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OBSERVATIONS CONCERNING PARODIA (ERIOCACTUS)

Giovanna Anceschi & Alberto Magli share their observations of the misunderstood populations of *Parodia claviceps* (F. Ritter) F. H. Brandt living in the Province of Misiones (Argentina)

Photographs by the authors

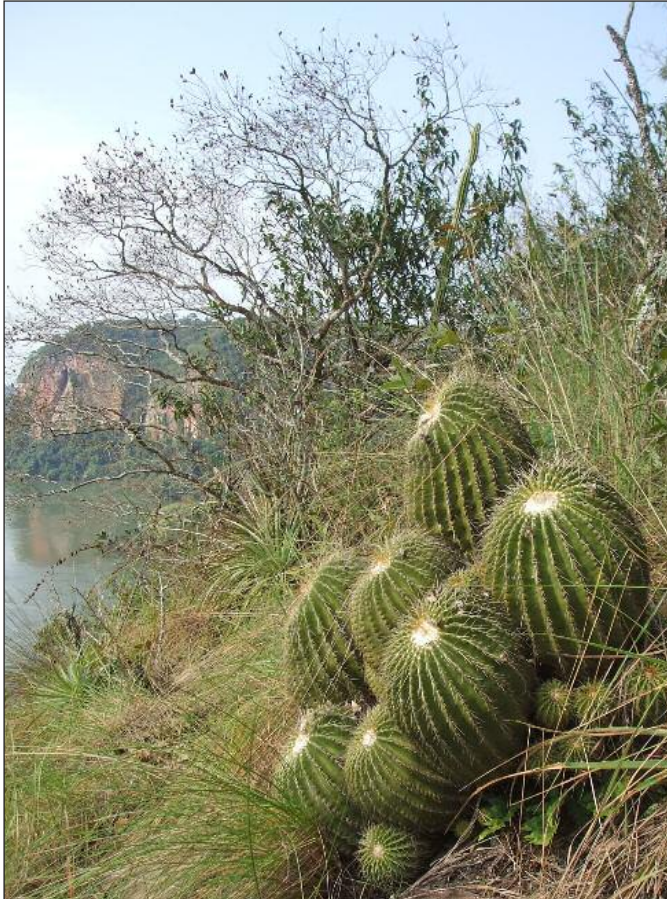


Fig.1 *Parodia claviceps* Argentina, Misiones, San Ignacio, R. N. Osununú, 22 Jul 2007, A&M 246 (cactusinhabitat.org 2010)

When Graham Charles suggested in an email that it might be interesting if we wrote about our experience with *Eriocactus* Backeberg (Anceschi & Magli 2010, 24-26) for the Cactus Explorer readers, we welcomed the idea.

Among all the segregates of *Parodia* Spegazzini, *Eriocactus* is our favourite, and perhaps the only one that deserves separate recognition at generic level. In fact, in 2010, when we first published cactusinhabitat.org, we seriously wondered about the possibility of a genus *Eriocactus*, being separated from *Parodia*. But the results of the molecular data (Nyffeler 1999; Nyffeler & Eggli 2010) convinced us that, if on one hand our idea



Fig.2 *Parodia claviceps* Argentina, Misiones, San Ignacio, R. N. Osununú, 22 Jul 2007, A&M 246

about a possible classification of *Eriocactus* being separate from *Parodia* (for its most basal position within the group) was confirmed, on the other hand this separation should also include *Brasilicactus* Backeberg and *Brasiliparodia* F. Ritter, which instead we consider in every respect part of *Parodia* sensu lato, despite the different morphology of the flower in *Brasilicactus*.

We know in fact, through the latest molecular studies, that the characters of the flowers and of the different pollination syndromes (Nyffeler & Eggli 2010.15; Schlumpberger & Renner, 2012, 1347-1348) are not indicators of the proximity or remoteness of two evolutionary lines. At a morphological level it would seem that the forms of growth

(for example globular vs. columnar) are less subject to phenomena of evolutionary convergence (Schlumpberger & Renner 2012, 1347-1348), and therefore of higher taxonomical value. For these reasons, despite the holomorphological characters of *Eriocactus* being distinct from those of the other members of the group, for consistency we prefer to keep it as a segregate of *Parodia*. There is another reason why we feel connected with this group, a sentimental reason, which is that an *Eriocactus* was the first taxon we found and started to document in its own habitat. Not only was it our first cactus in habitat, our A&M 1, but fatalistically this meeting also gave rise to our first "case": an episode in which our observations, related deductions and assumptions contrasted strongly with the known data. It is this case of *Eriocactus*, which from now on we will call *Parodia*, and its close relatives that we shall examine in this article.

In early October 2005 we were in Buenos Aires, and we were making the final arrangements for our first long trip around South America. During the visit to the Botanical Garden, a gardener put us in touch with the Darwinian Institute and with Roberto Kiesling. We were excited about this meeting having heard about Kiesling and his knowledge of the Argentinian cacti. We made an appointment to meet him and to get information on some of the taxa that marked the steps of our journey. Among the cactus of Argentina, in the province of Misiones, there was *Parodia schumanniana* (K. Schumann) F. H. Brandt. Kiesling was very friendly and answered all our questions. With regards to *P. schumanniana* he told us that we could find the taxon in the Parque Provincial Teyú Cuaré, where from the viewpoint near the rangers' cottage it was possible to observe the plants on the rocky walls overlooking the Río Paraná.

We later found out that it was not in the 78 hectares of the P. P. Teyú Cuaré we had to look, but in the neighbouring Reserva Natural Osununú, owned by the Fundación Temaikén. Due to aggressive human intervention, the two protected areas have a difficult task in protecting this surviving area of the Mata Atlántica. At Osununú ("who thunders" in Guaraní language), we found the viewpoint



Fig.3 *Parodia claviceps* Argentina, Misiones, San Ignacio, R. N. Osununú, 13 Oct 2005, A&M 1

we were looking for, and the spectacle that greeted us was magnificent and unforgettable. Groups of *Parodia*, club-shaped, bright green, with golden spines, were perched on the rock walls, almost vertical above the big river. All framed by the intense green of the subtropical forest [Fig.3].

That first time we stayed in San Ignacio from 12th to 18th October we did various surveys of the Reserva and the Park but without ever being able to get close to the plants, which seemed to live only on the rocky walls far from our reach. So we recorded our first A&M based on what little documentation we were able to obtain, noting that *P. schumanniana* lived there, and promising ourselves that we would get better organized and come back and get a closer look at the plants.

The following year, in December 2006, we were in Agudo, the unique German community in the Quarta Colonia of Rio Grande do Sul, in the south of Brazil. In fact, we are referring to the Italian fourth colony of immigration in that State, consisting of the towns of Agudo, Dona Francisca, Faxinal do Soturno, Nova Palma and Pinhal Grande. We went there to study the population of *Parodia horstii* (F. Ritter) N. P. Taylor, which lives on the Morro overlooking the town. We wanted also to start the surveys on populations of *Parodia claviceps* (F. Ritter) F. H. Brandt, living on the rocky walls in the Rio Jacuí basin. We cannot thank the municipality of Agudo enough for their help. It was also thanks to



Fig.4 *Parodia claviceps* Brazil, Rio Grande do Sul, Agudo, Morro Finkenberg, 8 Dec 2006, A&M 93

them, together with the forestry engineer of the municipality Janete Dumke, that we adventurously reached our first population of *P. claviceps* on Morro Finkenberg. The forest beside the Finkenberg's house ends suddenly, on the brink of a precipice, and on the rocks below, fearless of the abyss, the plants are living [Fig. 4]. For us it was a little complicated, but clinging to the trees and moving into the limited space available, we were able to reach them and we documented some of them [Fig. 5].

The second survey of the species in the Jacuí basin started in a curious way. We were in Agudo and we stumbled upon a brochure that advertised the beauty of the Quarta Colonia. In one of the photos we saw a large group of *Parodia*, on the rocks above a big water surface. It was the dam of Itauba, built to contain the Jacuí river in the area of Pinhal Grande. Also in this case the Municipality of Agudo did its utmost to help us, putting us in touch with colleagues.

On December 9th 2006 we arrived at Pinhal Grande. The following day, on board a small motor boat, we began to sail along the banks of the Represa Itauba. The valley, now a lake, is surrounded by steep rock walls [Fig. 6]. It seemed to show no trace of cacti, but fortunately the boatman suggested a place where he thought there might be some, and sure enough we found them. The display was impressive, and not just for cactus enthusiasts. Hundreds of plants looked out over the water from the walls [Fig. 7]. Many specimens were



Fig.5 *Parodia claviceps* Brazil, Rio Grande do Sul, Agudo, Morro Finkenberg, 8 Dec 2006, A&M 93

located a few metres from the water's surface [Figs.8 & 9], allowing for accurate documentation. The day was made complete by seeing a plant of astonishing size: metres of *P. claviceps* and an infinite number of stems in a single individual, perched on a rock, almost in the water [Figs.10-12]. Of course, it raises a question about the future survival of the population, which is now living in a beautiful setting, but completely alien and artificial, which will undergo inevitable climate change. We can also imagine the consequences of any rises in water level.

Seven months later, near the end of that second South American tour, exhausted after the last months spent between bus transfers and long walks in the Andean regions (of Argentina, Chile, Peru and Bolivia), from Santa Cruz de la Sierra (Bolivia), we allowed ourselves a flight to Asunción, the Paraguayan capital. The idea was to get back on the Trans-Chaco, almost to the north-west border with Bolivia (P. N. Tnte. Enciso), to study some populations of *Gymnocalycium*, and then going from Asunción, down to the Rio Paraná, the natural border between Paraguay and Argentina. The remaining steps of the journey included some species of the genus *Parodia*. In Paraguay we were looking for *Parodia nigripina* (K. Schumann) F. H. Brandt, a taxon closely related to *P. schumanniana* which lives in the Dpt. Cordillera (to which we will return later) and for *P. schumanniana* itself, living a little further south, in the Dpts. of Paraguari and Guairá. And finally, in Argentina, looking



Fig.6 Habitat of *Parodia claviceps*. Barragem Itaúba, Brazil, Rio Grande do Sul, Pinhal Grande, 10 Dec 2006



Fig.7 *Parodia claviceps* Brazil, Rio Grande do Sul, Pinhal Grande, Barragem Itaúba, 10 Dec 2006, A&M 94. (cactusinhabitat.org 2010)



Fig.8 *Parodia claviceps* Brazil, Rio Grande do Sul, Pinhal Grande, Barragem Itaúba, 10 Dec 2006, A&M 94. (cactusinhabitat.org 2010)



Fig.9 *Parodia claviceps* Brazil, Rio Grande do Sul, Pinhal Grande, Barragem Itaúba, 10 Dec 2006, A&M 94.

for the population of *P. schumanniana* of Misiones, left open in 2005.

We made camp in Carapeguá for the research on the populations of *P. schumanniana* in the Dpt. of Paraguari. There we met Gabriel Lezcano, a mathematics teacher and now a dear friend, who was the guide in those first excursions in search of *P. schumanniana*, and also in the subsequent years.

We include the taxa *P. grossei* (K. Schumann) F. H. Brandt, and *P. ampliostata* (K. Schumann) F. H. Brandt, for us properly considered as synonyms of *P. schumanniana*.

The first visit to the Monumento Natural Macizo Acahay, 16th July 2007, was really exciting. After climbing up to the top on the north-east side, between the granite rocks, in a lovely setting, we saw up close our first large population of *P. schumanniana* [Fig. 13], (excluding those Argentinian of Misiones). From the first comparison in habitat, then confirmed by the later ones, the differences between *P. schumanniana* and *P. claviceps* were clear. The holomorphology of the two taxa are quite distinct [see also Table 1 on page 33].



Fig.10 *Parodia claviceps* Brazil, Rio Grande do Sul, Pinhal Grande, Barragem Itaúba, 10 Dec 2006, A&M 94. (cactusinhabitat.org 2010)

Starting from the kind of growth; generally simple (first globular and then columnar) < 180 x 30cm (h x Ø) for the first taxon, vs. simple or in groups (first globose and then clavate) < 70 x 25 (h x Ø) for the second [Figs.13-14], then passing through all the other elements of distinction (ribs, areoles, spines, etc.) [Figs.16-17], we arrive at the clearly different topology of the habitats occupied by the two taxa. *P. claviceps* lives on the almost vertical rock walls of Basalt of the Serra Geral formation (a slope that is almost 90 degrees) in the river basin of the Jacuí and the Jaguarí rivers, Rio Grande do Sul, Brazil. These rocky walls develop the conditions for a microclimate, strongly differentiated from the humid subtropical general area around them, essentially consisting of forest formations of the Mata Atlantica Biome.



Fig.11 *Parodia claviceps* Brazil, Rio Grande do Sul, Pinhal Grande, Barragem Itaúba, 10 Dec 2006, A&M 94. (cactusinhabitat.org 2010)



Fig.12 *Parodia claviceps* Brazil, Rio Grande do Sul, Pinhal Grande, Barragem Itaúba, 10 Dec 2006, A&M 94. (cactusinhabitat.org 2010)

The steep slope which prevents even intense rain from permanently moistening the rock, and the strong and direct sunlight, transforms some of these walls into a genuinely xerophyte habitat, allowing for the formation of flora, otherwise unthinkable in these areas (Larocca 1998 ,12).

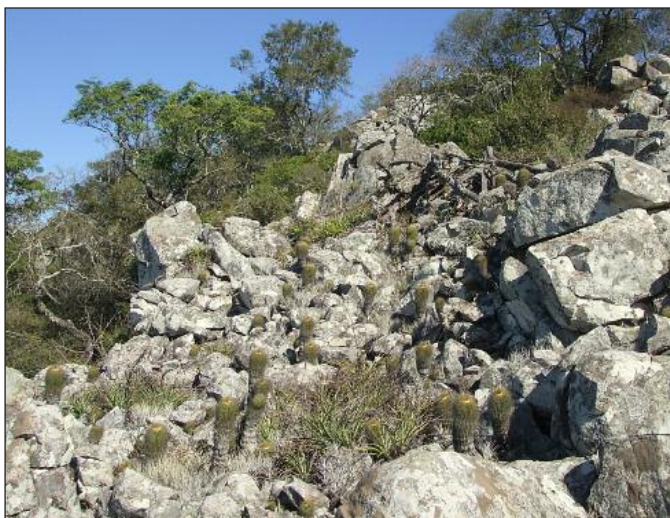


Fig.13 *Parodia schumanniana* Paraguay, Paraguari, Carapeguá, M. N. Macizo Acahay, 16 Jul 2007, A&M 243 (cactusinhabitat.org 2010)

The populations of *P. schumanniana* live in south-western Paraguay, on the sandstone outcrops of the Silurian, i.e. sandstone of Caacupé (Cordillera de los Altos, Cerro Santo Tomás and Cerro Verá [Figs.18-19]), and on the granitic rocks of the Silurian (Macizo Acahay) [Fig. 13], in the Dept. of Paraguari. They also live on the sandstone outcrops of the Permian, i.e. Passa Dois series, including in the Independencia-Villa Rica area (Cerro Acatí, Cerro Pelado) in the Dept. of Guairá



Fig.14 *Parodia schumanniana* Paraguay, Paraguari, Carapeguá, M. N. Macizo Acahay, 16 Jul 2007, A&M 243

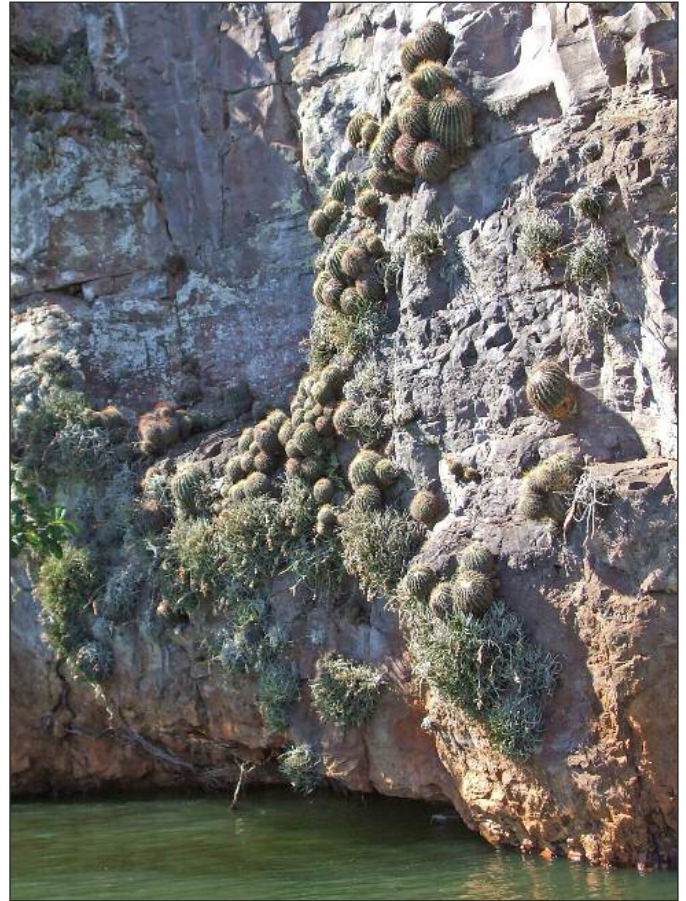


Fig.15 *Parodia claviceps* Brazil, Rio Grande do Sul, Pinhal Grande, Barragem Itaúba, 10 Dec 2006, A&M 94



Fig.16 *Parodia schumanniana* Paraguay, Paraguari, Carapeguá, M. N. Macizo Acahay, 16 Jul 2007, A&M 243.

(Esser 1982, 38:13). All the surveys carried out have highlighted that these populations live far from watercourses, unlike the surveys for *P. claviceps*.

At the end of July 2007, after the stop-off between Caacupé and Carapeguá, we arrived in Encarnación and from there we went through Argentina to get to San Ignacio once



Fig.17 *Parodia claviceps* Brazil, Rio Grande do Sul, Pinhal Grande, Barragem Itaúba, 10 Dec 2006, A&M 94. (cactusinhabitat.org 2010)

more, with the intention of organizing visits to Osununú-Teyú Cuaré to get at the populations of *P. schumanniana* that we missed in 2005.

We asked a resident of the area who seemed to remember seeing the plants, and he offered to accompany us. He knew the protected area, which consists of an amphitheatre rock formation, covered with a wet subtropical forest overlooking the Rio Paraná. He told us

	Parodia claviceps	Parodia schumanniana
habit	simple or clustering	usually simple
stem	globose to clavate < 70 x 25cm (h x Ø)	globose then cylindric < 180 x 30cm (h x Ø)
ribs	23 - 38	21 - 48
areoles	> 3-4mm < 3-4 mm on oldest plants	7-15mm apart
spines	awl like, curved, wavy or twisted central: 0 - 3 (- 5), < 30mm radial: 0 - 6 (- 8)	slender, acicular, straight or slightly curved central: 0 - 1, < 10 - 30mm radial: 5 - 7, the lowest < 65mm
pericarpel and floral tube	c. 32mm	c. 20 - 25mm
habitat	Basaltic rock walls of Serra Geral, gradient close to 90°, on the Jacuí and Jaguarí rivers (Rio Grande do Sul, BR) nearly vertical rocky slopes on the Paraná river, in the R. N. Osununù -P. P. Teyú Cuaré (Misiones, AR)	Hills with granitic rock outcrops and sandstone reliefs, in the Paraguari Dpt. (PY), sandstone reliefs in the Guairá Dpt. (PY). Far from rivers.

Table 1

about the half moon inlet on the river, circumscribed by the rock formation, also covered by dense forest, where there is a small mountain, Cerro Pelón [Fig. 20], in the centre. He believed that the plants were there.

The following day, after getting past the ridge from the west, we passed through a forest of tall trees where everything looked the same and there was a complete lack of reference points. There was just dense forest, the heat, the birds singing and nothing else. That day our guide was not too well, and it took time to get to the base of the small mountain, which we then had to climb. The humidity had made the ground slippery and the vegetation was quite tangled. Finally, we reached the summit on the west side, we went round the hill, and on the river side, we began to see the first samples of *Parodia* ... Big and wonderful! [Figs.1 & 2]



Fig.18 *Parodia schumanniana* Paraguay, Paraguari, La Colmena, Cerro Verà, 20 Sept 2011, A&M 753.

But the first impression was one of amazement, it was not *P. schumanniana*, as reported in the literature (Nicolai 1893; Kiesling 1995, Anderson 2001, Hunt et al., 2006), and the plants were not those we had seen a few days before in Paraguay: instead they were identical to those encountered in the south of Brazil: same growth, same form, same size, same ribs, areoles, spines, etc. [Figs.21-23] They also shared the same environmental conditions: almost vertical rock walls above the river, immersed in the same subtropical forest (Mata Atlantica Biome) as the *Parodia* of Rio Jacuí.

That day we stayed for a long time to study and document that population of cacti. From the top of the cerro we could see the eastern extremities of the reserve, the rocks of Osununù, where in 2005 we had seen the plants for the first time, as promised by



Fig.19 *Parodia schumanniana* Paraguay, Paraguari, La Colmena, Cerro Verà, 20 Sept 2011, A&M 753.



Fig.20 Habitat of *Parodia claviceps* R. N. Osununu, Argentina, Misiones, San Ignacio, 3 Oct 2011



Fig.22 *Parodia claviceps* Argentina, Misiones, San Ignacio, R. N. Osununu, 22 Jul 2007, A&M 246.



Fig.21 *Parodia claviceps* Argentina, Misiones, San Ignacio, R. N. Osununu, 22 Jul 2007, A&M 246. (cactusinhabitat.org 2010)

Kiesling [Fig. 24]. However, we did not know then that it was not *P. schumanniana* but rather *P. claviceps*, here in its most northwestern distribution area; about 250km as the crow flies from its westernmost location in the state of Rio Grande do Sul, Brazil, in the municipality of Jaguarí.

On the way back, the guide lost his sense of direction, and only after wandering in the forest, led by the noise of the river, we finally reached the familiar rocks of Teyú Cuaré. We



Fig.23 *Parodia claviceps* Brazil, Rio Grande do Sul, Agudo, Morro Finkenberg, 8 Dec 2006, A&M 93



Fig.24 *Parodia claviceps* Argentina, Misiones, San Ignacio, R. N. Osununu, 22 Jul 2007, A&M 246. (cactusinhabitat.org 2010)

were tired, but excited to have new information to bring to all enthusiasts.

From our inferences based on the studies in habitat, and its comparison with the literature, it appears evident that *P. schumanniana* is an endemic taxon of Paraguay, whose populations are detectable, as already mentioned, in the south-west of the country on

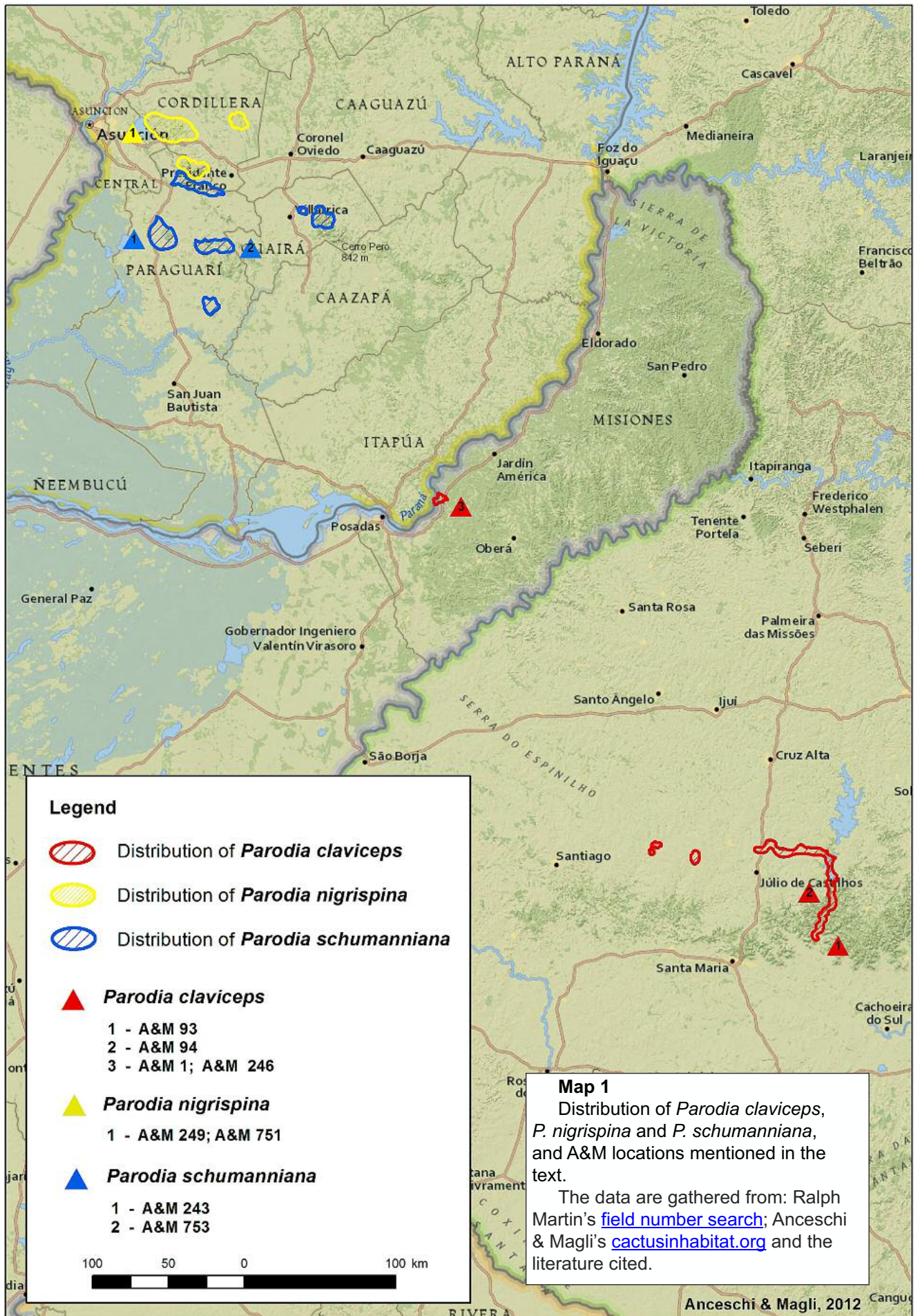




Fig.25 *Parodia nigrispina* Paraguay, Cordillera, Tobatí, Cerro Tobatí, 11 Sep 2011, A&M 249.

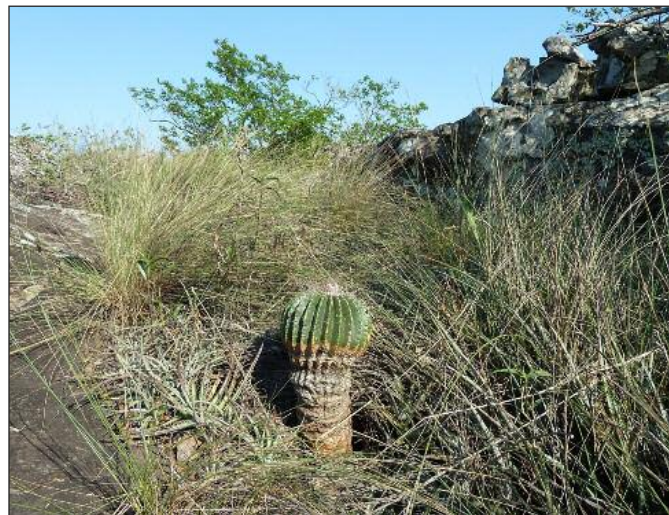


Fig.26 *Parodia nigrispina* Paraguay, Cordillera, Tobatí, Cerro Tobatí, 14 Sep 2011, A&M 751.



Fig.27 *Parodia nigrispina* Paraguay, Cordillera, Tobatí, Cerro Tobatí, 11 Sep 2011, A&M 249.



Fig.28 *Parodia schumanniana* Paraguay, Paraguari, La Colmena, Cerro Verà, 20 Sept 2011, A&M 753

sandstone outcrops and granitic rocks.

We believe that the taxon has never crossed the great natural barrier formed by the Río Paraná. We would like to emphasize that the line of the southernmost populations of *P. schumanniana* (Acatí, Capilla Tuya, Verá) is between 170 and 200km away as the crow flies from the river and the Osununú-Teyú Cuare area.

In addition, contrary to the current opinion, which classifies *P. claviceps* as a subspecies of *P. schumanniana* (Anderson 2001, Hunt et al., 2006), as result of the combination proposed by Hofacker (1998, 6:12), we would like to point out that the taxon historically related to *P. schumanniana* (and perhaps not distinct) is not *P. claviceps*, but *P. nigrispina* as Gerloff et al. (1995: 142) have already suggested.

In the first vague description of *Echinocactus*

nigrispinus K. Schumann (1899, 9: 45), the type is reported "between Carepe-guà and Aca-ay", but in fact no population of *P. nigrispina*, as currently conceived, has ever been found in these parts, where instead only *P. schumanniana* lives.

The current conception of *P. nigrispina* was fixed by Buining (1970, 49 (11): 179). In Schumann's description, he identified the populations in Dept. Cordillera (PY) above the location of Chololò. Populations which have their centre between the sandstone outcrops of the Silurian, sandstone of Caacupé (Esser 1982, 38:57-59), between Caacupé, Tobatí and the Yhaguy Guazu river [Figs.25-26], as was also reported by Gerloff et al. (1995, 142). The conditions for the survival of the taxon are quite critical, as we have already stressed (Anceschi & Magli (2010, 40). Besides geographical location to the north of the Dpts.



Fig.29 *Parodia claviceps* Argentina, Misiones, San Ignacio, R. N. Osununu, 3 Oct 2011, A&M 1

Paraguarí and Guairá, there are various distinctions that Buining listed to separate his *Notocactus nigrispinus* (K. Schumann) Buining from *Notocactus schumannianus* (Nicolai) A. Berger: The first show a tendency to form groups compared to the second which has usually simple growth; the first have shorter stems (< 40cm compared with < 180cm the second); the first also has stronger and less bristly spines, from dark grey to yellow compared with the second's bristly, thin spines, brown to yellowish (when young), then brown. Based on our studies in habitat the distinctions proposed by Buining are usually verifiable (even if it is now difficult with adult individuals to form groups). We have to add that, despite its name, *P. nigrispina* often highlights pale grey-coloured spines and not dark grey [Fig. 27]. In spite of this, the two taxa are very similar [Fig.28].

The real reason that we still distinguish *P. nigrispina* is the distinct distribution areas. The



Fig.30 *Parodia claviceps* Argentina, Misiones, San Ignacio, R. N. Osununu, 3 Oct 2011, A&M 1

two species are parapatric: we have not yet found any area where the two intergrade. So, although this would be a case in which the subspecies category may have a possible meaning, we think that a natural species is composed of populations, in their turn composed of individuals, and not by variety or subspecies; or in agreement with Hennig, of semaphoronts. "(The characters bearer)... The individual in a certain, theoretically infinitely small, time span of its life, during which it can be considered unchangeable" (Hennig 1996, 65). The infra-population (var.) and intra-population (ssp.) differences, within a species, are part of the biological concept of species, a species considered as a process, not as a static unit, so from our point of view they do not deserve taxonomic recognition (see Anceschi & Magli 2010, 12-14). This is the reason we prefer to keep *P. nigrispina* at the species level.

Having clarified the links between the taxa

	Gerloff et al. (1995)	Anderson (2001)	Hunt (1999)	Anceschi & Magli (2010)
Parodia claviceps	BR (Rio Grande do Sul)	BR (Rio Grande do Sul)	BR	AR (Misiones), BR (Rio Grande do Sul)
	Gerloff et al. (1995)	Anderson (2001)	Hunt et al. (2006)	Anceschi & Magli (2010)
Parodia schumanniana	PY (Paraguarí, Guairá, Misiones?) Including <i>Notocactus ampliocostatus</i> and <i>Notocactus grossei</i>	AR (north-eastern), PY	AR (Misiones), BR (Rio Grande do Sul)*, PY	PY (Paraguarí, Guairá)

Table 2 Revised distribution of *Parodia claviceps* and *Parodia schumanniana* from the previous sources.

* According to Hofacker (2000, 10:12) there are no populations of *P. schumanniana* in Brazil.

in question, we can ask ourselves why a population of *P. claviceps* is located 250km from the rest of its range. The assumptions are two-fold. The first is that between the two locations, Osununú-Teyú Cuaré in Argentina and the Municipality of Jaguari in Rio Grande do Sul, Brazil, as pointed out by Larocca (1998, 64), there could be little-explored areas such as the Serra do Pirapó and the Ijuí and Icamaquã river valleys, where *Parodia* populations could be hidden, still unknown. The hypothesis that the most likely candidate to populate it might be *P. claviceps* is suggested by the most westerly extension of the taxon, compared to the other *Eriocactus*, living in southern Brazil.

The second is that in the 16.0-14.8 Ma, as reported by Arakaki et al. (2011, 8380), from the probable beginning of the diversification for the clade *Notocactae*, extinction in *P. claviceps* may have intervened interrupting the spatial continuity, generally observed between the different populations which constitute a natural species.

Regarding instead the different attribution made by the previous researchers to the Osununú-Teyú Cuaré populations, we believe that probably none of them have ever personally visited all the taxa concerned in their respective habitats. It is clear for example that if you do not know the populations of *P. claviceps* of southern Brazil, the populations of Argentina may look similar to *P. schumanniana*, but as we have shown, the real relationship between these taxa is different.

During our last visit to Osununú and Teyú Cuaré, in October 2011, the rangers informed us that, both for safety reasons, due the rising level of the Rio Paraná, caused by the construction of the Yacyretá Dam, and for preservation reasons, it is no longer possible to get access to the internal forest where the Cerro Pelón and the cacti are. However, we have had the opportunity to go for a long walk in that park that we love so much, and to look again at *P. claviceps* on the rocks of Osununú, as we did for the first time six years earlier [Figs.29 & 30].

Implications of this article for the genus *Parodia* Spegazzini:

The revised distribution of *Parodia claviceps* and *Parodia schumanniana* compared to the previous sources is shown in Table 2 on page 37.

Update of the risk assesment of the conservation status of *Parodia nigrispina* compared to the previous sources (see also Anceschi & Magli 2010, 40).

Metzing, D. (1994) Endangered, EN

Hunt et al. (2006) Vulnerable, VU D2

Anceschi & Magli (2010)* Critically Endangered, CR B1ab(iii,v)+2ab(iii,v);C2a(i)

* In September 2011, we once again visited the distribution area of *P. nigrispina* in the zones comprised between Piribebuy, Caacupé, Tobatí and Atyrá. While in Piribebuy (Esser 1982, 60) the taxon is extinct, in Tobatí, in the same zone we monitored between 2007 and 2008, we recorded small but encouraging improvement. The population has increased from 7 to 15 plants. The difficult to access population, near the Cerro Tobatí also shows a slight increase compared to the 2008 survey (from approx. 20 to 25 individuals). At the market in Asunción we saw specimens of *P. nigrispina* and *Discocactus hartmannii* (K. Schumann) Britton & Rose on sale piled in a basket. The two taxa are almost extinct in Paraguay (Anceschi & Magli 2010: 39-40).

Giovanna Anceschi & Alberto Magli

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