

Schütziana

The Gymnocalycium Online Journal



Volume 7, Issue 3, 2016
ISSN 2191-3099

This document was published as a pdf file: October 22nd 2016

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Published: October 22nd 2016

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Publisher: WORKING GROUP SCHÜTZIANA, Fichtenweg 43, 14547 Fichtenwalde, Germany

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SCHÜTZIANA is the journal of the WORKING GROUP SCHÜTZIANA.

Source of supply: SCHÜTZIANA is available only as a pdf-file via World Wide Web and can be downloaded from: www.schuetziana.org/download.php.

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ISSN 2191–3099

Cover picture: *Gymnocalycium friedrichii* var. *moserianum* VoS 239, Paraguay, south of Nueva Asuncion, 275 m, seedling (photo: V. Schädlich)

Editorial

Dear *Gymnocalycium* enthusiasts

32th International *Gymnocalycium* Meeting - 2nd to 4th September 2016 in Radebeul (Germany)



Holger Lunau

From 2nd to 4th September, 2016, Radebeul in Germany was the venue of for the 32nd meeting of the *Gymnocalycium* specialists and friends from six European countries. The get-together in the hotel “Goldener Anker”, situated in the charming local centre Altkötzschenbroda on the river Elbe, refuted the opinion often voiced by cactus lovers that *Gymnocalycium* is an uninteresting genus. Even before the beginning of the conference, two dozen participants were discussing passionately the results of their latest collecting trips to Latin America and all the news concerning the genus, while sitting in a beer garden in splendid weather. The discussions were not solely about the subject of the meeting “The relationship of *Gymnocalycium robustum* and *Gymnocalycium affine*”.

The conference started officially in the evening. Volker Schädlich (Spremberg, Germany), who had again been trusted with the organisation of the meeting, welcomed the participants and explained the packed agenda. For the next three days Ludwig Bercht (Eck en Wiel, The Netherlands) guided expertly through the program, as usual with his sound expert knowledge and good sense of humour.

Then it was Horst Kallenowsky’s turn (Hamburg, Germany) to provide the first highlight. His report “A Tour of *Gymnocalycium*’s Diversity in Central Argentina” illustrated for all the guests what really beautiful plants grow in the Province Córdoba. Magnificent photographs of cacti alternated with information on the country and its people – a captivating travelogue, which provided plenty of material for discussion over a vespertine glass of beer.

The next morning the meeting started at 9 o’clock and it was good to be on time because the hall was filled to capacity. Obviously the congress subject “The Relationship of *Gymnocalycium robustum* and *Gymnocalycium affine*” generated a lot of interest from the participants. It has already become a tradition that the first speaker is Wolfgang Papsch (Kalsdorf, Austria). He presented a detailed overview of the relevant literature concerning this plant taxon from the northern part of the Argentinian Province Córdoba. It became obvious quickly that nothing is obvious in northern Córdoba. Among others, the question came up as to the relationship of the recently described *G. campestre* with species like *G. erinaceum*, *G. robustum* or *G. affine*. In addition, species like *G. kuehhasii*, *G. parvulum* subsp. *agnesiae* and *G. parvulum* subsp. *huettneri* also grow in this area.

With the help of his excellent knowledge of habitats in Córdoba as well as a great number of various data, such as conditions at locality, growth patterns and time of flowering, Thomas Strub (Binningen, Switzerland) had a go at lifting the fog of taxonomy and nomenclature somewhat. However, even he had to admit that it is difficult to name the individual taxa correctly outside their respective type locality. Thus plants from the area around San Pedro Toyos can neither be assigned to *G. robustum* nor to *G. campestre* without ambiguity, although they clearly do not belong to *G. erinaceum*. A further example is *G. parvulum* subsp. *huettneri*, which occurs in the southern distribution area of *G. affine* and can be distinguished from the latter solely in its offsetting patterns. The same applies to *G. parvulum* subsp. *agnesiae* and *G. campestre*.

In Thomas Strub's opinion *G. robustum*, *G. affine* as well as probably *G. campestre* are related, with *G. campestre* having a special position due to its hybrid origin (tetraploid). A second group could be formed by *G. amerhauseri*, *G. erinaceum* and *G. kuehhasii*.

Plants growing at Cerro Colorado which are distinct just because of the comparatively enormous size of their body also cause a headache. These plants flower earlier than *G. robustum*, but at the same time as *G. kuehhasii*. However, *G. spec. "Cerro Colorado"* resembles *G. kuehhasii* only in its juvenile stage, but not later on.

As there are diploid and tetraploid specimens of the subspecies *Gymnocalycium* in northern Córdoba and as this is vital for understanding the individual species and their differentiation from each other, Mario Wick (Fichtenwalde, Germany) presented another explanatory overview of terms like chromosomes, chromosome set, ploidy, cleavage and hybrid origin of species.

After such a number of confusing facts lunch was a welcome change. Then Reiner Sperling (Salzkotten-Niederntudorf, Germany), co-author of *G. kuehhasii*, explained his view of this beautiful species and presented various localities. Jaroslav Prochazka (Brno, Czech Republic) subsequently went into detail with pictures and additional information on the localities of *G. kuehhasii* and related groups which he had visited.

In the afternoon there was a break from the Gymnos: Ludwig Bercht gave a lecture about "The Species *Weingartia* – Latest Findings from my Point of View". His report was complemented with many magnificent photographs of the localities.

After a shared evening meal Reinhard Müller (Leipzig, Germany) led us to "Cacti Sites in Latin America", focusing on Copiapoas in Chile and presenting an impressive scenery.

On the third and last day of the conference Andreas Berthold (Leipzig, Germany) took the participants on a tour of "Mexico in the Spring of 2016". Again wonderful pictures of cacti from various genera could be admired.

As usual, it was Ludwig Bercht who had the closing words, which were met with approving applause by the participants. To sum up his estimation of the weekend, it was another perfectly organized, with regards to ambitious content and on the whole wonderful meeting in a friendly atmosphere.

We would like to express our warmest thanks to Mrs Iris Blanz (Fernitz, Austria), to Mr Brian Bates (Bolivia) and to Mr Graham Charles (United Kingdom), who support us with the translation into English, to Mrs Larisa Zaitseva for the translation into Russian (Tscheljabinsk, Russia), to Mr Takashi Shimada (Japan) for the translation into Japanese and to Mr Daniel Schweich (France), who has mirrored our publications under <http://www.cactuspro.com/biblio/>.

***Gymnocalycium friedrichii* (Werderm.) Pažout ex Schütz – Evaluation from a different perspective**

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ABSTRACT

People have often puzzled over the first finding place of *G. friedrichii*. Due to newspaper reports from the year 1938, the author is sure that the first collection area of the plant is in the territory of Paraguay. It is reported why it is necessary to define a neotype for *G. friedrichii*. The entire distribution area of the species is discussed and the findings gained from these facts are evaluated.

KEYWORDS: *Gymnocalycium*, *Gymnocalycium friedrichii*, *Gymnocalycium mihanovichii*, *Gymnocalycium stenopleurum*, *Gymnocalycium mendozaense*, Cactaceae

A lot has already been written about this gem from the Chaco of Paraguay and Bolivia. It could be assumed that everything has been put down on paper. However, when having a closer look at the published literature, we come across discrepancies. It is not my intention to repeat well-known facts, but to limit myself to what is necessary to understand this contribution.

It was Adolfo Maria Friedrich, who discovered the plants during his activity as a war correspondent in the Chaco War (1933-1935). He collected on behalf of Professor Emil Hassler, a Swiss doctor, natural scientist and botanist, known for his collections and contributions to the investigation of the Paraguayan flora.

In 1936 Erich Werdermann describes the plants received from Friedrich as *Gymnocalycium Mihanovichii* (Frič et Gürke) Britton et Rose var. *Friedrichii* Werdermann (Werdermann 1936) in "Blühende Kakteen und andere sukkulente Pflanzen, Mappe 29" (fig. 1).

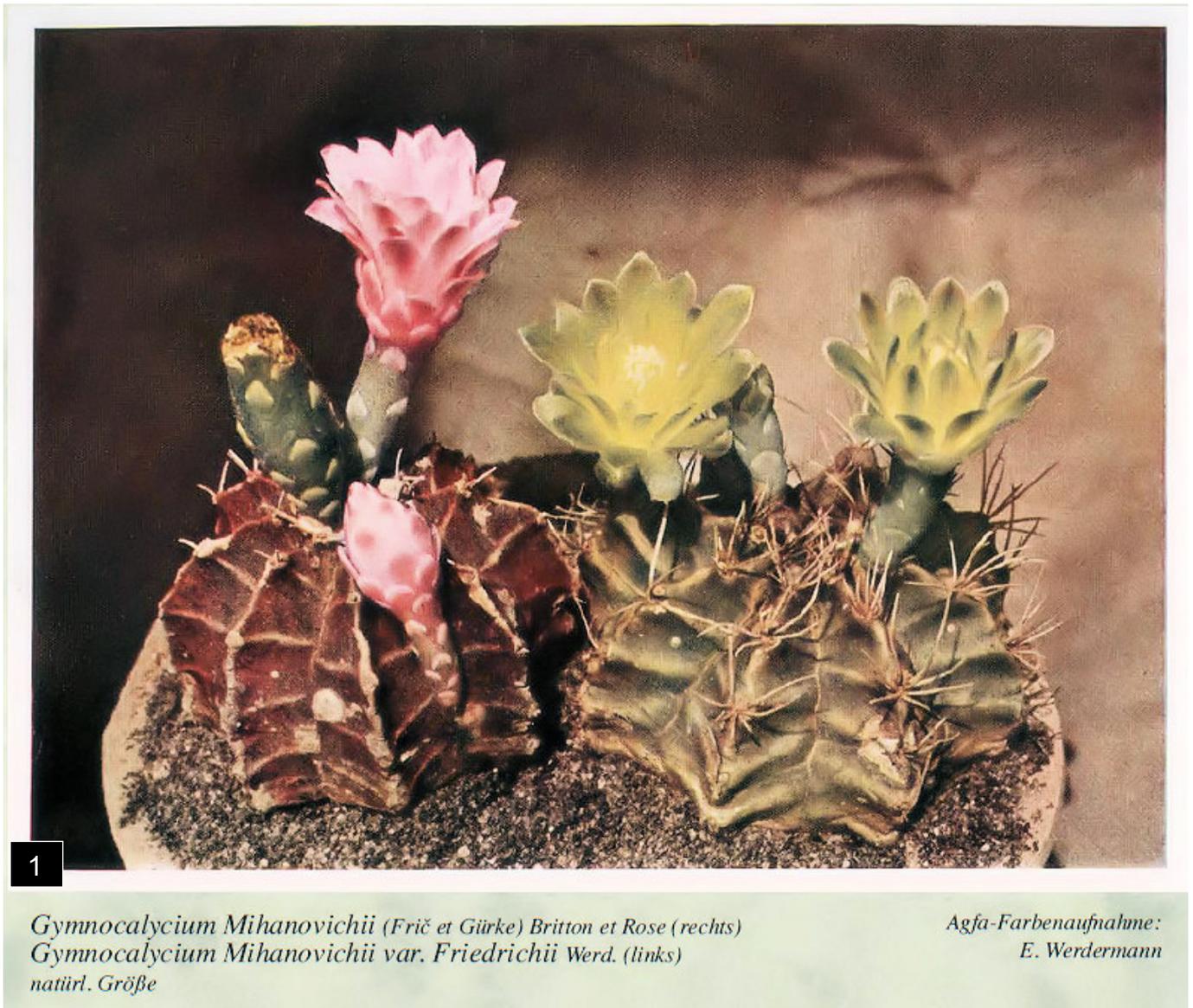


Fig. 1: Picture from the first description "Blühende Kakteen und andere sukkulente Pflanzen, Mappe 29"

František Pažout (Prague, Czech Republic), who took an intensive interest in this morphogenetic group, ranks the variety *friedrichii* as a species of its own in the Czech cacti magazine FRIČIANA in 1964. As Pažout, however, failed to state a direct and complete reference to the valid publication, the combination remains invalid according to ICBN rules (Pažout 1964).

In a publication on *G. friedrichii* the two authors Hans Till and Helmut Amerhauser report in detail about the history of this species in the magazine GYMNOCALYCIUM in 2005. They prove by accurate research that *Gymnocalycium friedrichii* is a (according to nomenclature rules) validly described taxon (Till & Amerhauser 2005).

To summarize, the following facts can be stated: Bohumil Schütz scrutinizes the topic in detail in a paper on the *G. mihanovichii* / *G. friedrichii* complex in 1978. He accepts the rank of a species suggested by Pažout. As Schütz refers to the basionym (called synonym), he effects a valid combination:

Gymnocalycium friedrichii (Werderm.) Pažout ex Schütz FRIČIANA (Schütz 1978).
Basionym: *Gymnocalycium mihanovichii* (Frič & Gürke) Britton & Rose var. *friedrichii*
Werdermann, Blühende Kakteen und andere sukkulente Pflanzen, Tafel 113, Mappe 29
(31st Oct, 1936).

Till and Amerhauser mention concerning this topic: Type: A. Friedrich s.n.: B (holotype, destroyed), as a substitute: picture and description as well as a neotype HA 94-976 = HT 2463 - Isiporenda, Bolivia, at the state border to Paraguay 270 m s.m. (WU) (Till & Amerhauser 2005).

A plant from Bolivia, HA 94-976, is deposited as a neotype. Thus the confusion about the actual type locality of *G. friedrichii* is going on, although A. M. Friedrich gave a detailed description of his journeys in "Möllers Deutscher Gärtnerzeitung" in 1938. In issue 6, pp. 63-64 of that volume he writes the following on finding *G. friedrichii* (Friedrich, 1938):

"Echinocactus (Gymnocalycium) is the most common species of Gymnocalycium in the Chaco area. There is hardly a stretch of 100 km without Mihanovichii growing there. Mihanovichii's flowers are half-closed, never opening completely, not even when fully exposed to the sun at midday. The flowers are olive green, as is generally known, never with a tinge of rose colour. The pulp is red, the plant body is green to purple, totally smooth, up to 25 cm in size with a diameter of about 10 cm. Spination is very variable, bristle-like, sometimes abundantly covered with 2 to 3 long spines.

Flowers of friedrichii var. (?) are shiny bright to dark rose coloured. When exposed to the sun the flower opens completely like a daisy flower. The pulp is white (transparent, without colour). The body is green to purple, covered with a coarse-grained skin. Grows to a size of 8 to 10 cm with an average of 6 cm. Spination very sparse.

Mihanovichii grows in the same places as the so-called var. friedrichii. Therefore this is not a variety due to location. However, Prof. Werdermann assumed it to be a variety, erroneous as this might be. A picture was also taken of the variety, showing a half-withered flower, which supports the assumption that it is really a variety of the principal form.

I want to seize the opportunity to point out to all cactus friends who are owners of this species to handle it with care, as the species (variety) has been found only at one single locality and this site is about 700 km landwards (of course measured by the road). In addition, in that area not a single drop of water can be found and troops are not garrisoned there any longer, so the makeshift paths through the forests have been grown over completely. For these reasons it cannot be expected that new specimens of this species can be collected."

Friedrich's report was published in 1938, only three years after the end of the Chaco War. It can be assumed that he still had an exact knowledge of the locality of *G. friedrichii*. His report elaborates on the fact that *G. friedrichii* grows together with *mihanovichii* and "can be found about 700 km landwards". As we know today, *G. mihanovichii* only occurs in Argentina (in the provinces Chaco, Formosa, Salta) and in northern Paraguay. Thus the old locality can only be situated in the territory of present-day Paraguay. The distance indication (700 km landwards) supports this assumption, as it is about 770 km between Asuncion and Mayor Pablo Lagerenza (at that time Fortín Ingavi). This staging post used to be an important base of the armed forces during the armed hostilities between Bolivia and Paraguay. So far I have known only three localities where *G. friedrichii* and *G. mihanovichii* grow together, northeast of Lagerenza (VoS 266 and VoS 267), west of Madrejon (VoS 252 and VoS 253) and southwest of Agua Dulce (VoS 1241 and VoS 1242).

Till and Amerhauser chose HA 94-976 = HT 2463 as a substitute for the destroyed type of *G. friedrichii*. These plants miss the typical features of *G. friedrichii*: matt epidermis, thin ribs and outside cell walls arching in outside direction (toad skin).

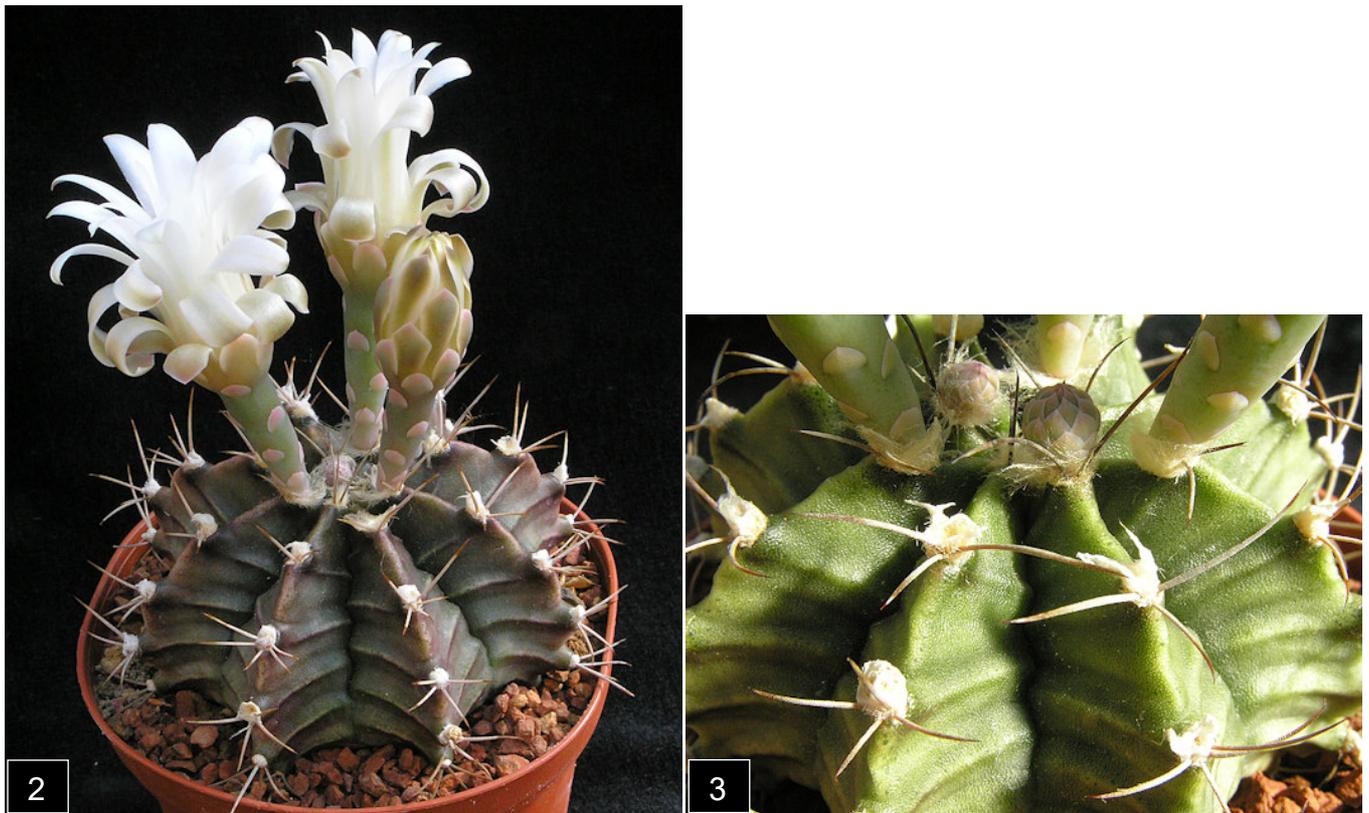


Fig. 2-3: Seedlings from STO 976 - The typical features of *G. friedrichii* are missing: matt epidermis, narrow ribs and outer cell walls arching to the outside (toad skin), photos: Marek Grepl

Furthermore, the locality is not situated in Paraguay, but in Bolivian territory in the area of the huge wetlands Bañados de Izozog. *G. mendozaense* Bercht & Schädlich, which HA 94-976 must definitely be ranked with, grows in this region. Further localities in the close-by vicinity of Isiporenda are HA 03-1722 (identical with VoS 61), VoS 62, VoS 1905 and VoS 1906 – all belonging to *G. mendozaense*.

Moreover, *G. friedrichii* has never been found in this area so far. The plant reproduced in the magazine GYMNOCALYCIUM 18(4): 648 (2005) (fig. 7), which is shown as a reference to the neotype, does not correlate with *G. friedrichii*. Nueva Asuncion is mentioned as locality, but here again *G. mendozaense* is presented. In figures 11 and 12 of the same publication the authors show “a (plant) of the rare, relatively small type form with rose-coloured flowers”. Figure 12 had been quoted as “subsp. *evae* var. *torulosum* with rose-coloured flowers from San José” a year before. In that case it is also clearly visible that the plant in the picture is not *G. friedrichii* but a plant closely related to *G. anisitsii* (Till & Amerhauser 2004).

These facts require a new definition of a neotype of *G. friedrichii*.

***Gymnocalycium friedrichii* (Werderm.) Pažout ex Schütz; FRIČIANA 8(51): p. 17 (1978).**

Basionym: *Gymnocalycium mihanovichii* (Frič & Gürke) Britton & Rose var. *friedrichii* Werderm., Blüh. Kakt. and. Sukk. Pflanze 4, Mappe 29: pl. 113 (31st Oct, 1936).

Type: A. Friedrich s.n.: B (Holotypus, destroyed), as a substitute for the destroyed type is determined:

Neotype (hic. design.): VoS 266, leg. Volker Schädlich, 20.09.2006, corpus in liquore alcoholico, Paraguay, Alto Paraguay, northeast of Lagerenza, 215 m (WU Inv. nr. 3993, neo).



4
Fig. 4: Neotype of *G. friedrichii* VoS 266

In 2009 the combination of *G. friedrichii* subsp. *eytianum* (Cárdenas) H. Till & Amerhauser is put into effect by H. Till and H Amerhauser in the magazine GYMNOCALYCIUM. The two authors hold the opinion that the *G. eytianum* plants described by Cárdenas do not belong to *G. megatae*, but that they represent a subspecies of *G. friedrichii*. To illustrate this statement the authors show four pictures (fig. 1, 2, 4, 7) with plants which are supposed to fit in with the described taxon. The pictures 1, 2 and 7, however, present without any doubt *G. mendozaense* (Till & Amerhauser 2009).

For a better understanding I would like to render the wording of the first description of *G. eytianum* Cárdenas at this point (Cárdenas 1958):

***Gymnocalycium eytianum* Cárdenas, nov. spec.**

Simplex, globosus, paulo depressus, glauco viridis interdum brunescente, 10-15 cm altus, 20-30 cm crassus. Costis plus minusve 18 in mammillae 4 cm latae solutis. Areolis circularibus vel ellipticis 5 mm diam., cinereo tomentosus. Aculei non distinguuntis in radiales aut centrales, 4-5, subulatis, flavido bruneis vel albidis, 1,5-2,5 cm long. Flores urceolatis, 4-4,5 cm long. Ovario elliptico, 2 cm long., squamis 2 mm long., roseis, praedito. Tubus paulo curvatus, 5 mm long., viride nitentis, squamis orbicularibus 2-3 mm long., 5 mm latis, praeditus. Phylla perigoni exteriora lanceolata, albidula, 12 mm long., phylla interiora 15 mm long., lanceolata, alba. Stamina ab fundum tubus, usque basim petalis, 5-7 mm long., filamenta tenuia, alba; antherae brunescens. Stylus crassus, albus, 7 mm long., 15-16 stigmaticis lacinis, diluto flavis coronatus.

Patria: Bolivia, provinci Cordillera, departamenti Santa Cruz, prope Eyti in itinere Caipipendi-Ipati, 1200 m.

Solitary, globular, flattened at the top, 20-30 cm wide, 10-15 cm in height, bluish green, sometimes brown. Ribs about 18, 1 cm high, 4 cm wide at the base, rather straight and divided into 4 cm wide protuberances by narrow transversal furrows. Areoles round to elliptic, 5 mm in diameter, with grey felt-like wool. Spines cannot be distinguished into central and marginal spines, 4-5 in number, close to the body at the side, 1.5-2.5 cm long, awl-shaped, brownish-yellow to whitish. Young spines straight, yellowish green at the base, brown at the end.

Flower buds rounded, about 4, forming a circle around the immersed apex. Open flowers wide, cup-shaped, tapered towards the upper end, 4-4.5 cm long. Ovaries about 2 cm long, with a tuft of cream-coloured silky hair at the base and covered with circular, 2-3 mm long and 5 mm wide scales of reddish colour. Uppermost tube scales 7 mm long, 7 mm wide, succulent. Outer perianth leaves 12 mm long, lanceolat, white at the base, greenish at the top with reddish tips. Inner perianth leaves 15 mm long, lanceolat, all white. Stamina reaching from the base of the tube to the base of the perianth leaves, 5-7 mm long, filaments thin, anthers brownish. Style about 7 mm long, thick, white. Stigma 15-16 lobes, yellow, 6 mm long. Style not longer than stamina.

Origin: Bolivia, Province Cordillera, Dep. Santa Cruz, near Eyti, on the route from Caipipendi to Ipati, 1200 m. March, 1949, M. Cárdenas, No. 5065 (type plant), in herbarium Cárdenasianum, Cochabamba.

The exact description and the picture in Cárdenas's first description do not raise any doubts that the plant described here must be assigned to *G. megatae*. In 2015 I could systematically search the locality given in Cárdenas's first description near Eyti and the stretch between Caipipendi to Ipati. Only four years before could this be done merely in part as large parts of the region were flooded. My companion and I found *G. megatae* Y. Ito (*G. eytianum* sensu Cárdenas) and *G. pflanzii* (Vaupel) Werdermann in this area, as described by Cárdenas.

As to the distribution of *G. friedrichii*, Till and Amerhauser mentioned in various publications in GYMNOCALYCIUM that in the area situated in the front zone of the Serrania de Charagua the following taxa can be found:

Type form of *G. friedrichii* with rose-coloured flowers (2005)

G. friedrichii var. *moserianum* (2005)

G. stenopleurum (2005)

G. friedrichii subsp. *eytianum* (2009)

Although the distribution area of *G. friedrichii* is relatively small according to Latin American standards there is a considerable scope of variation for this species, too. The most eastern localities discovered so far are situated to the south and east of the military post Agua Dulce, Dep. Alto Paraguay, Paraguay. The most western localities extend as far as the area situated in front of the Serrania de Charagua in south-eastern Bolivia. The area in the east is still flat (locality at an altitude of 120 m), but it rises to the west up to an altitude of 670 m. There is no locally connected distribution area of *G. friedrichii*. Because of these gaps in distribution (up to about 220 m in linear distance), the area can be divided into five subareas, according to present knowledge (fig. 5).

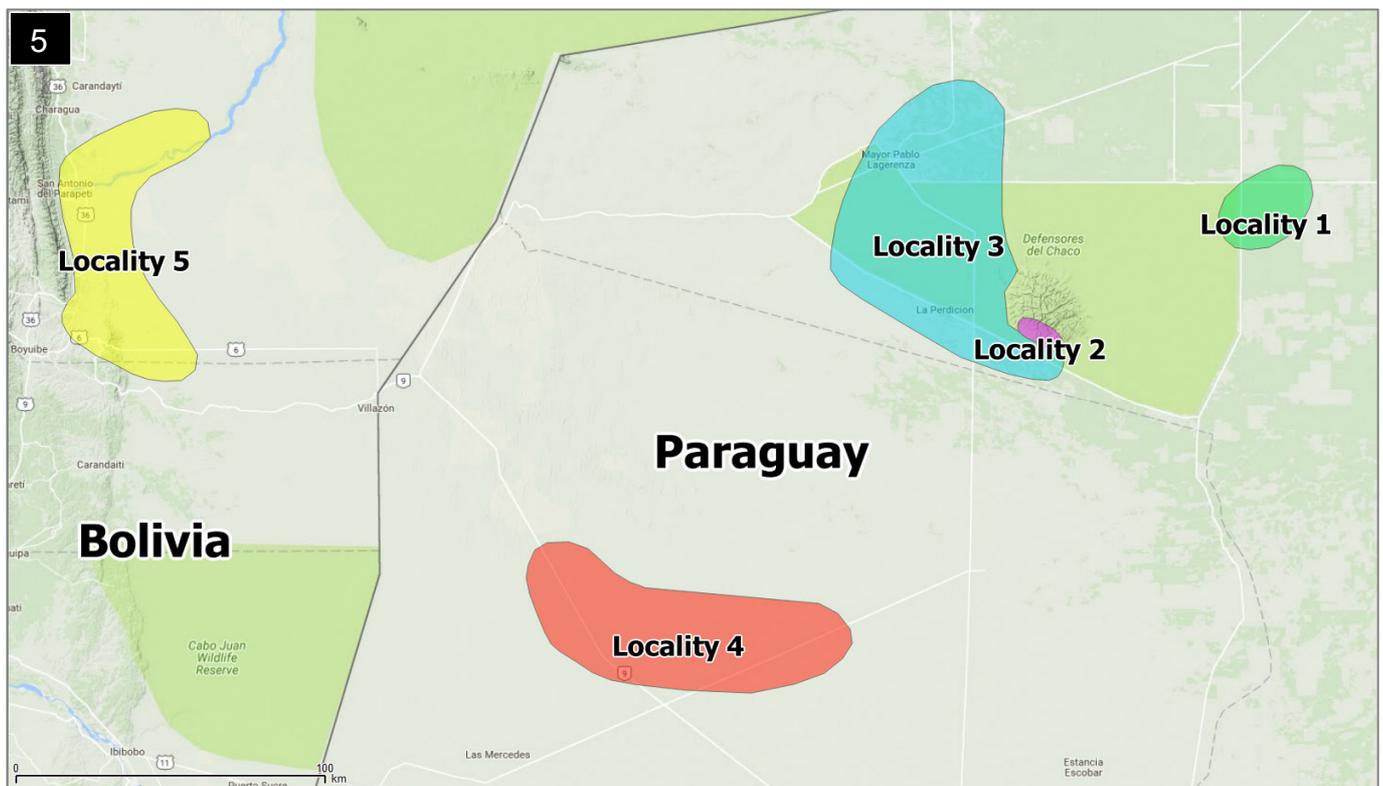


Fig. 5: Distribution area of *G. friedrichii* in Paraguay and Bolivia, map: Mario Wick

Locality 1 – in north-eastern Paraguay, localities VoS 14a and VoS 1241 (fig. 6-11).

The plants grow in dense Chaco vegetation in loess loam soil. The terrain is flat, the individual plants do not get large, only up to 60 mm in height and 70 mm in diameter. They possess 8 to 10 ribs. It is a striking feature that these populations always have only one spine per areole. The spine is 6 mm long at the most and twisted towards the rib in claw-like fashion, quite often pressed laterally to the rib. The flowers grow to a size of 50 mm.



Fig. 6: Habitat in locality 1



Fig. 7: Seedling at the locality VoS 1241 southwest of Agua Dulce, 130 m, photo: Christian Hefti



8

Fig. 8: Rarely found adult plant at the locality VoS 1241, photo: Christian Hefti



9



10

Fig. 9-10: Four year-old seedlings in culture, from locality 1



Fig. 11: Four year-old seedling in culture, from locality 1

Locality 2 – Cerro Leon, Paraguay, localities VoS 22a, VoS 249, VoS 1227 (fig. 12-17).

These plants were first described as *G. stenopleurum* by Ritter (Ritter 1979). A population which differs in several features from plants from other localities could develop in this exposed rocky locality. The plants grow to a size of 300 mm and a diameter of up to 150 mm, at the apex the areoles are often densely covered with wool. There are 8 to 15 ribs and 3-5 lateral spines, up to 50 mm long, often projecting from the body in all directions. In case a central spine exists it is mostly stronger and longer, not brittle or falling off. The flowers reach a size of up to 90 mm.



12

Fig. 12: Locality 2, the chain of hills of Cerro Leon in Paraguay



13

Fig. 13: Here the plants grow in rocky substrate



14

Fig. 14: The plants described as *G. stenopleurum* by F. Ritter can occasionally form very long central spines



15

Fig. 15: Locality VoS 249: The plants grow up to a size of 300 mm and up to 150 mm in diameter



Fig. 16: Locality VoS 249: The plants grow up to a size of 300 mm and up to 150 mm in diameter

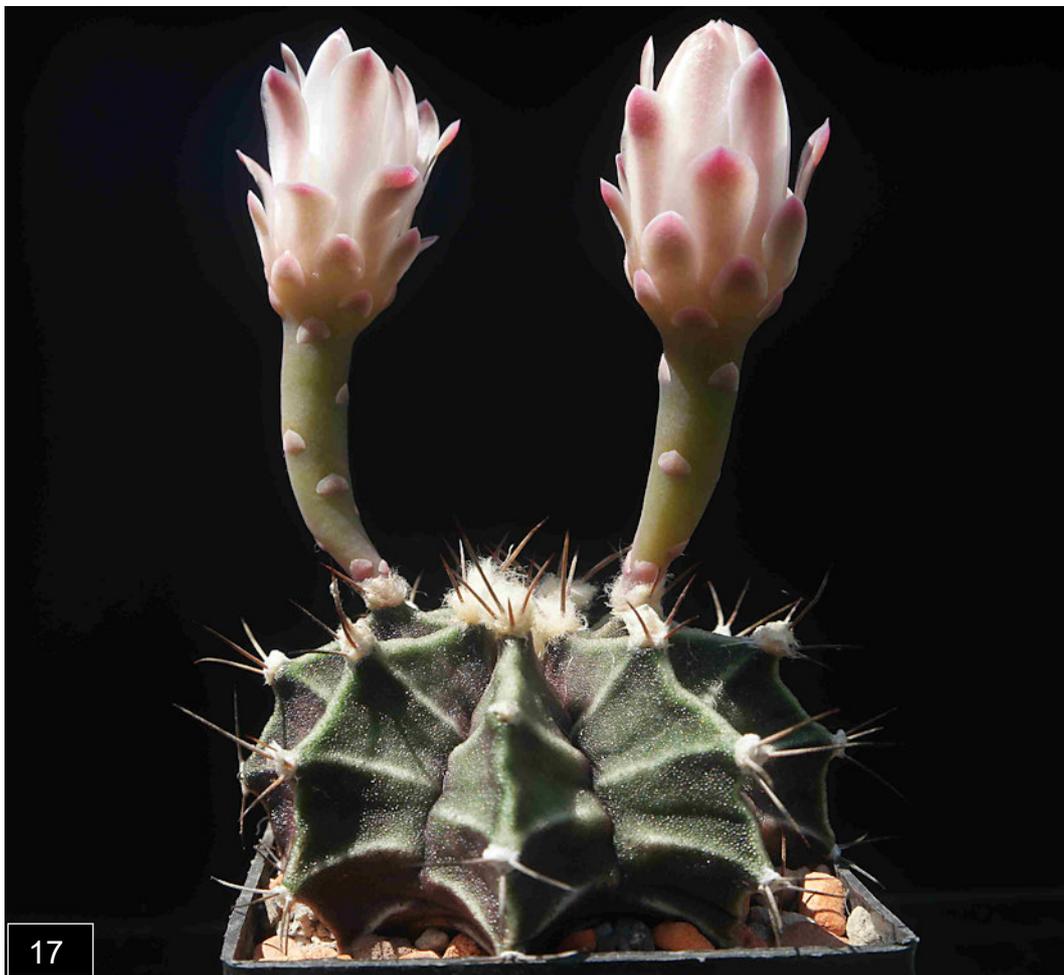


Fig. 17: Seedling in culture from locality 2

Locality 3 – in northern Paraguay, localities VoS 17a, VoS 18, VoS 253, VoS 266, VoS 268, VoS 569, VoS 598, VoS 599 (fig. 18-23).

The plants from locality 3 also grow in dense Chaco vegetation in loam loess soil in a flat area. The solitary bodies develop to a size of 120 mm and width of 70 mm. They have 8 to 11 ribs, up to 5 lateral spines, there is rarely a central spine. The flowers can have a length of up to 60 mm.



18

Fig. 18: *G. friedrichii* at locality VoS 268 north of Dest. Gral. P. Colman, 187 m



19

Fig. 19: *G. friedrichii* at locality VoS 569 north of Pablo Lagerenza, 209 m



20

Fig. 20: *G. friedrichii* at locality VoS 599 south east of Lagerenza'i, 219 m



21



22

Fig. 21: VoS 268, nine year-old seedlings in culture Fig. 22: VoS 17, six year-old seedlings in culture



Fig. 23: VoS 266, four year-old seedlings in culture

Locality 4 – north of La Patria, localities VoS 9a, VoS 11, VoS 237, VoS 239, VoS 247 (fig. 24-31).

This taxon was described as *Gymnocalycium friedrichii* var. *moserianum* by F. Pažout (Pažout 1966). The plants grow in a flat area in dense Chaco vegetation. The soil contains loam loess. The solitary bodies grow to a size of 200 mm and 100 mm in diameter. There are 8 to 15 ribs, up to 5 marginal spines and rarely one central spine are formed. The flowers can become 60 mm long.



Fig. 24: Habitat in locality 4



25

Fig. 25: *G. friedrichii* at locality VoS 237 northwest of La Patria, 248 m



26

Fig. 26: *G. friedrichii* at locality VoS 239 southwest of Nueva Asuncion, 275 m



Fig. 27: *G. friedrichii* at locality VoS 247 southwest of Nueva Asuncion, 279 m

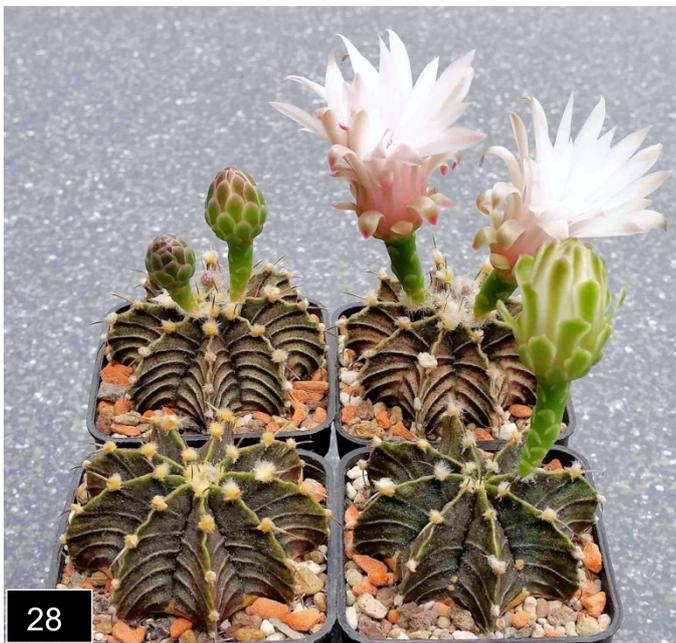


Fig. 28: VoS 9, six year-old seedlings in culture

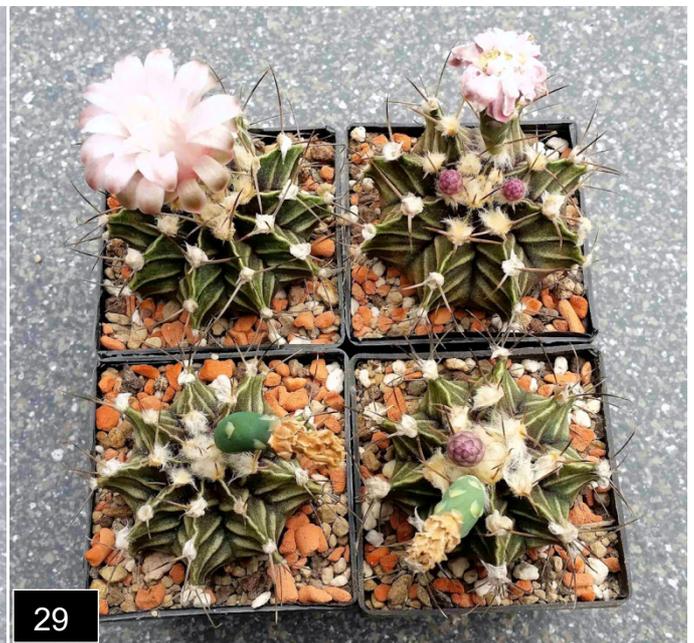


Fig. 29: VoS 237, seven year-old seedlings in culture



Fig. 30-31: VoS 239, seven year-old seedlings in culture

Locality 5 – south of Charagua, Bolivia, localities VoS 64, VoS 335, VoS 336, VoS 610, VoS 1912, VoS 1916, VoS 1918 (fig. 32-37).

Here the plants also grow in dense Chaco vegetation on loam loess containing soil on small hills or on flat terrain. The solitary bodies can reach a height of 120 mm and become 70 mm wide. Plants which form up to 16 ribs grow here. It is striking that even in seedlings a higher number of ribs can be found. Marginal spines up to 5, there is rarely a central spine. The flowers grow to a length of about 60 mm.



Fig. 32: During rainfall the roads in locality 5 become impassable



Fig. 33: *G. friedrichii* at locality VoS 335 east of Charagua in direction of Yapiroa, 606 m



Fig. 34: *G. friedrichii* at locality VoS 1916 west of La Floresta, 629 m



Fig. 35: VoS 64, seven year-old seedling in culture

Fig. 36: VoS 335, six year-old seedling in culture

Fig. 37: VoS 336, six year-old seedlings in culture

Localities 1, 3, 4, 5

The bright horizontal stripes on the ribs are a distinctive feature of this species, especially with seedlings. This feature often disappears in adult plants. Structures of flower, fruit and seed are identical for all localities. On comparing localities 1 and 5 (easternmost and westernmost) there are differences as to size of the plants, numbers of spines and ribs. Outside cell walls arching in outside direction (toad skin) and narrow ribs are characteristic of all the populations investigated.

Locality 2

The taxon named *G. stenopleurum* by F. Ritter differs in some features from the plants of the other localities investigated. Its occurrence is limited to the area of Cerro Leon. The plants grow on rocky substrate in loamy soil between quartz rocks together with endemic *G. paediophilum*

F. Ritter. In the close surroundings of the hills *G. eurypleurum* F. Ritter can be found on the plain.

The size of the bodies is remarkable, I could find plants with a size of up to 30 mm. *G. stenopleurum* can be distinguished from the *G. friedrichii* forms in its apex areoles, which are densely covered with wool. This gives the adult specimens the appearance of the whole apex being covered with wool. The plants from the Cerro Leon mostly possess 5 marginal spines (up to 50 mm long) and often a central spine of 20 to 28 mm length. The flowers reach a size of up to 90 mm.

CONCLUSION

Due to different ecological conditions the populations have developed separately. In the plain of the Chaco the effects of very small topographic and edaphic differences on the vegetation can be seen. The locations are spatially separated from each other, according to present knowledge. There are only few roads accessible by vehicle in that area, so it cannot be excluded with certainty that there are further populations in between the currently known localities. A distribution of *G. friedrichii* in north-eastern Paraguay can be excluded. This part of Paraguay is characterized by fossil dune ridges with a savannah-like landscape and thin, succulent thorn scrub. The soil is sandy, which are not favourable living conditions for *G. friedrichii*. The plants have adapted to the special conditions in dense xerophytic forest. Even during the dry seasons, when some trees and bushes shed their leaves, they still find enough shelter from intense sun radiation. In summer (rain period) a special microclimate develops at the localities, which is humid and warm. The flat terrain and the loess loam soil let the water drain away only slowly.

Due to the only slight differences between the investigated plants from localities 1, 3, 4 and 5 it can be assumed that the plants can all be assigned to *G. friedrichii*.

The taxon considered as a species of its own called *G. stenopleurum* by F. Ritter is allocated to *G. friedrichii* as a subspecies due to shared features and the spatially separated locality.

CONSPECTUS

***Gymnocalycium friedrichii* (Werdermann) Pažout ex Schütz**

Basionym: *Gymnocalycium mihanovichii* (Frič & Gürke) Britton & Rose var. *friedrichii* Werderm., Blühende Kakteen und andere sukkulente Pflanzen, Tafel 113, Mappe 29.

Synonyms:

Gymnocalycium mihanovichii var. *friedrichii* Werdermann.

Gymnocalycium mihanovichii var. *piraretaense* Pažout, in Kaktusar. Listy 16: 159. 1951.

Gymnocalycium mihanovichii var. *angustostriatum* Pažout, in Fričiana 1(7): 3-4. 1962.

Gymnocalycium friedrichii var. *moserianum* Pažout, in Succulenta 45: 99-100. 1966.

Gymnocalycium friedrichii var. *pazoutianum* Moser & Valniček, in Kaktusy 3: 58-60. 1967.

Gymnocalycium friedrichii var. *angustostriatum* Pažout ex Milt, in CACTACEAE etc. 2: 61-63. 2016.

***Gymnocalycium friedrichii* (Werderm.) Pažout ex Schütz subsp. *stenopleurum* (Ritter) Schädlich comb. et stat. nov.**

Basionym: *Gymnocalycium stenopleurum* Ritter, Kakteen in Südamerika, Band 1, 265-266 (1979).

ACKNOWLEDGEMENT

I am grateful to Marek Grepl (Lutín, Czech Republic) and Christian Hefti (Grindel, Switzerland) for providing pictures as well as to Mario Wick (Fichtenwalde, Germany) for establishing the map of localities. I really appreciate the ease with which Gert Neuhuber (Wels, Austria) and Holger Lunau (Berlin, Germany) were helpful.

Photos by the author if not indicated differently.

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***Gymnocalycium bruchii* (Spegazzini) Hosseus subsp. *deminii* Gapon et Neuhuber, a new subspecies from Cerro Uritorco**



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ABSTRACT

A new subspecies *Gymnocalycium bruchii* subsp. *deminii* Gapon et Neuhuber (2016) is evaluated. Additional information on the history of this plant, its population distribution and colonized habitat is given; an extended description and differential diagnosis is provided.

KEYWORDS: *Gymnocalycium*, *Gymnocalycium bruchii* subsp. *deminii*, *Gymnocalycium andreae*, Cactaceae, Cerro Uritorco, Mats Nilsson

INTRODUCTION

As early as 30 years ago, Mats Nilsson also climbed up the Cerro Uritorco in the northern part of Córdoba Province during his first visit of natural habitats in Argentina in 1986 (Nilsson, 1988). There he collected interesting plants belonging to the subgenus *Gymnocalycium*. At first sight he identified them as *G. bruchii*. Later on, when the plants showed yellow flowers, they were classified under his number MN 80 as *G. andreae*. *G. andreae* was also reported from a higher part of Sierra Chica (Cerro Uritorco) in 1932 as *var. grandiflorum* (Krainz et Andreae, 1957). Gert Neuhuber also collected *G. andreae* in higher parts of Sierra Chica in passing between El Manzano and La Cumbre at an altitude of 1580 a.s.l. in 1999. Later on it was described again as *G. andreae* subsp. *pabloi* (Neuhuber 2011), but on subspecies level. *G. andreae* from Cerro Uritorco is also documented, but from a higher altitude than the population of *Gymnocalycium* related with MN 80. In many aspects *G. sp.* MN 80 is reminiscent of *G. bruchii*, common in Sierra Chica. Later field research in this area provided more specimens of this population and allowed a better scope of variation in habitat and culture to be defined.

This study is intended to evaluate resemblance of plants compiled under the label MN 80 and after differentiation from other taxa belonging to *G. bruchii* it should lead to a description of this interesting plant.

Several specimens of related populations originating from Cerro Uritorco have been studied in natural habitat (Tom 15-794/1) and culture (MN 80 - original offsets and seedlings; Tom 15-794/1, seedlings raised from habitat seeds). A population directly related to MN 80 has so far only been found in only a small area at the highest border of romerillal vegetation formation in the southern part of the mountain massif.

The epithet should have been dedicated here to Mats Nilsson (Sweden) the discoverer of this population, who collected this plant as MN 80 already in 1986, as mentioned before. Therefore, it was initially planned to publish the plant as *G. bruchii* subsp. *nilssonii*.

Parallel to this study a description of this plant as *G. bruchii* subsp. *deminii* Gapon et Neuhuber was developed and published in the Russian internet journal Cacti Year-Round (Gapon et Neuhuber 2016) before this paper was released. As the contents of this article with its plant description had already been prepared, it is still published here and can be recommended and used as an extended description of the new subspecies.

Here is the original description by Gapon and Neuhuber (2016):

***Gymnocalycium bruchii* (Spegazzini) Hosseus subsp. *deminii* Gapon & Neuhuber subsp. nov.**

Type: Argentina, Provincia de Córdoba, Sierra Chica, Cerro Uritorco, 1613 m s.m., leg. V. Gapon VG11-1176, 29 November, 2011, Holotype: WU (Inventory No 3502, planta sicca).

Isotype: WU (Inventar Nr. 3981, flos in liquore alcoholico).

Description: Body small, up to 15 mm diam. (up to 27 mm in culture), at first solitary, then freely offsetting, flattened on top. Epidermis dark green. Ribs usually 8-10. Areoles with short, white, woolly felt, slightly elongated, up to 2 mm long. Spines 8-9(-12), very thin, up to 6 mm long, straight or slightly curved, creamy to white, the base is darker; 1 (rarely 2) central spine(s) standing straight up, a little bit darker, up to 4 mm long. Flowers from areoles near the apex, bell-shaped, 25-32 mm long and 25-42 mm in diameter. Inner petals pale yellow at first, later creamy, darker at the base, outer petals with light pink-brown middle stripe. Pericarpel short, green, scales green, with light or pale-pinkish margins. Receptacle white. Filaments white; anthers yellowish. Style white; stigma pale yellow with 7 (up to 9) stigma lobes, the base of the stigma is at the level of the upper edge of the uppermost anther ring; ovary white-walled, 5-6 mm long, up to 6 mm diam.; fruit round, green when ripe, vertically dehiscent; seeds black, partially or completely covered with a dry brown skin (subgenus *Gymnocalycium*).

The name is dedicated to Dimitry Demin, who accompanied V. Gapon on his trip in 2011.

Extended Description: Based on the study of natural plants Tom 15-794/1 and original plants MN 80:

Diagnosis: *Gymnocalycium bruchii* subsp. *deminii*, belonging to the subgenus *Gymnocalycium*, *G. bruchii*-species group. Stem not solitary, but always offsetting, of small size in adult plants, reaching up to 50 mm in diameter, globose, medium green, almost matt, with 9-14 ribs, with horny-white spines, seldom darker in the basal part, up to 16 mm long, with mostly 2 central spines; Flower small, up to 40 mm long, of funnel form, perianth segments cream-coloured to pale yellow, throat creamy white; seed oval, with cuticle sheath (subgenus *Gymnocalycium*).

Differential diagnosis: Adult plants of the nominate subspecies differ in smaller size of stems, which seldom exceed 30 mm, number of spines 13-17, they are shorter, central spines missing, flowers of rose shades. Nominate subspecies could be found at lower altitudes of Sierra Chica and its promontories. *G. bruchii* subsp. *atroviride* (Neuhuber, 2009b) was described as from a higher part of Sierra Chica in an area south of the Uritorco massif in between La Cumbre and

Asconchinga. This taxon differs in darker epidermis, more open habit, darker spines, seldom one central spine; flower white to light rose coloured. *G. bruchii* subsp. *elegans* (Neuhuber, 2009b) was described in the vicinity of subsp. *atroviride*, growing together with *G. andreae* subsp. *pabloi* (Neuhuber, 2011). This taxon differs in its higher number of lateral spines, which are finer and shorter. With resemblance to the nominate subspecies, old plants have more open bodies, adult plants rarely one central spine; flowers light rose.



Fig. 1-4: *G. bruchii* subsp. *deminii* VG 11-1176: plants at habitat (1-3), plants in culture (4) (all photos Victor Gapon)

Description: Plant body globose in young as well as in adult plants (natural habitat), adult plants up to 50 mm in diameter and 40 mm in height; epidermis medium green, sometimes with darker tinge in sunlight; root thick, either one or composed of two major branches; ribs 8-13 (-14), convex, straight, longitudinal furrows broad and deep, slightly undulate in all parts of the body, if plant keeps full turgor almost flattened in lower part; transverse cleft short and not so sharp, usually limited to the median part of the rib, seldom crossing the entire rib, joining two longitudinal furrows if plant is not fully turgid; tubercles narrow, obtuse, prominent also in fully turgid plants, placed below the areoles, just above the transverse cleft, in older plants more compressed, forming small, prominent chins. Areoles ovate, from 6 to 10 mm apart, with horn-whitish hair, particularly when young. Spines in upper part of body clearly white to horn-coloured in whole length with darker base of spines, usually greyish in lower part of body, spines in section partly round, relatively thin, part of spines in old plants distinctly flattened, this feature is probably caused by pressure of developing flower buds; radial spines 9-11, 5-18 mm long,

usually 4-6 mm long in younger plants and 8-18 mm long in adult plants, radially arranged, rigid and slightly twisted in young plants, in older plants straighter or twisted across the body, more rigid and in very old plants irregularly arranged, lower spine shorter, usually 1, often second pair or second and third pairs of lateral spines longer, first pair can be missing or only one short spine can occur; central spines 0-1 in young plants, adult plants usually with central spines on each areole, (0-)1-2(-4), spines just as stiff and rigid as radial spines, on tips softer, seldom basally flattened in older plants, same length or longer than longest radial spines.

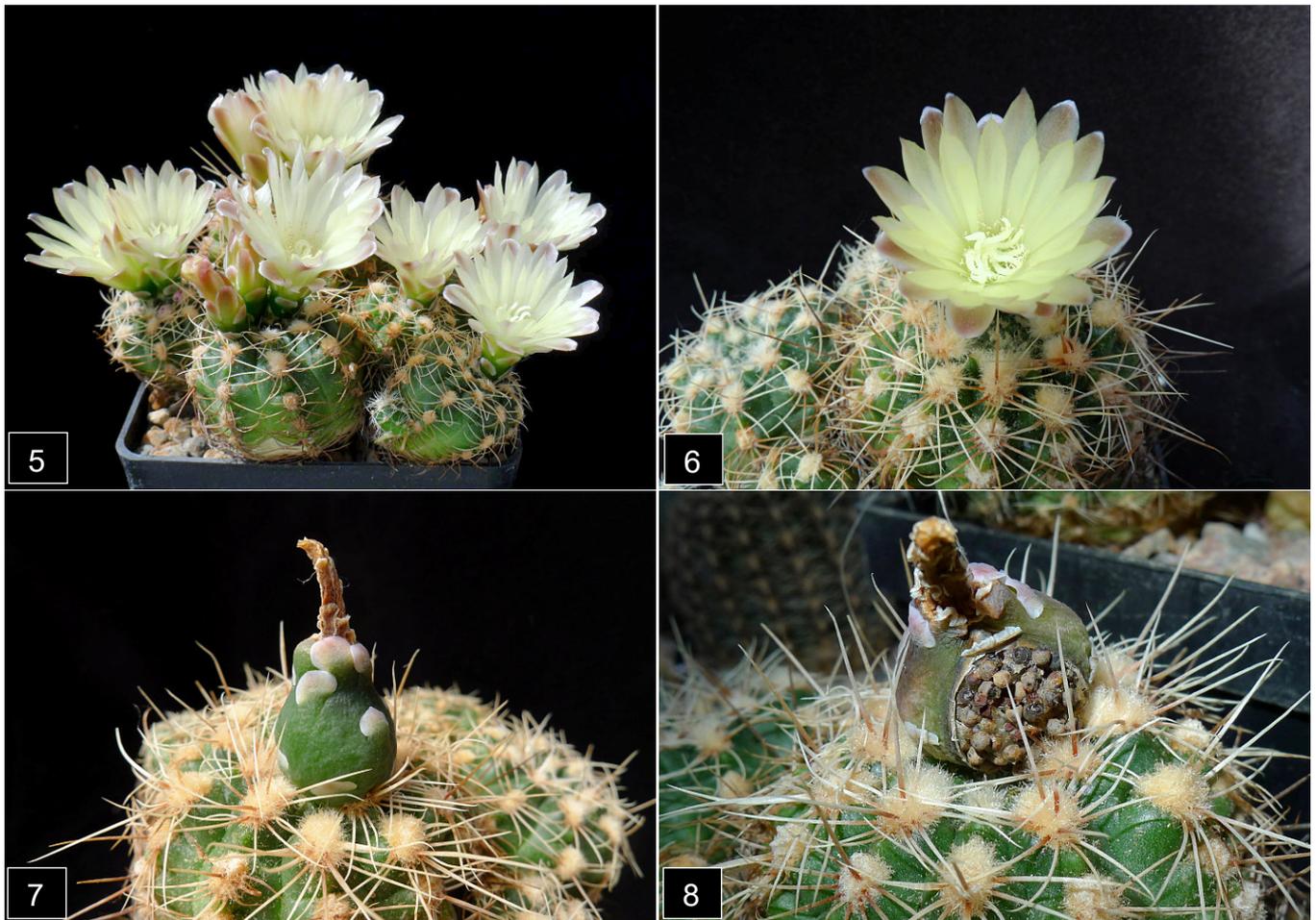


Fig. 5-8: *G. bruchii* subsp. *deminii* MN 80: plants with flowers (5-6), fruit (7-8) (all photos Mats Nilsson)

Flowers bisexual or unisexual with developed dioecism (differentiated into male and female flowers), small, short, 26-39 mm long and 38-42 mm wide in full anthesis; flower bud obovate, later with more pointed end; in full anthesis perianth and pericarpel distinctly separated, pericarpel glossy dark green, thick, 6-10 mm long, with about 8 dark green scales which are whitish on margins, basal scales smaller with small pointed ends; perianth funnel form, outer perianth segments from short spatulate, longer than wide, to oval, progressively longer, up to 23 x 5-7 mm, at outer side greenish in basal part and dark green-purplish in upper part, fading to whitish or pale yellowish at margins, whitish cream to pale yellow at inner side; inner perianth segments oblong, 16-25 x 3-5 mm, pale yellow to cream; receptacle narrow, creamish coloured, ovary ovate-oblong, style light yellowish, basal part whitish, 1.5 mm in section at base, distal not narrowed, 7-10 mm long; stigma lobes 7-10; filaments regularly inserted all over receptacle wall, whitish, apices of uppermost filaments reaching the base or tip of the stigma lobes; anthers white. Fruit oblong, 10-16 x 10-12 mm, dark green. Seed 1.2-1.4 mm, black, usually more than

70% of the testa surface covered with cuticular sheath, but absent from several parts of the testa; hilum-micropylar-region ovate to wide drop shape.

Distribution and Habitat: Populations of the new subspecies have been found so far only in a very small area on a southern slope of Cerro Uritorco, Sierra Chica. Cerro Uritorco is the highest point (1949 m, sometimes indicated 1979 m a.s.l.) in the northern part of Sierra Chica. Geologically and morpho-structurally belonging to the unique Cerro Uritorco massif, it is composed of a plutonic and metamorphic basement from the late Proterozoic – early Paleozoic age (Beltramone, 2004). The central part of Sierra Chica belongs to La Pampilla, its morphostructure is divided by the Calabalumba failure with its Calabalumba river. The name “Cerro Uritorco” (Uritu urqu) means “Male Hill”.



Fig. 9-11: *G. bruchii* subsp. *deminii* MN 80: offsets from original plants: flowering plants (9-10), flower buds (11)



Fig. 12-13: flower sections of *G. bruchii* subsp. *deminii* MN 80, female flowers

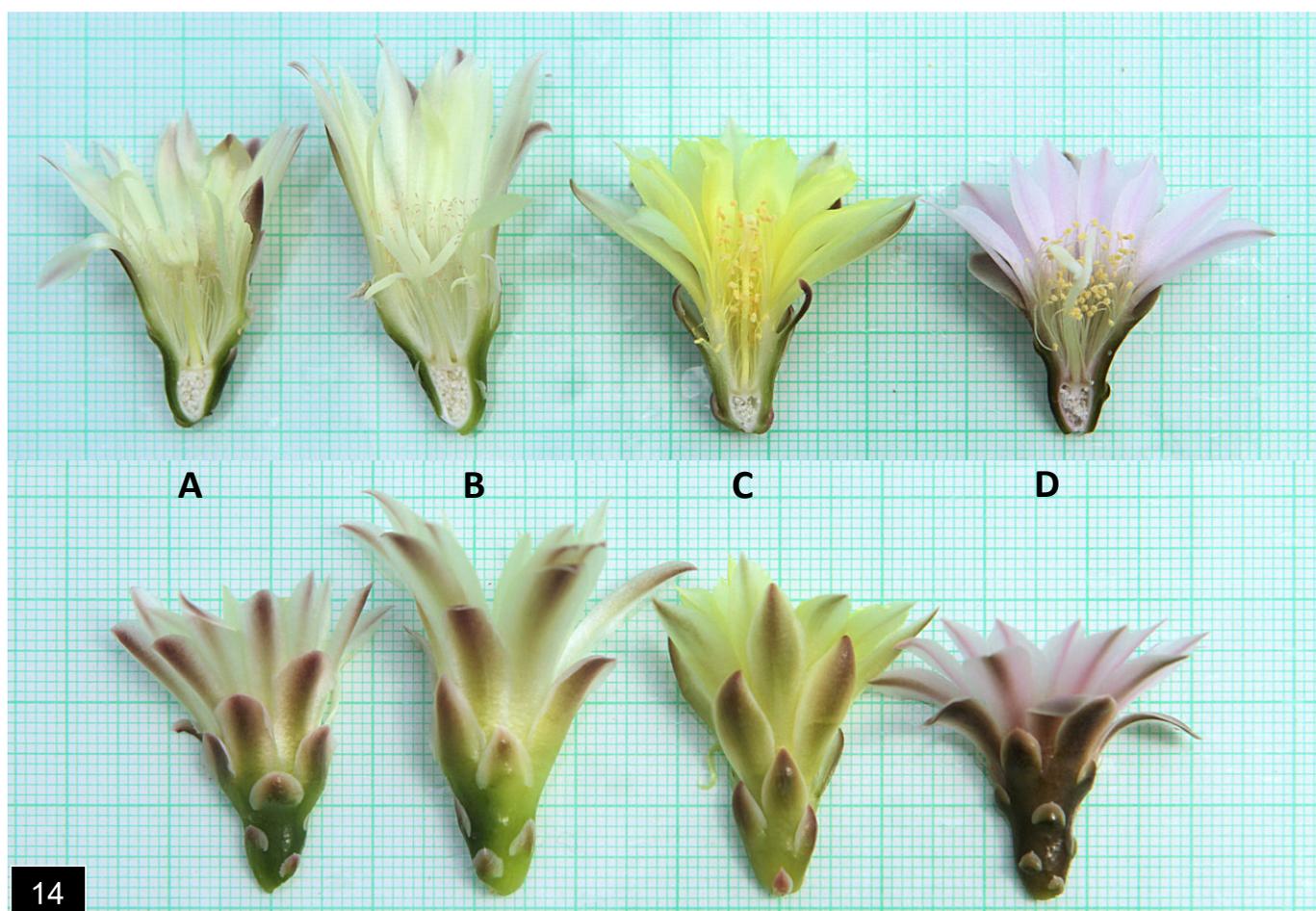


Fig. 14: flower sections; *G. bruchii* subsp. *deminii* MN 80 (A-B), *G. andreae* (C), *G. bruchii* subsp. *bruchii* (D)

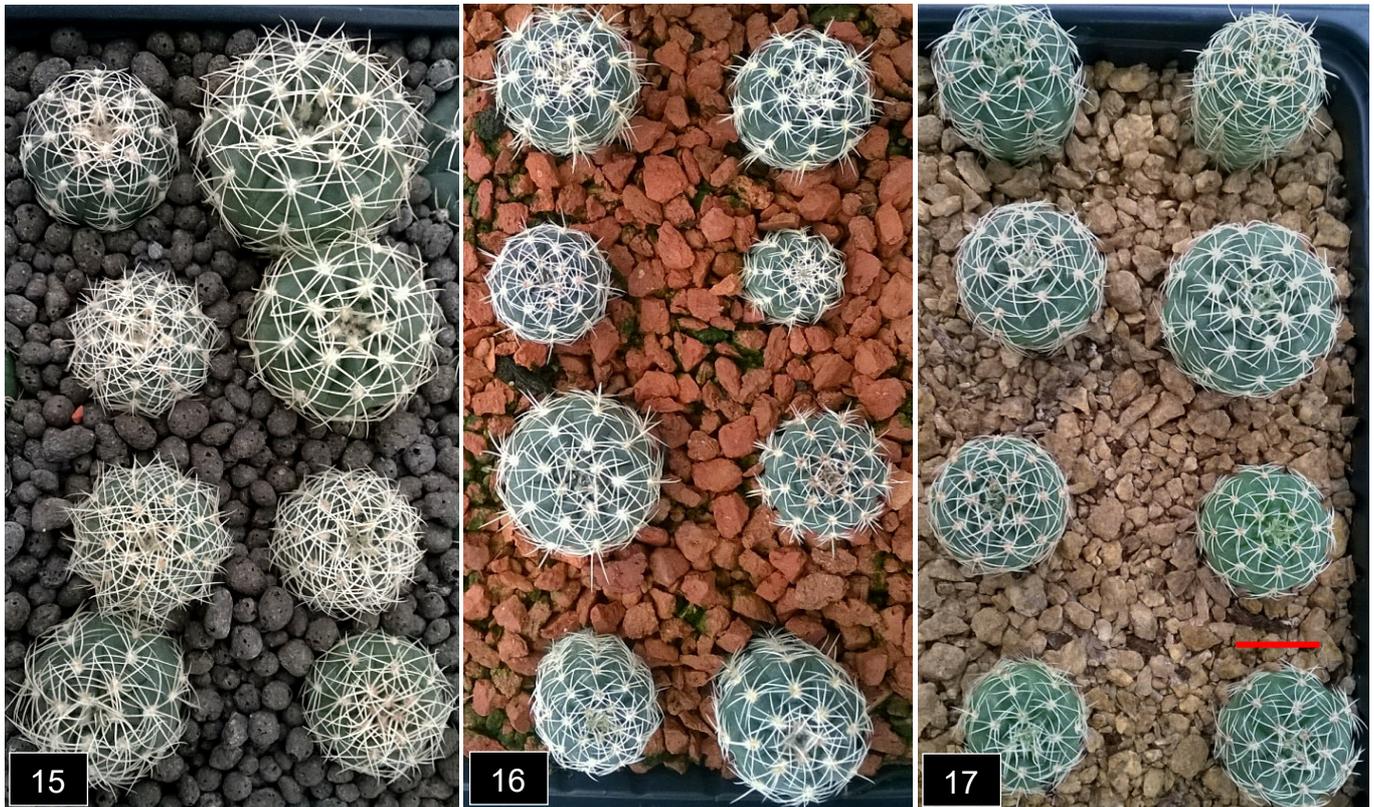


Fig. 15-17: young plants of *G. bruchii* subsp. *deminii* in culture: Tom 15-794/1 (15), VG-1176 (16), MN 80 (17), red bar = 10 mm

The habitat colonized by populations of *G. bruchii* subsp. *deminii* ranges from a small flat eastern margin (habitat Tom 794) to the lower part (habitat VG-1176) of a southwestern oriented valley at an altitude of 1620 m a.s.l. (the bottom part of the valley is called Valle de Los Espiritus). The vegetation formation belongs to Romerillal (Matoral Serrano) with a dominance of shrubs *Heterothalamus alienus* (Asteraceae) and grasses of *Stipa spp.* and *Festuca spp.* (Poaceae), with sparse occurrence of *Baccharis sp.* shrubs. Gapon et Neuhuber (2016) noted that sympatrically *G. monvillei*, *G. mostii* and *Echinopsis aurea* (Cactaceae) can be found, at the habitat of Tom 794 only *G. monvillei* (Cactaceae) could be found. Plants of *G. bruchii* subsp. *deminii* grow fully exposed to the sun or partially in the shade of grasses in the sandy soil, consisting of metamorphic segments. At a higher altitude the vegetation is reduced to mountain pastures with grasses and few individuals of *Heterothalamus alienus* and *Baccharis sp.*, as to Cactaceae, *G. monvillei* and *G. andreae* var. *grandiflorum* can be found.

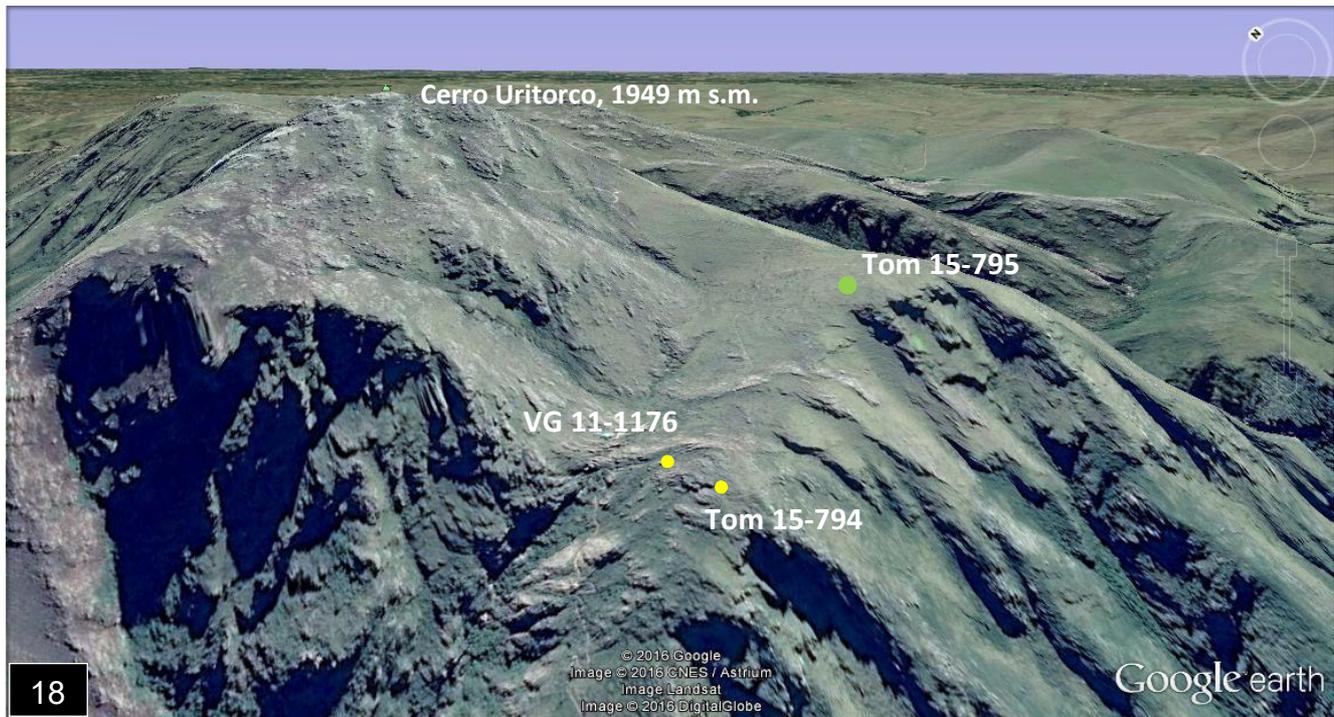


Fig. 18: Habitats of *G. bruchii* subsp. *deminii*, Cerro Uritorco (fig. via Google earth): habitat VG 11-1176, 1613 m, type locality; habitat Tom 15-794, 1,620 m, (yellow points); habitat of *G. andreae* var. *grandiflorum* Tom 15-795, 1744 m, (green point)

DISCUSSION

The *G. bruchii*-species group includes many described taxa on different taxonomic levels (Spegazzini, 1923, 1925; Vaupel, 1924; Hosseus, 1926; Backeberg et Knuth, 1936; Oehme, 1941; Backeberg, 1959; Simon, 1973; Ito, 1952; Rausch, 1989; Piltz, 1987; Neuhuber, 1994, 2003, 2005, 2009a, 2009b, 2012; Papsch, 2012, 2013; Gapon et Neuhuber 2016). If we follow the latest revision of *G. bruchii* provided by Papsch (2012, 2013) the *G. bruchii*-species group can generally be divided into two groups according to morphological differences between young and adult plants. These two groups mostly correlate with the altitude of their occurrence. This study compares distribution, ecology, morphology of vegetative and generative organs and taxonomy of the group.

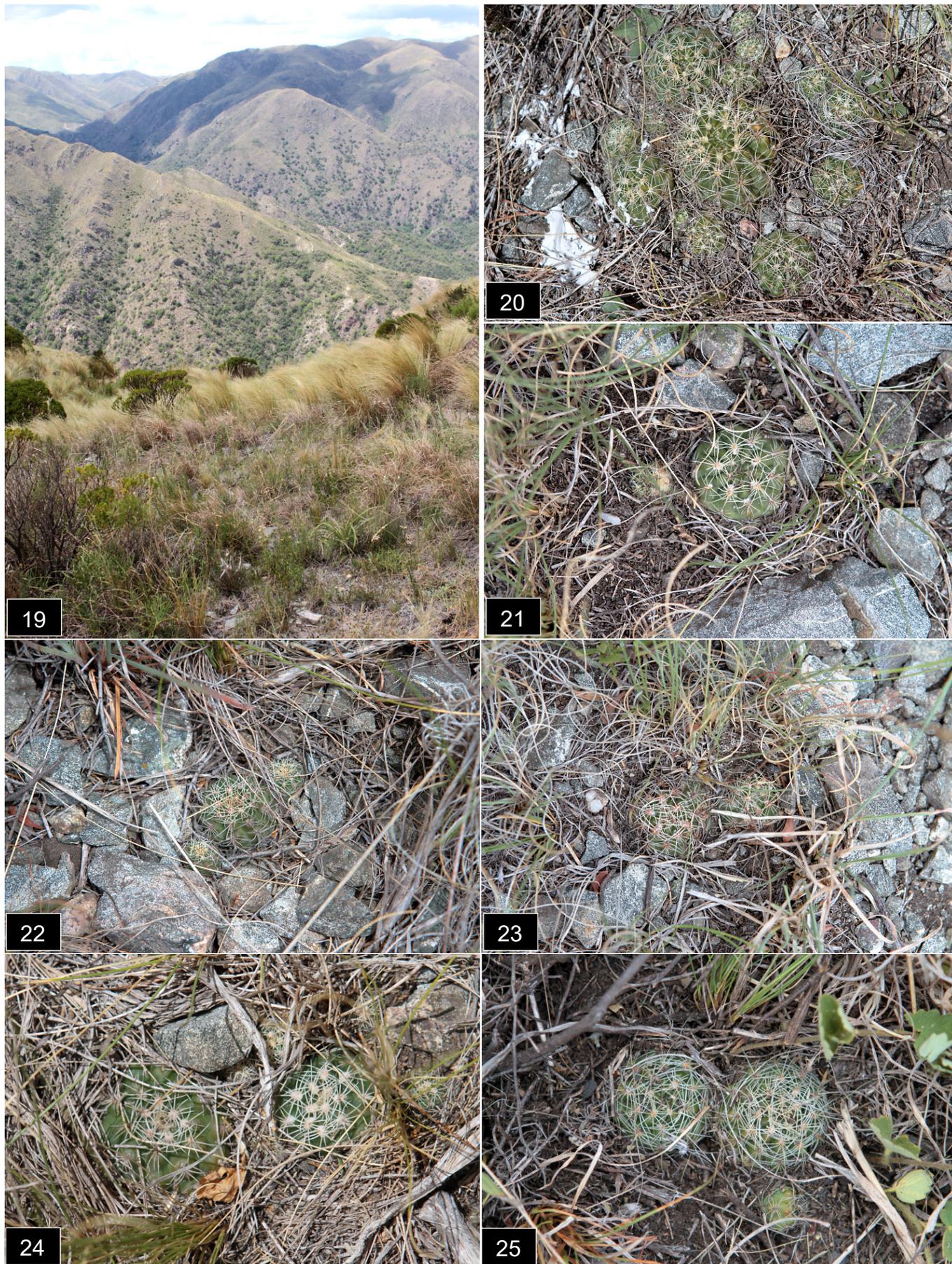


Fig. 19-25: *G. bruchii* subsp. *deminii* Tom 15-794/1, habitat (19), plants at habitat (20-25)

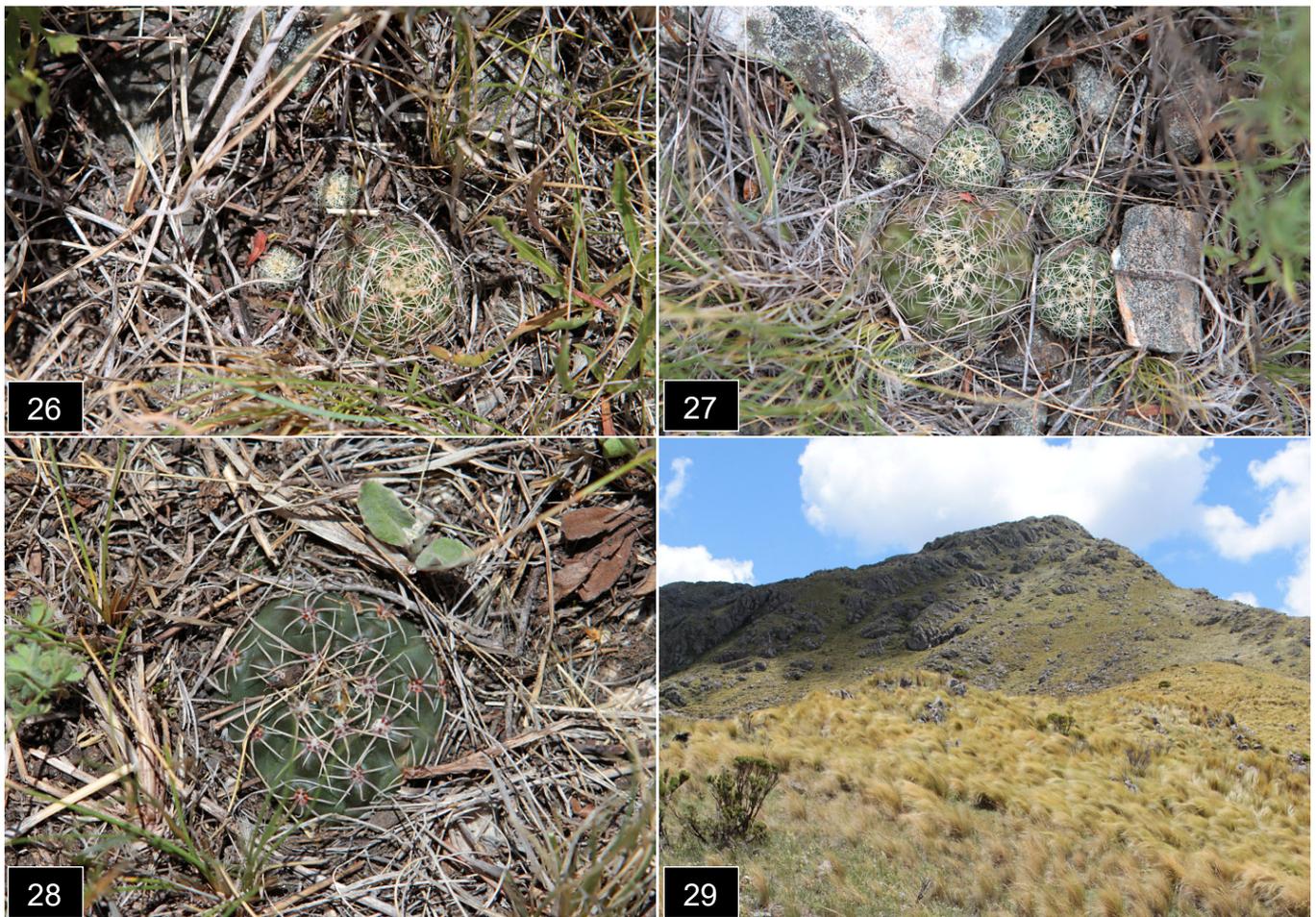


Fig. 26-29: *G. bruchii* subsp. *deminii* Tom 15-794/1 at habitat (26-27), *G. andreae* var. *grandiflorum* Tom 15-795/1 (28) and habitat (29)

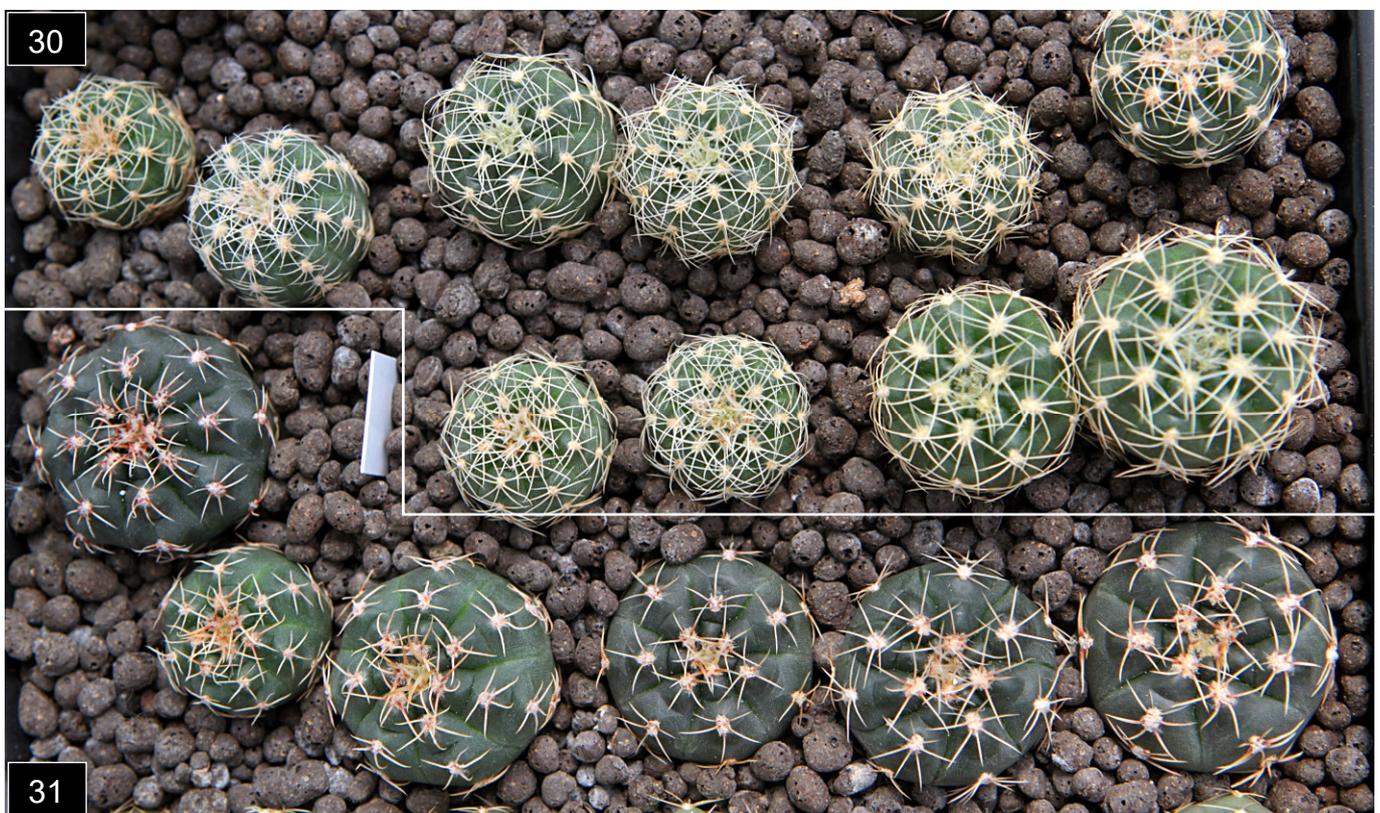


Fig. 30-31: Differences between young plants in culture: *G. bruchii* subsp. *deminii* Tom 15-794/1 (30), *G. andreae* var. *grandiflorum* Tom 15-795/1 (31)

1. Young and old plants have the same morphological features – positioning of spines, number of spines, spines close to the body – covering the body; young plants have the same appearance as old ones. Mostly growing at lower altitudes, 650-1400 m. Here the nominate subspecies and other described taxa missing in the second group could be included.

2. Different morphological features between young and old plants, with older plants getting a more open habitus or different arrangement or length of spines. Growing mostly at higher altitudes, above 1400 m. This group could be associated with *G. bruchii* subsp. *atroviride*, subsp. *brigittae*, *G. carolinense* (sensu Neuhuber) and *G. meregallii*.

The pictures of *G. bruchii atroviride* in the first part of this paper (Papsch, 2012; fig. 36-39) are not a good match with the description and population mentioned by Neuhuber (2009b). If we studied plants of *atroviride* in culture (LB 1086, MM 1020, MM 1022), we could see pronounced differences in morphology from the nominate subspecies (fig. 33-34), resembling populations from higher altitudes, with bigger, more open spined plants and central spines (fig. 35-37).

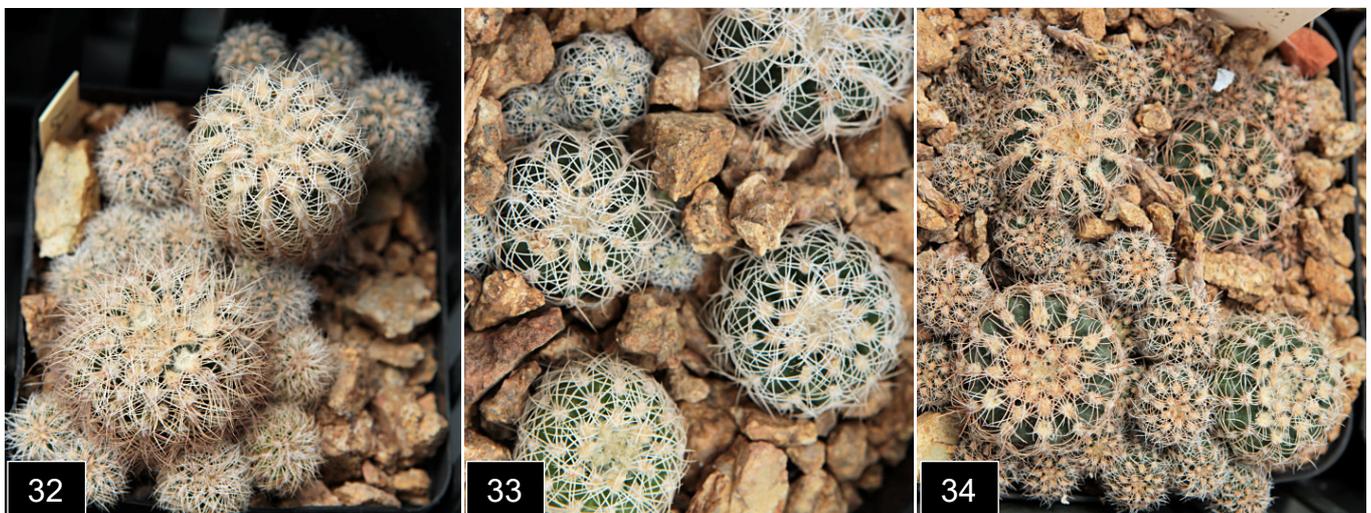


Fig. 32-34: *G. bruchii* face from lower altitudes: *G. bruchii* subsp. *pawlovskyi* (*niveum*) Tom 07-260/2, Los Coquitos (32), *G. bruchii* subsp. *bruchii* (*albispinum*) FB, W of Alta Gracia (33), *G. bruchii* subsp. *bruchii* (*cumbrecitense*) WP 455/873, E of Villa Alpina (34)

As to the question about the origin of plants described as subsp. *atroviride*, one might say that the appearance of the plants bears a resemblance to the groups of *G. andreae* (fig. 35) or *G. amerhauseri* (fig. 36), maybe along the Sierra Chica unstabilized populations can be found with an appearance different from the nominate subsp., even as different as showing an appearance like subsp. *atroviride* (fig. 35-37). At these higher situated habitats both taxa, *G. andreae* and *G. amerhauseri*, could be found. Neuhuber (2009b) mentioned that he also found the nominate subspecies at the habitat of subsp. *atroviride*, and members of the *G. bruchii*-species group can always be found at habitats of *G. andreae* in the Sierra Chica, so this could support the idea of hybridization, as already mentioned by Papsch (2012).

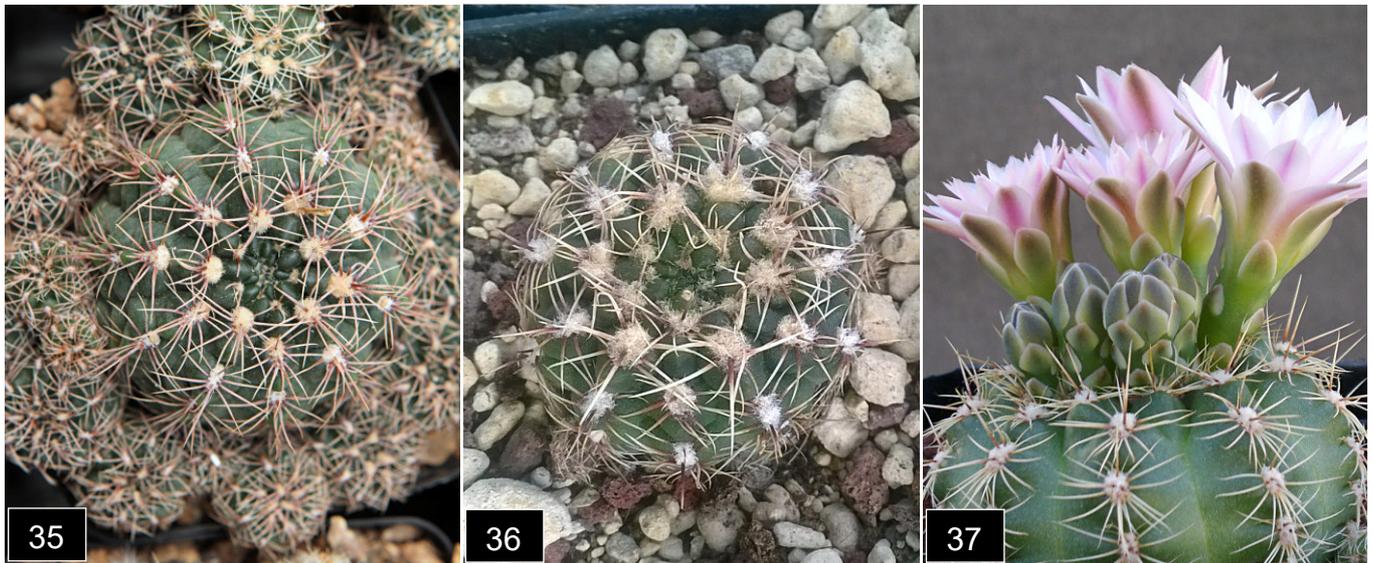


Fig. 35-37: *G. bruchii* subsp. *atroviride* LB 1086 (35), *G. bruchii* subsp. *atroviride* MM 1020 (36), *G. bruchii* subsp. *atroviride* MM 1022 photo: Massimo Meregalli (37)

G. bruchii subsp. *susannae* (Sierra Grande) and *G. bruchii* subsp. *elegans* (Sierra Chica) represent plants with intermediate features of both groups with habitats at higher altitudes. *G. bruchii* subsp. *deminii* can be associated with this intermediate characteristic as well.

This is a very casual differentiation. To make correct decisions on the relationship of different populations, their systematics and taxonomy within the *bruchii*-species group have to be studied in more detail, in field as well as in culture, including studies on the molecular level.

The recently described subsp. *deminii* differs in being distributed in the more flat part of the plateau on the southern part of Cerro Uritorco, which are separated and isolated from other southern parts of Sierra Chica, with pale yellow flowers and mostly two central spines, spines rigid.

The influence of *G. andreae* genes can be discussed. The populations of subsp. *deminii* are homogeneous with quite uniform plants and plant morphology doesn't indicate a direct relationship with *G. andreae*. This is different in the case of flower colour. Its pale yellow colour seems to be uniform within the population, an already well-established character (Gapon et Neuhuber, 2016; Gapon 2016, personal communication). A different shape of outer petals can sometimes be seen and scales which are more pointed, in some flowers similar to petals and scales of *G. andreae* (fig. 14B). *G. andreae* (Cerro Uritorco) flowers later than plants of *G. bruchii* subsp. *deminii* (investigation under the same condition of culture). *G. andreae* was found at an altitude of 1744 m, thus some 120 m higher in altitude, and it has not been found sympatrically with *G. bruchii* subsp. *deminii* (see fig. 18). The question is what was the development of this *G. bruchii*-population like. Was it influenced by *G. andreae* as an ancestor in the process of speciation or were both taxa influenced parallel by another ancestor? Recent studies (Demaio et al. 2010, 2011, Meregalli et al. 2010) show that *G. bruchii* is phylogenetically a more recent species than *G. andreae*. If we assume a hybrid origin, however, a donor of genes responsible for the yellow colour of flowers and possible recent hybrids inside the population of subsp. *deminii* cannot be found. This fact could be different in some populations of both taxa (*G. bruchii* and *G. andreae*) at higher altitudes of Sierra Chica and Sierra Grande where both taxa can grow sympatrically. I have not found intermediate specimens at habitats of *G. andreae* subsp. *pabloi* and *G. bruchii* in Sierra Chica. But in the collection of *G. andreae*

subsp. *pabloi* of Albrecht 09-18 one plant seems to have intermediate or more *G. bruchii* habit, flowering yellow (fig. 39). In the Sierra Grande recent hybrids could be found, e.g. collection of WP 359/754-2, El Mirador (fig. 38) or in the population of STO 702, 1 km before the crossroads to Chuchilla Nevada in northern direction (original collection of Franz Strigl).



Fig. 38-39: *G. bruchii* subsp. *brigittae* x *andreae* WP 359/754-2, El Mirador, Chuchilla Nevada (38), *G. andreae* subsp. *pabloi* A 09-18 (39) photo: Wolfgang Papsch

ACKNOWLEDGEMENT

I would like to thank Mats Nilsson for information on his collection and plant material of original MN 80 as well as for providing pictures, Victor Gapon for field information and providing pictures, Wolfgang Papsch and Massimo Meregalli for useful information and pictures.

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