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Cover picture: *Gymnocalycium castellanosii* var. *rigidum* x *saglionis* MaW 13-418, Sierra de Los Quinteros, Province La Rioja, Argentina, 1378 m (photograph: M. Wick).

Editorial

Dear *Gymnocalycium* friends,

Wolfgang Papsch



We have to celebrate an anniversary. Maybe the attentive reader has noticed that this edition starts the tenth year of the SCHÜTZIANA series. Ten years in which various authors have tried to raise questions about systematics, nomenclature or distribution of the genus *Gymnocalycium* and quite often this has brought about some clarification of the issue under discussion. The contents lists, which can be accessed online, gives proof of this.

As usual, the present edition is another motley mixture of topics. The contribution about hybrids of *Gymnocalycium* in general and natural hybrids in particular follows something like a trend. Last year's Gymno meeting in Radebeul is thoroughly reflected in this issue with a paper on red flowering *Scabroseminea*.

We hope you will have fun reading this wide range of topics, illustrated with a lot of pictures.

Enjoy yourselves!

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/>.

Remarks about so far unknown *Gymnocalycium* hybrids in their habitat

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ABSTRACT

More and more natural hybrids are getting known and described within the genus *Gymnocalycium*. The authors give an overview of the presently specified *Gymnocalycium* hybrids and they also report on three so far unpublished natural hybrids of the species *G. campestre* x *G. monvillei*, *G. monvillei* x *G. campestre* and *G. castellanosii* var. *rigidum* x *G. saglionis*.

KEYWORDS: Cactaceae, hybrid, *Echinocactus*, *denudatus intermedius*, *contractus*, *Gymnocalycium*, x 'Jan Suba', x pazoutianum, x pazoutianum cv. 'Stanislav Buzek', *schuetzianum*, *hennisii*, x anbold, x heidiaea, x monan, x momo, *esperanzae*, x mocamp, x campmo.

INTRODUCTION

Gymnocalycium hybrids have been known for some time. As early as 1885 H. Hildmann presented a hybrid between *Echinocactus denudatus* and *E. monvillei* named *E. denudatus intermedius* (Hildmann 1885). Since then a number of cultivated hybrids between various *Gymnocalycium* species have been presented to the public. On the Internet innumerable pictures of *Gymnocalycia* from the aggregate *G. anisitsii*, *G. friedrichii* and *G. mihanovichii* can be found on the respective platforms and in social media. They are presented with the request for identification. However, they show hybrid features which make a reliable identification of the species impossible, as they are not pure species.

Recently a growing number of natural hybrids between various species and even subgenera have become known and published. In nature, in contrast to culture, hybridisation is an important component of speciation and thus of evolution and therefore strictly has to be separated from hybridization in culture.

DISCUSSION

In biology, an individual that is a cross-pollination of different genera, species, subspecies, races or lines of breeding is called a hybrid. An intergeneric hybrid originates from a cross-pollination of species from different genera is a nothogenus. In case of a cross-pollination of different species of one genus we talk of a species hybrid, it is a nothospecies.

Reports about hybrids are intermittently published in cactus literature, usually referring to bastards which have been brought about consciously (or unconsciously) in cultivation. This applies especially to interspecific, but also intergeneric cross-pollinations within genera, e.g. *Echinopsis* and *Trichocereus* or *Epiphyllum* and *Aporocactus*. The aim of this crossbreeding is to achieve attractive flowers and a variation of flower colours. Here the well-known Knebel hybrids of *Epiphyllum* and Paramount hybrids of *Echinopsis* x *Trichocereus* should be mentioned as examples. The plants originating from such pollination are popular and in high demand with many collectors because of their flowers.

Within the genus *Gymnocalycium*, too, many hybrids have been produced in cultivation in the past, mainly due to a lack of isolation of the parents during pollination. As early as 1885 H. Hildmann presented a cross-pollination between *Echinocactus denudatus* and *E. monvillei* named *E. denudatus intermedius* (Hildmann 1885). Among the offspring there were three plants which, according to the author, had to be regarded as a separate species, just like the two original species. The attached illustration shows a four-year-old specimen (Fig.1).

In 1891 the same author described *Echinocactus contractus* in the first volume of the "Monatsschrift für Kakteenkunde" (MfK). This plant allegedly originated from a cross-pollination of *E. monvillei* and *E. gibbosus* (Hildmann 1891/1892). The hybrid's arrangement of spines is similar to that of *Gymnocalycium gibbosum* (Fig. 2) as can be seen from the illustration accompanying the description.

Well-known crossbreeds originating from the Czech area are certainly those of *G. baldianum* and *G. denudatum* (Fig. 3). *Gymnocalycium* x 'Jan Suba', a hybrid with rose coloured flowers which came about by cross-pollinating *G. denudatum* var. *backebergii* and *G. baldianum*. It was described for the first time by J. Elsner in the National Cactus and Succulent Journal (GB) (Elsner 1970). J. J. Halda also deals with this cross-pollination, calling it *G. x pazoutianum* (Halda 1998), and the reciprocal cross-pollination, namely *G. baldianum* with *G. denudatum* var. *backebergii*, is called *G. x pazoutianum* cv. 'Stanislav Buzek' (Halda 2002) by him.

G. schuetzianum is also suspected to be of hybrid origin. According to Ritter it was found near Cruz del Eje in the province Córdoba, but so far it has not been rediscovered. If it is a hybrid, *G. monvillei* could certainly be one of the parents (Fig. 4).

The name *G. hennesii* (Putnam 1978) also appears in literature. It is assumed to have originated from a cross-pollination of *G. quehlianum* and *G. platense*. It is unclear what the parent *G. platense* refers to.

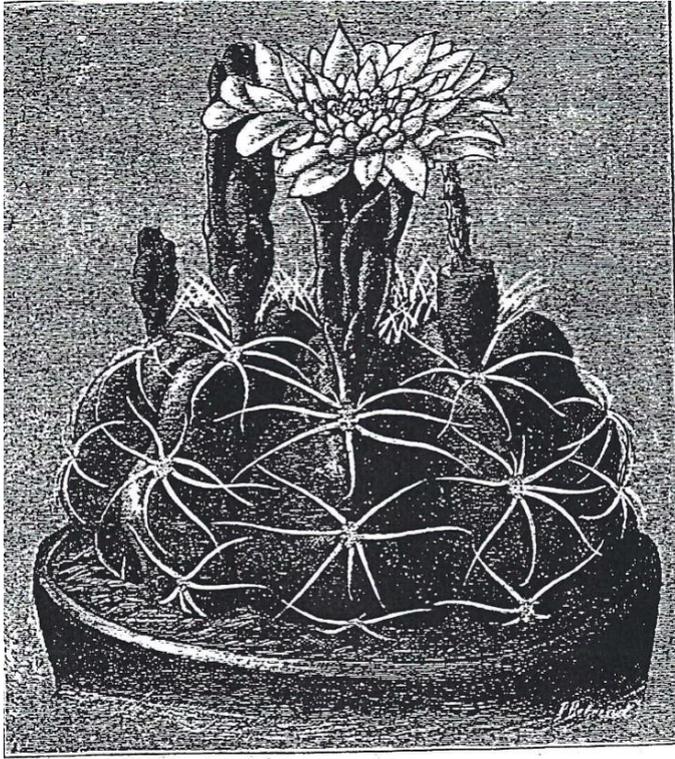
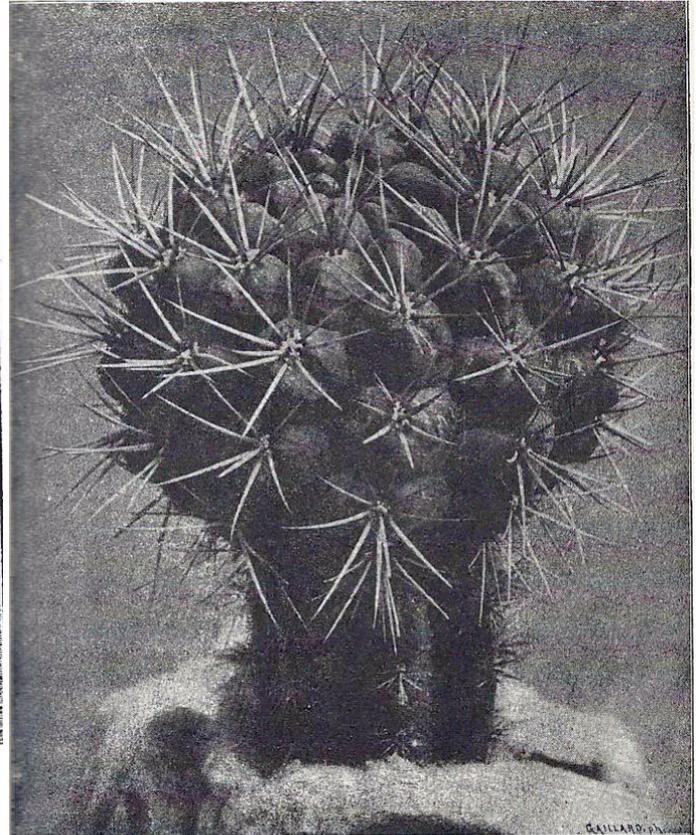


Fig. III.
Echinocactus denudatus intermedius Hildm. Blumen weiss.

Fig. 1: Copy of "Gartenzeitung" 1885.



Echinocactus contractus, Hildm.
Aus der Sammlung des Herrn H. Hildmann, Kunst- und Handelsgärtners in Birkenwerder.

Fig. 2: Copy of Mfk 1891/92.



Fig. 3: *Gymnocalycium* x 'Jan Suba'.



Fig. 4: *Gymnocalycium schuetzianum* FR 430
(Photograph: V. Schädlich).

The origin of the hybrid *Gymnocalycium* x *anbald*, described by Stuchlik and a cross-pollination of *G. andreae* and *G. baldianum*, is reported to have taken place in F. Boszing's greenhouse in Salzburg (Stuchlik 2002).

Descriptions of natural hybrids within the genus *Gymnocalycium* are rare. So far only three nothospecies have been described. G. Neuhuber described *Gymnocalycium* x *heidiae* from the province Catamarca. The author notes that one parent is certainly *G. baldianum*, however, Neuhuber could not specify the pollination partner (Neuhuber 1999).

In 2005 M. Kurka collected seeds of a natural hybrid of *G. monvillei* and *G. andreae* in the Sierra Grande around El Condor. The original seedlings clearly show the intermediate nature. Kurka describes this hybrid in *Gymnofil* as *Gymnocalycium* x *monan*, sticking to the nomenclature rules applied to the astrophotum hybrid by W. Haage and O. Sadovský (1957) (Kurka 2017).

Currently a hybrid of *G. monvillei* and *G. mostii* from south of Icho Cruz in the province Córdoba has been described as *Gymnocalycium* x *momo* by V. Gapon and N. Schelkunova in the Russian magazine "Kaktus Klub" (Gapon and Schelkunova 2018).

It is not easy to recognize natural hybrids in nature. Differences in habit from those of the parent plants must be striking in order to establish the hybridogenic origin of the plant. Usually variations in body shape and spination are attributed to natural variability of the individual species in their natural surroundings.

On the southeastern edge of the distribution area of *G. bicolor simplex* (Fig. 5), plants were discovered of which, at an early stage of growth, a part could not be distinguished from *G. prochazkianum* (Fig. 6). With increasing age and size it strongly resembles *G. prochazkianum*. Sowings have revealed that these morphological features of the hybrid population originating from the species *G. bicolor simplex* and *G. prochazkianum* (Fig. 7-10) are genetically well established. This hybridisation can be taken for granted and *G. bicolor simplex* was certainly the mother plant.



Fig. 5: *Gymnocalycium bicolor simplex*.



Fig. 6: *Gymnocalycium prochazkianum*.



Fig. 7-8: *Gymnocalycium bicolor simplex* x *Gymnocalycium prochazkianum*, Orcosuni, province Córdoba.



Fig. 9-10: *Gymnocalycium bicolor simplex* x *Gymnocalycium prochazkianum*, Orcosuni, province Córdoba.

Similar facts apply to *G. esperanzae*. In this case *G. basiatrum* (Fig. 11) and *G. castellanosii* subsp. *armillatum* (Fig. 12) seem to have been the parent plants with *G. basiatrum* being the stock plant (Fig. 13-14).



Fig. 11: *Gymnocalycium basiatrum*.



Fig. 12: *Gymnocalycium castellanosii* subsp. *armillatum*.

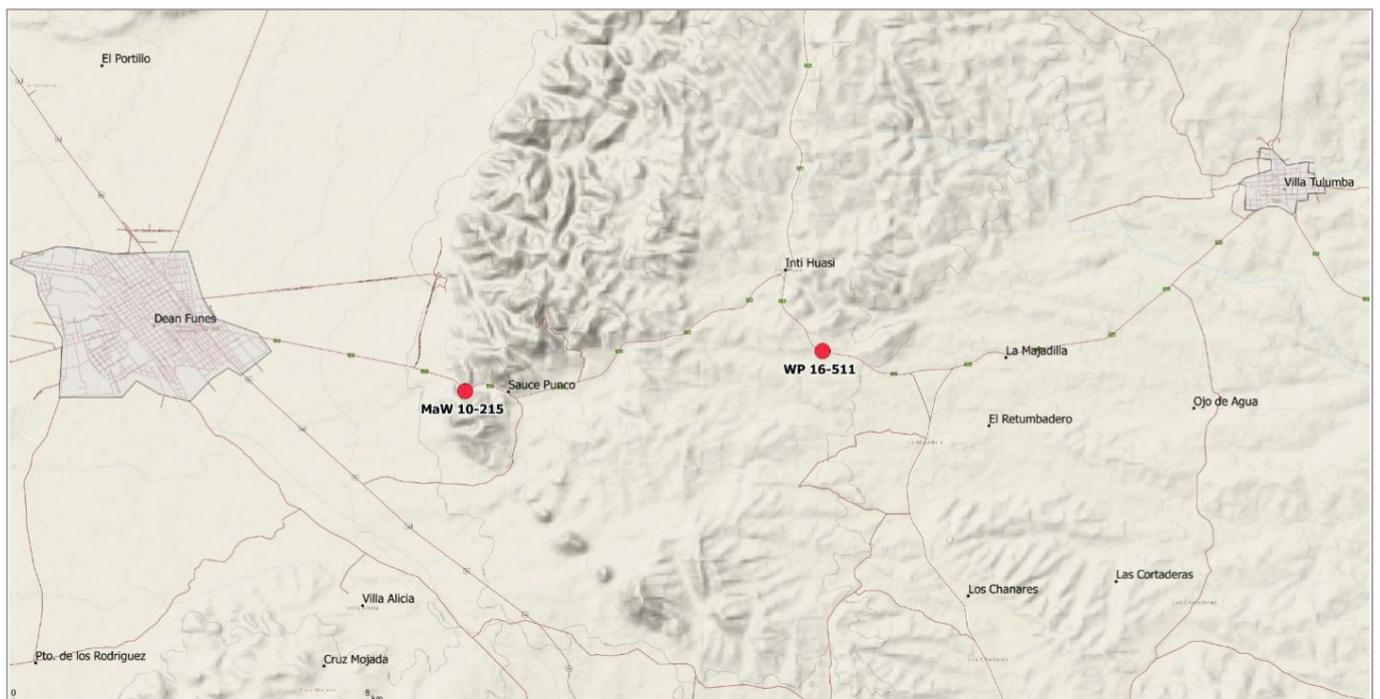
In the past the hybrids resulting from these cross-pollinations attained complete fertility in the sequence of generations. This is often achieved by doubling the chromosome set ($4n$), although this does not apply to *G. esperanzae* because this species is diploid ($2n$). However, there seem to be no problems with fertility in its natural habitat.



Fig. 13-14: *Gymnocalycium esperanzae* in its locality.

It is a stroke of luck if potential pollination partners flower at the same time in a locality and one (or more) intermediate plants can be found. The specimens regarded as hybrids can be compared in situ with the presumed parent plants.

This was the situation in an area west of Villa Tulumba in the province Córdoba (locality WP 511) in November 2016. Between La Majadilla and Intihuasi areas of rubble covered with low grass spread in sweeping hilly terrain. In rather open areas of coarsely broken rock *G. monvillei* was found in full flower (Fig. 15-16). All stages of vegetation from the beginning of budding to bearing fruit could be perceived. One species from the subgenus *Gymnocalycium*, here called *G. aff. campestre* of which the exact identity is still doubtful, prefers areas densely covered with grass only slightly higher in altitude. There the soil is a bit more humic and sometimes also overgrown with *Selaginella*. There, too, all the plants were budding or flowering (Fig. 17-18).



Map 1: Localities of WP 511 *G. aff. campestre* x *monvillei* and MaW 215 *G. monvillei* x *campestre*.



Fig. 15-16: *Gymnocalycium monvillei* in locality WP 511.



Fig. 17-18: *Gymnocalycium* aff. *campestre* in locality WP 511.

When studying the plants in situ only a few scattered specimens could be found which possessed features of both *Gymnocalycium* species growing in this locality. Spination of some of these intermediate plants is similar to that of *G. monvillei*. On average, however, it is markedly finer and more attached to the body. Some plants clearly show the influence of the second parent in the arrangement of their curvy, downward bent spines (Fig. 19-22).

The intermediate characteristics of the plant easily be recognized from the structure of the flower. *G. monvillei*'s flowers are relatively short and wide funnel-shaped. The ovary is more or less spherical, the throat mostly greenish and the style clearly surpasses the top stamina. The flowers of *G. aff. campestre* are large compared with the size of the body, long and narrow funnel-shaped, the ovary is very much elongated. Its throat colour is of an intensive magenta tinge and the style reaches the lower stamina (Fig. 23). The flowers of the intermediate plants are structured similarly to *G. monvillei*, but markedly longer, the ovary is elongated ovate, the throat is reddish, and the style just reaches up to the top stamina (Fig. 25).

During the period of observation there were no fruits among the hybrids. Therefore, no statement can be made about the appearances of the seed and fertility at the moment.



Fig. 19-20: *Gymnocalycium* aff. *campestre* x *Gymnocalycium monvillei* in locality WP 511.



Fig. 21-22: *Gymnocalycium* aff. *campestre* x *Gymnocalycium monvillei* in locality WP 511.



Fig. 23: flower section *G.* aff. *campestre*.

Fig. 24: *G.* aff. *campestre* in locality WP 511.

The established morphological features of the hybrid plants indicate that *G. monvillei* was the pollen donor. Thus, these plants would be the third hybrids originating from crosses of *G. monvillei*.



Fig. 25: Flower section *Gymnocalycium* aff. *campestre* x *monvillei*.

About 8 km in a straight line from the above-mentioned locality (MaW 215) in the vicinity of Sauce Punco the co-author found seeds on an adult specimen of *G. monvillei* (Fig. 26). When he sowed them at home, seedlings grew that are definitely hybrids of *G. monvillei* and *G. campestre* (Fig. 28-31) with the latter species being the pollen donor. This is the reciprocal cross of WP 511. Apart from *G. monvillei* and *G. campestre* (Fig. 27) no further *Gymnocalycium* species could be found at the locality. The seedlings differ from *G. monvillei* and are more or less intermediate between the parental plants in their appearance, with *G. monvillei*'s features being more prevailing.

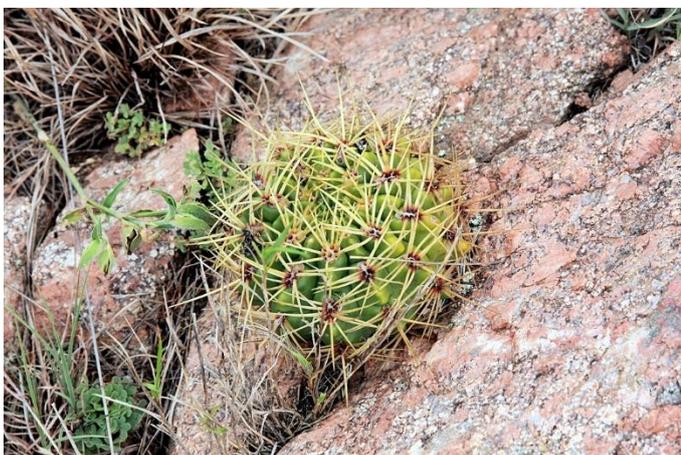


Fig. 26: *G. monvillei* in locality MaW 215.



Fig. 27: *G. campestre* in locality MaW 215.

The flower combines the features of both parent plants, but its diameter is only that of the male parent's flower. In the meantime, the hybrid plants have been pollinated among each other and produced fruits. The F2 seeds differ in their appearance from those of *G. monvillei* but are closer to *G. campestre* than to the mother plant (Fig. 32-33). The seeds did not germinate easily, and the few seedlings died a few weeks after germination so that no F2 plants could be obtained. The explanation is that *G. campestre* is tetraploid (4n) and *G. monvillei* diploid (2n) so that the seeds were probably triploid.



Fig. 28-29: *Gymnocalycium monvillei* x *G. campestre*, offspring of imported seeds (F1).



Fig. 30-31: *Gymnocalycium monvillei* x *G. campestre*, offspring of imported seeds (F1).



Fig. 32: Seeds from MaW 215 *G. monvillei* (F1).
(Photographs: Volker Schädlich).



Fig. 33: Seeds *G. monvillei* x *G. campestre* (F2)

Following the usual nomenclature these plants could be called *Gymnocalycium* x mocamp and the crossbreed respectively *Gymnocalycium* x campmo.

A further interesting natural hybrid of striking appearance could be found in a single specimen in the distribution area of *G. castellanosii* var. *rigidum* in the Sierra de Los Quinteros. It was probably brought about by pollination of *G. castellanosii* var. *rigidum* (Fig. 34) with the sympatric *G. saglionis* (Fig. 35).



Fig. 34: *Gymnocalycium castellanosii* var. *rigidum* in locality MaW 419.



Fig. 35: *Gymnocalycium saglionis* at the locality of *G. castellanosii* var. *rigidum* MaW 419.

Regrettably no viable seeds could be found, that is why the hybridogenic status of the plant could not be proved, although it is very likely judging from the appearance of the specimen. We suppose that *G. castellanosii* var. *rigidum* was the mother plant.



Fig. 36: Hybrid of *G. castellanosii* var. *rigidum* and *G. saglionis* at the locality MaW 419.

An interesting future area of research might be the question of fertility and seed form of hybridogenic descendants of the F₂-generation and those following it, especially for cross-pollinations whose parent plants belong to different subgenera of the genus *Gymnocalycium*. In this context it would be of great interest to know the ploidy level of the parent plants.

ACKNOWLEDGEMENT

We are very much indebted to Volker Schädlich for providing the photographs (Fig. 4, Fig. 32 and Fig. 33).

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Red flowering and related *Gymnocalycia* of the subgenus *Scabrosemineum*

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ABSTRACT

The red flowering *Gymnocalycia* of the subgenus *Scabrosemineum* are divided into two related groups due to morphological features. The old and ever debatable *Gymnocalycium oenanthemum* is united with other red flowering forms of *G. nigriareolatum*. The second group is made up of *G. tillianum* and *G. carminanthum* with the first one being entitled to species rank. *G. ambatoense* and *G. catamarcense* subsp. *acinacispinum* are also included in the latter group.

KEYWORDS: *Cactaceae*, *Gymnocalycium*, *ambatoense*, *carminanthum*, *catamarcense* subsp. *acinacispinum*, *nigriareolatum*, *oenanthemum*, *tillianum*.

Almost from the beginning of acknowledging the genus *Gymnocalycium* it has been tried to develop a classification of the respective species. Recently Demaio et al. (2011) have often been able to confirm previous classifications to a large extent based on DNA analysis, but they also had to introduce a new subgenus. It could be established that the subgenus *Microsemineum* Schütz is limited to only one species, *Gymnocalycium saglionis*, and that all the other species have to be assigned to a newly introduced subgenus, the subgenus *Scabrosemineum* Demaio et al.

Based on this knowledge Helmut Amerhauser and Walter Till (2013) amended and improved Hans Till's classification of subgenera, which is based on morphological features. The aggregate 'Oenanthema' was devised as a part of this classification, consisting of three species:

G. ambatoense Piltz (x)

G. ambatoense subsp. *plesnikii* Halda & Milt

G. nigriareolatum Backbg.

G. nigriareolatum var. *nigriareolatum* fa. *carmineum* H. Till (x)

G. nigriareolatum var. *densispinum* Backbg. ex H. Till (x, pro parte)

G. nigriareolatum var. *simoi* H. Till

G. oenanthemum Backbg. (x)

G. oenanthemum subsp. *carminanthum* (Borth & Koop) H. Till (x)

G. carminanthum subsp. *carminanthum* var. *montanum* Slaba (x)

The taxa marked by (x) will be discussed here, and of course, also *G. tillianum* Rausch, which was placed within the aggregate ‘*Hosseiana*’, and also *G. catamarcense* subsp. *acinacispinum* H. Till & W. Till from the aggregate ‘*Spegazziniana*’.

Gymnocalyxium oenanthemum

In 1934 Curt Backeberg describes these red flowering plants as a new species in his “Blätter für Kakteenforschung”. The name chosen for the species carries the meaning “with ruby coloured flower”. It is not known how Backeberg got the plant, but it can be assumed that it was a consignment of plants, as was common procedure at that time. Backeberg specifies Mendoza as natural origin, which cannot be true. Later he changed it to Córdoba, which is certainly also incorrect.

The valid description is fairly good for those days (in the original version the description is given in four languages – German, English, Dutch and French).

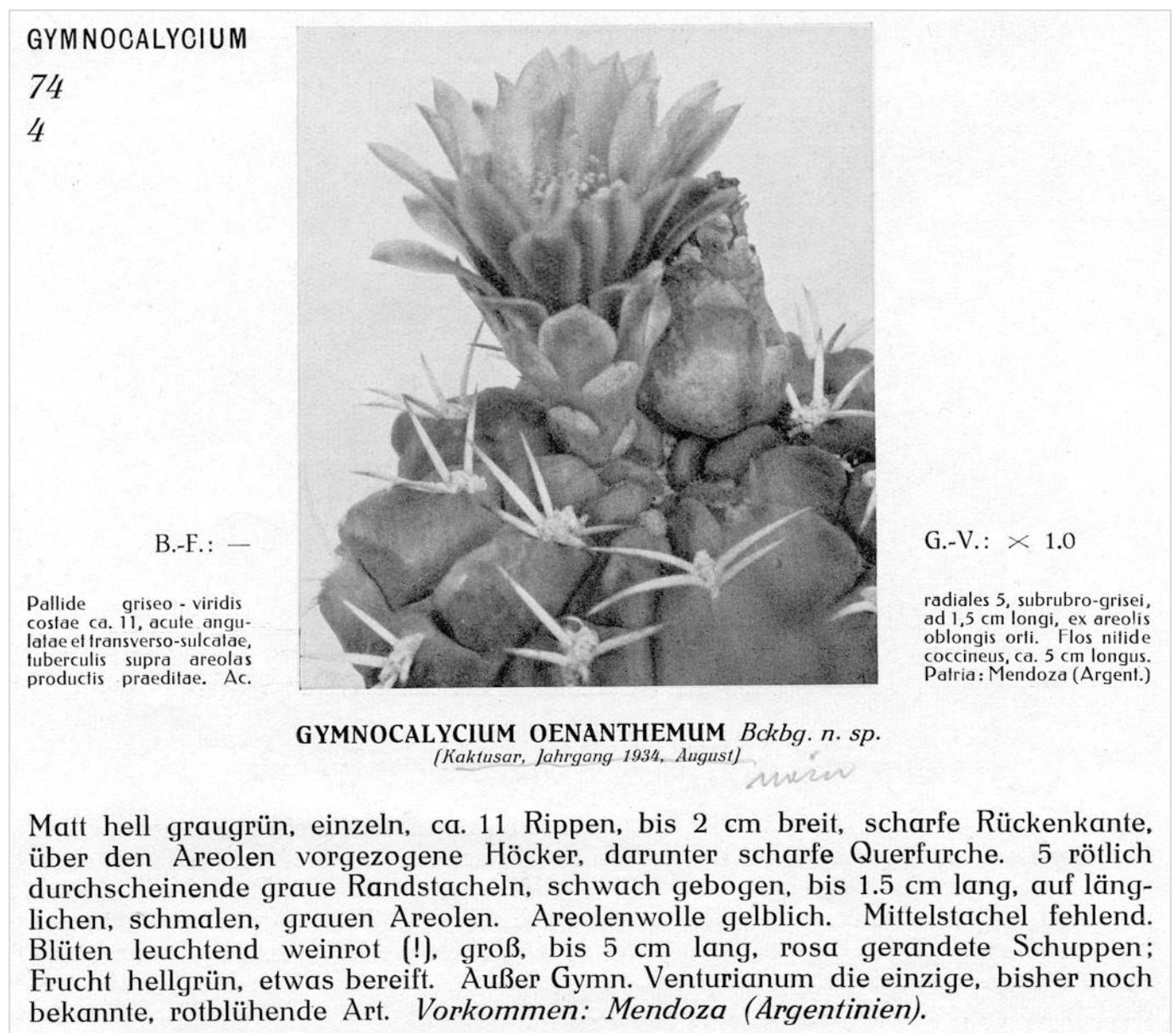


Fig. 1: Copy of the original description of *Gymnocalyxium oenanthemum*.

As can be seen in Fig. 1, a picture of the plant is added to the first description. When later on numerous field researchers found further red flowering plants, they used to try to relate these new discoveries to *G. oenanthemum*. The comparison is almost always made with populations which must be assigned to *G. carminanthum*. (Charles 2009). The fact that the red flowering *G. nigriareolatum* fa. *carmineum* might also be in a way connected with *G. oenanthemum* is mentioned, but not further discussed by Charles.

Unfortunately, no material of *G. oenanthemum* has been reliably documented or secured, neither are there any descending plants nowadays, therefore we can only rely on the first description and the picture. Table 1 lists the features given in the first description and compares them with documented plants, that is plants of which the origin is known and which possess red flowers. Above all, the form of the ribs and protuberances as well as the arrangement of spines can be evaluated.

Table 1: Comparison of body, flower and seed features of *G. oenanthemum*, *G. nigriareolatum* fa. *carmineum* STO 255, *G. nigriareolatum* var. *densispinum* P 24 (red flowering) and *G. carminanthum* BO 130.

Feature	<i>G. oenanthemum</i>	<i>G. nigriareolatum</i> fa. <i>carmineum</i> STO 255	<i>G. nigriareolatum</i> var. <i>densispinum</i> P 24	<i>G. carminanthum</i> BO 130
Body	solitary	solitary	solitary	solitary
- Form		spherical	spherical	compressed spherical
- Colour	mat light greyish green	dull light green	mat green	mat bluish green to greyish green
Ribs				
- Number	ca. 11, up to 2 cm wide	ca. 10	ca. 15	6-11, about 25 mm wide at the base
- Form	sharp-edged, conspicuous chin transverse groove	sharp-edged low protuberances, hardly any transverse groove	low protuberances, chins , poorly developed transverse groove	flat, chin-like protuberances edged near the apex, transvers groove
Spines				
- Lateral spines	5	ca. 7	7	(5-) 7 (-9)
- Form	slightly bent	protruding, slightly curving	slightly protruding, straight	bent towards the body
- Central Spines	0	1	0	0 (-1)
- Form		bent upwards		
Flower				
- Colour	shining ruby	rosy to crimson	red	light crimson
- Length	up to 5 cm long	ca. 45 mm long	ca. 5 cm long	up to 45 mm long
Fruit				
- Form		spherical		
- Colour	light green, slightly frosted			dark to olive green
Seed	1 mm, black	mat black		1 mm, black

According to the first description, *G. oenanthemum* possess ribs about 2 cm wide with a sharp edge, distinctly prominent protuberances, separated by a narrow transverse groove on the rib. The five radial spines are slightly curved and project from the body, there is no central spine. On comparing these facts with those applying to three red flowering *Scabroseminae* (BO 130, STO 255 and P 24 pro parte) as accomplished in table 1, it must be established that the noted description of features yields few differences.

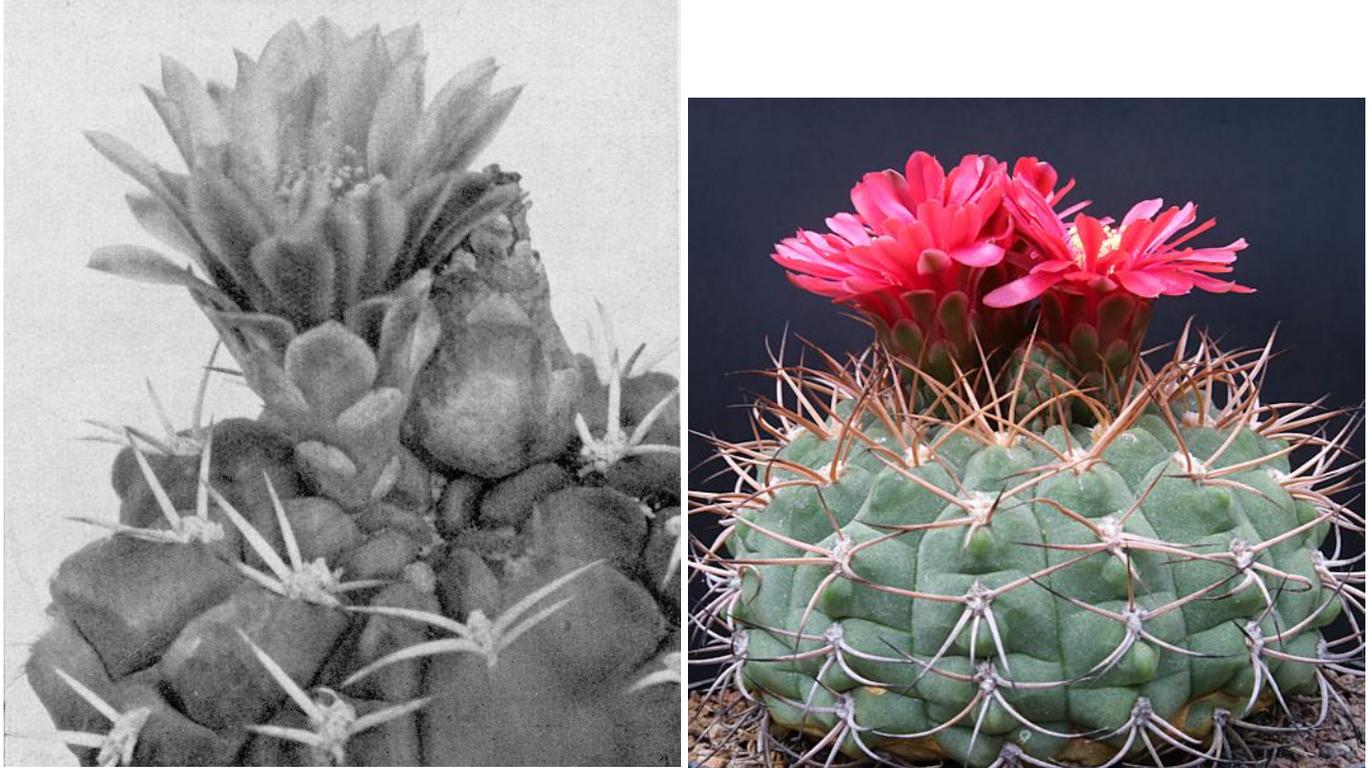


Fig. 2: Comparison of *G. oenanthemum* and *G. carminanthum* BO 130.

The "faces" of the plants have more informative value. Fig. 2 presents the original picture by Backeberg and a photograph of *G. carminanthum* BO 130 next to each other. The ribs of *G. oenanthemum* are edged with distinctly chin-like protuberances, while those of BO 130 are wider, less raised with more rounded protuberances. When we take a closer look at the rib forms as in Fig. 3, I draw the conclusion that *G. oenanthemum* and *G. carminanthum* are two different species.

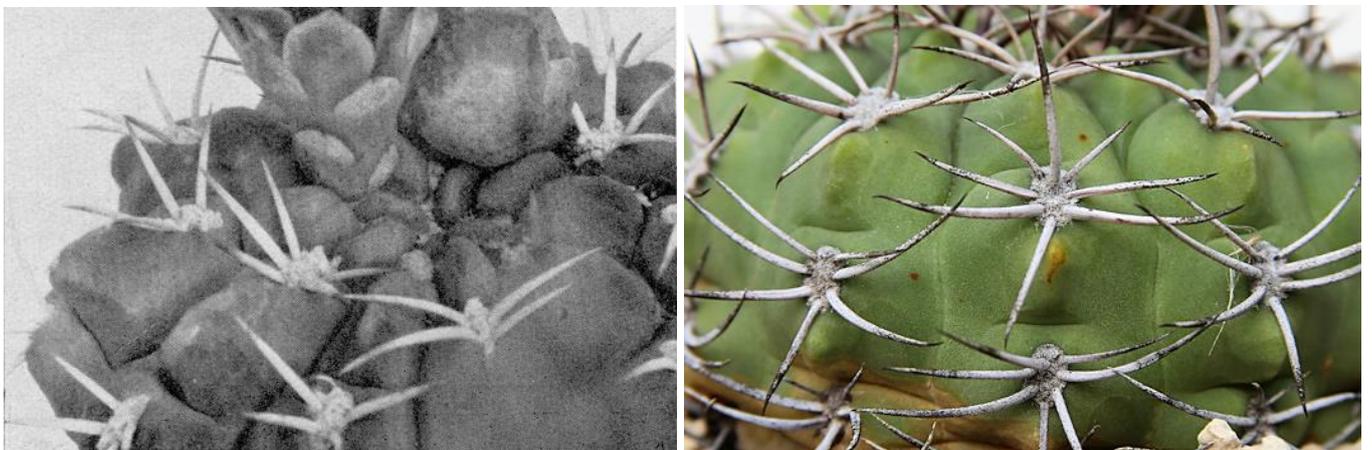


Fig. 3: Comparison of details of *G. oenanthemum* and *G. carminanthum* P 133.

In the year when *G. oenanthemum* was described Backeberg also published the first description of *G. nigriareolatum* (also with incorrect place of origin). Supposedly the plant material was

obtained together with that of *G. oenanthemum* and was collected in nature in close vicinity. The reason why the plants were described separately is in my opinion the different colour of their flowers: *G. nigriareolatum* has white flowers with a red throat. It is interesting to note that nowadays it is repeatedly reported about red flowering plants within populations of *G. nigriareolatum*. As early as at the beginning of the 1960s Fechsler sent white as well as red flowering *G. nigriareolatum* to Europe. *G. nigriareolatum* var. *densispinum* also flowers partly in red. With *G. nigriareolatum* fa. *carmineun* a population with solely red flowers was described.



Fig. 4: Comparison of rib details of *G. oenanthemum* and a red flowering *G. nigriareolatum* var. *densispinum* P 24.



Fig. 5: Red flowering plant of *G. nigriareolatum* var. *densispinum* P 24.

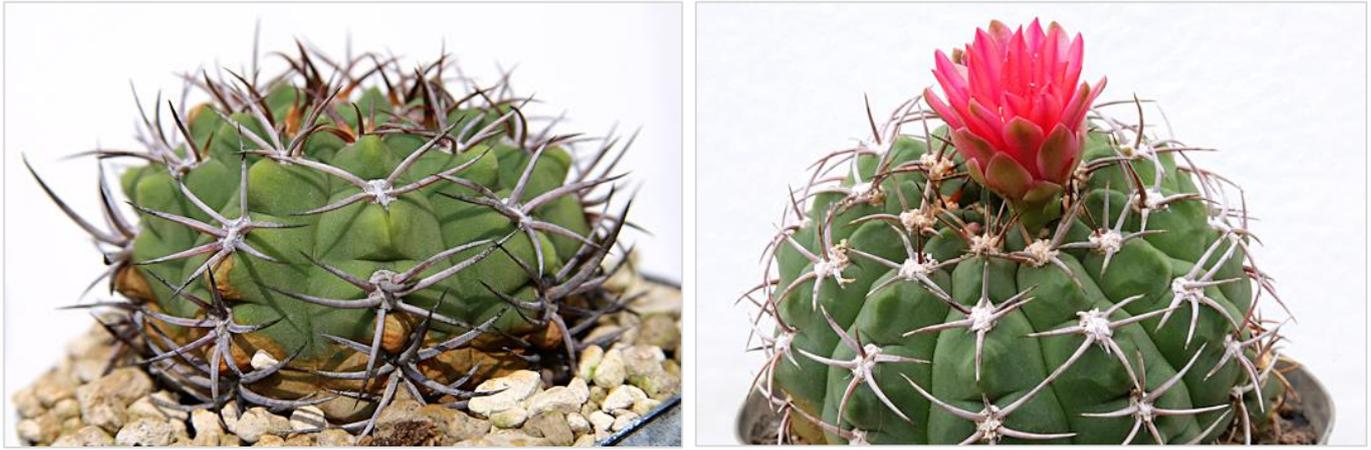


Fig. 6 and 7: Offspring of *Gymnocalycium* WR 720.

Fig. 4 presents the reference material *G. nigriareolatum* var. *densispinum*. It is Jörg Piltz's collection P 24. The illustrated plant has red flowers (Fig. 5).

The forms of ribs, protuberances and chins are very similar. This is for me a confirmation of the assumption that these plants must be placed close to *G. oenanthemum*.

An even more accurate match appears when comparing the photographs of *G. oenanthemum* with Fig. 6 and 7. Both are seedlings from Walter Rausch's locality WR 720. To my knowledge, Walter Rausch has not published so far where he found those plants.

In his paper on the identity of *G. nigriareolatum* (Till 1998) Hans Till also compares the features of *G. oenanthemum* and *G. nigriareolatum*. He comes to the following conclusion: "Apart from the presumably wrong locality Mendoza the diagnoses of *G. nigriareolatum* and *G. oenanthemum* differ so much that on careful examination no connection can be established. Therefore *G. oenanthemum* Backeberg is to be retained as a separate species." Thus, Till has left the door open for himself to describe the red flowering species from Villa Dolores with the collection number STO 255 as *Gymnocalycium nigriareolatum* fa. *carmineum*. In the same paper Till also validates the description of *G. nigriareolatum* var. *densispinum* Backeberg, which had always remained invalid up to then.

I assume that further observations at the localities and in cultivation will definitely confirm that *G. oenanthemum* belongs to the red flowering (part of the) population of *G. nigriareolatum*. I do not agree with the classification of *G. oenanthemum* as a form of *G. carminanthum* or *G. tillianum*.

Gymnocalycium tillianum* and *Gymnocalycium carminanthum

Plants of the subgenus *Scabrosemineum* which also have red flowers grow in the higher as well as the lower regions of the Sierra de Ambato. It is almost unbelievable that the plants growing at higher altitudes became known first. It was Walter Rausch who found *Gymnocalycium* species with red flowers high up in the Sierra de Ambato when looking for further *Lobivia* relatives in 1967. In 1970 the plants carrying the field number WR 227 were described as *Gymnocalycium tillianum* by him. The altitude given is between 2.600 and 3.500 m.a.s.l. the plants' spination is rather strong. The seeds are very interesting because they do not show a black testa as would be expected, but a reddish brown one with a large, light creamy hilum ring. During my visit to Hans

Till's in 1986 I had the opportunity to take a picture of the imported plant (in his collection labelled HT 393), of which an offset had been deposited as holotype (Fig. 8).



Fig. 8: *Gymnocalycium tillianum* WR 227 (greenhouse number HT 393) of which an offset was deposited as holotype. Picture taken in 1986 at Hans Till's collection.

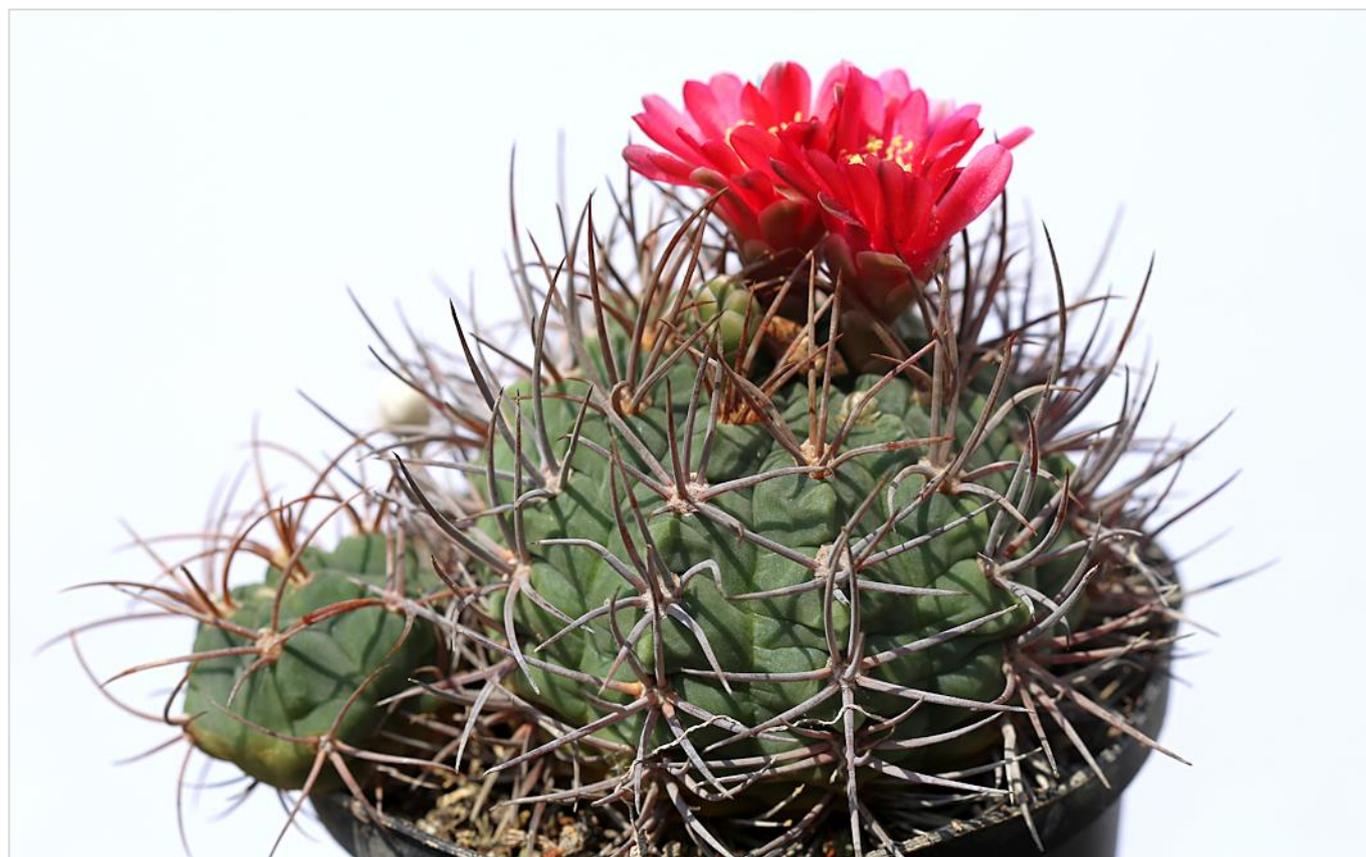


Fig. 9: *Gymnocalycium tillianum* WR 227.

In 1976 *Gymnocalycium carminanthum* (Fig. 10) was described by Hans Borth and Helmut Koop. The plants were found along the road leading from Miraflores via Los Angeles to higher regions. According to their statement, the plants carrying the field number BO 130 grow at an altitude between 1.300 and 1.800 m.a.s.l. The plants are compressed spherical and they possess flat ribs with slight protuberances only at the apex. The transverse groove amounts to only one third of the rib's width. In the first description the variety of forms is demonstrated with pictures. There is a small but important deficiency in the first description. It quotes a plant as holotype, which at that time was located in the Conservation and Type Collection of Linz Botanical Garden, consequently a living specimen. According to nomenclature rules a holotype is required to be a preserved specimen. This topic was once again discussed during the *Gymnocalycium* meeting in Radebeul in September 2018. As a consequence of this discussion Wolfgang Papsch contacted Linz Botanical Garden about this matter. The results of this research are not to be repeated here. They can be looked up in the third SCHÜTZIANA edition of 2018. The result of these activities was the (valid) first description of *Gymnocalycium carminanthum* Borth & Koop ex Papsch. The holotype is an imported plant from the first collection (BO 130) in 1973.

Following the road from Los Angeles further upwards Rudolf Slaba was the first to find plants which can be distinguished from *G. carminanthum* by their smaller bodies, more ribs and spines protruding from the body. A direct relationship with *G. tillianum* was not accepted, above all because the seeds were black and not reddish brown as in *G. tillianum*. The plants were described as *Gymnocalycium carminanthum* var. *montanum* with the field number SL 35a (locality 2.600 m.a.s.l.) (Fig. 11).



Fig. 10: *Gymnocalycium carminanthum* BO 130.



Fig. 11: *G. carminanthum* LB 5426 at the locality near El Rodeo.



Fig. 12: *G. carminanthum* var. *montanum* SL 35a.

According to Papsch, this description is invalid because it is based on the invalid description of *G. carminanthum* Borth and Koop. Based on more detailed research Franz Berger (2009) demonstrated that this taxon cannot be attributed to *G. carminanthum*, but rather to *G. tillianum*. As the basionym is not validly described, performed recombination as *G. tillianum* subsp. *montanum* is also not valid.

There is a locality of red flowering plants in the mountains above Rosario de Colana (western side of the Sierra Ambato) at an altitude of 2.320 m.a.s.l. Many field researchers have visited that place, not least due to the fact that it can be easily accessed by car. There are many field numbers for those plants, for instance my own LB 4482 and 4706. It is interesting to note that among these plants there are those with adjacent spines as well as those with protruding ones (Fig. 13-16).



Fig 13-14: *Gymnocalyxium* LB 4482 at its locality near Rosario de Colana and at home.

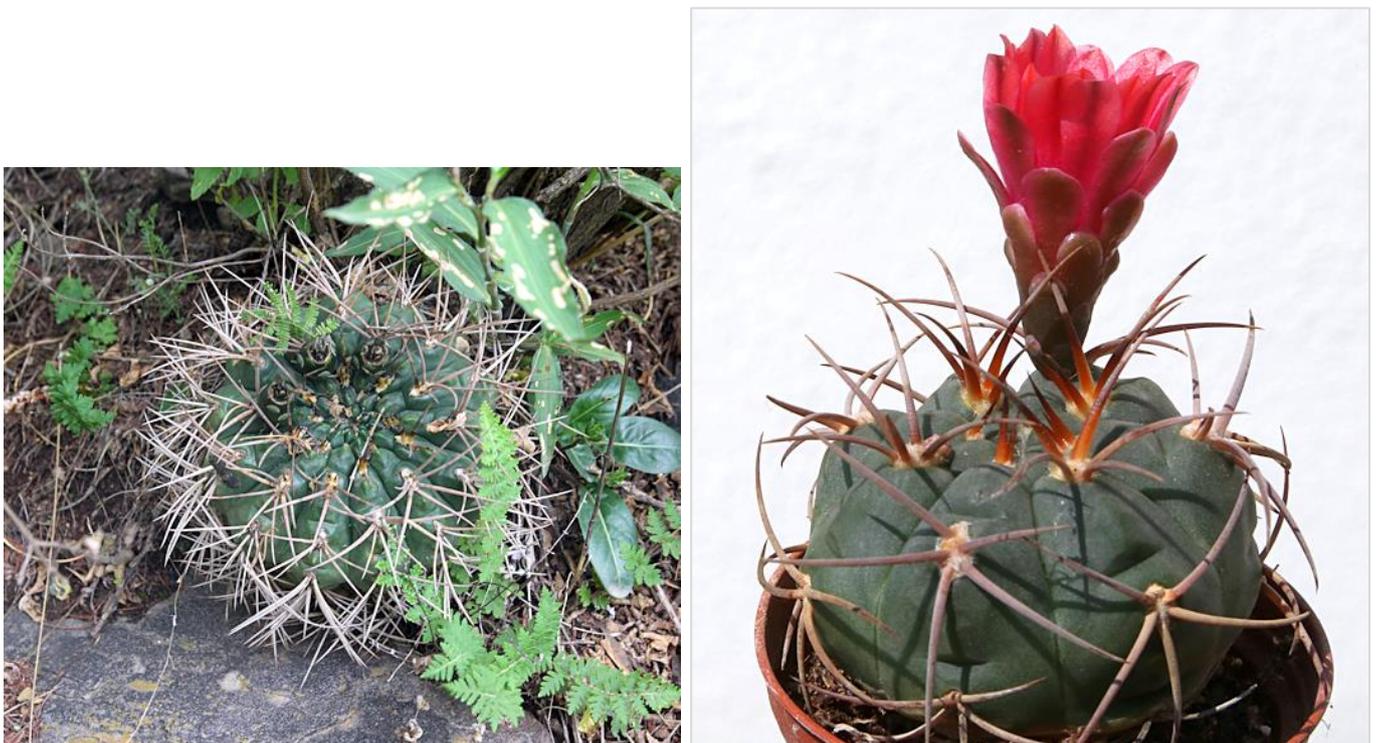


Fig. 15-16: *Gymnocalyxium* LB 4706 at its locality near Rosario de Colana and at home.

I am more and more convinced that there are smooth transitions in nature between *G. carminanthum* and *G. tillianum*. Further molecular investigations are required to resolve the issue.

Gymnocalycium ambatoense* and *Gymnocalycium catamarcense* subsp. *acinacispinum

In places of lower altitudes in the Sierra de Ambato, for example at Miraflores (on the way up to Los Angeles) there grow plants which are strongly reminiscent of *G. carminanthum* judging from their appearance (see Fig. 17 and 18). The significant difference, however, lies in the colour of their flowers, which is silky, shining white with a red throat.



Fig. 17: *G. carminanthum* BO 130.



Fig. 18: *G. ambatoense* P 22.

Jörg Piltz also found such plants near Concepción, Catamarca and attributed his field number P 22 to them. In 1980 the first description *Gymnocalycium ambatoense* Piltz followed.

There are red-flowering cactus localities with the same plants flowering in lighter colours or in yellow at lower altitudes. These localities are not very far apart from each other geographically. (*G. baldianum*, *Echinopsis aurea / dobeana*, *Parodia microsperma / malyana*). Morphological features and site make us assume that the same applies to *G. ambatoense* and *G. carminanthum* and that both taxa belong to the same species. If it turns out that *G. tillianum* and *G. carminanthum* are the same species, *G. ambatoense* must be placed one rank below *G. tillianum*. In case *G. tillianum* and *G. carminanthum* should be two separate species, *G. carminanthum* must be ranked below *G. ambatoense*. Here, too, further molecular investigation should enlighten the situation.

As a result of descriptions by other field researchers we (Volker Schädlich, Reiner Sperling and I) found plants east of Joyango at 1.675 m.a.s.l. at the beginning of 2018. These plants can be attributed to *G. carminanthum* without any problem. One plant with orange flowers came as a little surprise.



Fig. 19 and 20: *Gymnocalycium carminanthum* LB 5587 east of Joyango.



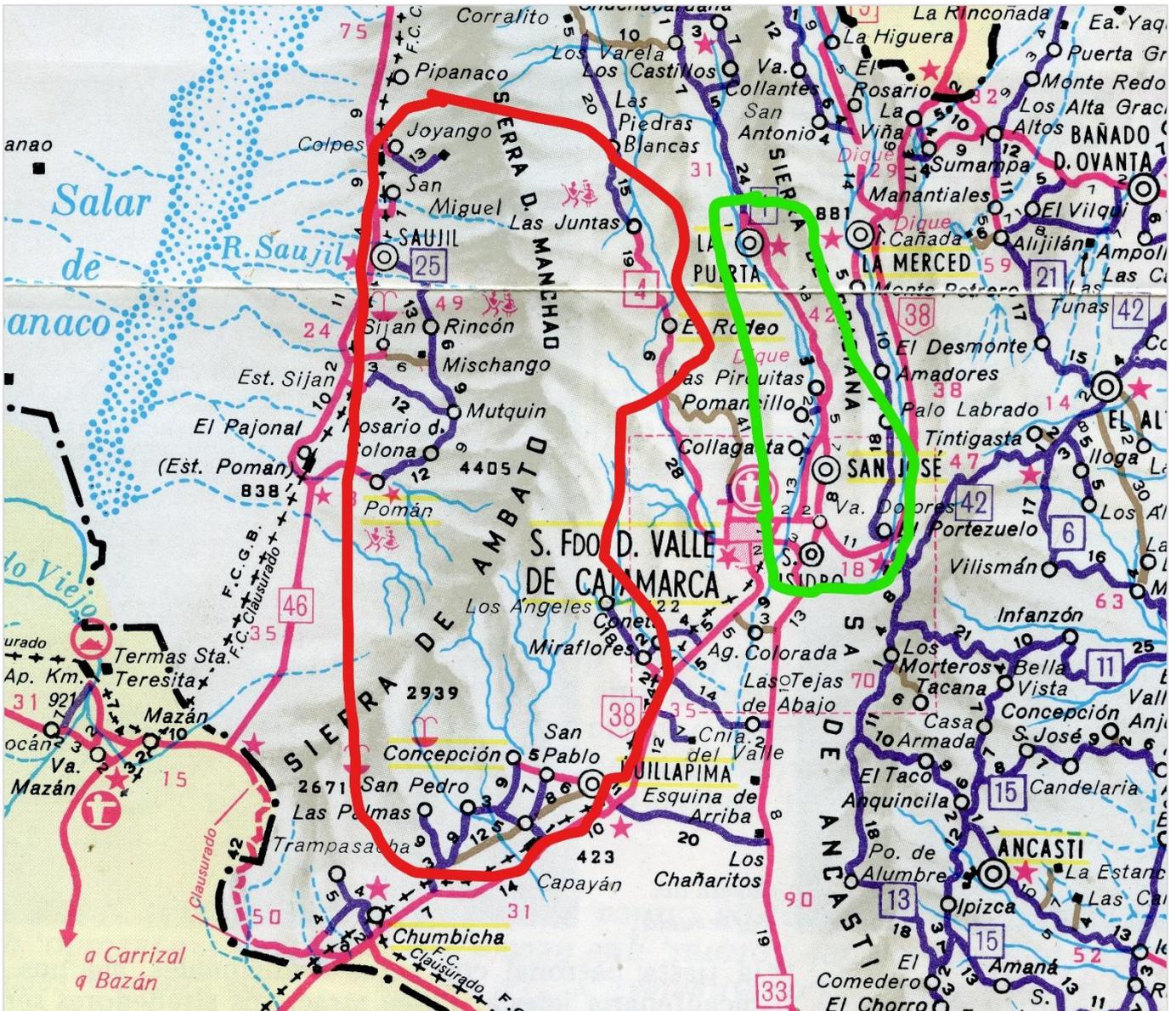
Fig. 21: *Gymnocalycium* LB 5589 west of Joyango.



Fig. 22: from left to right: flower sections of *G. nigriareolatum* var. *densispinum* P 24 pro Parte, *G. tillianum* WR 227, *G. carminanthum* BO 130, *G. carminanthum* var. *montanum* SL 35a and *G. ambatoense* P 22.

The area next to Joyango in a western direction is interesting. At an altitude of 1.460 m.a.s.l. we found plants with white flowers and a red throat. The question was whether these plants had to be counted among those which Hans and Walter Till had described as *Gymnocalyxium catamarcense* subsp. *acinacispinum* in 1995. This subspecies was described by the two authors in a paper on *G. catamarcense* (*hybopleurum*) based on plants occurring between Mischango and Mutquin. This locality is situated further to the south of Joyango. They pointed out that the subsp. *acinacispinum* differs remarkably from the type (*G. catamarcense*), possibly because it does not belong to the *G. catamarcense* group in our opinion. This taxon has white flowers with a red throat. Here, too, further molecular investigation is very much required.

CONCLUSION



Map 1: Distribution area of both groups of species.

Although exact confirmation by molecular analyses is really necessary, my present point of view is that we can distinguish between two species groups which, after a lot of further discussion, can probably not be separated easily.

One species includes the taxa *G. nigriareolatum* and *G. oenanthemum* (indicated in green colour on the distribution map) and the other one *G. tillianum*, *G. carminanthum*, *G. ambatoense* and *G. catamarcense* subsp. *acinacispinum* (shown in red). I put this assumption up for discussion.

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