ought to be added to the synonymy of the species. To clarify our taxonomic understanding of *E. pseudomelanostele*, we note that its synonym *Haageocereus pseudomelanostele*, is considered by E. A. Molinari-Novoa (2015, 13: 19) to be among the synonyms of *Echinopsis multiangularis* (Haworth) Molinari, having the basionym *Cereus multiangularis* Haworth, previous the latter (1819) to *Cereus pseudomelanostele* (1931), basionym of *E. pseudomelanostele*. In this regard, we recall that Hunt et al. (2006, text: 136) rejected *Haageocereus multiangularis* (Haworth) F. Ritter with the basionym C*ereus multiangularis* Haworth [not *Cactus multiangularis* Willd (1814), also rejected] = *Haageocereus pseudomelanostele*? We also recall that Eggli, in Anderson & Eggli (2011, 335, 668), also expressed a similar position, reporting that *C. multiangularis* cannot be identified with certainty as *H. pseudomelanostele*. Based on these considerations, we prefer to identify the populations in question with the name *Echinopsis pseudomelanostele*. While choosing *E. multiangularis* instead of *E. pseudomelanostele*, E. A. Molinari-Novoa (2015, 13: 19) also considered the epithets *acanthocladus*, *aureispinus*, *carminiflorus* and *turbidus* as synonyms; ssp. *chryseus* is not summarized by the author, as absent in the Department of Lima, the subject of his updated list.

Eriosyce

***Eriosyce islayensis* ssp. *grandis* (Rauh & Backeberg) G. J. Charles & *Eriosyce islayensis* ssp. *omasensis* (Ostolaza & Mischler) G. J. Charles represent part of the synonymy of *Eriosyce islayensis* (C. F. Förster) Kattermann**

Hunt et al. (2006, text: 109) divided *Eriosyce islayensis* (C. F. Förster) Kattermann into three ssp., adding to the type subspecies, *Eriosyce islayensis* ssp. *grandis* (Rauh & Backeberg) G. J. Charles & *Eriosyce islayensis* ssp. *omasensis* (Ostolaza & Mischler) G. J. Charles. The ssp. *grandis*, as *Islaya grandis* Rauh & Backeberg, had previously been correctly considered a synonym of *E. islayensis* by Anderson (2001, 298), an opinion then confirmed in Anderson & Eggli (2011, 261), where *E. islayensis* ssp*. grandis* was also added to the synonymy (2011, 261). Regarding ssp. *omasensis*, the last two authors continue to recognize it in the rank of species as *Eriosyce omasensis* (Ostolaza & Mischler) Ostolaza (Anderson 2001, 302; Anderson & Eggli 2011, 265). In our opinion, given the continuity of the large area occupied by the populations in the coastal area of the Peruvian desert (i.e. Departments of Arequipa, Ica, Lima, Moquegua, and Tacna), and the slight morphological variations between these (see A&M 1146, Arequipa, north-east of Matarani; A&M 1147, Arequipa, Chala, Chala Viejo; A&M 1206, Ica, Chincha, east of Chincha; and A&M 1210, Lima, north-east of Coayllo), configurable in the normal diversity found within a dominant natural species, we have decided to consider the above ssp. as simply synonyms of *E. islayensis*.

Gymnocalycium

***Gymnocalycium andreae* (Bödeker) Backeberg, *Gymnocalycium bruchii* (Spegazzini) Hosseus & *Gymnocalycium calochlorum* (Bödeker) Y. Ito are distinct taxa? And what is the relationship of *Gymnocalycium carolinense* (Neuhuber) Neuhuber with these?**

Charles (2009, 83) in recognizing *Gymnocalycium carolinense* (Neuhuber) Neuhuber as a good species, then wonders why Neuhuber in 1994 first described *G. carolinense* as a ssp. of *Gymnocalycium andreae* (Bödeker) Backeberg, rather than relating it to *Gymnocalycium bruchii* (Spegazzini) Hosseus as in Hunt et al. (2006, text: 126), where it is considered synonymous with the latter taxon, to which in his view it appears to be more related. In our opinion the answer is simple: it is because the populations of *G. carolinense* are morphologically more related to *G. andreae* than to *G. bruchii*. Moreover, in this group of closely related taxa, which also includes *Gymnocalycium calochlorum* (Bödeker) Y. Ito, that in the complex geographically extend over an area which includes the Sierra Grande, the Sierra Chica and the Sierra de Comechigones in the Province of Córdoba (AR), and the Sierra de San Luis, in the Province of San Luis (AR), if the current conception of *G. bruchii* were the one expounded by Papsch in Schütziana (2013 (4) 1: 3-26), there would be no holomorphological continuity solution between *G. andreae* and *G. bruchii*, as two of the ssp. elected by this author to form the group of *G. bruchii* (i.e. *Gymnocalycium bruchii* ssp. *brigittae* (Piltz) Papsch (ibidem: 6, figs. 21-23) and G*ymnocalycium bruchii* ssp. *carolinense* (Neuhuber) Papsch (ibidem: 6, fig. 19), are morphologically closer to the first taxon (ibidem: 7, figs. 25-27) than to the second (ibidem: 4, figs. 1-9, 5, figs. 10-18). So, wanting to keep a distinction between *G. andreae* and *G. bruchii* (a distinction also highlighted at the molecular level by Demaio et al. (2011, 98 (11): 1846, 1848, 1850), i.e. between a taxon (*G. andreae*), larger (<4.5 cm diameter), with fewer ribs (c. 8) and fewer spines (1-3 centrals and 6 radials), (Hunt et al. 2006, text: 126), against one (*G. bruchii*), of smaller dimensions (1-2 x 1-2 cm (height x diameter), more ribs (c. 10) and more spines (0-3 centrals, and 12-17 radials), sometimes covering the stem surface (ibedem: 127), *G. carolinense* and *G. bruchii* ssp*. brigittae* must be included among the synonyms of *G. andreae* in order not to create interference phenomena between the parameters that support the separation between the two taxa. Finally, given the current state of knowledge, albeit morphologically and molecularly close (see Demaio et al. 2011, 98 (11): 1846, 1848, 1850), we prefer to keep *G. bruchii* and *G. calochlorum* separate. For the morphological relationships between *G. andreae* and *G. carolinense*, see the following comparisons:

A&M 1249, *G. andreae*, Argentina, Córdoba, Tanti, south-west of Tanti, El Descanso, 1949 m (photo 75), with A&M 929 (2013-12-20 & 2013-12-29), (*G. carolinense*), Argentina, San Luis, La Carolina, north of La Carolina, (photos 10, 41), and A&M 937 (*G. carolinense*), Argentina, San Luis, La Carolina (photo 55);

A&M 1248, *G. andreae*, Argentina, Córdoba, Tanti, south-west of Tanti, Arroyo Aguas Turbias, 1746 m (photo 69), with (*G. carolinense*), A&M 929 (2013-12-20), Argentina, San Luis, La Carolina, north of La Carolina (photo 10);

A&M 1248, *G. andreae*, Argentina, Córdoba, Tanti, south-west of Tanti, Arroyo Aguas Turbias, 1746 m (photos 65-66) with (*G. carolinense*) A&M 936, Argentina, San Luis, Inti Huasi (photos 21, 30);

A&M 1248, *G. andreae*, Argentina, Córdoba, Tanti, south-west of Tanti, Arroyo Aguas Turbias, 1746 m (photos 68) with (*G. carolinense*) A&M 936, Argentina, San Luis, Inti Huasi (photo 20);

A&M 1248, *G. andreae*, Argentina, Córdoba, Tanti, south-west of Tanti, Arroyo Aguas Turbias, 1746 m (photos 70) with (*G. carolinense*), A&M 929 (2013-12-20), Argentina, San Luis, La Carolina, north of La Carolina (photo 01) and (*G. carolinense*) A&M 936, Argentina, San Luis, Inti Huasi (photo 35).

In summary, because the characters of *G. bruchii* can be really distinctive with respect to *G. andreae*, we must consider *G. carolinense* and *G. bruchii* ssp. *brigittae* to be synonomous with the second taxon. Despite the morphological and molecular closeness (ibidem), we prefer to keep *G. calochlorum* distinct from *G. bruchii*.

Gymnocalycium fischeri **Halda & al. a distinct species from** ***Gymnocalycium capillaense*** **(Schick) Hosseus**

Contrary to Hunt et al. (2006, text: 128) and Hunt, D. R. (2016, 64), who considered *Gymnocalycium fischeri* Halda & al. to be among the synonyms of *Gymnocalycium capillaense* (Schick) Hosseus, and in agreement with Charles (2009, 87-89) and Anderson & Eggli (2011, 316), the studies we conducted in habitat lead us to keep the two taxa separate. Despite the evidence of a morphological similarity between *G. fischeri* and *G. capillaense*, also recognized by Charles (2009, 89), there are several distinctions that do not allow us to assimilate the first taxon into the synonyms of the second:

a) a greater ease which *G. capillaense* forms groups.

b) in agreement with Eggli, although not twice as much, as the author reports (2011, 316), *G. fischeri* reaches larger dimensions than *G. capillaense*, i.e. <11.4-12.4 cm in diameter for the first taxon, see A&M 947, Argentina, San Luis, El Volcan, Campo La Sierra, 945 m (photos 41-42 and 38, respectively), vs. <8-10 cm in diameter for the second taxon, see A&M 357, Argentina, Córdoba, Capilla del Monte, road to Los Mogotes (photo 03) and A&M 361, Argentina, Córdoba, Capilla del Monte, Capilla de la Virgen del Valle (photos 21-23, respectively).

c) still in agreement with Eggli, which highlights the possibility of central spines (1 (-4) in old specimens for *G. fischeri* (ibidem), we confirm that while we have never detected central spines on specimens of *G. capillaense*, albeit rarely, adult specimens of *G. fischeri* with 1 central spine can be found, see A&M 940, Argentina, San Luis, San Luis, Daniel Donovan, 885 m (photos 27-29, 33-34).

Based on the reported evidence, we prefer to recognize *G. fischeri* in the rank of species.

Are there good reasons to keep *Gymnocalycium rhodantherum* (Boedeker) Backeberg distinct from *Gymnocalycium hossei* (F. A. Haage) A. Berger?

In the words that follow, Charles (2009,159) underlined the close relationship between *Gymnocalycium rhodantherum* (Boedeker) Backeberg and *Gymnocalycium hossei* (F. A. Haage) A. Berger: “If one wants to take a wider concept of a species then it would be sensible to include *Gymnocalycium rhodantherum* as a synonym of *G. hossei* which would extend its distribution further west to include the Sierra de Famatina”. Indeed, in habitat there is no specimen of the first taxon that does not show a clear relationship with the morphological range of the second, the semaphoronts (Hennig 1966, 6-7, 32-33, 63, 65-67), of the two taxa are practically superimposable, and it is incredible that the passion for names still leads many enthusiasts to keep the two taxa separate. In support of the above, particularly compare the semaphoronts of the following list:

A&M 919, (*G. rhodantherum*), Argentina, La Rioja, Chilecito, east of Chilecito, 1130m, (photo 57), with A&M 896, *G. hossei*, Argentina, La Rioja, Señor de la Peña, west of Señor de la Peña, 865 m, (photos 28-30);

A&M 919, (*G. rhodantherum*), Argentina, La Rioja, Chilecito, east of Chilecito, 1130m, (photo 63), with A&M 893, *G. hossei*, Argentina, La Rioja, north-east of Anillaco, 1032 m, (photo 14);

A&M 919, (*G. rhodantherum*), Argentina, La Rioja, Chilecito, east of Chilecito, 1130m, (photos 74-75), with A&M 899, *G. hossei*, Argentina, La Rioja, between Señor de la Peña and Ruta 7, 900 m, (photo 40);

A&M 919, (*G. rhodantherum*), Argentina, La Rioja, Chilecito, east of Chilecito, 1130m, (photo 82), with A&M 899, *G. hossei*, Argentina, La Rioja, between Señor de la Peña and Ruta 7, 900 m, (photo 43).

And more generally compare the populations of ours A&M 919 and A&M 922 (*G. rhodantherum*), with the A&M 893, A&M 896 and A&M 899, *G. hossei*.

On the basis of what has been highlighted it is correct to assimilate *G. rhodantherum* to the synonyms of *G. hossei.*

Gymnocalycium nigriareolatum **Backeberg a dominant species that includes the populations of** ***Gymnocalycium pugionacanthum*** **Backeberg ex H. Till**

In the edition of cactusinhabitat.org 2011-2013 and related booklet (Anceschi & Magli 2013a, 98), *Gymnocalycium nigriareolatum* Backeberg and *Gymnocalycium pugionacanthum* Backeberg ex H. Till both appeared as accepted taxa. The position was in line with that of other authors (i.e. Hunt et al. 2006, text: 131-132; Charles, G. 2009, 174-175, 190-192; Anderson & Eggli 2011, 321-322, 324; Hunt, D. R. 2013, XXiii; 2016, 65-66, 134). In the comment accompanying the *G. pugionacanthum* card in cactusinhabitat.org, however, we underlined the close relationship between the two taxa, an opinion already expressed by Charles (2009, 175). This consideration arose from the evidence that various populations we've detected in 2011 in the Belén area, Catamarca, Argentina (A&M 434, A&M 436, A&M 438), and others detected further north in the direction of Hualfin (A&M 441, A&M 445) attributed to *G. pugionacanthum*, actually showed in many of their components characters difficult to distinguish from those of *G. nigriareolatum* in the area of the capital San Fernando (A&M 120, A&M 127). Hence the possible understanding of *G. nigriareolatum* as a dominant species, which expands from the area of San Fernando del Valle de Catamarca, then to the north-west in the Catamarca region, to the south and to the north of the city of Belén, through the Cuesta de Belén, connection point between the cities of Andalgalá and Belén in the precordillera direction. To verify the connection points between the populations of *G. nigriareolatum* thus conceived, in November 2013 we carried out a series of new surveys in the Belén area, with particular

attention to the populations east of the city, specifically between La Puntilla (rocky tip at the east end of the town of Belén), La Cuesta de Belén, La Quebrada del Cura and Andalgalá, corresponding to our A&M 873, A&M 875, A&M 876, A&M 879, A&M 880 and A&M 882a. Basically the surveys showed a progression from the semaphoronts (Hennig 1966, 6-7, 32-33, 63, 65-67), which on average manifest rounded spines, longer and thinner, close to those of the typical *G. nigriareolatum*, found in the Belén area, just east of the city, and north towards Hualfin, to the semaphoronts that on average show pectinate, strong, rigid radial spines, more or less straight (typical of the concept of *G. pugionacanthum*), more evident in the Cuesta de Belén area, to then fall on average in the characters of the first type west of the Cuesta. We emphasize ‘on average’, as intermediate characters between the two types are often detectable within the same population in all the taxon’s areas. Aware of Meregalli & Kulhánek’s article (2015, 6 (3): 11-24), whose purpose was to limit the distribution of the populations referable to the description of *G. pugionacanthum*, through the choice of an epitype, to the single area of the Cuesta de Belén, for the spination characters, which would distinguish the populations of this specific area compared to those of the neighboring areas, we would like to substantiate the following objections to the two authors:
a) the authors state: “… , no plants closely matching the type form of *G. pugionacanthum* [i.e. ... along the Cuesta de Belén ...] were seen in more distant locations of the region. “ (Ibid., 17). This is not true. If by the authors’ own admission, the individual presented in their fig. 28 (ibidem, 21, fig. 28), is conceived by them as being part of the possible range of the type they propose, we would like to stress that specimens with those morphological characters, not only they are found in the vicinity of the city of Belén, compare the individual in fig. 28 with those of our A&M 434 (photo 05) and A&M 436 (photos 22, 24), two surveys previously attributed by us to *G. pugionacanthum*, now to *G. nigriareolatum*, but also in the populations of the typical *G. nigriareolatum* of the Cuesta del Portezuelo, in the city area of San Fernando, compare again fig. 28 with the A&M 127 (photos 7-8, 10).
b) the authors give a great pains to limit the population of their *G. pugionacanthum* to the Cuesta de Belén and the hills just east of the Cuesta in the Belén direction, excluding possible morphological continuities with their type, i.e. with “strong, straight, rigid pectinate spines” (ibidem, 15) or as in the redescription with “… ; lateral spines

3-4 (-5) pairs, pectinate, straight or slightly bent or curved, …" (ibidem, 17), both in the east direction that in the north direction, than in the area of the city of Belén (ibidem 22-23). Actually, as also recognized by the authors themselves, intermediate forms of spination exist (ibidem, 19), and they certainly do not stop either before the city of Belén in an easterly direction, nor at the end of the Cuesta de Belén in a western direction. Of the extension of the forms with longer, thinner and more rounded spines (those closest to the typical *G. nigriareolatum*, we have already expressed ourselves in point a). For semaphoronts with shorter, pectinate, more or less straight and strong spines, more closer to the conception of *G. pugionacanthum*, certainly dominant on the Cuesta de Belén, we refer to our A&M 438, La Puntilla, (photo 33), and compare this with the following specimen presented by Meregalli & Kulhánek (ibidem, 18, fig. 14), and again A&M 441, La Cienaga de Abajo, (photos 36, 38, 44-45), to be compared respectively with these other specimens presented by the authors (ibidem, 18, figs. 12, 13, and 11). Both surveys are now far away from the Cuesta de Belén, nonetheless, several individuals show pectinate radial spines, more or less straight, strong and rigid. It also seems correct to remind that some of the populations of *G. nigriareolatum* that live in the San Fernando area also show pectinate radial spines, stronger and more evident than those of the typical form of the same area. We are talking about the *densispinum* populations of *G. nigriareolatum* (A&M 120 (2007), A&M 120 (2011), which constitute a further morphological *trait d'union* between *G. nigriareolatum* and *G. pugionacanthum*. Very similar semaphoronts to the *densispinum* populations are detectable up to north of Belén, compare again A&M 441, La Cienaga de Abajo (photos 44-45), with A&M 120 (2011), Catamarca, Dique El Jumeal (photos 19, 21, 24, 48).

c) more generally, in order that the science of classification has some meaning (i.e. that approaches something approximately true in nature) and performs some distinctive function, we believe it is fundamental that it is the type that must adapt to the natural populations, not the natural populations to the type. For example, the replacement of the idea of a type as currently conceived, i.e. based on **a single individual**, with another that considers **a set of individuals**, would be more representative of the real variety of a natural species.

Based on what has been said, we feel it appropriate to proceed in the direction of the assimilation of the populations of *G. pugionacanthum* into the dominant *G. nigriareolatum*.

Lagenosocereus

Lagenosocereus luetzelburgii **(Vaupel) Doweld &** ***Arrojadoa leucostele*** **(Gürke) Anceschi & Magli**

The current understanding of the genus *Stephanocereus* A. Berger composed not only of *Stephanocereus leucostele* (Gürke) A. Berger, but also of *Stephanocereus luetzelburgii* (Vaupel) N. P. Taylor & Eggli (Anderson 2001; Hunt et al. 2006; Anderson & Eggli 2011; Hunt 2013), is basically due to the observation made by Eggli, that the juvenile characters of the two taxa are very similar (Taylor & Eggli 1991). Actually, the field studies relating to the morphology of the two species show more differences than similarities. In particular, while *S. leucostele* in its ontogenetic process can be assimilated to a "giant *Arrojadoa*" (evident are the common ring-like cephalia on the stem tips, a character that only rarely appears on some old individuals of *S. luetzelburgii*), the semaphoronts (Hennig 1966, 6-7, 32-33, 63, 65-67), globular at first, then with the characteristic elongated bottle-neck shape of *S. luetzelburgii*, make this taxon unique in the *Cactaceae*. The habitats of the two taxa are also quite distinct; while *S. leucostele* is characteristically found in the Bahian caatinga, *S. luetzelburgii* populates the campo rupestre of the Chapada Diamantina (Taylor & Zappi 2004, 290-291). This distance is also confirmed at the molecular level, where preliminary studies of gene sequences in tribe Cereeae, conducted at Kew by Patricia Soffiatti (unpubl. Data in Taylor 2002, 14: 28), show that *S. luetzelburgii* is separate from *S. leucostele*, being the first basal to a range of more derived cereoids, while the second is immediately basal to *Arrojadoa* Britton & Rose (represented in the analysis by *A. dinae*, *A. rhodantha*, and *A. penicillata*). The molecular closeness of both species of *Stephanocereus* to *Arrojadoa* is instead underlined by Machado et al. (2006), data then assimilated in this sense by Hunt (2013, xii). On the other hand, if it is true that unlike *Arrojadoa* pollinated by hummingbirds (ornithophily), *Stephanocereus* has a distinct pollination syndrome, based on nocturnal pollination by bats (chiropterophily), we recall as underlined by Taylor & Zappi (2004, 291), that A. Cardoso photographed a hummingbird while visiting the *S. luetzelburgii* flowers. In this regard, we also know that in *Echinopsis rhodacantha* (Salm-Dyck) Förster, there may be mismatches between the floral syndrome (i.e. ornithophily), and the pollinators actually observed visiting the flowers of the taxon (i.e. halictid bees, probably of the genus Dialictus) (Eggli & Giorgetta 2015, 20: 3, 8). In the same vein, molecular analysis also show that floral traits and related pollination syndromes are no longer able to distinguish taxa at a generic level (Ritz et al. 2007; Lendel et al. umpubl. data & Nyffeler et al. umpubl. data in Nyffeler & Eggli 2010; Schlumpberger & Renner 2012; Anceschi & Magli 2013a; 2013b). That said, on the basis of morphological and molecular data in our possession, we prefer to distinguish the truly exceptional form of *Stephanocereus luetzelburgii* in the monotypic genus *Lagenosocereus* Doweld, as *Lagenosocereus luetzelburgii* (Vaupel) Doweld, and instead include *S. leucostele* among the members of *Arrojadoa* as *Arrojadoa leucostele* (Gürke) Anceschi & Magli (for the latter see on p. 39 of the present booklet).

Melocactus

***Melocactus amethystinus* Buining & Brederoo is morphologically and territorially hardly recognizable compared to *Melocactus bahiensis* Luetzelburg**

In July 2016, we made a base for about a week in the little town of Ituaçu, in the State of Bahia, Brazil, in the transitional area between the Caatinga ecoregion and the Chapada Diamantina campo rupestre. Near the town we found some populations of *Melocactus* Link & Otto, see A&M 1444, Ituaçu, Rêgo Novo, 600 m, which made us reconsider our previous idea of evaluating *Melocactus amethystinus* Buining & Brederoo as a distinct species compared to *Melocactus bahiensis* Luetzelburg (Anceschi & Magli 2013a, 99). The more evident character that in Hunt et al. (2006, text: 184) distinguishes *M. amethystinus* (here recognized at a subspecific level), compared to *M. bahiensis*, are in the rib count, 9-14, triangular in section, acute for the first taxon vs. 10-13, and more or less rounded for the second. In this regard, it should be noted that the photo illustrating *ssp. Bahiensis* in Hunt et al. (2006, atlas: 165, 165.2), instead shows a plant with 9 ribs! According to the authors, the two taxa would also occupy distinct areas, Bahia and Minas Gerais for ssp. *amethystinus*, vs. Bahia and Pernambuco for ssp. *bahiensis* (ibidem, text: 184). Now, the population of A&M 1444 shows both individuals with more rounded ribs (photos 24-25), similar to the conception that Hunt et al. have of ssp. *bahiensis* (ibidem, atlas: 165, 165.2), and individuals with ribs triangular in section, acute (photos 27-28), similar to the authors' concept of ssp. *amethystinus* (ibidem, atlas: 165, 165.1), as well as individuals with intermediate characters between the two (photo 21). They all carry 9 ribs, which as highlighted above is a character common to both taxa, and not a distinctive element of *M. amethystinus*. Furthermore, as we said at the beginning, the Ituaçu populations led us to re-evaluate the populations previously encountered in the north-east Minas Gerais and attributed to *M. amethystinus* (A&M 315, A&M 324, A&M 342). Recalling that the northeast of Minas Gerais should be a distinctive area of *M. amethystinus* only, the population of A&M 315 (Taylor & Zappi in Harley 25526; Horst 381), Brazil, Minas Gerais, Itaobim, 1 km west of town on the north side of Rio Jequitinhonha, 2009-04-19, instead shows individuals with the characters of *M. bahiensis* (i.e. more or less rounded ribs). In this regard, compare A&M 315 (*M. amethystinus*) photo 01, again with the photo that identifies *M. bahiensis* ssp. *bahiensis* in Hunt et al. (2006, atlas: 165, 165.2); the two individuals could live side by side in the same population. Since the morphological and locational distinctions between the two taxa have proved to be so fallabile, we prefer to transfer the populations previously attributed to *M. amethystinus* to *M. bahiensis*, as well as assimilating the first taxon into the synonymy of the second.

Melocactus violaceus **ssp.** ***margaritaceus*** **N. P. Taylor, a synonym of the dominant** ***Melocactus violaceus*** **Pfeiffer**

The study journey 2015-2016 (16 Nov. 2015 - 2 Aug. 2016), ended with a series of surveys conducted in the area of Imbassaí, Bahia, Brazil, on the northeast coast near the capital Salvador. Among these, A&M 1462 (photos 01-17) is related to *Melocactus violaceus* ssp. *margaritaceus* N. P. Taylor, one of the three ssp. in which Hunt et al. (2006, text: 190), divides the dominant *Melocactus violaceus* Pfeiffer; compare the population we detected with the photo representing the taxon in Hunt et al. (ibidem, atlas: 176, 176.3). In fact, the population encountered shows intermediate characters with ssp. *violaceus*, a closeness also evident in the photo with which the authors identify the type species (ibidem, atlas: 177, 177.2). The small distinctions related to the floral character, of which we already know about the fallability in distinguishing taxa (Ritz et al. 2007; Lendel et al. umpubl. data & Nyffeler et al. umpubl. data in Nyffeler & Eggli 2010; Schlumpberger & Renner 2012; Anceschi & Magli 2013a; 2013b), and the color of the fruit, i.e. white for ssp. *margaritaceus* vs. lilac to pale pink for ssp. *violaceus*, they seem really laughable elements to try to somehow identify additional taxa within dominant and variable species such as *M. violaceus*, a taxon spread over an area involving as many as 9 states of Brazil (i.e. Alagoas, Bahia, Espírito Santo, Minas Gerais, Paraíba, Pernambuco, Rio de Janeiro, Rio Grande do Norte, Sergipe). Despite that the third ssp. (ssp. *ritteri*), does not highlight particular distinctive features (Hunt et al. 2006, atlas: 177, 177.1), since we have not visited the places where the taxon is said to be endemic (ibidem, text: 190), we prefer to postpone opinion on its taxonomic position. For the reasons explained, we include *M. violaceus* ssp. *margaritaceus* in the synonymy of *M. violaceus*.

Opuntia

Is *Opuntia arechavaletae* Spegazzini distinct from *Opuntia monacantha* Haworth?

In Anderson (2001, 508) and Anderson & Eggli (2011, 468), *Opuntia arechavaletae* Spegazzini is considered in the synonymy of *Opuntia monacantha* Haworth, while Hunt et al. are of a different opinion (2006, text: 197), and consider *O. arechavaletae* a species in its own right, although in the note accompanying the taxon, Hunt (ibidem) specifies that perhaps it is only a variant of *O. monacantha*. Indeed, the descriptions of the two taxa are superimposable (ibidem, 206), moreover the characteristic fruit of *O. monacantha*, i.e. “pear shaped” (Anderson 2001, 508; Anderson & Eggli 2011, 468), see A&M 1348, Uruguay, Cerro Largo, Laguna Merin, Reserva Privada Bagñado del Jacarè (photos 7-9), is also part of the concept of *O. arechavaletae* (Hunt et al. 2006, atlas: 490, 490.4). In turn, the images representing the two taxa in the lexicons, see for *O. monacantha* Hunt et al. (2006, atlas: 491, 491.4, 491.5) and Anderson & Eggli (2011, 468), and for *O. arechavaletae* Hunt et al. (2006, atlas: 490, 490.4), are referable to a single species, that of A&M 1348. For the reported evidence, we assimilate *O. arechavaletae* among the synonyms of *O. monacantha*.

Is *Opuntia dillenii* (Ker-Gawler) Haworth distinct from *Opuntia stricta* (Haworth) Haworth?

The current interpretation of the widespread *Opuntia dillenii* (Ker-Gawler) Haworth is controversial. In Hunt et al. (2006, text: 201), the taxon is considered to be synonymous with the equally widespread *Opuntia stricta* (Haworth) Haworth, and defined as "the widespread spiny form of *O. stricta*" (ibidem). It is interesting to note that the three photos representing *O. stricta* in NCL (ibidem, atlas: 499, 499.4, 499.5, 499.6), always show only the *dillenii* form, with an obovate segment, never the *stricta* form. Anderson (2001, 495, 520-521) and Anderson & Eggli (2011, 455-456, 478), keep the two taxa separate, the latter showing for *O. stricta* a taxon with an elliptical segment (2011, 478). Both Anderson (2001, 495) and Anderson & Eggli (2011, 456) report that in the past Benson (1982, 500) believed that the two taxa were the same species, while Howard & Touw (1982) have kept the two species separate. As far as we are concerned, we found Benson's documentation convincing (1982, 497-501), which considers *O. dillenii* to be a variety of *O. stricta*, showing that in Florida the populations of the two taxa overlap in many areas, in which only on a few occasions the two forms (i.e. *O. stricta* with a more or less elliptical segment, spineless and *O. dillenii* with an obovate segment and 1-11 spines for areola) are distinguishable from each other. The author shows an accurate photographic documentation of the two forms, and of the transitions between them. Benson also adds that in the Caribbean islands the *dillenii* form completely replaces the *stricta* form. Having documented the transition between the two forms in the southern United States, we consider *O. dillenii* a part of the same dominant biological unit bearing the name *O. stricta*. Below is the distribution of the taxon thus conceived: Bahamas; Bonaire, Sint Eustatius and Saba (Bonaire, Sint Eustatius, Saba); Brazil (Alagoas, Bahia, Paraíba, Pernambuco, Sergipe); Cayman Islands; Cuba; Curaçao; Dominican Republic; Ecuador; Jamaica; Mexico (Campeche, Oaxaca, Querétaro, Quintana Roo, San Luis Potosí, Tabasco, Tamaulipas, Veracruz, Yucatán); Puerto Rico; Sint Maarten (Dutch part); Saint Martin (French part); United States (Alabama, Florida, Georgia, South Carolina, Texas); Venezuela; Virgin Islands (data gathered from: Durán, R., Gómez-Hinostrosa, C., Hernández, H. M., Tapia, J. L., Terrazas, T. & Loaiza, C. 2017. *Opuntia stricta* (amended version of 2013 assessment). The IUCN Red List of

Threatened Species 2017. Downloaded on 24 January 2020. Note: Puerto Rico, is taken from the distribution of *O. dillenii* in Anderson (2001, 495) and in Anderson & Eggli (2011, 455).

Parodia

Parodia turecekiana R. Kiesling: the transitional element between the populations of *Parodia submammulosa* (Lemaire) R. Kiesling in Argentina and those of *Parodia mammulosa* (Lemaire) N. P. Taylor in Uruguay and southern Brazil

In our article “The position of *Parodia turecekiana* in the *Parodia mammulosa* complex” (Anceschi & Magli 2014, 13: 60-73), we conceive the complex of the dominant *Parodia mammulosa* (Lemaire) N. P. Taylor as consisting of two internal vicariants (i.e. *submammulosa* and *turecekiana* populations) and two close relatives, the future external vicariants in our synopsis of the genus *Parodia* Spegazzini s.l. (Anceschi & Magli 2018, 36: 70-161), (i.e. *Parodia mueller-melchersii* (Frič ex Backeb.) N. P. Taylor and *Parodia maldonadensis* (Herter) Hofacker. A third external vicariant (i.e. *Parodia curvispina* (F. Ritter) D. R. Hunt, has been added to the already mentioned synopsis of the genus, published in Bradleya (ibidem: 93). In the article, we presented for the first time within our system, the idea of the dominant species in the Darwinian evolutionary sense (Darwin, 1859), divided (when present) into its internal vicariants (geographical races, subspecies, demes or populations of a species), and related to its external vicariants (here still defined close relatives of the taxon), starting from the concept of vicariance expressed in Hennig’s definition of species, that is “The species would therefore be defined as a complex of spatially distributed reproductive communities, or if we call this relationship in space ‘vicariance’ as a complex of vicarying communities of reproduction.” (1966: 47). Substantially, defining one or more taxa as internal vicariants is recognizing that at least potentially (Mayr 1942: 120) all these components might cross each other as part of the same biological unit. Being part of the same biological unit, the internal vicariants are not taxonomically distinct from the dominant, and are reported only through the use of the informal term “populations” (i.e. turecekiana populations for example). For close relatives of the taxon (the 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. In what way, apart from the alleged potential of crossing (or not), it would possible to distinguish between all the populations in question, an internal vicariant of a species from a close relative (or external vicariant) of the same species. In this and other cases highlighted in our penultimate booklet (Anceschi & Magli 2013a, 31-32), if molecular tests are missing or insufficient, to investigate such low levels of genetic relationships, comparative holomorphy between semaphoronts (Hennig 1966: 66-67) can be used as an accessory science to recognize genetic relationships that are to be presented in the taxonomic system. In the case of *P. mammulosa*, we are led to assess the populations *submammulosa* and *turecekiana* as internal vicariants of the system because the semaphoronts which are identifiers of the two groups are actually found even among populations of the type species. In the case of *P. mueller-melchersii* and *P. maldonadensis*, however, increased genetic autonomy is inferred by the fact that some semaphoronts which are identifiers of the taxa are not found in *P. mammulosa* (i.e. the *winkleri* and *veeniana* forms of *P. mueller-melchersii*, and the woolly crown of *P. maldonadensis*).
See the article for more information. Below is a summary of the implications for the genus *Parodia*.

To be transferred to the synonomy of *Parodia mammulosa*:
Parodia turecekiana
Notocactus turecekianus
Notocactus mammulosus ssp. *turecekianus*

A synopsis of the genus *Parodia* Spegazzini s.l. (Cactaceae). The first complete study on *Parodia* s.l.

In July 2018 our synopsis of the genus *Parodia* Spegazzini (Anceschi & Magli 2018, 36: 70-161) was published in Bradleya. The 92 pages of the article represent the compendium of 12 years of study journeys in the South American continent. The work constitutes the first, and so far, unique complete study on the genus *Parodia* s.l., having studied all the species in habitats, in the two centers of diversity of the genus. The first one is the Andean, located on the eastern slopes of the Andes in northwestern Argentina and southwestern Bolivia, and secondly that of the Pampas area, which is found in the lowland pampas regions of northeastern Argentina, southern Brazil, eastern Paraguay, and Uruguay. Usually, these two centers of diversity and their native species have been investigated both for spatial reasons (that is, related to the vastness of the areas involved), and by election, from two distinct types of researchers, i.e. the experts of *Parodia* s.s. in the Andean area and those of *Notocactus* s.l. in the Pampean area. These specialists, as such, have always been focused on finding the differences rather than the similarities between the members of the two areas, without ever grasping an overview (*synopsis*, from the Greek σύνοψις) of the genus as a whole. In the article, the history of the ex-segregates of the genus *Parodia* Spegazzini s.l. (Cactaceae), since 1819 has been reviewed. As in Anderson (2001), no informal group is recognized at the sub-generic level, to distinguish the ex-segregates of *Parodia* s.l.. A rather conservative approach was adopted to sum up the large number of proposed names within 62 natural species (37 from the Pampas regions and 25 from the Andean region). Accepted taxa are all at a specific level (according to Darwin “No clear line of demarcation has as yet been drawn between species and subspecies” (1859). For each accepted species, a complete synonymy is given down to the subspecies level (varieties are included only in the case of basionyms). 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 2013a, 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). c) About our theoretical approach to the results of molecular analysis, often in line with the results of our field data, we applied the principle of monophyly in the sense of Hennig (1966), and Nelson’s redefinition (1971: 472) of the concepts of paraphyly and polyphyly sensu Hennig. About our identification system of the relationship between species in their habitats, the dominant species in the Darwinian evolutionary sense has a crucial role (Darwin, 1859). 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 2012, 27).

1) 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 b) strong or weak external vicariants (or close relatives). 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 3) Ex-dominant species, now with fragmented distribution, 4) non-dominant species (or endangered species, at different degrees). The 62 accepted species, are grouped into 10 membership groups (see below), based on the relationship between the dominant species and their vicariants: 1) *P. maassii* complex, 2) *P. microsperma* complex, 3) Relatively dominant species in a restricted area (Andean area), 4) Non-dominant species with fragmented or very fragmented distribution (Andean area), 5) *P. erinacea*, 6) *P. mammulosa* complex, 7) *P. ottonis* complex, 8) Ex-dominant species, now with fragmented distribution (Pampas area), 9) Non-dominant species with fragmented or very fragmented distribution (Pampas area), 10) Ex-*Brasilicactus*/*Brasiliparodia* group & ex-*Eriocactus* group.

An enlarged description is taken from the field data [in square brackets in the article], 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.

See the article for more information. Below is the new combination presented in the synopsis.

Parodia ibicuiensis (Prestlé) Anceschi & Magli. A synopsis of the genus *Parodia* Spegazzini s.l. (Cactaceae). Bradleya 36: 105 (2018). **Type:** Estancia Nova, in the river area of the Rio Ibicui, Dept. Itaqui, Rio Grande Do Sul, Brazil, found in December 1981 by F. Stockinger and A. Gutierez, Stockinger 116, deposited in the Botanical Herbarium University of Utrecht/Netherlands (U).

Pierrebraunia

Pierrebraunia bahiensis (P. J. Braun & Esteves) Esteves, a brief note

Pierrebraunia Esteves is a controversial genus. In the latest literature it is included in *Arrojadoa* Britton & Rose by Anderson (2001, 117), considered as a separate genus in Hunt et al. (2006, text: 233) and in Anderson & Eggli (2011, 534), and again assimilated in *Arrojadoa* by Hunt (2013, xìì; 2016, 112) in the wake of anticipated molecular analysis (Machado et al. 2006). Based on the significant morphological distance between *Pierrebraunia* and *Arrojadoa* and pending the final results of the analysis, for the moment we prefer to keep the first taxon within the accepted genera in cactusinhabitat.org

Pilosocereus

Pilosocereus salvadorensis (Werdermann) Byles & G. D. Rowley or _Pilosocereus catingicola_ ssp. _salvadorensis_ (Werdermann) Zappi, not very distinct coastal populations within the dominant and widespread _Pilosocereus catingicola_ (Gürke) Byles & G. D. Rowley

In the last lexicons (Hunt et al. 2006, text: 235; Anderson & Eggli 2011, 537-538, Hunt 2013, xxviii), *Pilosocereus salvadorensis* (Werdermann) Byles & G. D. Rowley is distinguished as *Pilosocereus catingicola* ssp. *salvadorensis* (Werdermann) Zappi within *Pilosocereus catingicola* (Gürke) Byles & G. D. Rowley, substantially for the greater number of ribs: (5-) 6-12 vs. 4-6 for ssp. *catingicola*. Actually, *P. salvadorensis* represents only the coastal populations of the dominant and widespread *P. catingicola* that in a natural sense propagates from the Caatinga ecological region, on a wide coastal band involving 6 Brazilian states (i.e. Alagoas, Bahia, Paraíba, Pernambuco, Rio Grande do Norte, and Sergipe) (Taylor and Zappi 2004, 312), with slight morphological variations, which in our opinion do not deserve to be recorded at a taxonomic level. For this reason we consider *P. salvadorensis* and *P. catingicola* ssp. *salvadorensis* both synonyms of *P. catingicola*.

Pilosocereus gounellei **(F. A. C. Weber) Byles & G. D. Rowley and** ***Pilosocereus zehntneri*** **(Britton & Rose) F. Ritter, two distinct species**

In the latest literature, *Pilosocereus zehntneri* (Britton & Rose) F. Ritter is considered a ssp. of *Pilosocereus gounellei* (F. A. C. Weber) Byles & G. D. Rowley (Anderson 2001, 580-581; Hunt et al. 2006, text: 237; Anderson & Eggli 2011, 540-541; Hunt 2013, xxviii; Hunt 2016, 113, 142). The surveys we carried out in the habitats of the two taxa, in 2016 in Brazil, in the states of Minas Gerais and Bahia, highlighted a clear distinction in the habit of the two taxa, characters that we know to be more stable than others at the morphological level (i.e. floral traits, pollination syndromes etc.), in distinguishing taxa (Schlumpberger & Renner 2012). In fact, while *P. zehntneri* manifests itself as a tall bush, with candelabra branches, tending to assume an arboreal habit (A&M 1380, A&M 1382, A&M 1386, A&M 1389, A&M 1394, A&M 1402), *P. gounellei* forms low and massive bushes, that expand horizontally, rather than vertically, with candelabra-like branches too, but with a more massive structure of the branch and the rib (diameter <7 cm in the first taxon vs. <9 in the second) (A&M 1430, A&M 1433, A&M 1435). As explained above, we prefer to recognize both taxa at specific level.

Pilosocereus occultiflorus **P. J. Braun & Esteves, a synonym of** ***Pilosocereus pachycladus*** **F. Ritter**

In June 2016, west of Januaria, in northern Minas Gerais, Brazil, we conducted a survey on a population of *Pilosocereus occultiflorus* P. J. Braun & Esteves (A&M 1392), a taxon whose taxonomy is disputed by different authors. In Hunt et al. (2006, text: 238) *P. occultiflorus* (as P. xoccultiflorus) is considered on the basis of Taylor & Zappi (2004, 345), to be a hybrid between *Pilosocereus densiareolatus* F. Ritter and *Pilosocereus pachycladus* (ssp. *pachycladus*) F. Ritter, while in Anderson (2001, 583) and in Anderson & Eggli (2011, 543) it is recognized at the rank of species. From our point of view, the taxon is included in the morphological and geographical range of the variable, extended and dominant *P. pachycladus*. Compare A&M 1392 (*P. occultiflorus*) with the other A&M of *P. pachycladus* present in cactusinhabitat.org, while for the overlap of the description of *P. pachycladus* to that of *P. occultiflorus* see Anderson (2001, 583-584).

Pilosocereus pernambucoensis **F. Ritter, a further declination of the dominant *Pilosocereus pachycladus* F. Ritter**

In the concept of *Pilosocereus pachycladus* F. Ritter as a dominant species that can assume both a shrubby (A&M 348) and an arboreal form (see in this regard our inclusion of *Pilosocereus occultiflorus* P. J. Braun & Esteves in this booklet on page 82), also *Pilosocereus pernambucoensis* F. Ritter or *Pilosocereus pachycladus* ssp. *pernambucoensis* (F. Ritter) Zappi, according to the latest trend of transferring taxa from the rank of species or variety to that of subspecies (Anceschi & Magli 2010, 12-14; 2018, 36: 73), represents a further declination of the species in the arboreal form. No evident distinction separates it from the various other forms of the type species. In this regard, see also the really irrelevant details in the context of a variable, extended and dominant species such as *P. pachycladus*, which according to Hunt et al. (2006, text: 238-239), should differentiate the two taxa; that is, “csp and rsp poorly differentiated” for the ssp. *pernambucoensis* vs. “csp and rsp well differentiated” for *P. pachycladus*, and again “sd <1.6 mm, testa cells-flat” vs. “sd <2 mm, testa cells-flat to domed”, respectively to distinguish the first taxon from the second. For the reasons explained, we also include *P. pernambucoensis* among the synonyms of *P. pachycladus*.

Pilosocereus pentaedrophorus **ssp. *robustus* Zappi is distinct from *Pilosocereus pentaedrophorus* (Labouret) Byles & G. D. Rowley?**

In natural taxa such as *Pilosocereus pentaedrophorus* (Labouret) Byles & G. D. Rowley, whose distribution extends across four states of Brazil, i.e. Bahia, Minas Gerais, Pernambuco, and Sergipe, at elevations from 5 to 1,000 m asl (data gathered from: Taylor, N. P. & Zappi, D. 2013. *Pilosocereus pentaedrophorus*. The IUCN Red List of Threatened Species 2013. Downloaded on 17 January 2020), it seems inconsistent to elect taxonomic distinctions at the intraspecific level, such as those which should distinguish from the type species, ssp. *robustus*, that is “br <7.5 cm diameter” and “ri (5-) 6-10” for ssp. *robustus* vs. “br <4.5 (-6) cm diameter” and “ri 4-6 (-7)” for *P. pentaedrophorus* (Hunt et al. 2006, text: 239). Please note that the population of A&M 1428, *P. pentaedrophorus,* Brazil, Bahia, Tanhaçu, between Tanhaçu and Sussuarana, 401 m, in the distributional area of ssp. *robustus*, bears characters at the limit between the two taxa, i.e. br <6.3-6.9 cm in diameter, on 7-8 ribs. In the light of these considerations we prefer to consider *Pilosocereus pentaedrophorus* ssp. *robustus* Zappi in the synonymy of *P. pentaedrophorus*.

Tunilla

Tunilla erectoclada (Backeberg) D. R. Hunt & Iliff, the third species in *Tunilla* D. Hunt & Iliff

In our previous comment dedicated to the genus *Tunilla* D. Hunt & Iliff (Anceschi & Magli 2013a, 87-88), of the 12 initial species considered by the authors of the genus (Hunt & Iliff 2000, 9: 8-12), we had circumscribed two only, the recognition of taxa at a specific level, i.e. *Tunilla corrugata* (Salm-Dyck) D. R. Hunt & Iliff and *Tunilla soehrensii* (Britton & Rose) D. R. Hunt & Iliff. This is due to the difficult distinction, both morphologically and territorially, of the species in their natural habitats (as already highlighted by Kiesling & Ferrari (2005, 29); underlining that in some points of the areas occupied by the two species, there seem to exist merging points. The judgment on the recognition of a third possible taxon, namely *Tunilla erectoclada* (Backeberg) D. R. Hunt & Iliff, at that time for us not clearly attributable to the two accepted taxa, remained pending. Subsequent investigations carried out in 2013 in Argentina, Catamarca Province, El Rodeo, revealed scattered populations (A&M 866) showing the characters of *T. erectoclada* (see Anderson 2001, 664). In fact, the individuals in question show stem segments narrow, tongue shaped, erect in young growth, distinctly tuberculate, bright green (photo 06); areoles as many as 140 per segment, spines 4-7, from bent backward and lying next to the surface, to many, spreading (photos 05-06); flowers carmine red (photos 02-03, 06-08). We therefore add *T. erectoclada* as a third taxon to our understanding of *Tunilla*.

Weingartia

Rebutia – Sulcorebutia – Weingartia pulchra, *Rebutia – Sulcorebutia – Weingartia canigueralii* or *Rebutia – Sulcorebutia – Weingartia rauschii*? With which of these names to identify the populations of Cerro Ayrampo, Zudáñez, Chuquisaca, Bolivia

During our 2013-2014 journey, on March 14, 2014, we dedicated ourselves to the ascent to Cerro Ayrampo, a mountain that is 2826m high, and dominates the village of Zudáñez, in the Chuquisaca Department, Bolivia. The site is known to *Cactaceae* enthusiasts for being the type locality of *Sulcorebutia rauschii* Gerhart Frank. In an attempt to find new populations, we didn't go up along the usual path, but we have scoured from the base, the different hills making up the mountain, and then climbed it vertically from the base to the main peak, on the southwest side, to find that the first groups of the species live only at 2800-2805m (A&M 1061, A&M 1062), just before the top (A&M 1063, A&M 1064), while the populations living near the path, that rises from the southeast (covered on the way back), are also found at lower altitudes (A&M 1065). The populations of Cerro Ayrampo have been subject to various taxonomic interpretations that have affected different genera and species within them. The first consideration is to decide which genus it belongs to, i.e. *Rebutia* K. Schumann, *Sulcorebutia* Backeberg or *Weingartia* Werdermann? Our position on a genus *Weingartia* as distinct from *Rebutia* (Anceschi & Magli 2010, 18) is summarized in the 2013 booklet (Anceschi & Magli 2013a, 88). Our position is confirmed by Nyffeler & Eggli (2010), who in turn distinguished *Weingartia* (including *Cintia* Knize & Riha and *Sulcorebutia*) from *Rebutia* on the basis of the latest molecular research (Lendel & al. 2006; Ritz et al. 2007; Lendel et al. umpubl. data; Nyffeler & al. umpubl. data). We recall that in the latest edition of Das Grosse Kakteen-Lexicon (Anderson 2011), Eggli reproposes the idea of *Cintia*, *Rebutia*, *Sulcorebutia* and *Weingartia* as separate genera. On the contrary, in the 2nd edition of the NCL atlas, Hunt (2013, xììì) nothing changed compared to the previous edition (2006), i.e. keeping *Cintia, Sulcorebutia* and *Weingartia* included in *Rebutia*. The author concludes by quoting the analysis of Ritz et al. (2007), "... *Sulcorebutia* and *Weingartia* should be united into one genus, because neither molecular nor morphological data reveal a distinction between these genera". Partially in disagreement with the judgment of these latter authors, we believe that *Sulcorebutia* and *Weingartia* have very little in common at the morphological level, even if the results of their molecular analysis leave no room to different phylogenetic interpretations. In fact, as can be seen from the cladograms (ibidem, 1324, 1326), *Cintia*, *Sulcorebutia* and *Weingartia* form a single well-supported monophyletic clade (in Bayesian 1.00, posterior probabilities ≥ 0.80; ibidem, 1326), distinct from *Rebutia*, equally well supported (in Bayesian 1.00, posterior probabilities ≥ 0.80; ibidem). Summarizing, based on the evidence, according to Nyffeler & Eggli 2010 we include *Sulcorebutia* in *Weingartia*, distinguishing it from *Rebutia*. *Weingartia* is therefore the genus name for these populations, but what is the name for the species? Following a brief history of the taxon's interpretations at a specific level, involving the epithets *pulchra*, *canigueralli* and *rauschii*.

a) In Backeberg (1977, 469, 472), the three taxa are part of *Sulcorebutia*, and kept separate (*S. canigueralli̇i, S. pulchra, S. rauschii*).

b) In Anderson (2001, 601-602), the three taxa are part of *Rebutia*, namely *Rebutia canigueralli̇i* Cárdenas, which is divided into three ssp., among these ssp. *pulchra*, while *S. rauschii* and *Weingartia rauschii* (Gerhart Frank) F. H. Brandt are considered synonyms of *R. canigueralli̇i*.

c) In Hunt et al. (2006, text: 246, 250, 315) the three taxa are part of *Rebutia*, *R. canigueralli̇i* and *Rebutia pulchra* Cárdenas as separate species, *S. rauschii* - *W. rauschii*, as synonyms of *R. pulchra*.

d) In Anderson & Eggli (2011, 609-610, 612), the three taxa are part of *Sulcorebutia*, *Sulcorebutia canigueralli̇i* (Cárdenas) Buining & Donald and *Sulcorebutia pulchra* (Cárdenas) Donald as distinct species, *R. rauschii* - S. rauschii - *W. rauschii*, as synonyms of *S. canigueralli̇i*.

e) In Hunt (2013), nothing has changed compared to 2006.

Based on a comparison of the morphological characters between the above-mentioned literature and our field surveys (see A&M numbers), the main distinction between *S. rauschii* = *W. rauschii* (we have already opted for *Weingartia* at the generic level), and the other two taxa, i.e. *Weingartia canigueralli̇i* (Cárdenas) F. H. Brandt and *Weingartia pulchra* (Cárdenas) F. H. Brandt, is that the specimens representing the latter always show non-dark colored spines, i.e. different from black, that is dark brown or dark red; in the examined documents:

W. pulchra (Hunt et al. 2006, atlas: 260, 260.4 (as *R. pulchra*) col. brown variegated yellow

W. pulchra (Hunt et al. 2006, atlas: 260, 260.5 (as *R. pulchra*) col. white

W. pulchra (Anderson & Eggli 2011, 612 (as *S. pulchra*) col. reddish yellow

Only when the taxon photographed to represent *W. canigueralllii* (Anderson & Eggli 2011, 609 (as *S. canigueralllii*) or *W. pulchra* (Hunt et al. 2006, atlas: 260, 260.6 (as *R. pulchra*) is *S. rauschii* = *W. rauschii*, the specimens show dark spines. Furthermore, the average of the data contained in Backeberg's description of *S. rauschii* (1977, 472), is the one that best fits the data we collected in the Cerro Ayrampo populations. Finally, it is noteworthy that the description of *R. pulchra* in Hunt et al. (2006, text: 250), has substantially become that of *S. rauschii* of Backeberg (1977, 472), without anything remaining from the previous description of the first taxon (ibidem, as *S*. "*pulchera*"). Thus it seems that the new concept of *R. pulchra* has been "redesigned" on the characters of the well-known *S. rauschii* = *W. rauschii*. As for the reasons for the merging of *S. rauschii* into *R. pulchra*, in a note Hunt et al. (2006, text: 250) refers to Hunt (2006, CSI 21: 14), where, without other justifications, only a list of taxa to be subsumed in *R. pulchra* appears (i.e. *R. caracarensis*, *S. crispata*, *S. frankiana*, *R. inflexiseta*, and *S. rauschii*). For the reasons explained, with reference to the *Weingartia* populations of the Cerro Ayrampo, we prefer to strictly refer them to *W. rauschii*, keeping this taxon separate from *W. canigueralllii* and *W. pulchra*.

Taxonomic position of *Weingartia krahnii* (Rausch) F. H. Brandt within *Weingartia steinbachii* (Werdermann) F. H. Brandt

Reading about the relationships between *Rebutia* K. Schumann, *Sulcorebutia* Backeberg and *Weingartia* Werdermann, and to our inclusion of *Sulcorebutia* in *Weingartia*, on the basis of molecular studies' results (Ritz et al. 2007; Nyffeler & Eggli 2010) we refer to our comment on *Weingartia rauschii* (G. Frank) F. H. Brandt that appears in this same booklet (see pages 84-87). Regarding the relationship between *Weingartia krahnii* (Rausch) F. H. Brandt and *Weingartia steinbachii* (Werdermann) F. H. Brandt, the subject of this comment, we agree with Anderson (2001, 609-610), in including *W. krahnii* together with *Weingartia tiraquensis* (Cárdenas) F. H. Brandt in the synonymy of *W. steinbachii*, considering the first two taxa only variants in spination of the third. In this regard, one should note the extreme variability of the spines both structurally and chromatically, within the same population of *W. krahnii* (see A&M 1321, 30 Jan

2016 & A&M 1323). Also noteable is the difference in habitat between young and adult semaphoronts (see A&M 1323, photo 48, for the two side by side), hardly connected to each other if we hadn't been able to study all the distinct phases of the taxon's ontogenesis during our 9 days stay in Comarapa, Santa Cruz, Bolivia, from 28 Jan to 5 Feb 2016. By sharing Anderson's concept (ibidem), in relation to this group of taxa, we exclude the hypothesis that *W. krahnii* is a part of *Rebutia glomeriseta* Cárdenas, as supported by Hunt et al. (2006, text: 314; atlas: 259, 259.3 (in the atlas as *Sulcorebutia krahnii*). In this respect, we recall that Lowry & Carr subsequently considered *S. krahnii* as part of *Rebutia steinbachii* Werdermann (data gathered from: Lowry, M. & Carr, J. 2017. *Rebutia steinbachii* (amended version of 2013 assessment). The IUCN Red List of Threatened Species 2017. Downloaded on 07 January 2020). To complete the picture of the synonymy in *W. steinbachii*, as in Anderson (2001, 609-610), we consider *Weingartia totorensis* (Cárdenas) F. H. Brandt and *Weingartia lepida* (F. Ritter) F. H. Brandt (together with *Sulcorebutia aguilarii* hort. (Anderson & Eggli 2011, 612), as part of the first taxon.

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* All the photos mentioned are available on cactushabitat.org

04. Updates and comments on the conservation status of taxa

The surviving populations of *Gymnocalycium schroederianum* Osten, an ex-dominant species, now with fragmented distribution

Charles (2009, 116-121) divided *Gymnocalycium schroederianum* Osten into three subspecies, recognizing in addition to ssp. *schroederianum*, the following; *Gymnocalycium schroederianum* ssp. *bayense* R. Kiesling and G*ymnocalycium schroederianum* ssp. *boessii* R. Kiesling, E. Marchesi & O. Ferrari, respectively found south and north of the area of the type populations. Overall, the populations that constitute *G. schroederianum* are located between Argentina (Buenos Aires, Corrientes, Entre Ríos, Santa Fe), Brazil (Rio Grande do Sul), and Uruguay (Rio Negro). Based on our studies in the habitats of Cerro Curacá (A&M 956) and of the Sierras Bayas (A&M 961 and A&M 963), Olavarria, Buenos Aires Province, Argentina, in 2014, and in agreement with Hunt et al. (2006, text: 134), we believe that *G. schroederianum* ssp. *bayense* should be considered a synonym of *G. schroederianum* since, as also already highlighted by Charles (2009, 119), the only difference with the type populations is the geographical disjunction (i.e. about 500 km south for the ssp. bayense). Moreover, as already noted in the case of *Gymnocalycium pflanzii* (Vaupel) Werdermann (Anceschi & Magli 2013a, 58), the reason why the spatial continuity, which usually exists between the various populations that constitute a natural species is broken, may be different (i.e. populations that are not yet recognized, or more likely, that are extinct). Concerning Papsch's proposal (2001), to neotypify the name *Echinocactus hyptiacanthus* with a plant of this taxon from the Sierras Bayas, we agree with Charles (ibidem, 119), on the fact that there is already a neotypification by Kiesling of the same name, applied to one of the members of the group of *Gymnocalycium uruguayense* (Arechavaleta) Britton & Rose, and therefore consider Papsch's proposal superfluous. In our system, according to Hunt et al. (2006, text: 129, 131), we consider *Gymnocalycium hyptiacanthum* (Lemaire) Britton & Rose and

Gymnocalycium netrelianum (Monville) Britton & Rose to be of controversial application, while for further information on the group of taxa relating to *G. uruguayense*, we refer to the comment in our penultimate booklet (Anceschi & Magli 2013a, 67-70). It is interesting to note how Papsch (2015 (6) 2: 03-14, 2015 (6) 3: 4-10, 2017 (8) 2: 11-23) has again changed his concept of the species of *Gymnocalycium* that live in the Sierras Bayas, moving it from *G. schroederianum* ssp. *bayense* = *Echinocactus hyptiacanthus* = *Gymnocalycium hyptiacanthum* (2001), to *Gymnocalycium platense* (Spegazzini) Britton & Rose! Even for the latter taxon, the application is controversial (Hunt et al. text: 132, 323; Charles 2009, 264). With regard to *G. schroederianum* ssp. *boessii*, probably a new name for the populations previously attributed to *Gymnocalycium erolesii* Neuhuber & C. A. L. Bercht, the surveys we carried out between the 21 and 24 November 2015 (A&M 1227, A&M 1237), between Vera and Berna, in the northern part of the Province of Santa Fe, Argentina, in the Humid Chaco ecoregion, we believe that this taxon only represents a variant with thinner spines than the type populations and to those of the Sierras Bayas. It is our opinion that *G. schroederianum* represents a case of an ex-dominant species, now with fragmented distribution (Anceschi & Magli 2018, 36: 76), that is, a taxon whose previous dominance and territorial continuity can be inferred on the basis of the current distribution, now with strongly fragmented populations usually due to anthropic intervention, as in the case of *G. schroederianum*. In the north, the populations are affected by deforestation as land is turned into agriculture (both arable and stock-breeding), as is now the case in the whole Chaco from Argentina to Paraguay. The populations of the center are subject to the same risks, to which is added the cultivation of Eucalyptus. In 2016, we could ascertain that in the Province of Entre Ríos, the areas crossed by the the Ruta 14 between Colón, Concordia and Chajarí are completely disfigurated by the cultivation of these plants, and that only south of Mocoretá, already in the Province of Corrientes, the first native “blanqueales” appear (Anceschi & Magli 2014, 13: 62), which then leave the fields in a northerly direction to the lands destined for grazing (i.e. pampa grasslands with rocky outcrops), between Curuzú Cuatiá and Mercedes, now with sporadic cultivation of Eucalyptus. It is to be considered that the central areas have also been affected by floods in recent years. The southern populations, as also highlighted by Papsch (2015 (6) 2: 12), which assigns them Conservation Status: Critically Endangered, CR, are affected, in the author’s words by “Massive mining of rocks for cement production …” and granite extraction. It is singular that populations belonging to the same species, no longer connected to each other due to anthropic intervention, are then considered as distinct taxa, sometimes with the relative separate assessments on the conservation status. This is the case of the populations of *G. schroederianum*, to which Charles (2009, 117, 119, 121), assigns three distinct degrees of risk, Near Threatened for ssp. *schroederianum*, Vulnerable for the ssp. *bayense* and Least concern for the ssp. *boessii*. Being a single natural species, we prefer instead to draw up for *G. schroederianum* a global risk assessment, that is Endangered, EN B2ab(i,ii,iii,iv). Justification: the area of occupancy of the global population is estimated to be less than 500 km2 (in the southern areas we are talking about just a few square meters), and based on what is known and observed, it was found that all populations are severely fragmented, and that in all areas a decline in extent of occurrence, area of occupancy, quality of habitat and number of locations can be inferred.

05. Accepted taxa

List of accepted taxa of Cactaceae in cactusinhabitat.org in the publications 2010, 2013 and 2021. The taxa currently accepted are printed in ***bold italic***.

Genus	**species**	**pubblication year**
Armatocereus	***matucanensis***	2010
Armatocereus	**procerus**	2021
Arrojadoa	**leucostele**	2021
Arrojadoa	***penicillata***	2010
Arrojadoa	***rhodantha***	2021
Austrocylindropuntia	*exaltata*	2010
Austrocylindropuntia	***floccosa***	2021
Austrocylindropuntia	***shaferi***	2013
Austrocylindropuntia	***subulata***	2021
Austrocylindropuntia	*verschaffeltii*	2010
Austrocylindropuntia	***vestita***	2010
Blossfeldia	***liliputana***	2021
Brasilicereus	***markgrafii***	2010
Brasilicereus	***phaeacanthus***	2021
Brasiliopuntia	***brasiliensis***	2013
Brasiliopuntia	***schickendantzii***	2021
Browningia	***candelaris***	2010
Browningia	***columnaris***	2021
Browningia	***hertlingiana***	2021
Castellanosia	***caineana***	2010
Cereus	***aethiops***	2010
Cereus	***bradei***	2021

Cereus	***crassisepalus***	2021
Cereus	***euchlorus***	2013
Cereus	***fernambucensis***	2021
Cereus	***forbesii***	2013
Cereus	*hankeanus*	2010
Cereus	***hildmannianus***	2010
Cereus	***jamacaru***	2021
Cereus	***laniflorus***	2021
Cereus	***lanosus***	2013
Cereus	***minensis***	2021
Cereus	***phatnospermus***	2013
Cereus	***saxicola***	2013
Cereus	***spegazzinii***	2010
Cereus	***stenogonus***	2010
Cleistocactus	*baumannii*	2010
Cleistocactus	*buchtienii*	2010
Cleistocactus	*hyalacanthus*	2010
Cleistocactus	*parviflorus*	2010
Cleistocactus	*santacruzensis*	2010
Coleocephalocereus	***aureus***	2010
Coleocephalocereus	***goebelianus***	2021
Coleocephalocereus	***purpureus***	2010
Copiapoa	***cinerascens***	2010
Copiapoa	***cinerea***	2010
Copiapoa	***columna-alba***	2010
Copiapoa	***grandiflora***	2010
Copiapoa	***taltalensis***	2010
Corryocactus	***brevistylus***	2010

Corryocactus	***erectus***	2010
Corryocactus	***melanotrichus***	2010
Corryocactus	***tarijensis***	2013
Cumulopuntia	***boliviana***	2010
Cumulopuntia	***chichensis***	2013
Cumulopuntia	***echinacea***	2010
Cumulopuntia	***rossiana***	2013
Cumulopuntia	***sphaerica***	2010
Cylindropuntia	***tunicata***	2013
Denmoza	*rhodacantha*	2010
Discocactus	***boliviensis***	2013
Discocactus	***ferricola***	2013
Discocactus	***hartmannii***	2010
Discocactus	***horstii***	2010
Discocactus	***placentiformis***	2010
Echinopsis	***acanthura***	2021
Echinopsis	***acrantha***	2021
Echinopsis	***albispinosa***	2013
Echinopsis	***ancistrophora***	2013
Echinopsis	***angelesiae***	2010
Echinopsis	***aurea***	2010
Echinopsis	***balansae***	2013
Echinopsis	***baumannii***	2013
Echinopsis	***bertramiana***	2013
Echinopsis	***bridgesii***	2013
Echinopsis	***bruchii***	2010
Echinopsis	***buchtienii***	2013
Echinopsis	***bylesiana***	2021

Echinopsis	***calochlora***	2013
Echinopsis	***camarguensis***	2013
Echinopsis	***candelilla***	2013
Echinopsis	***candicans***	2010
Echinopsis	***caulescens***	2013
Echinopsis	***celsiana***	2013
Echinopsis	***cephalomacrostibas***	2021
Echinopsis	***chalaensis***	2021
Echinopsis	***chrysantha***	2010
Echinopsis	***chrysochete***	2013
Echinopsis	***cinnabarina***	2021
Echinopsis	***decumbens***	2021
Echinopsis	*fallax*	2010
Echinopsis	***ferox***	2010
Echinopsis	***formosa***	2010
Echinopsis	***guentheri***	2013
Echinopsis	***haematantha***	2013
Echinopsis	***haynei***	2021
Echinopsis	***hempeliana***	2013
Echinopsis	***hennigiana***	2021
Echinopsis	***histrix***	2021
Echinopsis	***horstii***	2013
Echinopsis	***huascha***	2013
Echinopsis	***kieslingii***	2013
Echinopsis	***korethroides***	2010
Echinopsis	***laniceps***	2021
Echinopsis	***lateritia***	2013
Echinopsis	***leucantha***	2010

Echinopsis	***leucotricha***	2013
Echinopsis	***mamillosa***	2013
Echinopsis	***marsoneri***	2021
Echinopsis	***martinii***	2021
Echinopsis	***maytana***	2021
Echinopsis	***melanostele***	2021
Echinopsis	***micropetala***	2021
Echinopsis	***mirabilis***	2013
Echinopsis	***nothochilensis***	2013
Echinopsis	***nothohyalacantha***	2013
Echinopsis	*nothostrausii*	2013
Echinopsis	***obrepanda***	2013
Echinopsis	***oxygona***	2010
Echinopsis	***pachanoi***	2021
Echinopsis	***pamparuizii***	2021
Echinopsis	***parviflora***	2013
Echinopsis	***pasacana***	2010
Echinopsis	***platinospina***	2013
Echinopsis	***pomanensis***	2013
Echinopsis	***pseudomelanostele***	2021
Echinopsis	***pugionacantha***	2013
Echinopsis	***quadratiumbonata***	2013
Echinopsis	***randallii***	2013
Echinopsis	***rauhii***	2021
Echinopsis	***rhodacantha***	2013
Echinopsis	*rhodotricha*	2013
Echinopsis	***rojasii***	2010
Echinopsis	***rondoniana***	2021

Echinopsis	***rowleyi***	2021
Echinopsis	***samaipatana***	2013
Echinopsis	***santacruzensis***	2013
Echinopsis	***schickendantzii***	2013
Echinopsis	***sextoniana***	2021
Echinopsis	***smaragdiflora***	2021
Echinopsis	***spiniflora***	2010
Echinopsis	***stilowiana***	2013
Echinopsis	***strausii***	2021
Echinopsis	***strigosa***	2013
Echinopsis	***tacaquirensis***	2010
Echinopsis	***tarijensis***	2010
Echinopsis	***terscheckii***	2010
Echinopsis	***tetracantha***	2013
Echinopsis	***thelegona***	2013
Echinopsis	***thionantha***	2010
Echinopsis	***tominensis***	2013
Echinopsis	***trollii***	2013
Echinopsis	***urbis-regum***	2021
Echinopsis	***volliana***	2021
Echinopsis	***weberbaueri***	2013
Echinopsis	***werdermanniana***	2013
Eriosyce	***bulbocalyx***	2010
Eriosyce	***islayensis***	2021
Eriosyce	***strausiana***	2010
Eriosyce	***umadeave***	2010
Espostoopsis	***dybowskii***	2021
Eulychnia	***iquiquensis***	2010

Facheiroa	***cephaliomelana***	2021
Facheiroa	***estevesii***	2021
Facheiroa	***squamosa***	2021
Frailea	***cataphracta***	2013
Frailea	***chiquitana***	2013
Frailea	***concepcionensis***	2013
Frailea	***fulviseta***	2013
Frailea	***gracillima***	2010
Frailea	*horstii*	2010
Frailea	***mammifera***	2013
Frailea	***phaeodisca***	2010
Frailea	***pumila***	2010
Frailea	***pygmaea***	2010
Frailea	***schilinzkyana***	2010
Gymnocalycium	***alboareolatum***	2021
Gymnocalycium	***andreae***	2021
Gymnocalycium	***anisitsii***	2013
Gymnocalycium	***baldianum***	2010
Gymnocalycium	***bayrianum***	2021
Gymnocalycium	***bodenbenderianum***	2013
Gymnocalycium	***borthii***	2021
Gymnocalycium	***bruchii***	2021
Gymnocalycium	***buenekeri***	2013
Gymnocalycium	***calochlorum***	2021
Gymnocalycium	***capillaense***	2013
Gymnocalycium	***cardenasianum***	2013
Gymnocalycium	***castellanosii***	2013
Gymnocalycium	***chiquitanum***	2013

Gymnocalycium	***denudatum***	2010
Gymnocalycium	***eurypleurum***	2013
Gymnocalycium	***ferrarii***	2013
Gymnocalycium	***fisheri***	2021
Gymnocalycium	***glaucum***	2021
Gymnocalycium	***horridispinum***	2021
Gymnocalycium	***horstii***	2013
Gymnocalycium	***hossei***	2021
Gymnocalycium	***kieslingii***	2021
Gymnocalycium	***marsoneri***	2013
Gymnocalycium	***megatae***	2013
Gymnocalycium	***mesopotamicum***	2021
Gymnocalycium	***mihanovichii***	2010
Gymnocalycium	***monvillei***	2010
Gymnocalycium	***mostii***	2013
Gymnocalycium	***nigriareolatum***	2010
Gymnocalycium	***oenanthemum***	2021
Gymnocalycium	***paediophilum***	2013
Gymnocalycium	***paraguayense***	2010
Gymnocalycium	***pflanzii***	2010
Gymnocalycium	*pugionacanthum*	2013
Gymnocalycium	***reductum***	2021
Gymnocalycium	*rhodantherum*	2013
Gymnocalycium	***ritterianum***	2021
Gymnocalycium	***robustum***	2013
Gymnocalycium	***saglionis***	2010
Gymnocalycium	***schickendantzii***	2013
Gymnocalycium	***schroederianum***	2021

Gymnocalycium	***spegazzinii***	2010
Gymnocalycium	***stellatum***	2010
Gymnocalycium	***stenopleurum***	2010
Gymnocalycium	***uebelmannianum***	2021
Gymnocalycium	***uruguayense***	2010
Gymnocalycium	*zegarrae*	2010
Haageocereus	*chilensis*	2010
Haageocereus	*platinospinus*	2010
Harrisia	*tetracantha*	2010
Hylocereus	***setaceus***	2013
Hylocereus	***undatus***	2021
Lagenosocereus	***luetzelburgii***	2021
Lepismium	***cruciforme***	2013
Lepismium	***lumbricoides***	2013
Maihuenia	***patagonica***	2010
Maihuenia	***poeppigii***	2010
Maihueniopsis	***glomerata***	2010
Maihueniopsis	***molfinoi***	2021
Melocactus	*amethystinus*	2010
Melocactus	***bahiensis***	2021
Melocactus	***ernestii***	2010
Melocactus	***levitestatus***	2021
Melocactus	***peruvianus***	2021
Melocactus	***violaceus***	2021
Melocactus	***zehntneri***	2021
Micranthocereus	***auriazureus***	2010
Micranthocereus	***purpureus***	2021
Micranthocereus	***violaciflorus***	2010

Neoraimondia	***arequipensis***	2010
Neoraimondia	***herzogiana***	2010
Opuntia	***aurantiaca***	2013
Opuntia	***discolor***	2010
Opuntia	***elata***	2010
Opuntia	***ficus-indica***	2013
Opuntia	***megapotamica***	2021
Opuntia	***monacantha***	2021
Opuntia	*prasina*	2013
Opuntia	***pubescens***	2021
Opuntia	***quimilo***	2013
Opuntia	***retrorsa***	2010
Opuntia	***rioplatense***	2021
Opuntia	***salmiana***	2013
Opuntia	*schickendantzii*	2013
Opuntia	***stenarthra***	2013
Opuntia	***stricta***	2021
Opuntia	***sulphurea***	2013
Oreocereus	*celsianus*	2010
Oreocereus	*hempelianus*	2010
Oreocereus	*leucotrichus*	2010
Oreocereus	*trollii*	2010
Parodia	***alacriportana***	2013
Parodia	***allosiphon***	2013
Parodia	*arnostiana*	2013
Parodia	***aureicentra***	2013
Parodia	***ayopayana***	2021
Parodia	***buiningii***	2010

Parodia	***calvescens***	2013
Parodia	***carambeiensis***	2010
Parodia	***chrysacanthion***	2010
Parodia	***claviceps***	2010
Parodia	***columnaris***	2013
Parodia	***comarapana***	2021
Parodia	***commutans***	2013
Parodia	***concinna***	2013
Parodia	***crassigibba***	2010
Parodia	***erinacea***	2010
Parodia	***fusca***	2013
Parodia	***gaucha***	2021
Parodia	***haselbergii***	2010
Parodia	***hausteiniana***	2021
Parodia	***hegeri***	2021
Parodia	***herteri***	2010
Parodia	***horrida***	2010
Parodia	***horstii***	2010
Parodia	***ibicuiensis***	2021
Parodia	***langsdorfii***	2010
Parodia	*leninghausii*	2010
Parodia	***lenninghausii***	2013
Parodia	***linkii***	2010
Parodia	***maassii***	2010
Parodia	***magnifica***	2010
Parodia	***mairanana***	2021
Parodia	***maldonadensis***	2013
Parodia	***mammulosa***	2010

Parodia	***microsperma***	2010
Parodia	***mueller-melchersii***	2010
Parodia	***muricata***	2013
Parodia	*neoarechavaletae*	2010
Parodia	***neobuenekeri***	2010
Parodia	***neohorstii***	2010
Parodia	***nigrispina***	2010
Parodia	***nivosa***	2010
Parodia	***nothorauschii***	2013
Parodia	***ocampoi***	2021
Parodia	***otaviana***	2013
Parodia	***ottonis***	2010
Parodia	***oxycostata***	2013
Parodia	*penicillata*	2010
Parodia	***prestoensis***	2021
Parodia	***procera***	2021
Parodia	***rechensis***	2013
Parodia	***ritteri***	2013
Parodia	***schumanniana***	2010
Parodia	***schwebsiana***	2021
Parodia	***scopa***	2010
Parodia	***stockingeri***	2021
Parodia	***stuemeri***	2010
Parodia	***subterranea***	2013
Parodia	***taratensis***	2021
Parodia	***tenuicylindrica***	2013
Parodia	***tuberculata***	2021
Parodia	*turbinata*	2010

Parodia	***warasii***	2010
Parodia	***werdermanniana***	2010
Pereskia	***bahiensis***	2021
Pfeiffera	***ianthothele***	2013
Pierrebraunia	***bahiensis***	2021
Pilosocereus	***aurisetus***	2010
Pilosocereus	***catingicola***	2021
Pilosocereus	*crassisepalus*	2010
Pilosocereus	***fulvilanatus***	2010
Pilosocereus	***gounellei***	2021
Pilosocereus	*jauruensis*	2013
Pilosocereus	*laniflorus*	2010
Pilosocereus	***magnificus***	2010
Pilosocereus	*minensis*	2010
Pilosocereus	***pachycladus***	2010
Pilosocereus	***pentaedrophorus***	2021
Pilosocereus	***zehntneri***	2021
Pterocactus	***tuberosus***	2010
Quiabentia	***verticillata***	2010
Quiabentia	***zehntneri***	2021
Rebutia	***deminuta***	2013
Rebutia	***fabrisii***	2013
Rebutia	***fiebrigii***	2013
Rebutia	***minuscula***	2010
Rebutia	***pygmaea***	2010
Rebutia	***robustispina***	2013
Rebutia	***steinmannii***	2021
Rhipsalis	***floccosa***	2021

Rhipsalis	***shaferi***	2013
Stetsonia	***coryne***	2010
Tacinga	***estevesii***	2021
Tacinga	***inamoena***	2010
Tacinga	***palmadora***	2021
Tacinga	***saxatilis***	2021
Tephrocactus	***alexanderi***	2010
Tephrocactus	***articulatus***	2010
Tephrocactus	***molinensis***	2010
Tephrocactus	***verschaffeltii***	2021
Tephrocactus	***weberi***	2010
Tunilla	***corrugata***	2013
Tunilla	***erectoclada***	2021
Tunilla	***soehrensii***	2013
Uebelmannia	***buiningii***	2021
Uebelmannia	***gummifera***	2010
Uebelmannia	***horrida***	2010
Uebelmannia	***meninensis***	2010
Uebelmannia	***pectinifera***	2010
Weberbauerocereus	*weberbaueri*	2010
Weingartia	***cintiensis***	2021
Weingartia	***fidana***	2010
Weingartia	***neocumingii***	2021
Weingartia	***rauschii***	2021
Weingartia	***steinbachii***	2021

06. cactusinhabitat booklet South America 2011/2013, addenda and corrigenda

Page 15, line 16: *for* ancesty *read* ancestry

Page 24, line 2: for *Acanthocereus* read *Arthrocereus*

Pages 32-33 (Summary and conclusions), *between* the third and the fourth point *insert the following entries*:

• For higher taxa, we can attempt to reconstruct the steps in the series of transformations linking current species groups to their extinct ancestors using Hennig's system (ibid., 89), based on symplesiomorphies/synapomorphies (ancestral characters/derived characters), through the most probable interpretative hypothesis of the data.

• According to Hennig: "... there is no simple and absolutely dependable criterion for deciding whether corresponding characters in different species are based on synapomophy." (ibid., 128). The interpretation of synapomorphies is a problem of intuitive nature.

Page 55, line 19: *for* 2005 *read* 2006

Page 59, line 1: *for* east *read* west

Page 62, line 20: *for* 1983 *read* 1982

Page 68, lines 5-6: *delete* ; 2005; 2011 *after* 363

Page 75, line 21: *for* 2009 *read* 2003

Page 76, line 21: *for* 1999 *read* 1999a

Page 80, line 8: *for* 50-74 *read* 59-83

Page 80, line 9: *for* 50-53 *read* 59-62

Page 80, line 10: *for* 59-61 *read* 68-70

Page 80, line 11: *for* 62-65 *read* 71-74

Page 80, line 12: *for* 69-70 *read* 78-79

Page 82, line 23, 24, 25 (twice): *for* 376 *read* 380

Page 83, line 13: *for* A&M 376, photos 01-11 *read* A&M 380, photos 03-11

Page 118, *between* Charles, G. & Meregalli, M. 2008. … *and* Charles, G. 2009. … *insert*

Charles, G. 2005. *Gymnocalycium*. In: Hunt, D. R. & Taylor, N., Notulae Systematicae Lexicon Cactacearum Spectantes VI. Cactaceae Systematics Initiatives 20: 17-18.

Page 119, line 15: *for* The Genera of Cactaceae *read* The genera of the Cactaceae

Pages 120-121, *between* Lowry, M. 2005. … *and* Mace, T. 1978. … *insert* Lowry, M. 2012. NCL updates etc. *Parodia*. On the identity of *Parodia mairanana* Card. Cactaceae Systematics Initiatives 28: 26-27.

Page 121, line 1: *for* 1978 *read* 1975

Page 123, *between* Taylor, N. P. 2007. … *and* Till, H. 2002. … *insert* Taylor, N. P. 2008. Notes on *Opuntia* from the Rio Grande basin, Bolivia. Cactaceae Systematics Initiatives 23: 23-25.

07. cactusinhabitat.org 2013 (website data) updates, addenda and corrigenda

***Armatocereus matucanensis* Backeberg ex A. W. Hill 1938**

synonyms added: *Armatocereus riomajensis*

***Austrocylindropuntia subulata* (Mühlenpfordt) Backeberg 1942** assimilates

***Austrocylindropuntia exaltata* (A. Berger) Backeberg 1941**

synonyms added: *Austrocylindropuntia exaltata, Cylindropuntia exaltata*, *Maihueniopsis exaltata*, *Opuntia exaltata*, *Austrocylindropuntia subulata* ssp. *exaltata*

surveys added: Perù, Arequipa, Cabanaconde, Cruz del Condor, 3800 m, 2007-06-02, A&M 215 (transferred from *Austrocylindropuntia exaltata*)

note added: in cactusinhabitat.org 2010 and 2013, the A&M 215, now identified with *A. subulata*, was attributed to *Austrocylindropuntia exaltata* (A. Berger) Backeberg. The latter taxon is now considered a synonym of the first.

February 2021

***Brasiliopuntia schickendantzii* (F. A. C. Weber) R. Puente & Majure 2014** replace

***Opuntia schickendantzii* F. A. C. Weber 1898**

synonyms added: *Opuntia schickendantzii*

note added: in cactusinhabitat.org 2013, the A&M 516 and A&M 521, now identified with *B. schickendantzii*, were attributed to *Opuntia schickendantzii* F. A. C. Weber.

February 2021

***Cereus crassisepalus* Buining & Brederoo 1973** replace

***Pilosocereus crassisepalus* (Buining & Brederoo) Anceschi & Magli 2010**

synonyms added: *Pilosocereus crassisepalus*

note added: in cactusinhabitat.org 2010 and 2013, the A&M 309, A&M 311 and A&M 313, now identified with *C. crassisepalus*, were attributed to *Pilosocereus crassisepalus* (Buining & Brederoo) Anceschi & Magli.

June 2021

***Cereus euchlorus* F. A. C. Weber ex K. Schumann 1897**

distribution, added: Paraguay (Amambay, Itapuà)

note added: In the cactusinhabitat edition 2013, the *Cereus* population of P. N. Cerro Corá, Dept. Amambay, Paraguay (2011-08-18, A&M 727, photos 8-19), now identified with *Cereus euchlorus,* was incorrectly attributed to *Pilosocereus jauruensis* (Buining & Brederoo) P. J. Braun.

July 2014

surveys added: Paraguay, Dept. Amambay, P. N. Cerro Corá, 2011-08-18, A&M 727

***Cereus laniflorus* (N. P. Taylor & Zappi) Anceschi & Magli 2021** replace ***Pilosocereus laniflorus* (N. P. Taylor & Zappi) P. J. Braun & Esteves 2001**

synonyms added: *Pilosocereus laniflorus*

note added: in cactusinhabitat.org 2010 and 2013, the A&M 297 and A&M 298, now identified with *C. laniflorus*, were attributed to *Pilosocereus laniflorus* (N. P. Taylor & Zappi) P. J. Braun & Esteves.

June 2021

***Cereus minensis* Werdermann 1933** replace ***Pilosocereus minensis* (Werdermann) Byles & G. D. Rowley 1957**

synonyms added: *Pilosocereus minensis*

note added: in cactusinhabitat.org 2010 and 2013, the A&M 300, A&M 303, A&M 331, A&M 339 and A&M 343, now identified with *C. minensis*, were attributed to *Pilosocereus minensis* (Werdermann) Byles & G. D. Rowley.

June 2021

Cipocereus transferred from **Pilosocereus** to **Cereus**

***Cumulopuntia boliviana* (Salm-Dyck) F. Ritter 1980**

distribution, added: Tucumán

***Cumulopuntia sphaerica* (Förster) E. F. Anderson 1999**

synonyms added: *Cumulopuntia leucophaea*, *Cumulopuntia mistiensis*, *Tephrocactus mistiensis, Sphaeropuntia sphaerica*

synonyms removed: *Cumulopuntia ignota*, *Opuntia ignota*, *Tephrocactus ignotus*

***Discocactus hartmannii* (K. Schumann) Britton & Rose 1922**

synonyms added: *Discocactus silicicola*

Echinopsis bridgesii **Salm-Dyck 1850**

synonyms added: *Echinopsis ayopayana*, *Echinopsis kladiwana*, *Echinopsis krahn-juckeri*

distribution, added: Potosí

conservation status: replaced (3) Least Concern, LC **with** (4) Least Concern, LC

Echinopsis buchtienii **(Backeberg) Anceschi & Magli 2013**

synonyms added: *Cleistocactus areolatus* sensu Werdermann, *Cleistocactus ayopayanus*

synonyms removed: *Cleistocactus palhuayensis*, *Cephalocleistocactus pallidus*, *Cleistocactus viridiflorus*

synonyms transferred to *Echinopsis nothohyalacantha*: *Cleistocactus tupizensis* sensu Backeberg

distribution, added: La Paz

distribution, removed: Chuquisaca, Potosí, Santa Cruz, Tarija

conservation status: replaced (3) Least Concern, LC **with** (4) Least Concern, LC

surveys transferred to *Echinopsis nothohyalacantha*: Bolivia, Potosí, Tupiza, Puerta del Diablo, 3000 m, 2007-03-28, A&M 186; Bolivia, Tarija, Quebrada de Paicho Sur, 2011-06-29, A&M 564; Bolivia, Chuquisaca, Culpina, Loc. Santa Rosa, 2011-06-30, A&M 575; Bolivia, Chuquisaca, road to Culpina, 2011-06-30, A&M 581; Bolivia, Chuquisaca, Culpina, Com. Sajlina, 2011-06-30, A&M 585; Bolivia, Tarija, between Tomayapo and Carmen del Obispo, 2011-07-02, A&M 608

Echinopsis candelilla **(Cárdenas) Anceschi & Magli 2013**

synonyms added: *Cleistocactus muyurinensis*, *Cleistocactus piraymirensis*, *Seticleistocactus piraymirensis*, *Cleistocactus candelilla* ssp. *piraymirensis*, *Cleistocactus candelilla* var. *pojoensis*

synonyms removed: *Cleistocactus dependens*, *Seticleistocactus dependens*

Echinopsis chrysochete **Werdermann 1936**

synonyms added: *Lobivia tenuispina*

Echinopsis formosa **(Pfeiffer) Salm-Dyck 1850**

synonyms added: *Lobivia rosarioana*, *Echinopsis formosa* ssp. *rosarioana*

Echinopsis nothohyalacantha **Anceschi & Magli 2013**

synonyms added: *Cleistocactus tupizensis* sensu Backeberg (transferred from *Echinopsis buchtienii*)

distribution, added: Cochabamba

surveys added: Bolivia, Potosí, Tupiza, Puerta del Diablo, 3000 m, 2007-03-28, A&M 186 (transferred from *Echinopsis buchtienii*); Bolivia, Tarija, Quebrada de Paicho Sur, 2011-06-29, A&M 564 (transferred from *Echinopsis buchtienii*); Bolivia, Chuquisaca, Culpina, Loc. Santa Rosa, 2011-06-30, A&M 575 (transferred from *Echinopsis buchtienii*); Bolivia, Chuquisaca, road to Culpina, 2011-06-30, A&M 581 (transferred from *Echinopsis buchtienii*); Bolivia, Chuquisaca, Culpina, Com. Sajlina, 2011-06-30, A&M 585 (transferred from *Echinopsis buchtienii*); Bolivia, Tarija, between Tomayapo and Carmen del Obispo, 2011-07-02, A&M 608 (transferred from *Echinopsis buchtienii*)

note added: in cactusinhabitat.org 2010 and 2013, the A&M 186, A&M 564, A&M 575, A&M 581, A&M 585 and A&M 608, now identified with *Echinopsis nothohyalacantha* (*tupizensis populations*), were incorrectly attributed to *Echinopsis buchtienii* (Backeberg) Anceschi & Magli.

February 2021

Echinopsis samaipatana **(Cárdenas) Anceschi & Magli 2013**

synonyms added: *Cleistocactus samaipatanus* ssp. *divi-miseratus*, *Bolivicereus samaipatanus* var. *divi-miseratus*, *Borzicactus samaipatanus* var. *divi-miseratus*

synonyms removed: *Akersia roseiflora*

Echinopsis strausii **(Heese) Anceschi & Magli 2021** replace

Echinopsis nothostrausii **Anceschi & Magli 2013**

synonyms added: *Demnosa strausii*, *Echinopsis nothostrausii*, *Cephalocereus straussii*

Echinopsis tarijensis **(Vaupel) H. Friedrich & G. D. Rowley 1974**

distribution, added: Chuquisaca

Echinopsis tominensis **(Weingart) Anceschi & Magli 2013**

synonyms removed: *Cleistocactus capadalensis*

synonyms transferred to *Echinopsis micropetala*: *Cleistocactus clavicaulis*, *Cleistocactus crassicaulis*, *Cleistocactus viridialabastri*

distribution, added: Cochabamba, Potosí, Santa Cruz

distribution, removed: Tarija

surveys transferred to *Echinopsis micropetala*: Bolivia, Tarija, between Palos Blancos and Villamontes, 2011-07-12, A&M 651

***Eriosyce strausiana* (K. Schumann) Kattermann 1994**

synonyms removed: *Eriosyce andreaeana*, *Neochilenia andreaeana*, *Neoporteria andreaeana*, *Acanthocalycium andreaeanum*

***Frailea pygmaea* (Spegazzini) Britton & Rose 1922**

distribution, added: Brazil (Rio Grande do Sul)

***Gymnocalycium bodenbenderianum* (Hosseus ex A. Berger) A. W. Hill 1933**

note added: in cactusinhabitat.org 2013, the A&M 427, now identified with *G. bodenbenderianum*, was incorrectly attributed to *Gymnocalycium glaucum* F. Ritter. September 2018

surveys added: Argentina, Catamarca, Cerro Negro, 2011-04-04, A&M 427 (transferred from *Gymnocalycium glaucum*)

***Gymnocalycium denudatum* (Link & Otto) Mittler 1844**

synonyms added: *Gymnocalycium angelae*, *Gymnocalycium denudatum* ssp. *angelae*

***Gymnocalycium glaucum* F. Ritter 1963**

surveys added: Argentina, Catamarca, between Copacabana and Tinogasta, 1995, BKS 131, photo Bernhard Schweitzer

surveys transferred to *Gymnocalycium bodenbenderianum*: Argentina, Catamarca, Cerro Negro, 2011-04-04, A&M 427

***Gymnocalycium mostii* (Gürke) Britton & Rose 1918**

synonyms added: *Gymnocalycium valnicekianum* var. *bicolor*, *Gymnocalycium prochazkianum* ssp. *prochazkianum*, *Gymnocalycium valnicekianum* ssp. *prochazkianum*, *Gymnocalycium prochazkianum* ssp. *simile*, *Gymnocalycium prochazkianum* ssp. *simplex*, *Gymnocalycium valnicekianum* ssp. *valnicekianum*

***Gymnocalycium nigriareolatum* Backeberg 1934** assimilates

***Gymnocalycium pugionacanthum* Backeberg ex H. Till 1987**

synonyms added: *Gymnocalycium catamarcense* ssp. *acinacispinum*, *Gymnocalycium catamarcense*, *Gymnocalycium pugionacanthum*, *Gymnocalycium catamarcense* ssp. *schmidianum*

conservation status: replaced (3) Least Concern, LC **with** (4) Least Concern, LC

surveys added: Argentina, Catamarca, Belén, Cerro de la Virgen, 2011-04-11, A&M 434 (transferred from *Gymnocalycium pugionacanthum*); Argentina, Catamarca, Belén, Cerro de la Cruz, 2011-04-11, A&M 436 (transferred from *Gymnocalycium pugionacanthum*); Argentina, Catamarca, Belén, La Puntilla, 2011-04-12, A&M 438 (transferred from *Gymnocalycium pugionacanthum*); Argentina, Catamarca, Belén, La Cienaga de Abajo, 2011-04-13, A&M 441 (transferred from *Gymnocalycium pugionacanthum*); Argentina, Catamarca, Belén, La Cienaga de Abajo, 2011-04-13, A&M 445 (transferred from *Gymnocalycium pugionacanthum*); Argentina, Catamarca, Hualfín, 2011-04-16, A&M 449 (transferred from *Gymnocalycium pugionacanthum*)

note added: in cactusinhabitat.org 2013, the A&M 434, A&M 436, A&M 438, A&M 441, A&M 445 and A&M 449, now identified with *G. nigriareolatum*, were attributed to *Gymnocalycium pugionacanthum* Backeberg ex H. Till.

June 2021

***Gymnocalycium stenopleurum* F. Ritter 1979**

synonyms added: *Gymnocalycium friedrichii* ssp. *stenopleurum*

Maihueniopsis glomerata (Haworth) R. Kiesling 1984

synonyms removed: *Maihueniopsis albomarginata*, *Maihueniopsis atacamensis*, *Opuntia atacamensis*, *Tephrocactus atacamensis*, *Pseudotephrocactus atacamensis*, *Maihueniopsis camachoi*, *Opuntia camachoi*, *Tephrocactus camachoi*, *Maihueniopsis colorea*, *Opuntia colorea*, *Tephrocactus coloreus*, *Maihueniopsis crassispina*, *Opuntia crassispina*, *Maihueniopsis domeykoensis*, *Opuntia domeykoensis*, *Maihueniopsis grandiflora*, *Maihueniopsis leptoclada*, *Maihueniopsis neuquensis*, *Opuntia neuquensis*, *Tephrocactus neuquensis*, *Maihueniopsis ovallei*, *Opuntia ovallei*, *Tephrocactus ovallei*, *Maihueniopsis ovata*, *Opuntia ovata*, *Pseudotephrocactus ovata*, *Tephrocactus ovatus*, *Opuntia reicheana*, *Tephrocactus reicheanus*, *Maihueniopsis tarapacana*, *Opuntia tarapacana*, *Tephrocactus tarapacanus*, *Maihueniopsis wagenknechtii*, *Opuntia wagenknechtii*

distribution, removed: Catamarca, La Rioja, Salta; (from the II Región de Antofagasta to the Región Metropolitana)

distribution, added: ? after Chile

***Melocactus bahiensis* (Britton & Rose) Lützelburg 1923** assimilates

***Melocactus amethystinus* Buining & Brederoo 1972**

synonyms added: *Melocactus amethystinus*, *Melocactus bahiensis* ssp. *amethystinus*, *Melocactus ammotrophus*, *Melocactus gluxianus*, *Melocactus griseoloviridis*, *Melocactus lensselinkianus*

distribution, added: Pernambuco

conservation status: replaced (2) Least Concern, LC with (1) Least Concern, LC

surveys added: Brazil, Minas Gerais, Itaobim, 1 km west of town on the north side of Rio Jequitinhonha, 2009-04-19, A&M 315 (Taylor & Zappi in Harley 25526; Horst 381) (transferred from *Melocactus amethystinus*); Brazil, Minas Gerais, Itinga, BR 367, east of town, 2009-04-20, A&M 324 (transferred from *Melocactus amethystinus*); Brazil, Minas Gerais, Grão Mogol, Trilha do Vau, 2009-04-29, A&M 342 (transferred from *Melocactus amethystinus*)

note added: in cactusinhabitat.org 2010 and 2013, the A&M 315, A&M 324 and A&M 342, now identified with *M. bahiensis*, were attributed to *Melocactus amethystinus* Buining & Brederoo.

June 2021

***Melocactus ernestii* Vaupel 1920**

distribution, added: Rio Grande do Norte

***Opuntia elata* Salm-Dyck 1834**

surveys added: Paraguay, Dept. Concepción, Concepción, San Alfredo, 2011-08-25, A&M 731 (transferred from *Opuntia ficus-indica*)

note added: In cactusinhabitat.org 2013, the A&M 731, now identified with *Opuntia elata*, was incorrectly attributed to *Opuntia ficus-indica* (Linnaeus) P. Miller.

February 2020

***Opuntia ficus-indica* (Linnaeus) P. Miller 1768**

surveys transferred to *Opuntia elata*: Paraguay, Dept. Concepción, Concepción, San Alfredo, 2011-08-25, A&M 731

surveys transferred to *Opuntia sulphurea*: Argentina, Córdoba, Capilla del Monte, road to los Mogotes, 2011-03-11, A&M 358; Argentina, Córdoba, Capilla del Monte, Dique el Cajón, 2011-03-18, A&M 371; Bolivia, Tarija, Tarija, Loc. Ventolera, 2011-06-03, A&M 531

***Opuntia megapotamica* Arechavaleta 1905** assimilates

***Opuntia prasina* Spegazzini 1925**

synonyms added: *Opuntia prasina*

surveys added: Argentina, Córdoba, Capilla del Monte, north of the Balneario, 2011-03-10, A&M 353 (transferred from *Opuntia prasina*); Argentina, Córdoba, Capilla del Monte, Paseo La Toma, 2011-03-12, A&M 364 (transferred from *Opuntia prasina*)

note added: in cactusinhabitat.org 2013, the A&M 353 and A&M 364, now identified with *O. megapotamica*, were attributed to *Opuntia prasina* Spegazzini.

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***Opuntia salmiana* Parmentier ex Pfeiffer 1837**

distribution, added: Tarija

***Opuntia schickendantzii* F. A. C. Weber 1898**

distribution, added: Chuquisaca

***Opuntia stenarthra* K. Schumann 1899**

synonyms added: *Opuntia roborensis*

distribution, added: Bolivia (Santa Cruz)

***Opuntia sulphurea* Gillies ex Salm-Dyck 1834** replace

***Opuntia sulphurea* G. Don ex London 1830**

synonyms added: *Opuntia brunescens*, *Opuntia hildemannii*, *Platyopuntia hildemannii*, *Opuntia maculacantha*, *Platyopuntia maculacantha*, *Opuntia sericea*, *Opuntia spinibarbis*

surveys added: Argentina, Córdoba, Capilla del Monte, road to los Mogotes, 2011-03-11, A&M 358 (transferred from *Opuntia ficus-indica*); Argentina, Córdoba, Capilla del Monte, Dique el Cajón, 2011-03-18, A&M 371 (transferred from *Opuntia ficus-indica*); Bolivia, Tarija, Tarija, Loc. Ventolera, 2011-06-03, A&M 531 (transferred from *Opuntia ficus-indica*)

note added: In cactusinhabitat.org 2013, the A&M 358, A&M 371 and A&M 531, now identified with *O. sulphurea*, were incorrectly attributed to *Opuntia ficus-indica* (Linnaeus) P. Miller.

February 2020

***Parodia alacriportana* Backeberg & Voll 1949**

synonyms added: *Brasilicactus alacriportanu*s, *Brasilicactus brevihamatus*, *Brasilicactus buenekeri*, *Brasilicactus catarinensis*

Parodia allosiphon **(Marchesi) N. P. Taylor 1987**

synonyms added: *Ritterocactus allosiphon*

Parodia aureicentra **Backeberg 1934**

synonyms added: *Bolivicactus aureicentrus*

synonyms removed: *Echinocactus aureicentrus*

Parodia buiningii **(Buxbaum) N. P. Taylor 1987**

synonyms added: *Ritterocactus buiningii*

distribution, added: (Artigas, Rivera, Salto)

conservation status: replaced (3) Near Threatened, NT **with** (1) Critically Endangered, CR A4ac

Parodia calvescens **(N. Gerloff & A. D. Nilson) Anceschi & Magli 2012**

synonyms added: *Parodia turbinata* ssp. *calvescens*, *Wigginsia turbinata* ssp. *calvescens*

Parodia carambeiensis **(Buining & Brederoo) Hofacker 1998**

synonyms added: *Peronocactus carambeiensis*

Parodia chrysacanthion **(K. Schumann) Backeberg 1935**

synonyms added: *Bolivicactus saint-pieanus*

conservation status: replaced (3) Vulnerable, VU D2 **with** (1) Least Concern, LC

Parodia claviceps **(F. Ritter) F. H. Brandt 1982**

synonyms added: *Eriocephala claviceps*, *Eriocephala schumanniana* ssp. *claviceps*, *Eriocactus schumannianus* ssp. *claviceps*, *Notocactus schumannianus* ssp. *claviceps*

conservation status: replaced (3) Vulnerable, VU D2 **with** (4) Endangered, EN B1ab(ii,iii); 2ab(ii,iii)

Parodia columnaris **Cárdenas 1951**

synonyms added: *Bolivicactus columnaris*, *Parodia echinopsoides*

distribution, added: Chuquisaca

Parodia commutans **F. Ritter 1964**

synonyms added: *Bolivicactus commutans*

distribution, added: Potosí

conservation status: replaced (4) Least Concern, LC **with** (1) Least Concern, LC

surveys transferred to *Parodia subterranea*: Bolivia, Tarija, Quebrada de Paicho sur, 2011-07-02, A&M 600a

Parodia concinna **(Monville) N. P. Taylor 1987**

synonyms added: *Peronocactus concinnus*, *Notocactus concinnus* ssp. *agnetae*, *Peronocactus concinnus* ssp. *agnetae*, *Malacocarpus apricus*, *Notocactus tabularis* ssp. *bommeljei*, *Malacocarpus caespitosus*, *Notocactus concinnus* ssp. *multicostatus*, *Peronocactus concinnus* ssp. *multicostatus*, *Peronocactus tabularis*

synonyms removed: *Notocactus blaauwianus* var. *enormis*

conservation status: replaced (3) Least Concern, LC **with** (1) Vulnerable, VU A4acd

Parodia crassigibba **(F. Ritter) N. P. Taylor 1987**

synonyms added: *Ritterocactus crassigibbus*, *Ritterocactus meonacanthus*, *Notocactus uebelmannianus* ssp. *pleiocephalus*, *Ritterocactus uebelmannianus* ssp. *pleiocephalus*, *Ritterocactus uebelmannianus*

conservation status: replaced (3) Vulnerable, VU D2 **with** (1) Critically Endangered, CR A2ac

Parodia curvispina **(F. Ritter) D. R. Hunt 1997** replace

Parodia arnostiana **(Lisal & Kolarik) Hofacker**

synonyms added: *Notocactus curvispinus**, *Ritterocactus curvispinus*, *Parodia arnostiana*, *Ritterocactus arnostianus*, *Notocactus cristatoides* (transferred from *Parodia mammulosa*), *Notocactus rubropedatus* (transferred from *Parodia mueller-melchersii*), *Notocactus vilanovensis*

* Basionym

synonyms transferred to *Parodia mammulosa*: *Notocactus ritterianus*

conservation status: replaced (3) Vulnerable, VU D2 **with** (4) Data Deficient, DD

comments added: in cactusinhabitat.org 2013, the A&M 803 and A&M 805, now identified with *P. curvispina*, were attributed to *Parodia arnostiana* (Lisal & Kolarik) Hofacker. In our recent synopsis of the genus *Parodia* Spegazzini s.l. (Anceschi & Magli 2018: 36, 70-161), the latter taxon is considered a synonym of the first (ibidem, 93).

September 2018

Parodia erinacea **(Haworth) N. P. Taylor 1987**

synonyms added: *Notocactus beltranii*, *Wigginsia beltranii*, *Malacocarpus bezrucii*, *Notocactus bezrucii*, *Wigginsia bezrucii*, *Malacocarpus martinii*, *Wigginsia pauciareolata*, *Malacocarpus rubricostatus*, *Malacocarpus tetracanthus*

synonyms removed: *Wigginsia macracantha*, *Malacocarpus macracanthus*, *Notocactus macracanthus*, *Echinocactus sellowi* var. *macracanthus*, *Parodia paucicostata*

distribution, added: Corrientes, Santiago del Estero, (Bogotá)

Parodia fusca **(F. Ritter) Hofacker & P. J. Braun 1998**

synonyms added: *Peronocactus fuscus*, *Ritterocactus fuscus*, *Notocactus gerloffii*

conservation status: replaced (3) Vulnerable, VU D2 **with** (1) Vulnerable, VU A4ac

Parodia haselbergii **(Haage ex Rümpler) F. H. Brandt 1982**

synonyms added: *Acanthocephala haselbergii*, *Sericocactus haselbergii*, *Acanthocephala graessneri*, *Dactylanthocactus graessneri*

synonyms removed: *Parodia haselbergii* ssp. *haselbergii*

distribution, added: Santa Catarina

conservation status: replaced (3) Vulnerable, VU D2 **with** (1) Vulnerable, VU A4ac

Parodia herteri **(Werdermann) N. P. Taylor 1987**

synonyms added: *Ritterocactus herteri*

distribution, added: (Artigas, Rivera, Tacuarembó)

conservation status: replaced (3) Near Threatened, NT **with** (1) Critically Endangered, CR A4ac

Parodia horstii **(F. Ritter) N. P. Taylor 1987**

synonyms added: *Peronocactus horstii*, *Notocactus katharinae*, *Notocactus muegelianus, Wigginsia nothohorstii*

conservation status: replaced (3) Least Concern, LC **with** (1) Endangered, EN C1

Parodia langsdorfii **(Lehmann) D. R. Hunt 1997**

synonyms added: *Ritterocactus langsdorfii*, *Parodia langsdorfii* ssp. *multiceps*, *Ritterocactus langsdorfii* ssp. *multiceps*, *Wigginsia langsdorffii* ssp. *multiceps*

distribution, added: Lavalleja, Treinta y Tres

conservation status: replaced (3) Data Deficient, DD **with** (1) Vulnerable, VU A4ac

Parodia lenninghausii **(F. Haage) F. H. Brandt ex Eggli & Hofacker 2010**

synonyms added: *Eriocephala leninghausii*, *Eriocephala lenninghausii*, *Eriocactus leninghausii* var. *minor*

conservation status: replaced (3) Least Concern, LC **with** (1) Endangered, EN A4ac

Parodia linkii **(Lehmann) R. Kiesling 1995**

synonyms added: *Echinocactus linkii*, *Peronocactus linkii*, *Echinocactus megapotamicus*

distribution, added: Paraná, Santa Catarina, Paraguay (Itapúa, Paraguarí), (Rivera, Tacuarembó)

conservation status: replaced (3) Least Concern, LC **with** (1) Least Concern, LC

***Parodia maassii* (Heese) A. Berger 1929**

synonyms added: *Bolivicactus maassii*, *Parodia knizei*

distribution, added: Salta, Chuquisaca, Oruro

***Parodia magnifica* (F. Ritter) F. H. Brandt 1982**

synonyms added: *Eriocephala magnifica*

conservation status: replaced (3) Vulnerable, VU D2 **with** (1) Endangered, EN A4ac; B1ab(iii,v)+2ab(iii,v)

***Parodia maldonadensis* (Herter) Hofacker 2012**

conservation status: replaced (1) Vulnerable, VU B1ab(i,iii,v) **with** (4) Vulnerable, VU B1ab(i,iii,v)

***Parodia mammulosa* (Lamaire) N. P. Taylor 1987**

synonyms added: *Ritterocactus mammulosus*, *Notocactus albigemmatus*, *Parodia brasiliensis*, *Notocactus mammulosus* ssp. *brasiliensis*, *Ritterocactus mammulosus* ssp. *brasiliensis*, *Notocactus mammulosus* ssp. *erythracanthus*, *Ritterocactus mammulosus* ssp. *erythracanthus*, *Notocactus euvelenovskyi*, *Ritterocactus megalanthus*, *Notocactus submammulosus* ssp. *minor*, *Notocactus ritterianus* (transferred from *Parodia curvispina*), *Notocactus herteri* ssp. *roseoluteus*, *Ritterocactus mammulosus* ssp. *submammulosus, Parodia turecekiana*, *Notocactus turecekianus*, *Notocactus mammulosus* ssp. *turecekianus*

synonyms removed: *Parodia mammulosa* ssp. *mammulosa*

synonyms transferred to *Parodia curvispina*: *Notocactus cristatoides*

distribution, deleted: Corrientes

***Parodia microsperma* (F. A. C. Weber) Spegazzini 1923**

synonyms added: *Hickenia microsperma*, *Parodia microsperma* ssp. *herzogii*, *Parodia matthesiana*, *Parodia minima*, *Parodia riojensis*, *Echinocactus microspermus* var. *thionanthus*, *Parodia weberioides*

synonyms removed: *Parodia microsperma* ssp. *microsperma*

Parodia mueller-melchersii **(Backeberg) N. P. Taylor 1987**

synonyms added: *Ritterocactus mueller-melchersii*, *Notocactus mammulosus* ssp. *eugeniae*, *Ritterocactus mammulosus* ssp. *eugeniae*, *Notocactus mueller-melchersii* ssp. *gutierrezii*, *Ritterocactus mueller-melchersii* ssp. *gutierrezii*, *Ritterocactus rutilans*, *Notocactus rutilans* ssp. *veenianus*, *Ritterocactus rutilans* ssp. *veenianus, Notocactus mueller-melchersii* ssp. *winkleri*, *Ritterocactus mueller-melchersii* ssp. *winkleri*

synonyms removed: *Parodia mueller-melchersii* ssp. *mueller-melchersii*, *Parodia rutilans* ssp. *rutilans*

synonyms transferred to *Parodia curvispina*: *Notocactus rubropedatus*

Parodia muricata **(Otto ex Pfeiffer) Hofacker 1998**

synonyms added: *Peronocactus muricatus*

conservation status: replaced (3) Data Deficient, DD **with** (1) Endangered, EN A4ac

Parodia neobuenekeri **(F. Ritter) Anceschi & Magli 2010**

synonyms added: *Notocactus scopa* ssp. *neobuenekeri*, *Peronocactus scopa* ssp. *neobuenekeri*

conservation status: replaced (3) Data Deficient, DD **with** (4) Endangered, EN B1ab(ii,iii)+2ab(ii,iii)

Parodia neohorstii **(S. Theunissen) N. P. Taylor 1987**

synonyms added: *Peronocactus neohorstii*, *Ritterocactus horstii*

conservation status: replaced (3) Vulnerable, VU D2 **with** (1) Critically Endangered, CR A4ac

Parodia nigrispina **(K. Schumann) F. H. Brandt 1982**

synonyms added: *Eriocephala nigrispina*, *Eriocephala schumanniana* ssp. *nigrispina*

Parodia nivosa **Backeberg 1934** assimilates ***Parodia penicillata*** **Fechser & Steeg 1963**

synonyms added: *Parodia crucinigricentra*, *Parodia penicillata*

conservation status: replaced (3) Vulnerable, VU D2 **with** (4) Endangered, EN B1ab(ii,iii,v)

surveys added: Argentina, Salta, Cafayate, Quebrada del Rio Colorado, 2007-03-03, A&M 10 (transferred from *P. penicillata*); Argentina, Salta, Cafayate, Quebrada del Rio Yacochuya, 2007-03-06, A&M 149 (transferred from *P. penicillata*); Argentina, Salta, Cafayate, Quebrada del Rio Chuscha, 2007-04-25, A&M 197 (transferred from *P. penicillata*)

comments added: in cactusinhabitat.org 2013, the A&M 10, A&M 149, and A&M 197 now identified with *P. nivosa*, were attributed to *Parodia penicillata* Fechser & Steeg. In our recent synopsis of the genus *Parodia* Spegazzini s.l. (Anceschi & Magli 2018: 36, 70-161), the latter taxon is considered a synonym of the first (ibidem, 125-127). September 2018

***Parodia nothorauschii* D. R. Hunt 1997**

synonyms added: *Ritterocactus rauschii*

conservation status: replaced (3) Vulnerable, VU D2 **with** (1) Critically Endangered, CR A2ac

***Parodia otaviana* Cárdenas 1963**

synonyms added: *Bolivicactus otavianus*

distribution, added: Potosí

distribution, deleted: Cochabamba

conservation status: replaced (3) Vulnerable, VU D2 **with** (1) Least Concern, LC

***Parodia ottonis* (Lehmann) N. P. Taylor 1987**

synonyms added: *Peronocactus ottonis*, *Parodia glaucina*, *Notocactus globularis*, *Notocactus oxycostatus* ssp. *gracilis*, *Peronocactus oxycostatus* ssp. *gracilis*, *Parodia nothominuscula* ssp. *gravior*, *Notocactus ottonis* ssp. *horstii*, *Peronocactus ottonis* ssp. *horstii*, *Peronocactus minusculus*, *Notocactus ottoianus*, *Echinocactus tortuosus*

synonyms removed: *Parodia ottonis* ssp. *ottonis*

distribution, added: (Rio Grande do Sul)

***Parodia oxycostata* (Buining & Brederoo) Hofacker 1998**

synonyms added: *Peronocactus oxycostatus*

synonyms removed: *Parodia oxycostata* ssp. *oxycostata*

conservation status: replaced (4) Endangered, EN B2ab(ii,iii,v) **with** (4) Endangered, EN B2ab(ii,iii)+2ab(ii,iii); C2a(i)

***Parodia rechensis* (Buining) F. H. Brandt 1982**

synonyms added: *Brasilicactus rechensis*

***Parodia ritteri* Buining 1959**

synonyms added: *Bolivicactus ritteri*, *Parodia prolifera*, *Parodia camargensis* var. *prolifera*

distribution, added: Potosí

***Parodia schumanniana* (Nic.) F. H. Brandt 1982** replace

***Parodia schumanniana* (K. Schumann) F. H. Brandt 1982**

synonyms added: *Eriocephala schumanniana*, *Eriocephala grossei*

synonyms removed: *Parodia schumanniana* ssp. *schumanniana*

conservation status: replaced (3) Least Concern, LC **with** (1) Vulnerable, VU A2acd

***Parodia scopa* (Sprengel) N. P. Taylor 1987**

synonyms added: *Peronocactus scopa*, *Notocactus rudibuenekeri* ssp. *glomeratus*, *Peronocactus rudibuenekeri* ssp. *glomeratus*, *Notocactus scopa* ssp. *marchesii*, *Peronocactus scopa* ssp. *marchesii*, *Peronocactus rudibuenekeri*, *Notocactus scopa* ssp. *succineus*, *Peronocactus scopa* ssp. *succineus*

synonyms removed: *Parodia scopa* ssp. *scopa*

distribution, added: (Cerro Largo, Lavalleja, Maldonado, Rocha, Treinta y Tres)

conservation status: replaced (4) Least Concern, LC **with** (1) Vulnerable, VU A4ac

***Parodia stuemeri* (Werdermann) Backeberg 1936**

synonyms added: *Bolivicactus stuemeri*, *Parodia gigantea*, *Bolivicactus tilcarensis*

***Parodia subterranea* F. Ritter 1964**

synonyms added: *Bolivicactus subterraneus*, *Parodia ladae*, *Parodia robustihamata*, *Parodia slabana*

distribution, added: Tarija

conservation status: replaced (3) Least Concern, LC **with** (1) Least Concern, LC

surveys added: Bolivia, Tarija, Quebrada de Paicho sur, 2011-07-02, A&M 600a (transferred from *Parodia commutans*)

note added: in cactusinhabitat.org 2013, the A&M 600a, now identified with *P. subterranea*, was incorrectly attributed to *Parodia commutans* F. Ritter.

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***Parodia tenuicylindrica* (F. Ritter) D. R. Hunt 1997**

synonyms added: *Peronocactus minimus*

distribution, added: Uruguay (Artigas, Rivera, Salto, Tacuarembó)

conservation status: replaced (3) Vulnerable, VU D2 **with** (1) Endangered, EN A4ac

***Parodia warasii* (F. Ritter) F. H. Brandt 1982**

synonyms added: *Eriocephala warasii*

conservation status: replaced (3) Vulnerable, VU D2 **with** (1) Endangered, EN B1ab(v)

***Parodia werdermanniana* (Herter) N. P. Taylor 1987**

synonyms added: *Wigginsia werdermanniana*, *Peronocactus werdermannianus*

conservation status: replaced (3) Data Deficient, DD **with** (1) Critically Endangered, CR B1ab(iii,v)

***Pilosocereus pachycladus* F. Ritter 1979**

synonyms added: *Pilosocereus pernambucoensis*, *Pseudopilocereus pernambucoensis*, *Pilosocereus pachycladus* ssp. *pernambucoensis*

distribution, added: Alagoas, Ceará, Paraíba, Pernambuco, Piauí, Rio Grande do Norte

conservation status: replaced (2) Least Concern, LC **with** (1) Least Concern, LC

***Tephrocactus alexanderi* (Britton & Rose) Backeberg 1953**

synonyms removed: *Opuntia geometrica*, *Tephrocactus geometricus*

***Tephrocactus verschaffeltii* (F. A. C. Weber) D. R. Hunt & Ritz 2011** replace

***Austrocylindropuntia verschaffeltii* (Weber) Backeberg 1939**

synonyms added: *Austrocylindropuntia verschaffeltii*

note added: in cactusinhabitat.org 2010 and 2013, the A&M 142, A&M 200 and A&M 478, now identified with *T. verschaffeltii*, were attributed to *Austrocylindropuntia verschaffeltii* (Weber) Backeberg

February 2021

***Weingartia cintiensis* Cárdenas 1958** recognized as separate from

***Weingartia fidana* (Backeberg) Werdermann 1937**

synonyms added: *Gymnocalycium cintiense**, *Weingartia fidana* ssp. *cintiensis*

*Basionym

synonyms transferred from *Weingartia fidana*: *Sulcorebutia cintiensis*, *Rebutia fidaiana* ssp. *cintiensis*, *Rebutia fidana* ssp. *cintiensis*, *Weingartia fidaiana* ssp. *cintiensis*

distribution: Bolivia (Chuquisaca)

conservation status: (3) Least Concern, LC

surveys transferred from *Weingartia fidana*: Bolivia, Chuquisaca, between Camargo and San Pedro, 2011-06-30, A&M 567; Bolivia, Chuquisaca, between Camargo and San Pedro, 2011-06-30, A&M 572

comments added: despite the reported morphological proximity and territorial continuity existing between *Weingartia fidana* (Backeberg) Werdermann and *Weingartia cintiensis* Cárdenas (Anceschi & Magli 2013b, 88-89), on the basis of molecular evidence (Ritz et al. 2007, 94 (8): 1324, 1326), we also recognize *W. cintiensis* to the rank of species.

February 2021

***Weingartia fidana* (Backeberg) Werdermann 1937**

synonyms transferred to *Weingartia cintiensis*: *Sulcorebutia cintiensis*, *Rebutia fidaiana* ssp. *cintiensis*, *Rebutia fidana* ssp. *cintiensis*, *Weingartia fidaiana* ssp. *cintiensis*

surveys transferred to *Weingartia cintiensis*: Bolivia, Chuquisaca, between Camargo and San Pedro, 2011-06-30, A&M 567; Bolivia, Chuquisaca, between Camargo and San Pedro, 2011-06-30, A&M 572

comments added: despite the reported morphological proximity and territorial continuity existing between *Weingartia fidana* (Backeberg) Werdermann and *Weingartia cintiensis* Cárdenas (Anceschi & Magli 2013b, 88-89), on the basis of molecular evidence (Ritz et al. 2007, 94 (8): 1324, 1326), we also recognize *W. cintiensis* to the rank of species.

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Printed in July 2021 by Arti Grafiche BFT, Zola Predosa (BO) - Italy

The long journeys conducted through the most arid and semi-arid ecosystems on the planet, have made us aware that species are not interested in maintaining an identity through reproductive barriers, but they simply want to continue to exist or to be, transforming to each other in space and time through reproduction and crossing.

Giovanna Anceschi & Alberto Magli

ISBN: 9788894238822