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Cover picture: *Gymnocalycium angelae* WP 250-545, Tres Cerros, Prov. Corrientes, Argentina (photo: W. Papsch).

Editorial

Dear *Gymnocalycium* friends,

Wolfgang Papsch



The knowledge of a certain plant consists of numerous elements. First of all, there are the facts listed in its first description and the attached accompanying text. In case there are some characteristic pictures enclosed, the plant can easily be visualised. Further information can probably be gathered from presentations by the first author or persons who came across the plant in its natural habitat. Personal exchange with these people enables us to learn quite a few further details.

Needless to say, pictures and sound recording were not possible in the past. Therefore, important information is concealed in formerly published literature. It is usually a tedious endeavour to trace these often very valuable indications as to locality and person who discovered the plant. On top of that, access to old literature is hardly possible, not to mention the language barrier, especially when texts are written in Latin, which was common practice in the 18th and 19th century. Reports about botanists' journeys to new and unknown areas were an unfailing source of information even in the past. Thus, the explorers' routes can be retraced and conclusions can be drawn concerning possible localities of a plant. The contribution published in this issue is to be seen in this context. A further component is gaining knowledge from cultivation of the plant.

Nowadays modern methods of research are implemented in order to resolve issues concerning the identification of a plant, possible relationships and differentiation from other groups. Moreover, these methods even allow assigning its origin and distribution to a time frame.

Just like in a jigsaw puzzle, all the collected parts of information finally add up to an overall picture of the plant.

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Cacti between cows and climate change – looking for *Gymnocalycium* in Brazil, Uruguay and Argentina

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ABSTRACT

This contribution presents especially those *Gymnocalycium* species which grow in southern Brazil (federal states Mato Grosso do Sul and Rio Grande do Sul), in northern Uruguay (Departamento Artigas) as well as in Argentina (Province Corrientes). During a journey in November 2019 localities partly discovered decades ago were revisited to check out if cacti populations can still be found there. To conclude, only few plants grow in many localities, a great number of habitats have been destroyed by forestry and urbanisation and are thus irretrievably lost.

KEYWORDS

Cactaceae, *Gymnocalycium*, *anisitsii*, *angelae*, *horstii*, *horstii* subsp. *buenekeri*, *hyptiacanthum* subsp. *uruguayense*, *matoense*, Argentina, Brazil, Uruguay.

Time is running out. This bitter truth also applies to cacti in Brazil, Uruguay and Argentina, just like for many endangered animal and plant species on our planet deforestation, cattle and climate change leave very little room for the prickly beauties to grow. Road construction, forestry as well as growing villages and cities spell doom for original nature. Numerous cacti localities disappear at an increasingly growing speed.

This was a reason for my travel companion Volker Schädlich and me to fly to Brazil for almost five weeks at the end of October 2019. A little detour to the neighbouring countries Uruguay and Argentina was also on our agenda. We cherished the hope of being still able to spot localities which had not been visited by cacti lovers for a long period of time. At the eleventh hour, so to speak, we set out in order to trace *Gymnocalycium* in particular, beside *Discocacti*, *Fraileae* and *Notocacti*. We were very curious what we were in for.

However, before we started packing our suitcases Volker Schädlich compiled thousands of locality data and established a travel route of 8.000 km. Not infrequently did it lead us along dusty gravel roads across the federal states Mato Grosso do Sul, Paraná, Santa Catarina and Rio Grande do Sul. Additionally, we made little detours to Argentina and Uruguay. A reliable Renault Duster did not let us down – apart from a flat tyre, which was to be expected in the face of gravel roads. As had been the case in previous journeys, the free navigation app maps.me led us through the territory flawlessly, of course always supported by our GPS devices.



Fig. 1: Parque das Nações Indígenas in Campo Grande.



Fig. 2: Jackfruit tree (*Artocarpus heterophyllus*).

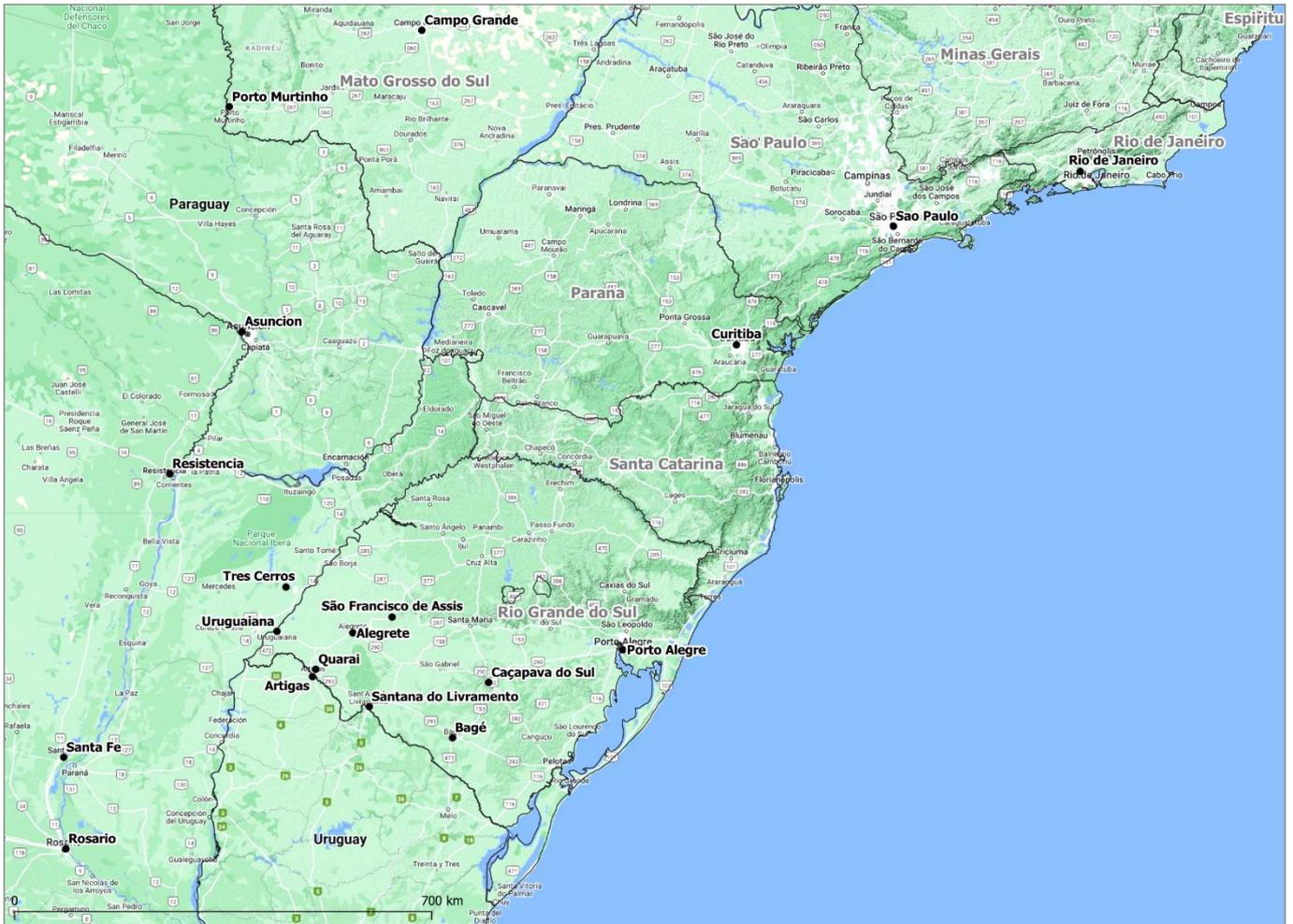


Fig. 3: Capybara (*Hydrochoerus hydrochaeris*).



Fig. 4: The southern lapwing (*Vanellus chilensis*) is also wide-spread in southern Brazil as well as Uruguay.

Coming from São Paulo we started the tour by checking our equipment in Campo Grande, the capital city of the federal state Mato Grosso do Sul. We retested the cameras and indulged in a day of sightseeing. The city of around 900,000 inhabitants has a modern appearance and is spaciouly laid out. A highlight for tourists is certainly the Parque das Nações Indígenas, where capybaras (*Hydrochoerus hydrochaeris*) roam about in the middle of the town. Parrots fly everywhere and they also like sitting on streetlamps, making incredible noise. At more than 30 degrees Celsius in the shade in the early morning we were glad to be able to travel in an air-conditioned car the next day. We embarked on a 400 km's journey in western direction to Corumba, which is situated on the border with Bolivia. We were curious if we would find *Discocacti* there and we had no idea that, temperature-wise, we would get out of the frying pan into the fire.



Map 1: Overview of the travel area (map: Mario Wick, map background: Google Maps).

We made good progress on the well-constructed BR 262. The Pantanal wetlands lay ahead of us and thus we were sure to see a lot of wildlife, even from the road. Yet, our positive anticipation suffered a setback because the closer we got to Pantanal, the smokier the air became. Finally, we discovered interminable burning or already burnt down areas. Whether spontaneous ignition in scorching heat had caused the inferno or if it was man-made could not be fathomed. Anyway, over a distance more than 100 kilometres grass, trees and scrubs were burning. Partly the flames were blazing right next to the road, from time to time we were afraid that the car finish might form bubbles. Having arrived in Corumba on Rio Paraguay breathing did not become easier. Until our departure from there three days later there was sometimes more, sometimes less smell of burning in the air.



Fig. 5: Fires in Pantanal over a distance of 100 km.



Fig. 6: Burnt-down territory.

We could be glad, nevertheless, as our search for *Discocacti* turned out to be fruitful several times. We found *Discocactus ferricola* not far from Corumba with its multitude of iron ore mines. Just like on the other side of the border at Puerto Suárez in Bolivia, the plants near Corumba also grow typically in rocky ground containing iron ore. The partly huge populations with hundreds of plants were all more or less marked by heat. According to the native population it had not rained for weeks, as a result temperatures rose to far above 40 degrees Celsius, on 31st October 2019 even as high as 47 degrees Celsius. That was my personal Latin American heat record.

Our journey took us via Bonito to the locality of *Discocactus hartmannii* var. *bonitoensis*. It almost borders on miracle that, despite the pressure of urbanisation, these plants still grow on a small hill in rocky ground between grass. Later we discovered for the first time a locality of *Discocactus mamillosus* north of Bella Vista, away from the impact of civilisation and roads. The plants grow underneath shrubs and small trees in grassland. The search for *Discocactus mamillosus* took much longer at another locality on Rio Caracol. The original vegetation had fallen prey to deforestation of which the intention was to set up a plantation of trees. Finally we came across half a dozen “survivors”.



Fig. 7: *Discocactus ferricola* Lun 19-67/1, south of Corumba.



Fig. 8: Flame Tree (*Delonix regia*), east of Corumba.



Fig. 9: The jabiru (*Jabiru mycteria*) survived.



Fig. 10: *Discocactus hartmannii* var. *bonitoensis* Lun 19-70/1, south of Bonito.

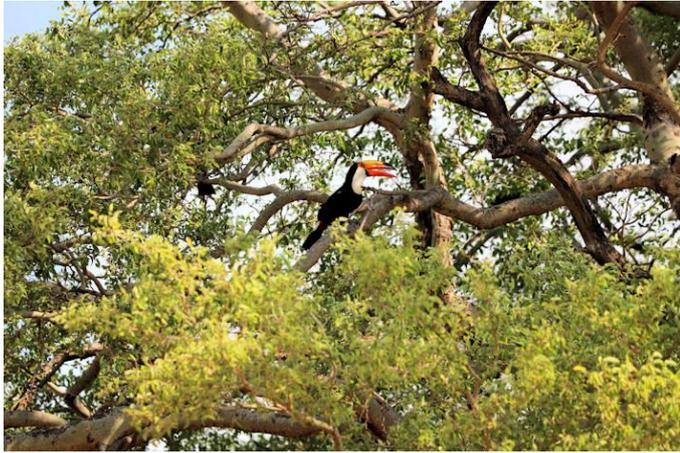


Fig. 11: Toucan (*Ramphastos toco*) near Albuquerque.



Fig. 12: *Discocactus mamillosus* Lun 19-71/1, north of Bella Vista.

Then our journey took us further west to Porto Murтинho and thereby to the first *Gymnocalycium* habitats of our tour. Sadly, our intensive and additionally very sudatory search for *Gymnocalycium matoense* in temperatures around 40 degrees Celsius was unsuccessful. We were not able to find one single plant anymore at the locality VoS 06-288 south of Caracol. The area had been burnt down again and again in the previous years – obviously with bad chances of survival for the cacti.

The situation was not really better at the presumed type locality of *G. matoense* (HU 452) east of Porto Murтинho. The habitat with small trees and shrubs, where among other plants *Discocactus silicicola*, *Frailea melitae* and *Gymnocalycium anisitsii* also grow, seemed to be cleared out, so to speak. Merely *Echinopsis rhodotricha* and only very few, terribly battered *G. anisitsii* had endured the locality with its loamy, sandy soil. Volker Schädlich, who has visited the locality several times during the last fifteen years, could hardly believe it. Nothing has remained of the formerly dense growth of the plants. The drought having continued for years – possibly a sign of climate change – gives even cacti a tough time.



Fig. 13: Stressed *Gymnocalycium anisitsii* Lun 19-73/1, east of Porto Murтинho.



Fig. 14: *Echinopsis rhodotricha* Lun 19-73/2 despite the draught full of sap.

The scorching heat left its marks on us as well. Although we refrained from using air condition in the car we had to struggle with colds. We were glad to be able to buy medicine at a chemist's.

We were more fortunate with our search at other localities near Porto Murтинho. We found *G. anisitsii* in several places between sparse woody perennials, often with its, at that place, typically strong inclination to sprout. These plants were described as the variety *multipliferum* by P. J. Braun in 1991. To date it remains unclear what causes the plant to sprout so lavishly, a phenomenon which also occurs with plants in our collections. We also spotted just a few *F. melitae* and *F. angelicana* in the bone-dry rest of Chaco vegetation. In one place we discovered

Praecereus saxicola - a very large, magnificently widely branched plant, whose multitude of buds had unfortunately not opened yet.



Fig. 15: Concealed in the soil: *Frailea melitae* Lun 19-74/1, northeast of Porto Murinho.



Fig. 16: *Praecereus saxicola* Lun 19-75/1, south of Porto Murinho.

Regardless of the multitude of plant findings at the well-known localities near Porto Murinho, our goal was also to find new localities of *G. anisitsii* if possible. So we drove in southern direction to Rio Apa, a tributary of the Paraguay River, to be successful there. The area is made available completely for agricultural purposes here as well. Now and again, green islands with bushes and trees emerged along drainage canals, however, there was no evidence that looking for *Gymnocalycium* there might be worthwhile. Instead we discovered greater rheas (*Rhea americana*), and once a nasua (*Nasua nasua*) scurried across the road. Finally we decided to dedicate the rest of the day to a boat trip on the River Apa in order to see caimans (*Caiman yacare*). Experts assume that millions of caimans live in the water network of the Apa River, which is 380 km long and forms the border between Brazil and Paraguay over almost all its length.

Eventually we hired a boat and a guide in a *poussada* (holiday complex) which looked like a deserted village. The guide took us on a cruise upstream on the River Apa, which was shallow during that season. And indeed, the shallow water was teeming with the large reptiles, which, however, kept their respectful distance from the boat. After the tour we got into a conversation with our guide and the owner of the *poussada* over a glass of beer. Although Volker and I do not have a command of a single word of Brazilian Portuguese, we could make ourselves understood with gestures. All of a sudden we seemed to be electrified. When we showed the mobile phone pictures of our cacti findings of the last few days to the two of them our guide announced that he knew a place on Rio Apa where exactly these spherical cacti grow.



Fig. 17: Oops, where does the little catfish come from?



Fig. 18: Yacare caiman (*Cayman yacare*).

As we had arranged, we met at the entrance of the *poussada* the next morning so as to set out shortly afterwards by boat downriver in direction of the confluence with Rio Paraguay. After about half an hour we entered a forest on the riverbank, which is about 200 meters away from the river. Even from afar we could spot the columns of *E. rhodotricha*. Our hearts beat faster – and there they stood before us: hundreds of *G. anisitsii* in all sizes, surrounded by of *Cleistocactus baumannii* subsp. *horstii*. We were jubilant. At this totally sound locality of *G. anisitsii* we could realize how flexible the spination of this species is. Not only were there individuals with long and short spines, but also almost spineless ones. Only one thing could not be detected, namely none of the plants showed even remotely the same frequency of sprouting as the plants few kilometres south of Porto Murinho.



Fig. 19: Forest on river bank at locality Lun 19-76/1 on Rio Apa, south of Porto Murinho.



Fig. 20: *G. anisitsii* Lun 19-76/1.

On our long way to southern Brazil we initially passed the place Antonio João, the locality of *Frailea matoana*. Although having been on that spot several times before and equipped with the exact GPS data, Volker Schädlich was the first to find the plants, but only after a one hour's search. They had withdrawn deep into the soil due to long lasting drought. Having found the tiny cacti without flowers was a great piece of luck. The locality not far from the road seemed to be still intact because later we found further individuals, yet all covered with soil and dust.



Fig. 21: *G. anisitsii* Lun 19-76/1.



Fig. 22: Cushion of *G. anisitsii* Lun 19-76/1.

We continued, always southbound, across Rio Uruguay, passing São Luiz Gonzaga and Santiago on our way to São Francisco de Assis. En route we visited many Notocacti localities we knew of. In particular the Notocactus and Gymnocalycium specialist Norbert Gerloff (acronym Gf), who passed away in 2019, had left a large amount of data and hints. His former companions, too, took notes busily. We were not always successful, but to our pleasant surprise we could trace many of the localities published as early as twenty or even thirty years ago. Basically, all the localities are similar. The Notocacti mostly grow in grazed pastures between rocks and slabs, sometimes

hidden in grass, sometimes underneath small bushes or totally exposed to sunlight. At first we were surprised by the fact that almost all the plants were growing well, often also flowering despite the drought until we solved the mystery. We noticed that small springs in the meadows yielded water even in high temperatures and kept the soil moist. Among our findings were *Notocactus glaucinus*, *Notocactus linkii*, *Notocactus ottonis* and *Notocactus rauschii* var. *fuscus*. The accompanying vegetation consisted almost always of *Cereus hildemannianus* and *Opuntia viridirubra* with its wonderful, orange flowers. However, the truth is also that many a cacti locality has ceased to exist due to deforestation in favour of eucalyptus plantations, among other reasons.



Fig. 23: *Notocactus glaucinus* Lun 19-82/1, south of São Luis Conzaga on Rio Icamazinho.



Fig. 24: *Notocactus linkii* Lun 19-83/1, south of São Luis Conzaga on Rio Taquarembo.

On our way between Santiago and São Francisco de Assis we came across *Notocactus mammulosus* for the first time. This spine-wise well-defended species forms huge cushions and later could be found at almost all localities in the direction of Uruguay. We also discovered plants that were higher than the maximum height of 22 cm mentioned in literature.



Fig. 25: *N. mammulosus* Lun 19-86/2, north of São Francisco de Assis.



Fig. 26: *N. fuscus* Lun 89-89/1, Monte Alegre.

We were in for the next highlight of our tour near São Francisco de Assis. The anxious question was if they still existed at locality Gf 260. We were relieved to find out that they did. After some searching we found *Gymnocalycium horstii* subsp. *buenekeri* at the northern face of a table mount. The flowers of the plants are very attractive, light peach-coloured to light rose-coloured. They are in high danger of extinction as they only occur in very few places protected by hills. Areas used for agricultural purposes have surrounded the plots, which are limited to a small region. Additionally, we could only discover juvenile plants measuring hardly more than five

centimetres. Fully-grown individuals, which can indeed grow to a size of 15 cm, were not to be seen. “No outcome” is also the statement that must be applied to flowers and fruits.

This was also true for the second locality of *G. horstii* subsp. *buenekeri*. At a northern face, too, of another table mount the plants covered underneath or between large fragments of rock. We had to look very closely here as well. If we had not had a Czech friend's GPS data, we would never have found the hidden succulent treasures. Much more noticeable was *N. glaucinus*, which had even captured the edge of the neighbouring eucalyptus forest, making the ground of the forest glow with its yellow flowers, just like glowworms. In contrast to this, the plants can no longer be found at locality LB 584. Now there is an agriculturally used eucalyptus forest at the position of the former hill.



Fig. 27: *Gymnocalycium horstii* subsp. *buenekeri* Lun 19-92/1, northwest of São Francisco de Assis.



Fig. 28: *Gymnocalycium horstii* subsp. *buenekeri* Lun 19-94/1, north of São Francisco de Assis.

After leaving São Francisco de Assis we were continually accompanied not only by *N. mammulosus*, but also by *Echinopsis oxygona*. The spherical to slightly columnar shaped, up to about 20 centimetres high plants mostly form small groups, have a more or less varied spination and are really unimpressive. However, their long, funnel-shaped, fragrant, light rose- to dark lavender-coloured flowers are a feast for the eyes. A *Gymnocalycium* friend, too, can rejoice in such an explosion of colours.

Our further tour took us continually in south-western direction to Alegrete, where we had to call on a garage to replace a tyre first. Around São Francisco de Assis we had the obligatory puncture, caused by endless driving on gravel roads. As the tyre was completely destroyed we had no choice but to buy a new one. An expensive affair, in Brazil as well. But in the end we could continue after a little less than one hour.

Southeast of the little town we visited a locality of *Gymnocalycium denudatum*, which Norbert Gerloff had already described in 1992 (Gf 267) and which is situated very far to the north. The plants, which are characterized by yellow, claw-shaped spines close to the body, had been described as *Gymnocalycium denudatum* subsp. *angulatum* by Prestlé in 2004. But more important than nomenclature issues was for us the question whether the plants still exist. The large number of cows grazing on the meadow did not bode well. Yet, far from it. At a watering hole between rocks and slabs there were, apart from large groups of *N. mammulosus*, hundreds of plants, though with relatively small bodies. Definitely the outcome of the presence of all those hoofed animals - however, this *Gymnocalycium* locality does still exist.

At this point it should be mentioned that when searching on meadows the cattle must never be forgotten. During our journey we once had to take to our heels because cows, led by a huge bull,

intended to encircle us. As the animals followed us as far as to the fence and never took their eyes off us, looking for cacti at this place was out of the question.



Fig. 29: *E. oxygona* Lun 19-157/2, between Santana da Boa Vista and Minas do Camaquã.



Fig. 30: Volker Schädlich professionally fits the spare wheel.

A little later the finding of *Gymnocalycium hyptiacanthum* subsp. *uruguayense* also made us rejoice and, even better, it was at a locality so far unknown. The region east of Uruguiana on the border with Argentina was, of course, a huge, fenced in pasture. Just like at other localities it is worthwhile searching specifically near the fence, which is where the cattle rarely gets. Thus cacti can grow relatively undisturbed along the edge of the meadows. The same applies to areas which are rocky and therefore nor attractive to ruminant animals. Good for the flora and for cacti lovers like us who look for plants, take pictures and tell like-minded people about it.



Fig. 31: You should always watch out for cows.



Fig. 32: *Gymnocalycium denudatum* subsp. *angulatum* Lun 19-97/1, southeast of Alegrete.

At this point it should be remarked briefly that many Gymno friends use the traditional and familiar name *G. uruguayense* instead of *G. hyptiacanthum* subsp. *uruguayense*. I myself keep to the last valid name in this paper. How *G. artigas* or *G. volskyi* are to be assessed in this context is not the subject of this publication.



Fig. 33: Volker Schädlich looking for cacti.



Fig. 34: *G. hyptiacanthum* subsp. *uruguayense* Lun 19-101/1, east of Uruguaiana.

It is only a stone's throw from Uruguaiana across Rio Uruguay into neighbouring Argentina. The huge border bridge over the enormous river gives an idea of the masses of water which roll towards Rio de la Plata during the rain season. Then the adjoining area is flooded as well. During our journey to the locality of *Gymnocalycium angelae* in the Argentinian Province Corrientes we could visualize this as the region on both sides of Rio Uruguay always seems to be flooded somehow. Fortunately, the roads are high-lying. Thus we could drive comfortably along Ruta 14, a tarmac road which continually runs parallel to Rio Uruguay as far as the Tres Cerros hill range. *Gymnocalycium* species can only be found on Cerro de Susini. As mentioned in former travelogues, the fenced-in private property is a protected nature reserve on whose terrain dinosaur skeletons have been found. The explicit consent of the neighbouring Estancia's owner is required in order to climb the hill. Persons ignoring this will find themselves at the nearest police station.

Our observations confirm that only few specimens of *G. angelae* grow within a very limited area on the hillside. At any rate, despite our intensive search we could discover only few specimens. However, those were in good shape and instead we found all the more *F. pumila* plants. To date it is not clear whether there are further localities of *G. angelae*, which is closely related to *G. denudatum*. Only field research can answer this question. But who will burden himself with a long-term search of an area extremely short in cacti, the more so as, coming from Europe, there are only a few weeks' holidays available.



Fig. 35: Park entrance of Tres Cerros.



Fig. 36: *Gymnocalycium angelae* Lun 19-103/1, Cerro de Susini, Argentina.

Everyone who has already done fieldwork knows about the important role of weather conditions during a search. After more than fourteen days in suffocating heat we were pleased when we could look forward to some cooling down in Uruguiana. Initially there was a drizzle from the darkest of the clouds. No problem, we thought, we are not made out of sugar. After all, we hadn't come all the way from Germany in order to sit in a hotel. There was heavy rain eventually, but we were still highly optimistic. Fortunately, the heavy rain stopped after three hours and we could focus on cacti again. On this occasion we also noticed that after heavy rainfalls the cacti are surrounded by water or even submerged – surely sometimes for several days. The small *F. pumila*, which can be found almost everywhere, were literally submerged in humus-filled depressions on large slabs.



Fig. 37: *Frailea pumila* Lun 19-104/1, north of Quarai, plants submerged.



Fig. 38: *Parodia sellowii* Lun 19-109/2, north of Quarai.

At the end of the day we could be satisfied as, among other species, *Frailea castanea*, *Parodia sellowii*, *Notocactus mueller-melchersii* and *N. ottonis* could be counted among our findings. The following days' field trips added *Frailea albifusca*, *Frailea lepida*, *Frailea phaeodisca*, *Notocactus buiningii* Buxb. and *Notocactus mueller-moelleri*. All habitats were similar, fenced-in meadows with short grass as far as the eye could see, soil containing pebbles and small rocks, partly interspersed with slabs and stones and often criss-crossed by small trenches, which sometimes contain water only temporarily. Shrubs and trees were generally missing.



Fig. 39: *Frailea castanea* Lun 19-112/3, east of Quarai.



Fig. 40: *Opuntia viridirubra* is widespread.



Fig. 41: *Gymnocalycium hyptiacanthum* subsp. *uruguayense* the size of a handball Lun 19-113/1, east of Quarai.



Fig. 42: Tiny: *Frailea* "elisae" Lun 19-112/2, east of Quarai.

The next important stopover on our southward journey was Quarai. From there we crossed, more exactly drove, across the border into Uruguay. Our route took us via the Uruguayan border town Artigas, along Ruta 4 and the following day along Ruta 30. We were able to trace many localities found by Ludwig Bercht, the late Dutch cacti lover who passed away much too early. He had travelled the area 20 years before. Habitats of *Gymnocalycium* with light magenta flowers, known as *uruguayense* var. *roseiflorum*, were particularly attractive to look at. Nowadays the taxon is generally regarded as synonym of *G. hyptiacanthum* subsp. *uruguayense*. The cacti also grow in grass or pastures along streams and little rivulets in northern Uruguay, but always somewhat elevated between rocks or slabs, so as not to be washed away in the next flood.

Sadly, due to lack of time, we could not investigate the white-flowering populations of *G. hyptiacanthum* south of Artigas at Sarandy del Arapey in more detail. Although we found plants at one place, we could not discover any flowers. Thus the question whether it was a white-flowering species remained.



Fig. 43: *Gymnocalycium hyptiacanthum* subsp. *uruguayense* Lun 19-113/1, east of Quarai.



Fig. 44: Well camouflaged in *Selaginella* moss: *Gymnocalycium hyptiacanthum* subsp. *uruguayense* Lun 19-115/1, east of Quarai.



Fig. 45: *Gymnocalycium hyptiacanthum* subsp. *uruguayense* (var. *roseiflorum*) Lun 19-123/1, northeast of Paso Campamento, Uruguay.



Fig. 46: *Gymnocalycium hyptiacanthum* subsp. *uruguayense* (var. *roseiflorum*) Lun 19-123/1, northeast of Paso Campamento, Uruguay.

I cultivate white-flowering plants in my collection, among others with the field number MM 421. I have asked myself again and again why *G. hyptiacanthum* subsp. *uruguayense* from the same altitude and generally the same environmental conditions flowers in such different colours. Sure, other *Gymnocalycium* species also manifest variation in colour within the same species (e.g. *Gymnocalycium nigriareolatum*), but the fact that three flower colours occur in a limited area within one taxon is extremely unusual with *Gymnocalycium*. Provided it is really genetic mechanisms which cause these differences in flower colour, it would be interesting to know whether this secret can be revealed one day. It should be mentioned in this context that rose-coloured and white-flowering *G. hyptiacanthum* subsp. *uruguayense* have so far been known only from the area south of Artigas. As far as I know such plants have not been discovered on the other side of Rio Uruguay in Brazil.

It also remains a secret, though of a totally different kind, why I tried to drive the car up a steep hill at Santana do Livramento instead of driving around at the foot of the hill and then look for *Gymnocalyciums*. Leaving caution aside just once we would almost have crashed down the slope from the slippery track. Fortunately, I could make the inhabitants of the village use spades so that we would get road adhesion and push us back on the track applying muscular strength. Anyway, we were deeply shocked, but our adventure could go on. As we were drenched in sweat we did not return to nature but to our hotel.



Fig. 47: With three spines: *Gymnocalycium hyptiacanthum* subsp. *uruguayense* Lun 19-25/1 west of Arroyo Catalan Grande, Uruguay.



Fig. 48: *Notocactus buiningii* Lun 19-126/3, Sepultura, Uruguay.



Fig. 49: *Notocactus mueller-moelleri* Lun 19-129/1, southeast of Quarai.



Fig. 50: *Gymnocalycium hyptiacanthum* subsp. *uruguayense* Lun 19-132-1, northwest of Santa Teresa.



Fig. 51: That would nearly have gone wrong.



Fig. 52: The author at a boundary stone between Brazil and Uruguay near Santana do Livramento.

During the following days we drove to São Gabriel, Dom Pedrito and Bagé. In the area surrounding Dom Pedrito we detected several *Gymnocalycium denudatum* subsp. *angulatum* localities which had been known for decades. Here, too, the plants grow generally in meadows between rocks and slabs, unprotected by the sun. Sadly, we had to realise here as well that some localities do not exist anymore. The locality of *G. denudatum* subsp. *angulatum* (Gf 304) in Dom Pedrito had changed into a silage plant. In other places the original vegetation is replaced by plantations of trees – among others Gf 1941 to Gf 1945 housing *G. denudatum* and various *Notocacti* at Lavras do Sul.



Fig. 53: Constant companion: Greater rhea (*Rhea americana*).



Fig. 54: Former locality of *Gymnocalycium denudatum* subsp. *angulatum* Gf 304, Dom Pedrito.



Fig. 55: *Gymnocalycium denudatum* subsp. *angulatum* Lun 19-135/1, east of Dom Pedrito at a quarry.



Fig. 56: *Gymnocalycium denudatum* Lun 19-141/1, Curral de Pedra, Lavras do Sul.

The last stage of our journey took us to various localities of *Gymnocalycium denudatum*, back again in northern direction to Caçapava do Sul, from where we explored the area around Minas do Camaquã and where we were on the lookout for *Gymnocalycium horstii* especially. Our first finding happened at a well-known locality (Gf 2156), a rocky hill at Santana da Boa Vista, which is vegetated with shrubs and small trees. We found many plants at this place, although mostly juvenile specimens. Neither here nor later at other localities did we see large groups or old plants.

It is interesting that *G. horstii* is obviously not selective as to the nature of soil. The species grows in sandy, loamy soil as well as on rather pebbly surfaces or in humus-containing cavities on rocks. In any case, *G. horstii* prefers shade, be it underneath bushes, small trees, close to rocks or large stones.



Fig. 57: *Gymnocalycium horstii* Lun 19-146/1, Santana da Boa Vista.



Fig. 58: *Gymnocalycium horstii* Lun 19-155/1, between Santana da Boa Vista and Minas do Camaquã.

In finally rather agreeable summer temperatures we found, despite a Brazilian friend's GPS data, intensive search and long marches, only four out of at least fifteen known *G. horstii* localities in the region of Minas do Camaquã. However, at three localities there were hardly more than a handful of cacti. Several times we were disappointed having to give up the search since dense shrubs and brushwood rendered getting on impossible. Apparently the vegetation has changed over the previous years since the discovery of the plants. Possibly formerly open spaces have grown over. It cannot be due to increased precipitation as the annual amount of precipitation has remained more or less stable in this area during the last 20 years. It may also be assumed that probably cacti collectors have depleted the localities.



Fig. 59: *Frailea horstii* Lun 19-154/1, west of Vila do Segredo.



Fig. 60: *Tillandsia* spec., between Santana da Boa Vista and Minas do Camaquã.

Before Volker Schädlich and I flew back home from Porto Alegre we came to an overall positive conclusion at the journey's end. We had managed to get to see all species of *Discocacti* growing along our route as well as all *Gymnocalycium* species apart from one exception and almost all *Frailea* growing in the respective regions. Additionally, there were many different *Notocacti*. Yet, it is to be feared that in many localities of *Discocacti* and *Gymnocalycium* no more plants will exist in a few years' time. Half a dozen specimens is not enough for a population's successful reproduction. Thus, we left Brazil with mixed feelings.

The localities of the plants mentioned in this article were found with the help of a large number of GPS data collected by various cacti lovers as well as based on research of field lists, in particular those of Norbert Gerloff, Ludwig Bercht and Massimo Meregalli.

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