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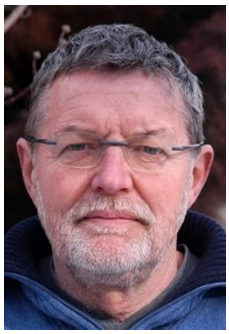

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Cover picture: *Gymnocalycium matoense* VoS 288, Mato Grosso do Sul, Brazil (photo: V. Schädlich)

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We would like to express our warmest thanks to Mrs Iris Blanz (Austria), who supports us with the translation into English, to Mr Takashi Shimada (Japan) for the translation into Japanese, to Mr Jiahui Lin (China) for the translation into Chinese, to Mr Václav Johanna (Czech Republic) for the translation into Czech and to Mr Daniel Schweich (France), who has mirrored our publications under https://www.cactuspro.com/biblio/.

In 1843 the feature of a bare calyx was sufficient for Ludwig Pfeiffer to establish a genus in its own right, which he named *Gymnocalycium* derived from this characteristic. He had noticed this feature, which up to then had been regarded as belonging to two different genera (*Echinocactus* and *Echinopsis*), in three cacti species. In the years to follow the number of species assigned to this genus was increasing. More than ninety years later Alberto Frič found a distinguishing feature with seed characteristics so that the meanwhile large genus could be further subdivided into five smaller groups (subgenera). This system was only marginally changed over the following years, merely the subgenera were subdivided further by Schütz and another subgenus was added. Just as K. Schumann, Y. Itô resorted once more to body morphology in his attempt at subdividing the genus into subgenera and, like Frič, F. Buxbaum based his classification on seed shape. Only around the change of the century was another structuring of the genus attempted. Hans Till combined seed attributes with flower characteristics for *Gymnocalycium* species and presented his classification in the journal GYMNOCALYCIUM in 2009.

However, at that point further accurate division of the genus based on morphology (body, flower, seed) seemed to have reached its limits.

The first DNA-assisted study by M. Meregalli et al.[1], followed by that of Demaio et al.[2], seemed to make it possible to verify previous divisions or to reveal them as wrong. So far, we are only able to combine groups of similar DNA with the help of DNA identification. It is not possible yet to identify species, although investigation methods are getting increasingly subtle and meaningful.

At the conference in Linz initial results were already presented. They will certainly be referred to in one of the upcoming editions of SCHÜTZIANA.

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[2] Demaio, P. H.; Barfuss, M. H. J. ; Kiesling, R.; Till, W.; Chiapella, J. O. (2011): Molecular Phylogeny of Gymnocalycium (Cactaceae): Assessment of Alternative Infrageneric Systems, a new Subgenus, and Trends in the Evolution of the Genus. - American Journal of Botany 98(11): p. 1841-1854.

Gymnocalycium marsoneri Frič ex Y. Itô, *Gymnocalycium megatae* Y. Itô, *Gymnocalycium matoense* Buining & Brederoo – one species?

Volker Schädlich

Part 2: *Gymnocalycium matoense*

Abstract

The second part of the series introduces *Gymnocalycium matoense* Buining & Brederoo. A short historic outline is given, the species' geographic distribution discussed and the plants are shown in their habitat as well as in cultivation.

Keywords: *Cactaceae*, *Gymnocalycium*, *delaetii*, *marsoneri*, *megatae*, *matoense*, *schickendantzii*, Argentina, Bolivia, Paraguay, Brazil

Introduction

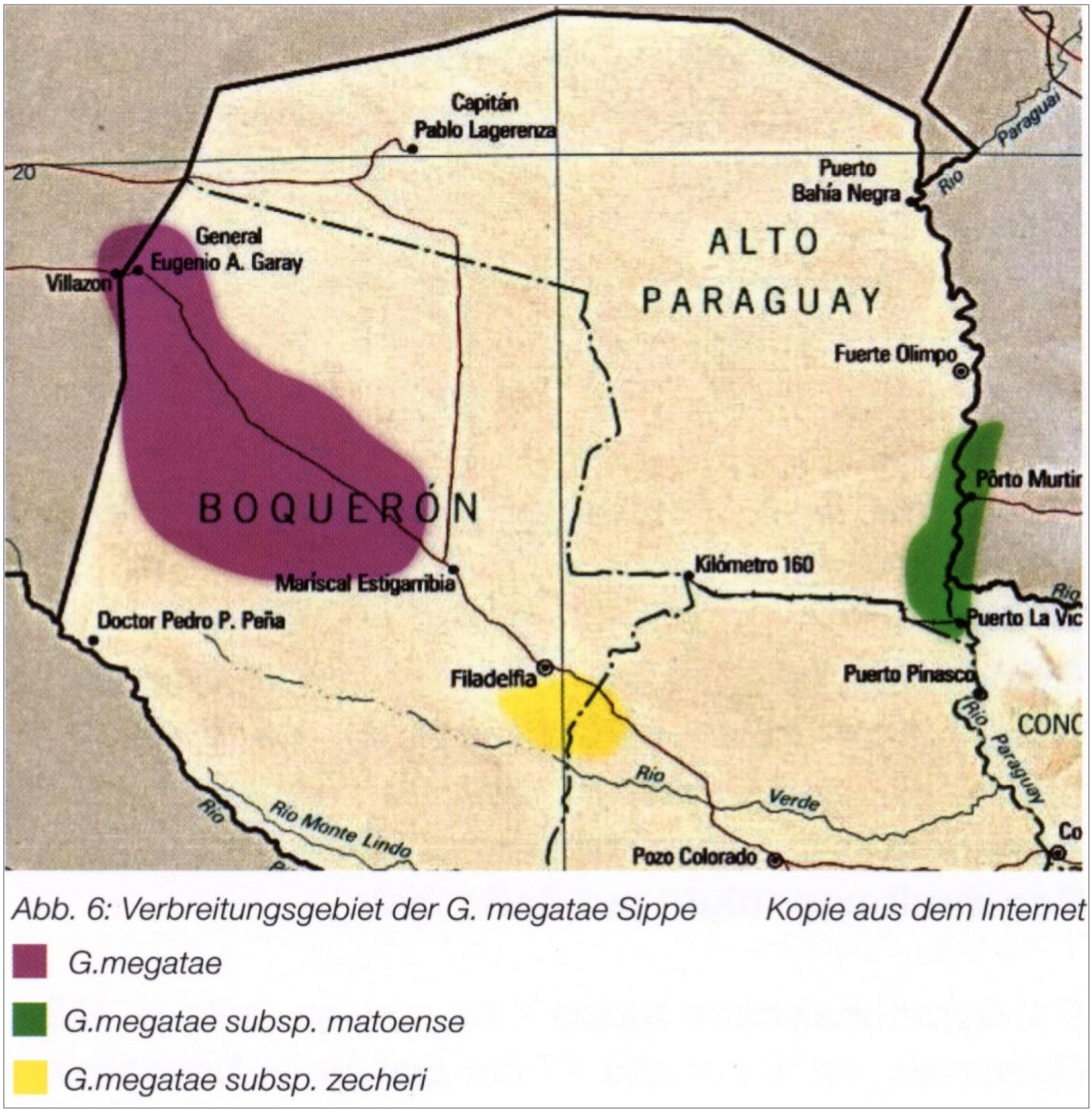
The first description of *Gymnocalycium matoense* took place in the German cacti magazine "Kakteen und andere Sukkulenten" (Cacti and other Succulent Plants)[1)] in 1975. A. F. H. Buining and L. Horst were at the locality on 16th September 1974 and discovered for the first time a plant from the genus *Gymnocalycium* in the province Mato Grosso do Sul in Brazil. Buining noted in the first description that they had been at the same locality several times before without discovering this plant. P. J. Braun and L. Horst visited the type locality of *G. matoense* again in 1983. At that time the locality was still intact so that they were able to rediscover the *Gymnocalycium* species and the accompanying flora mentioned in the first description. The type locality was destroyed by mining in the meantime. In 2006 Ludwig Bercht and the author were able to find the species at another locality.

In 1995 P. J. Braun & E. P. Esteves assigned *G. matoense* as subspecies to *G. marsoneri* Frič ex Y. Itô in the Dutch cacti magazine Succulenta[2)]. No reason for this recombination was published.

In 2008 another recombination was ventured by H. Till and H. Amerhauser in the Austrian journal GYMNOCALYCIUM[3)]. The authors placed *G. matoense* as a subspecies to *G. megatae* Y. Itô. Two years later an explanation for this recombination was published in the same magazine[4)]. A closer look at the part about *G. matoense* is going to be taken here. H. Amerhauser travelled Paraguay four times (in 1996, 2000, 2001 and 2010). H. Till was never in Paraguay and Mato Grosso do Sul in Brazil.

In 2001 the author visited Paraguay together with H. Amerhauser for two days. They set off from Paraguay with the intention of searching for cacti in the region around Porto Mortinho. For both of them it was the first time to travel this area. H. Amerhauser visited the area around Porto Mortinho again for two more days in 2010 together with M. Melojer, once more setting off from Paraguay. The locality data of all four excursions are available to the author, however, *G. matoense* was not found by them.

The distribution area map below was published in GYMNOCALYCIUM 23(4) 2010: 962.



Map 1: Reproduction taken from Till & Amerhauser (2010).

The distribution area of *G. matoense* marked on the map does not exist in reality. So far, no plants related to the group of *G. marsoneri*, *G. megatae* or *G. matoense* have been found in this area. The easternmost locality of *G. megatae* known so far is situated near Filadelfia, which is around 220 km in linear distance away from the locality specified by Till & Amerhauser (2010).

The following can be read on page 964 of the same publication (text in grey):

"Rio Paraguay can be considered the westernmost border of the distribution area Sectio *C Terminalia*. This border has been crossed only few times and mostly in the north, where large floods occur at times, after especially heavy rainfalls.

Fig 1: Rio Paraguay (Photo: H. Amerhauser (2020), there fig. 8).

These can be found particularly in the confluence region of Rio Apa and Rio Paraguay. Old specimens of *G. matoense* can reach a diameter of over 20 cm. Its body colour is predominantly dark green, only in exposed places is it light to chocolate brown.

Additionally, this is the only area known so far where, presumably as a consequence of repeated floods, localities common to *G. anisitsii*, *G. damsii* and *G. matoense* were found (fig. 8[4)]). Judging from the wording of his diagnosis, *G. matoense* can be compared with the *Gymnocalycium* group which Friedrich found on the western side of Rio Paraguay and which he called "bridal wreath" based on abundant flowers around the apex. Buining writes that it was by pure coincidence that he and his companion Leopoldo Horst found this group. Meanwhile more localities are known, also found by the second author, among others (fig. 9[4)])."

H. Till and H. Amerhauser were never at the confluence of the Rio Apa and the Rio Paraguay, as their field data show. In this area, we were only able to find *G. anisitsii* (map 2) in the immediate estuary of the Rio Paraguay in 2019. Figure 1 shows the Rio Paraguay near Concepción. The picture was taken from the bridge 'Nanawa'. However, the Rio Apa flows into the Rio Paraguay about 150 kilometres further north. There are no plants growing in this area that can be classified as *G. marsoneri*, *G. megatae* or *G. matoense*. At the airport of Concepción there was a small area where *G. anisitsii* (K. Schumann) Britton & Rose, *F. concepcionensis* Buining & G. Moser and *E. rhodotricha* K. Schum. could be found. However, these sites have been built over due to the increasing expansion of the city.

Fig. 2: "*G. megatae* subsp. *matoense* at its locality south of Porto Murtinho (photo: H. Amerhauser (2020), there fig. 9)."

Figure 2 depicts a plant from northern Paraguay, presumably from the region of Porto Murtinho in northern Chaco. Neither *G. megatae* nor *G. matoense* grow south of Porto Murtinho.

Map 2: Locality VoS 2878 *G. anisitsii* in the estuary region of Rio Apa, right on Rio Paraguay (map: M. Wick, map background: Bing).

The same publication continues on page 965:

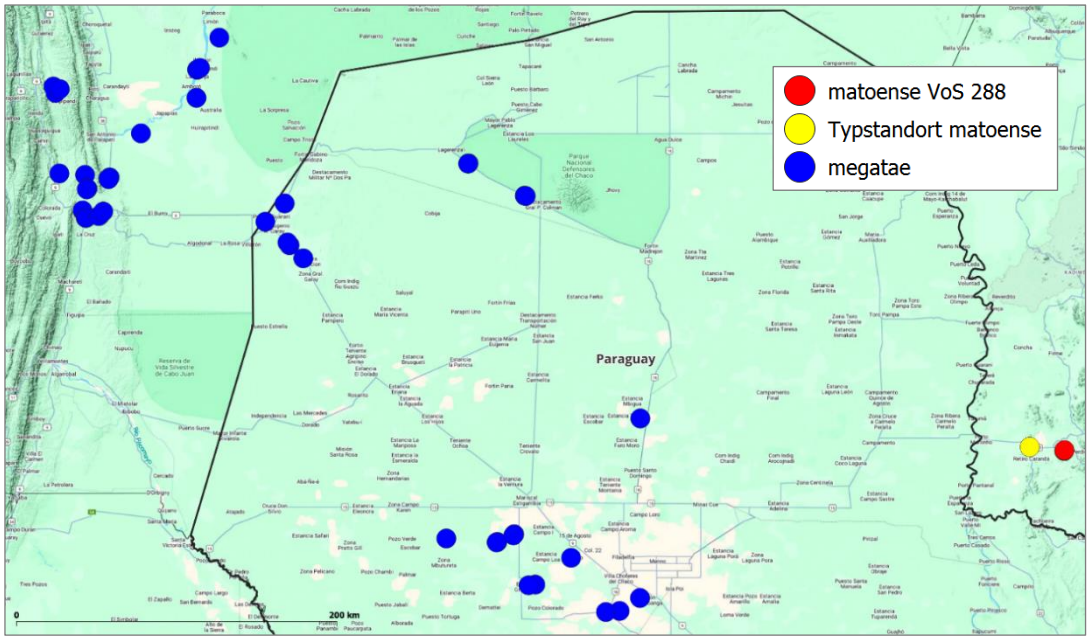
"*G. matoense* finds better living conditions in the moist zone influenced by Rio Paraguay than *G. megatae* in the dry Chaco area. Therefore it can grow to a larger size and it possesses up to twenty ribs. Another distinguishing feature are nine marginal spines curving in direction of or pressed to the body as well as frequently one vertically protruding central spine. According to the original diagnosis, the anthers are allegedly white. The co-author discovered filaments and anthers of the same colour as those of *G. megatae* in this group. We consider this group, too, as a subgenus of *G. megatae*:

Gymnocalycium megatae Y. Itô subsp. *matoense* (Buining & Brederoo) H. Till & Amerh., comb. nov.

Basionym: *Gymnocalycium matoense* Buining & Brederoo, Kakt. and Sukk. 26:265, 3 figs. (1975).

Synonym: *Gymnocalycium marsoneri* Frič ex Y. Itô subsp. *matoense* (Buining & Brederoo) P. J. Braun & Esteves, 74:131 (1995) fig. 10."

G. matoense does not grow in the moist zone influenced by Rio Paraguay but in Campo Cerrado east of Porto Murtinho, many kilometres away from the river (map 3). As can be seen on the map, all *G. megatae* localities are located west of Rio Paraguay. The species grows in Paraguay in small savannah-like habitats with soils consisting merely of sand. Only few trees and bushes grow at the localities of *G. megatae* in central Paraguay. Mostly *Stetsonia coryne* (Salm Dyck) Britton & Rose and *Opuntia elatae* Link & Otto ex Salm-Dyck can be found sporadically in certain places in the way of cacti. The prevailing plant is a grass (*Elionurus muticus*), which can grow to a height of 2 metres. The landscape east of Rio Paraguay's catchment area is totally different. It is characterized by floodplains, lagoons, palm tree savannahs and gallery forests. The amount of precipitation is 1,000-1,300 mm per square metre in a year.



Map 3: localities of *G. megatae* and *G. matoense* (map: M. Wick, map background: Google Maps).

Reproduction of the first description of *G. matoense*

„A. F. H. Buining and Brederoo

Corpus solitarium ad interdum paulum elongatum ad 15 cm diametitur, 7 cm altum est et interdum altius, perviride ad magis perbrunneoviride et etiam badium est radicibus ramosis. Costae ad 21 acutiores 15 mm latae sunt tuberibus fastigatis papilliformibus inter areolas instructae. Areolae ovales 8 mm longae et 4 mm latae sunt, primum tomento cremeo instructae, postae fere nudae, in costa 15 mm infer se distant. Spinae primum flavescentes, deinde suggriseae; fere 9 sunt quarum uno deorsum versa 15 mm longo est, supra eam utrimque 3 sunt 13 mm longae et in supremo plerumque par unum 11 mm longarum; in areolis veterioribus plantarum adultarum una spina centralis 17-19 mm longo est.

Flores gracile infundibuliformes sunt, 38 mm longi et ad 14 mm lati; percicarpellem pediculiforme in conum desinens squamis carnosis brunneoviridibus albomarginatis instructum est; receptaculum camponuliforme dilatatum squamulis carnasis semirotundis viridibus albomarginatis instructum est; folia transeuntia elongata summo loca retundata vel acute desinentia carnosa viridia albomarginata in acumen brunneoviridia sunt; folia perianthii exteriora spathulata-margine integro aliquo carnosa alba sunt acumine extrinsecus subbrunneoviridi; interiora spathulata, acumine dilatato, tenuia, margine integro, acumine tenue crenato, alba sunt; caverna seminifera ovalis ad producte cordata; ovula arboriformiter ramosa in fasciculis de 10-12; camera nectarea conica est, glandulae nectarea parietalis sunt; stamina primaria alba sunt in corona clausa in margine camerae nectarea, quam non praecludunt, 5 mm longa sunt; secundaria alba in 3-4 coronis 8 mm longa, tenuissima sunt; antherae omnes albae sunt; pistillum 8 mm longum, 1,5 mm crassum est; stigmata ad 8, 2,5 mm longa, alba sunt.

Fruntus bacca ovalis est pruina glaucescenti 2,5 cm longus, 1,6 cm diametiens est squamulis aliquibus unguiformibus instructus. Semen galeriforme 0,9-1 mm longum est, 0,8-0,9 mm latum; testa obsolete ochrea globulis rotundis irregulariter magnitudine et praeter marginem hili minimis instructa est; pecten discerni non potest; hilum producte ovale est textura subochrea; micropyle et funiculus aliquo demersi sunt; embryo ovularum est, cotydelones discerni non possunt, perispermium deest.

Habitat ad Porto Murtinho, Mato Grosso, Brasilia, in altitudine fere 140 m in rupibus planis et inter lapides fractos in locis apertis in catinga.

Holotypus in Herbario Ultrajecti, Hollandia, sub nr. H 452.

Plant flat spherical, often somewhat elongated, up to 15 cm in diameter, 7 cm tall, sometimes taller, from dark green to dark brownish green to chocolate brown, roots branching, apex sunken and bare. Ribs up to 21, fairly edged, 2 to 2.5 cm apart from each other at the base, arranged in tapered, narrow protuberances, which stick out noticeable between the areoles, often 6-7 mm above the areoles, protuberances 1.5-2 cm high. Areoles oval, 8 mm long, 4 mm wide, first with cream coloured felty wool, later almost bare, positioned at the base of the protuberances at a distance of 1.5 cm. Flower bud somewhat sunken above the areole in front of the transverse cleft. Spines develop later from the first bare areoles, first yellowish, later light grey; marginal spines 9, one of them directed downwards, about 15 mm long, 3 comb-shaped pairs pressed towards the plant on either side, 13 mm long, mostly an additional pair above the latter ones of the same texture, 11 mm long. 1 central spine at areoles some years of age, sticking out vertically, 17-19 mm long.

Flower closed, 38 mm long, 14 mm wide, slim funnel-shaped, bare; pericarp restiform, tapered, 15 mm long, up to 8 mm wide, bare, green, covered with nail- to heart-shaped succulent scales, whose edge is smooth, 2-3 mm long, 3-4 mm wide, bare, covered with semi-circular succulent scales, 3-4 mm wide, 3 mm long, eventually turning into elongated succulent transitional leaves, rounded at the top or pointed, 9 mm long, 5 mm wide, green, brownish green towards the top, edge white, outside perianth leaves spatulate, 14 mm long, 4.5 mm wide, edge smooth, somewhat succulent, white, tip light brownish green outside; inside perianth leaves thin, spatulate, with widened tip, 10 mm long, 5 mm wide, only tip finely crenated, white; seed cavity oval to stretched heart-shaped, 11 mm long, 4 mm wide; ovule attached to the pericarpel, branching dendriform in bunches of 10-12; nectar tube conical, 4.5 mm long, 3.5 mm wide; nectar glands attached to the pericarpel 2.5 mm long, primary filaments white, detached, forming a closed circle on the edge of the nectar tube without closing it off, 5 mm long, arching towards the stigma; the receptacle wall is thickened in a circular form behind the base of the primary filaments; secondary filaments in 3-4 circles, 1 circle slightly below the edge of the receptacle, the other ones on the edge, 8 mm long, very thin, white; anthers 2-2.5 mm long, white, style 8 mm long, 1.5 mm wide, white, 8 stripes on the stigma, 2.5 mm long, white, with papillae.

Fruit: juicy berry, oval, light blue, few of them greyish blue, along the edge nail-shaped scales of lighter colour; a small cap on top with a light brown bent edge with flower remains, pulp red. Seed: helmet-shaped 0.9-1 mm long, 0.8-0.9 mm wide; testa matt ochre coloured with small spherical cells of varying size, the smallest along the edge of the hilum; ridge not visible; hilum stretched oval, enfolding micropylar region and funiculus, which are somewhat sunken, hilum tissue bulging out from the testa wall, light ochre coloured. Embryo ovate, without perisperm, cotyledons not visible.

Locality: near Porto Murtinho, Mato Grosso, Brazil, at an altitude of 140 m a.s.l., in flat rocky soil, in open areas in the midst of Caatinga, together with *Discocactus silicicola* Buining et Brederoo, *Frailea melitae* Buining et Brederoo as well as bromeliads and small shrubs. A. F. H. Buining and L. Horst visited the locality on 16th September 1974. This was the first time that a plant from the *Gymnocalycium* genus was found in Mato Grosso. It is strange, however, that we did not come across this rare plant during earlier excursions to this very locality. Such a discovery is often merely accidental.“

Fig. 3: *G. matoense* HU 452 in the author's collection.

Gymnocalycium matoense in its habitat

The *G. matoense* localities known to the author are all situated east of the type locality at a distance of around 20 km. The plants from locality VoS 288 form offsets at older age at their habitat as well as in cultivation, as does the author's plant cultivated in his collection under the collective number HU 452. In 2006 the author could find *G. matoense* for the first time. Since then the author has visited the area and this habitat repeatedly. Although the population density is low, it has managed to survive. During the author's last visit in 2023 specimens could still be found. It is to be hoped that the heavily threatened population will continue to exist.

Fig. 4 and 5: Habitat of *G. matoense* VoS 288. The species grows here in Campo Cerrado. It is a savannah-like landscape with trees which are not very high. The ground consists of rocky bedrock covered by soil.

Fig. 6 and 7: The succulent accompanying flora consists of *Dyckia spec*. and *Cereus bicolor*.

Fig. 8: *G. matoense* VoS 288, author's first finding in 2006.

Fig. 9: *G. matoense* VoS 288 at its locality in September 2009.

The epidermis of the plants found was reddish-brown due to drought stress. As soon as the plants have taken in enough water and are in full growth the colour of the epidermis changes, getting green and slightly gleamy.

Fig. 10: In September 2012 only very few plants could be found after the dry season, which can last for four months in this region. The plants are still looking stressed.

In October 2016 and November 2019 the author revisited the locality of *G. matoense*. Yet, the plants could not be found again despite intensive search. It was extremely dry in Mato Grosso in 2019, at the same time there were devastating fires in Pantanal, which spread as far as Bolivia and Paraguay.

Fig. 11: In March 2023 the author could find *G. matoense* again at its locality. Thus, it has proved true once again that it makes sense to frequent localities more often. During the rainfall period the plants are taut and thus easier to make out.

Fig. 12 and 13: All the plants the author could find at locality in 2023 had a green epidermis. It can be assumed that the plants always possess a green epidermis during the rainfall period.

The species in cultivation

Fig. 14: Sowing of *G. matoense* VoS 288, six-month-old seedlings.

Fig. 15 and 16: left: two-year-old seedlings, right: four-year-old seedlings.

Cultivating seedlings is unproblematic. While *G. marsoneri* and *G. megatae* seedlings often react to cultivating mistakes (too much water in early spring) with dying off, seedlings of *G. matoense* are rather tough. More frequent watering throughout cultivation is advantageous for this species.

Fig. 17 and 18: *G. matoense* VoS 288 is a perennially flowering plant. They delight throughout the whole vegetation period. The plants start offsetting at older age.

Fig. 19: The tips of the outer petals of *G. matoense* VoS 288 possess an intensively red-brownish colouring at the outside.

Fig. 20 and 21: Flower section of VoS 288, the anthers are grey to blackish, deviating from the statement in the first description. The picture on the right presents a beautiful freak of nature: a plant in the author`s collection always forms orange-coloured stigma branches.

Fig. 22: Ripe bluish-red fruit of *G. matoense* VoS 288.

Fig. 23: Seed of *G. matoense* VoS 288

Fig. 24: Seeds of *G. matoense* HU 452.

The seeds of *G. matoense* are ± spherical, positioned straight or slightly inclined towards the HMR region at the base. Length 0.80-1.05 mm, M(30) = 0.929 mm, width 0.75-0.95 mm, M(30) = 0.859 mm.

Just as in the first part of this series about the relationship of *Gymnocalycium* marsoneri, no final statement is attempted concerning the question "*Gymnocalycium* marsoneri Frič ex Y. Itô, *Gymnocalycium megatae* Y. Itô, *Gymnocalycium matoense* Buining & Brederoo – all the same species?" A final assessment will be made in the third part of this series.

If not stated otherwise, all photographs by the author V. Schädlich.

ACKNOWLEDGEMENT

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Summary of the 4th International Gymno Meeting from 31st May to 1st June in Linz (Austria)

Ulf Marx

On Friday, 31st May 2024, numerous cacti friends got together once more in Linz Botanical Garden for the 4th International Gymno Meeting, which was again hosted by the Organisation "Cactus Gymno Team International".

In the early afternoon numerous offspring and professional literature were already being sold by conference members in the cultivation greenhouse of the garden. Thomas Schiefecker, head of the Botanical Garden, opened the special exhibition "Cacti and *Tillandsia* from Latin America – discoveries by eminent field researchers", which was open to the public until October 2014. The exhibition showcased the latest *Gymnocalycium*, *Sulcorebutia*, *Frailea* and *Tillandsia* discoveries by members of the Cactus International Team in the past decades. For the first time the newly discovered and so far undescribed *Gymnocalycium saladense* nom. nud. was presented to the general public in a display glass cabinet of its own. Wall charts made the audience also familiar with the field researchers themselves, who had taken enormous pains to find these plants in Latin America.

Afterwards the participants let the evening end on a cosy note in the Cactus GTI bar of the Botanical Garden.

On Saturday morning, the 1st of June, Ulf Marx welcomed further cacti friends from Poland, Italy, Germany, the Czech Republic and from Austria.

It is a well-established tradition for Wolfgang Papsch to give an introduction to the literature referring to the day's topic.

Due to DNA research it may seem out-dated at first glance to consider solely seed groups, however, it is still worthwhile having a look at the past. As early as over 100 years ago Prof. Friedrich Vaupel in Berlin tried to divide cacti into seed groups, but it was not until 1931 that Wilhelm Weingart mentioned *Gymnocalycium* for the first time in his seed classification. In the same year Ernst Schelle and Alberto Frič created a phylogenetic tree containing a branch called *Gymnocalycianae*, for which Frič intended to compile its own data bank with seed pictures. In 1935 Kurt Kreuzinger in Czechia did not only investigate flower sections, but he also mentioned five seed groups of *Gymnocalycium* in his catalogue, among them *Muscosemineum* with the keystone species *Gymnocalycium schickendantzii*. Kurt Backeberg in Germany fiercely criticised Kreuzinger's publication, speaking about the "dragging up of Vaupel's thoughts". In 1957 the Japanese Itô arranged the genus into 13 groups, those representing *Muscosemineum* were subdivided into *Ophiocephalum*, *Discocephalum* and *Goniocephalum*, whereas Bohumil Schütz returned to Kreuzinger's system in 1962. In 1965 Pažout rejected the term *Muscosemineum* (moss-like according to Schütz) and named the seed group *Coactosemineae* (felt-like). The Austrian Franz Buxbaum referred to *G. schickendantzii* as type in the 12 series of Hans Krainz's opus "Die Kakteen" ("The Cacti"). In 1984 Klaus Heid changed between the systems of Schütz and Buxbaum in his publication "Der Frankfurter Kakteen-Freund" ("The Frankfurt Cacti Friend"). Only in 2001 did Hans Till attempt to combine flower and seed forms in a new arrangement of the genus *Gymnocalycium* in the magazine "GYMNOCALYCIUM". The seed group *Muscosemineum* can be found in Till's Sectio *Terminalia*. Thus seed research came to an end and the first DNA investigations followed, carried out by Massimo Meregalli, Enrico Ercole & Michele Roda in 2010 and Pablo Demaio et al. in 2012.

The following discussion revealed that previous seed research supports current DNA analysis and helps laypeople to assign seeds correctly.

After that Volker Schädlich's presentation introduced members of *Muscosemineum* in their distribution area in Paraguay, Brazil and Bolivia, starting with the widespread *Gymnocalycium mihanovichii* in north-western Paraguay's Chaco region and extending to the Argentinian provinces Chaco and Formosa. In 2014 he rediscovered, together with Ralf Hillmann, the southernmost situated habitat of the plant called *G. mihanovichii* fa. *stenogonum* by Frič. It seemed doubtful for a long time that Frič had found the type specimen on Rio Paraguay near Puerto Casado Paraguay. The speaker was able to find *G. mihanovichii* again together with Ludwig Bercht and Michael Melojer

on Rio Paraguay in the woods of Puerto Casado in 2016. The region from northern Paraguay as far as eastern Bolivia is home to *G. friedrichii*. Although *G. friedrichii* and *G. mihanovichii* grow together in some places, they do not form hybrids. In 2012 Volker Schädlich together with Alexander Arzberber and Christian Hefti discovered a member of *Muscosemineum*, which Schädlich described as *G. arzbergeri* in 2022. Despite three more journeys to the area only one locality with few plants could be detected. By means of observation in cultivation and sowings throughout ten years it could be clearly told apart from *G. mihanovichii*.

Gymnocalycium megatae from northern Paraguay grows in high grass. The populations occurring around Filadelfia form offsets. Due to Mennonite settlements there are only few localities of the 30 cm high and 25 cm wide plants left. They can be found at an altitude of around 900 m a.s.l. in Bolivia and were described as *G. eytianum* by Cardenas. The Brazilian *G. matoense*, which was described by Buining and Brederoo and discovered by Volker Schädlich together with Ludwig Bercht 20 km east of the type locality, has almost disappeared because of fire clearing. In contrast to this, *G. anisitsii* has a large distribution area in Mato Grosso do Sul, in Tucabaca Valley in Bolivia and in north-eastern Paraguay. The species is very variable. The Bolivian *G. hamatum* is considered merely a form of *G. megatae* by the speaker. He also presented *G. eurypleurum* from northern Paraguay, discovered in the 1960s by Friedrich Ritter. It can tolerate long dry seasons and grows in groups. The conference participants could also admire the Bolivian *G. marekiorum*. Unfortunately, the type locality in the province Santa Cruz cannot be reached any longer.

According to the speaker, *Gymnocalycium mendozaense* must be positioned between *G. mihanovichii* and *G. friedrichii*. As far as classification is concerned, Volker Schädlich considers *G. pseudo-malacocarpus* (Lau 365 near Lourdes) and *G. griseo-pallidum* (Lau 368 near Salinas) as problematic.

After a short break Tomáš Kulhánek showcased the Argentinian representatives of the seed group *Muscosemineum*. Starting in north-western Argentina, locality pictures of *Gymnocalycium schickendantzii* with its varieties *pectinatum* and *periferalium* were shown. According to the speaker it is difficult to draw a distinct line between *G. schickendantzii* and *G. marsoneri*, another Argentinian member of the seed group *Muscosemineum*. Kulhánek showed reference

pictures of the locality as well as of his seedlings. In the speaker's opinion *G. schickendantzii* var. *bergeri* can easily be recognized not only from its brown anthers but also from its bright spines. Kulhánek's wanderings across the provinces from north to south gave the audience an understanding of the transitional forms. He also presented flower

sections and locality pictures of *G. michoga*, which had been shipped to Europe by Frič at the end of the 1920s and had been described by Itô in 1957.

A special highlight was *Gymnocalycium saladense* nom. nud., newly discovered on Rio Salado. It flowers white and, as opposed to *G. schickendantzii*, it possesses red fruits, which ripen earlier. It grows not far from *G. schickendantzii*. Old plants grow to a height of up to 50 cm and can be told apart from *G. pungens* by its distinctly shorter spines.

Gymnocalycium delaetii from Salta and Tucuman exhibits strong spines, a body with matt epidermis and blue fruits. The plants grow together with *G. spegazzinii*, *G. saglionis* and in some places with *G. marsoneri*. Tomáš Kulhánek presented *G. marsoneri*'s type locality in Salta and outlined transitions from *G. megatae* to *G. marsoneri*. *G. pungens*, described by Fleischer in the magazine Fričiana in 1962, was presumably found by Frič on his way from Colonia Dora to the province Chaco by train. It was widespread in the Czech Republic, yet to date there is no confirmed provenance. The speaker assumed that it might be a form of *G. schickendantzii* with extremely long spines.

After a lively discussion the cacti friends recharged their batteries at the buffet in the cultivating greenhouse and visited the Botanical Garden during lunch break.

In the early afternoon Volker Schädlich and Gert Neuhuber introduced *Muscosemineum* seeds. The seed pictures were combined with the respective species's distribution areas. This contribution is going to be published in its entirety in one of the future issues of SCHÜTZIANA.

Since DNA investigation is of special concern for the members of Cactus Gymno International, Michael Barfuss' presentation was eagerly looked forward to. In the first part (part two is going to be presented at the 5th International Gymno Meeting in Linz on 31st May 2025) the speaker explained the method and outlined the differences between barcoding and phylogenesis. Requirements for the former are suitable DNA markers. DNA sequences of correctly identified plants are deposited in a global data bank for world-wide access.

DNA barcoding can be used as a method for identifying species with the help of the DNA sequence of one or several short molecular markers (a short DNA sequence, which is unambiguously identified and whose position in the genome is known). In addition, bar coding can be applied for identifying the taxonomic rank at species level and above. However, this requires a taxonomic hypothesis, since a generated phylogenetic tree does not provide classification.

In contrast to this, phylogenetics, respectively research of relationship, is the investigation of evolution and relatedness throughout history between or within groups of organisms with the help of DNA-sequencing.

Currently bar coding is not satisfactory enough when used with cacti. Around 70-80 % of the species can be assigned with the help of two well-established, standardly applied marker genes (matK, rbcL). 20-30 % of the species, which are very young with respect to phylogeny, often possess identical DNA sequences in these marker genes. Here an assignment to a species is not possible so far. M Barfuss found and tested a third marker (ycf1), which seems to be very promising and allows for assignment to a species, even with more closely related ones. Yet, research of relationship (though not on species level) is possible with the markers used so far.

The speaker explained the proceedings of DNA extraction in detail and showed a DNA sequencing matrix of the *Gymnocalycium* species investigated. From this, the analysis program generates a phylogenetic tree. The shorter the branches in the phylogenetic trees, the closer the relationship of the individual samples tested. Branch points indicate a common origin here, consequently a presumed

common ancestor. The genetic distance can be calculated based on the number of base mutations. The *Muscosemineum* members can be roughly divided into three groups due to the hitherto existing results from investigations. The group's name is taken from the name of the taxon first described in literature.

The first group is the *Megatae* group with *Gymnocalycium megatae* as the longest described taxon. *G. marsoneri*, *G. marsoneri* subsp. *australis*, *G. hamatum*, *G. megatae* subsp. *holdii*, *G. griseo-pallidum*, *G. matoense*, *G. anisitsii* subsp. *tucavocense*, *G. eurypleurum* and *G. pseudo-malacocarpus* also belong in this group.

The second group is the *Schickendantzii* group with *Gymnocalycium schickendantzii*, *G. delaetii*, *G. schickendantzii* subsp. *bergeri* and *G.* aff. *michoga*.

Within the seed group *Pirisemineum*, too, the first investigations were carried out on *G. pflanzii*, *G. zegarrae*, *G. paediophilum*, *G. chacoense*, *G. chiquitanum* and *G. cabreraense*. The results will be presented at the next meeting in Linz on 31st May 2025.

After a short break Peter Lechner and Michael Barfuss reported on the subject DNA barcodes of the *Sulcorebutia* group.

The individual *Sulcorebutia* taxa occur, other than many *Gymnocalycium* species, only in an isolated, often very small areas which mostly do not overlap. Along the edge of the distribution area the *Sulcorebutia* vary in appearance, just like the *Gymnocalycium* species, due to changing environmental conditions. Peter Lechner illustrated with this example how fast the micro climate can change at a locality in Bolivia.

The third group is the *Anisitsii* group. It includes *Gymnocalycium* anisitsii, *G. mihanovichii*, *G. friedrichii*, *G. friedrichii* subsp. *stenopleurum*, *G. mendozaense*, *G. marekiorum* and *G. mareki-orum* subsp. *sanjoseanum*.

Identification with the help of DNA barcoding on species level is not really possible with the hitherto existing marker selection because of the evolutionary young age of the *Sulcorebutia*, although the investigated samples can be assigned

to groups here as well and relationship connections illustrated.

During the following buffet in the Botanical Garden in the evening eager discussions took place, too, until all the participants got together for the day's last presentation.

Norbert and Elisabeth Sarnes showcased Patagonia blooming to a degree we would never have expected. Even though cacti occur only to a limited extent in southern Argentina, the diversity of the presented plants was very impressive. In the first part Norbert took us from the country's north on the Atlantic Ocean in southern direction. We could admire *Gymnocalycium gibbosum* near Puerto Lobos and also saw *Pterocactus australis*, various bulbous plants, butterflies and also tortoises. They found *Austrocactus bertinii* near the coast around Sierra Grande and later *Notocactus submammulosus* as well as *Wigginsia sessiliflora*.

Wildlife appeared in the way of impressive orcas and penguin family units along the sea. Elisabeth took us further south as far as the Strait of Magellan. Here *Austrocactus bertinii* is clearly more strongly spinated and grows in sand. The creeper *Mutisia* from the composite family was flowering. *Pterocactus australis* accompanied them throughout the whole journey, although it can only be found easily when flowering. The couple could watch flamingos in the very remote area west of Puerto Deseado in the Santa Cruz province. Possibilities for boat excursions were offered on Rio Deseado, where the travellers were accompanied by dolphins, terns and cormorants. In the heartland the petrified forest of Jaramillo was visited, which developed 170-175 million years ago. A reproduction of Magellan's ship "Victoria" could be admired in Museum Nao Victoria. On Rio Santa Cruz the *Pterocactus australis* plants exhibited almost orange flowers and *Fabiana australis* was also in full bloom.

The way back took them through the country's south-eastern heartland along tremendous glacier walls. Gauchos were tending sheep and when somebody was sneaking up against the wind they could even watch armadillos and foxes. The route took them past Fitz Roy, which is difficult to climb, to Lago Posadas with its salt lagoons. Passing Monte Zaballos they continued to the border with the province Chubut where the sheep shearing world championships take place in Rio Mayo. The last part of the journey was called "Northern Andes" by Elisabeth. We were shown volcanoes covered with snow, *Austrocactus* spec. nov. in the very dry surroundings of Tecka and also large groups of *Maihuenia patagonica* in full bloom. These plants are not easy to maintain in cultivation. Getting closer to the Andes the vegetation became greener. *Austrocactus coxii* was flowering in multiple colours and so did the very variable *Pterocactus fischeri*. In the Rio Varvaco valley in direction of the border with the province Mendoza they found the southernmost distribution area of *Austrocactus hibernus* and reached the northernmost part of Patagonia.

Impressed by the multitude of flora and wildlife of southern Argentina, the conference participants chatted away until late at night. The fact that Jaroslav Prochazka had completed another decade on his last birthday was belatedly celebrated by all participants present. We look forward to a reunion on 30th and 31st of May 2025. The projected conference topic is the second part of the *Muscosemineum* and *Pirisemineum* seed groups (for details go to https://cactusgti.eu).

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