Schütziana

The Gymnocalycium Online Journal

Band 2, Ausgabe 2, 2011
ISSN 2191-3099

Content

Published: 04th June 2011

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

Editorial team and responsible for the content: www.schuetziana.org/contact.php
Mario Wick, 14547 Fichtenwalde, Fichtenweg 43, Germany, mario.wick@schuetziana.org
Massimo Meregalli, 10123 Torino, V. Accademia Albertina, 17, Italy, massimo.meregalli@schuetziana.org
Wolfgang Papsch, 8401 Kalsdorf, Ziehrenweg 6, Austria, wolfgang.papsch@schuetziana.org
Tomáš Kulhánek, 62400 Brno, Urbánkova 18, Czech Republic, tomas.Kulhánek@schuetziana.org.

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.

ISSN 2191-3099

Cover picture: *Gymnocalycium stellatum* MaW 152, 18 km north of Berrotaran, province Córdoba, Argentina (photo: M. Wick)

Editorial

Dear Gymnocalycium enthusiast!

Spring is a busy time. Our Gymnocalyciums in the glasshouses are flowering and seed production has started. So, we are somewhat late with our next issue of Schütziana.

This year is, at least some thirty kilometres southwest of Berlin in Germany, very extraordinary. We have had no rain for almost two months but sunshine almost the whole time. During May, we had more than 280 hours of sunshine. Usually, we have mixed weather with much more rain and lower temperatures and on average 90 hours of sunshine. It is said, it is the driest spring ever reported. The Gymnocalyciums like the weather very much. They have extraordinary numbers of buds and flowers.

In this issue Tomáš Kulhánek goes again to a hot place in Argentina, to the province of San Luis. He presents the second part of his overview of the *Gymnocalycium berchtii* species group – *Gymnocalycium nataliae*.

Thomas Strub has elaborated on his lecture presented at the 26. International Gymnocalycium Meeting in Niftrik, The Netherlands, about Gymnocalyciums with black, naked (without cuticle) seeds.

Gymnocalycium berchtii species-group: Part two - *G. nataliae* Neuhuber

Tomáš Kulhánek

Tylova 673, 672 01 Moravský Krumlov (Czech Republic)
e-mail: tomas.kulhanek@schuetziana.org

ABSTRACT. The second part dealing with taxa related to *Gymnocalycium berchtii* is focused on the variability of *G. nataliae* in its natural habitats. Known populations and occurred biocenosis are presented and their distribution is demonstrated on maps.

G. nataliae Neuhuber

[Gymnocalycium 18 (3) 2005: 635-638]

It was in 1988, on his third trip to Argentina, when Gert Neuhuber found, in the surrounding of Villa de Praga, small plants belonging to the subgenus *Gymnocalycium*. The description of this taxon was published 12 years later (Neuhuber 2005). This plant was named for Natalia Schelkunova, Moscow, Russia, secretary of the publication Kaktus-Klub.

G. nataliae also came into the greenhouses, thanks to the collection of F. Strigl. He collected plants four years later in 1992 near Estacion de Fomento Ganadero with field number STO 526.

The Gymnocalyciums corresponding with the description occupy very dry stony slopes and savannas of the Pampa de San Martin (SE of Lib. Grl. San Martin) and the area around Guanaco Pampa on the Eastern side of Villa de Praga. Variously extensive populations of *G. nataliae* colonize granitoids (pegmatits) or migmatitic rocks abundant with quartz and white-rose feldspar rising from steppes, and occasionally found directly on quartzite zones. Plants could inhabit rock crevices without or with soil filling or can be found on disintegrated gravels mixed with sandy gley soil in grass community. These cenoses are steppes mostly without shrubs, but if present, are dominated by *Eupatorium sp*. (*Asteraceae*) and *Hypothalamus alienus* (*Asteraceae*) and occasionally dwarf shrubs of *Acacia caven* can be seen. Accompanying plants from the *Cactaceae* family on these typical areas could be found *G. lukasikii ssp. emilii* growing mostly in the grassy areas directly in silt soil without rocks and gravels (see fig. 10, 52). *Notocactus submammulosus* and *Echinopsis aurea* also can be found and on some places G. sp. (*sanluisense* n.n. aff. = *sutterianum* aff. sensu Till et Amerhauser) could intervene from cenoses with a high density of shrub community.

The type location is situated East of Villa de Praga, NW of San Isidro on Guanaco Pampa (see fig.1 - data of type location G. Neuhuber, personal communication). Populations, occurring areas East of Pampa de San Martin and Guanaco Pampa, include very typical plants of *G. nataliae.* Mature plants are small, maximum 30-50 mm in diameter, depressed into the soil in these hard conditions. The epidermis is mostly dark brown-green with a metallic appearance covered by light grey bloom, in stronger sun, light grey-violet. Ribs flat 9-12(-14). Humps are hardly discernible on young and young mature plants. Very old forms can develop clearly discernible humps. These old forms are not mentioned in the first description. Areoles mostly with 7, occasionally 9 dark spines, mostly incarnadine or brown-rose coloured. Fruits are mostly olive green to brown-pink depending on the colour of the receptacle.

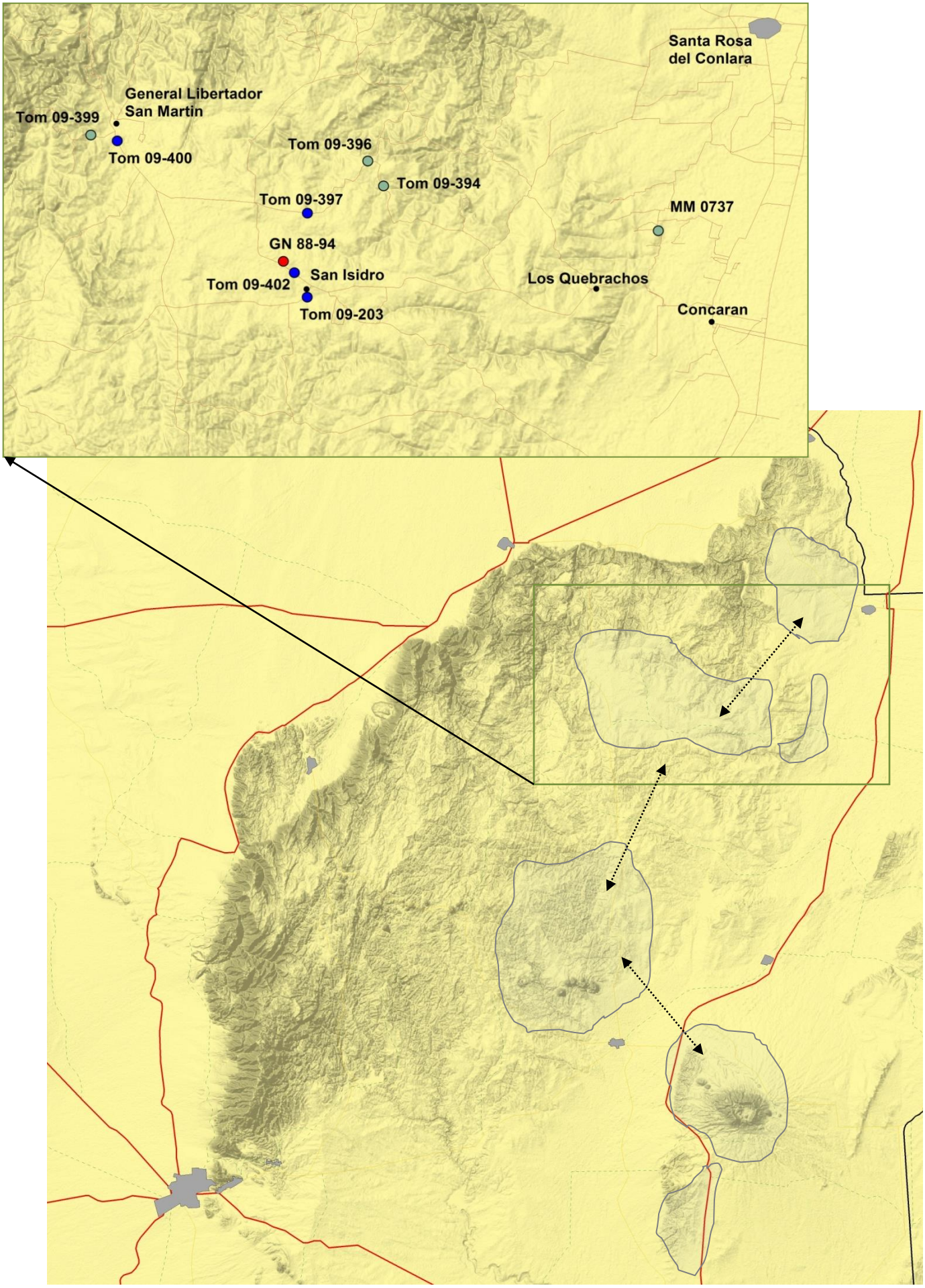

Fig. 1: Distribution map of *G. nataliae*, ● type locality, ● significant populations fit the description, ● *G. nataliae* aff.

One significant population colonizes granitoid elevation (abundant of quartz and white-rose feldspar) near Arroyo Guanaco Pampa W of San Isidro at an altitude of 930 msm (fig. 2-9).

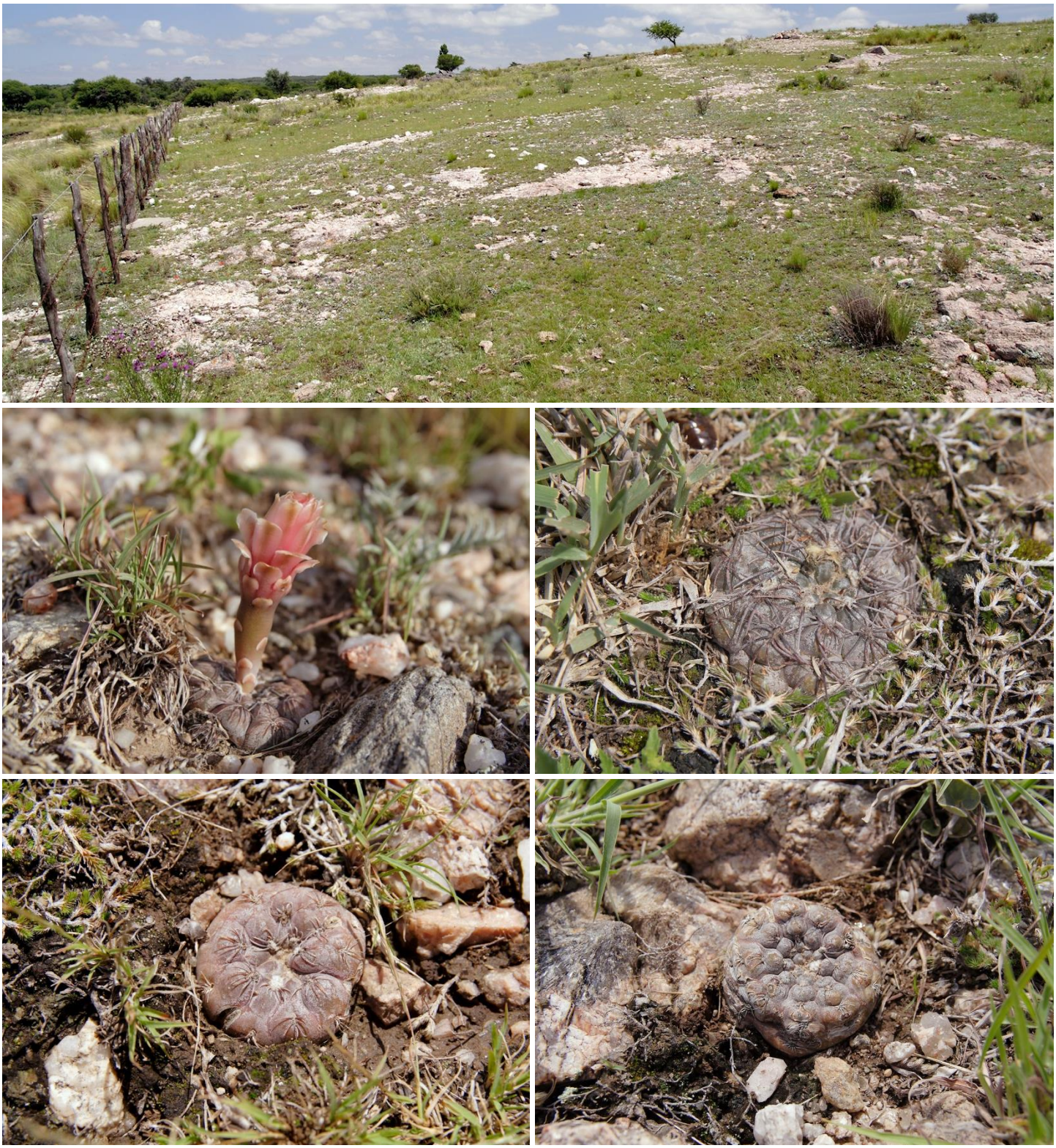

Fig. 2-6: *G. nataliae*, Tom 203, Arroyo Guanaco Pampa, W of San Isidro, 930 msm.

Fig. 7-8: *G. nataliae*, Tom 203, Arroyo Guanaco Pampa, W of San Isidro, 930 msm.

Fig. 9: *G. nataliae*, Tom 203, Arroyo Guanaco Pampa, W of San Isidro, 930 msm.

Fig. 10: *G. lukasikii spp. emilii* at the same place.

The next typical population occupies a flat slope not so far from the type locality, a few kilometres NW of San Isidro by Ruta 6, altitude 945 msm (figs.11-19). Plants very well match the description.

Fig.11-14: *G. nataliae*, Tom 402, NW of San Isidro, Ruta 6, 945 msm.

Fig.15-19: *G. nataliae*, Tom 402, NW of San Isidro, Ruta 6, 945 msm.

On the way from La Sala towards the crossing with Ruta 6. More or less 5 km S of La Sala and 5 km N of the type locality can be found another population of the typical form of *G. nataliae*. Habitat Tom 397, 950 msm.

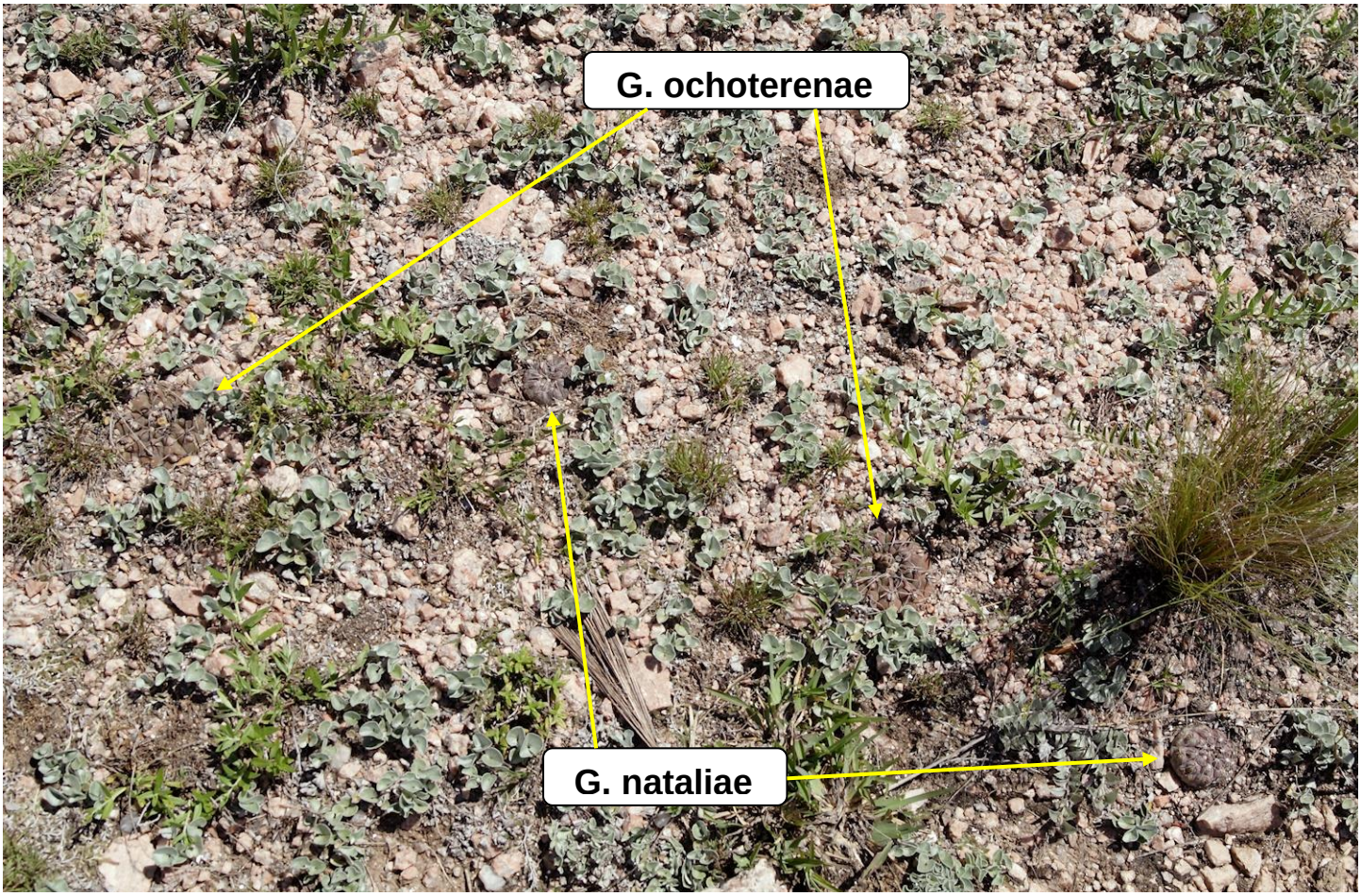

Fig. 20-21: *G. nataliae,* Tom 397, habitat S of La Sala, 950 msm.

Fig. 22-26: *G. nataliae,* Tom 397, S of La Sala, 950 msm.

Fig. 27: *G. nataliae,* Tom 397, S of La Sala, 950 msm.

Fig. 28: *G. ochoterenae,* S of La Sala, 950 msm.

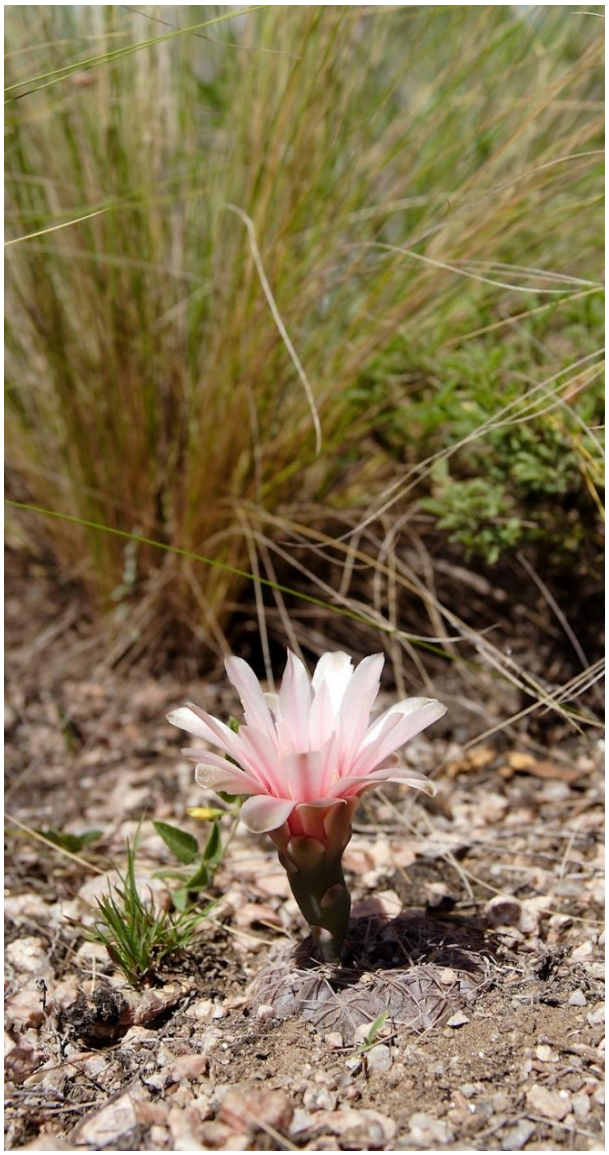

Fig. 29: *G. nataliae,* Tom 397, S of La Sala, 950 msm.

Fig. 30: *E. aurea* at this habitat.

Directly at this habitat can also be found *G. ochoterenae* which can be seen together with members of the *G. berchtii* spec. group in their northern area of distribution. Another accompanying species, besides everywhere occurring *O. sulphurea*, is *Echinopsis aurea*.

These three populations show the area corresponding to the typical plant form, from San Isidro area to the north of La Sala area (see map of distribution, fig. 1).

More variable populations of *G. nataliae* can be seen on the north-western border of Pampa de San Martin and more north-eastern side from the typical area by Cerro Plumerillo and Cerro Alsa. There *G. nataliae* can also be found in the close vicinity of G. sp. (*sanluisense* n.n aff.) and it is not out of the question that phenotypes could also be seen with combinations of characteristics of both species (e.g. Tom 09-399, fig. 43-44.; Tom 09-396, fig. 45-51; Tom 09-394, fig. 53-57). Sometimes it is difficult to distinguish them. This could be caused by exchange of genes on the border of different biocenoses or is it only wide variability? Such findings can be also demonstrated in the case of *G. morroense* which will be discussed in the next issue.

The plants in populations of *G. nataliae* in the area of Liberador General San Martin are more variable in such characteristics as flowers, fruits and spines. One of such populations can be seen on the flat slopes of Pampa de San Martin, near Estancia La Noria, altitude 960 msm (fig. 31-41). Plants colonize steppe biocenoses on pegmatitic granitoid rocks abundant in white-rose feldspar and quartz. In this population variability in the colour of the receptacle from olive green to very dark plum blue have been studied. The colour of the spines varies from light-rose to dark blood red and variability also can be seen in the length of spines and their arrangement. Sometimes with the occurrence of one central spine. Some plants‘ appearance can correspond with characteristics of *G. morroense* (see fig. 36), mostly mature plants have 5-7 spines. This finding can be also seen in some populations occurring in the eastern area of the group from Rincon del Carmen to the east, e.g. in the area W of Concaran (see population near Los Lobos, MM 730, presented in the preceding issue). Here are presented plants from two habitats near Cerro Plumerillo (figs. 45-57).

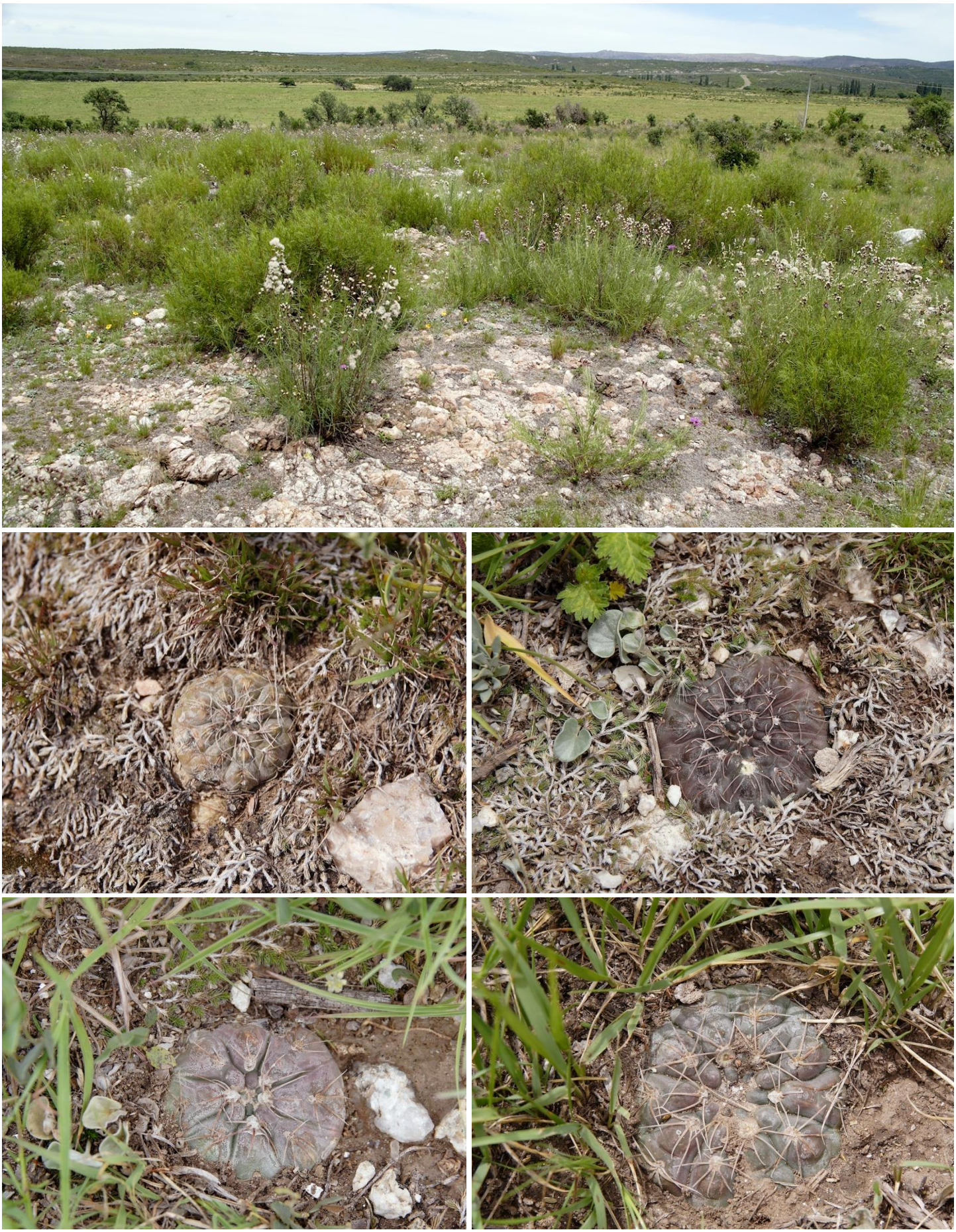

Fig. 31-35: *G. nataliae,* Tom 400, Pampa de San Martin, Est. La Noria, 960 msm.

Fig. 36-40: *G. nataliae,* Tom 400, Pampa de San Martin, Est. La Noria, 960 msm.

Fig. 41: *G. nataliae,* Tom 400,
Pampa de San Martin, Est. La Noria, 960 msm.

Fig. 42: *G. lukasikii ssp. emilii* at this habitat.

Fig. 43-44: *G. sp*. (*nataliae* aff.), Tom 399, San Martin - Digue La Huertita, 995 msm.

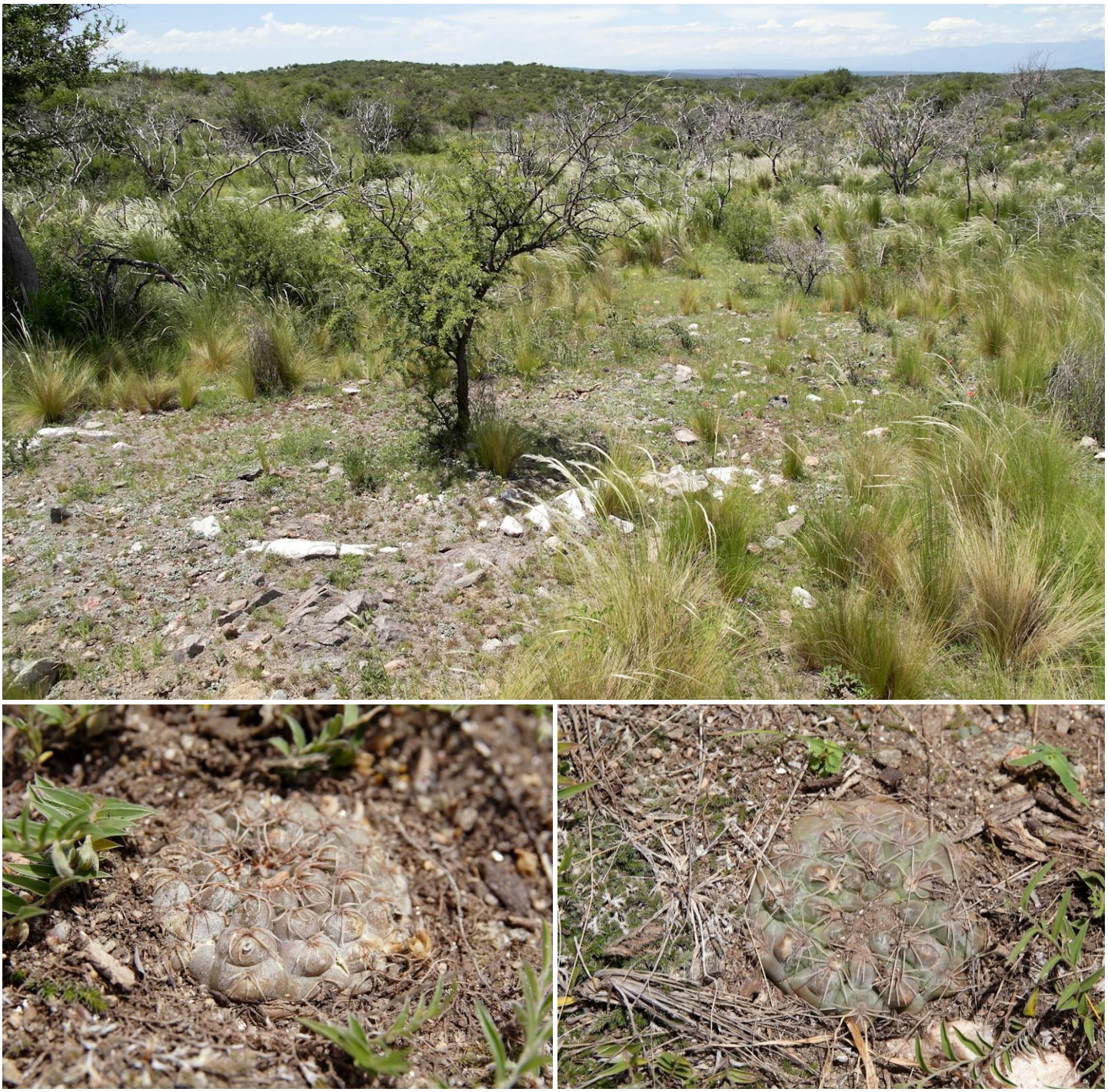

Fig. 45-47: *G. nataliae* aff., Tom 396, La Cienaga - La Casilla, 913 msm.

Fig. 48-51: *G. nataliae* aff., Tom 396, La Cienaga - La Casilla, 913 msm.
Fig. 52: *G. lukasikii* ssp*. emilii* (here 10 cm in diameter) at this habitat.

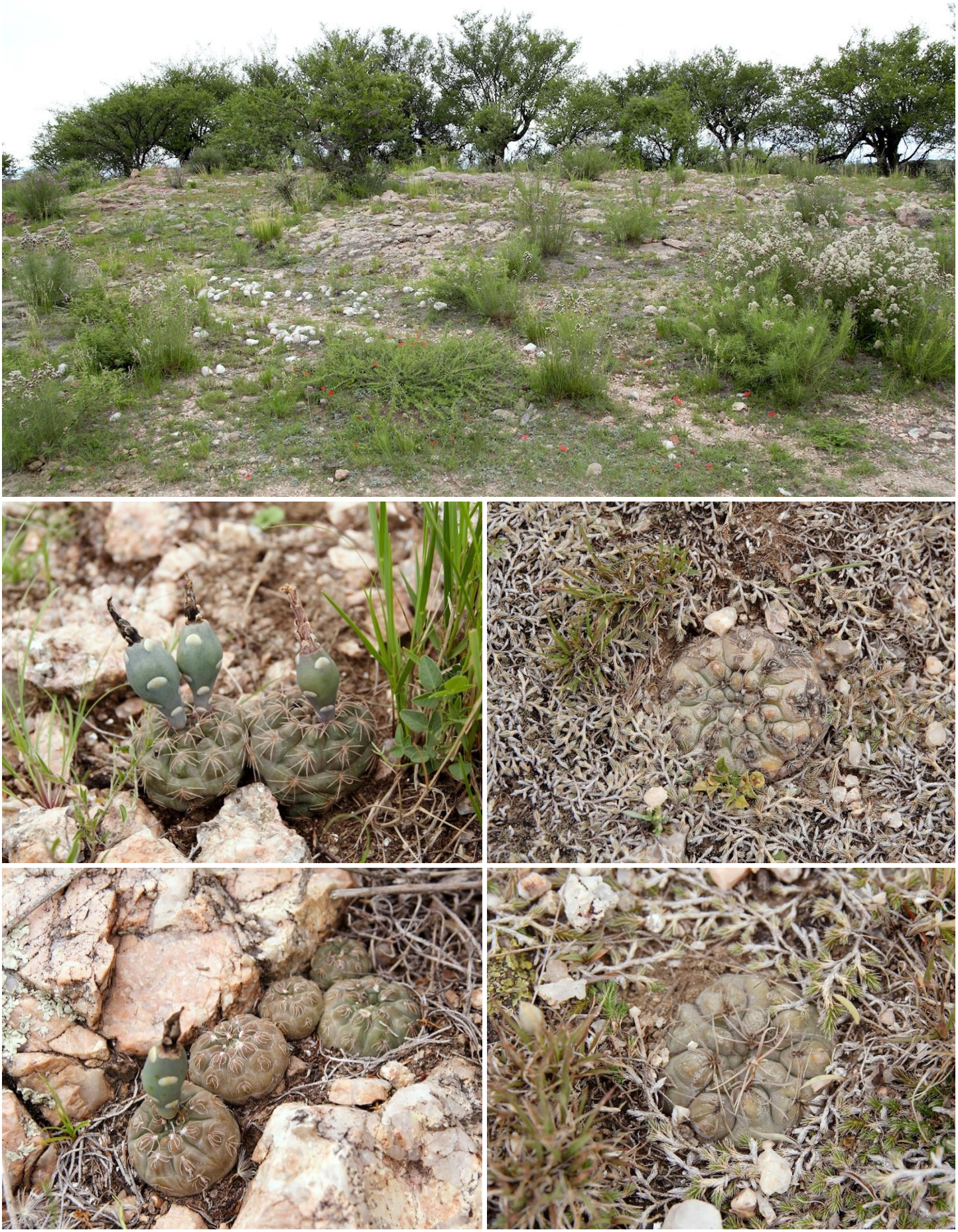

Fig. 53-57: *G. nataliae* aff., Tom 394, N of Est. Maria del Carmen, 880 msm.

Fig. 58: *G. sp.* ? and

Fig. 59: *G. ochoterenae* at this habitat.

The last three populations I would like to show here have been studied in the lower part of Sierra del Morro and Sierra del Yulto. Lithological, this southern area of the Conlara metamorphic complex has almost not been covered by plutonic rocks as it is in northern area, but igneous rocks (see geological maps in the preceding issue). These populations can be classified in the area of *G. morroense* and probably belong to it, but many characteristics are related to *G. nataliae*. The epidermis is mostly dark brown with a metallic appearance, covered by a slight bloom, in stronger sunlight grey-violet. Spines mostly 7 (Sa. del Morro) or 5 straight (Sa. del Yulto), light brown to red-brown. Plants are also differentiated by their bigger size and old form with humps. In populations of *G. nataliae* the epidermis of ripe fruit can be seen changing to a brown-rose colour (fig. 65). This characteristic could also be studied at these habitats. As accompanying *Cactaceae* could only be found a small form of *G. borthii* (or *G. lukasikii ssp. emilii*?).

Briefly it should be said that mentioned characteristics of *G. nataliae* and *G. morroense* (colour of epidermis and spines, spine arrangement on the areoles, colour of fruits) are occurring tessellated in the area of both taxa, depending on the shared cenosis.

The next instalment will deal with *G. morroense*.

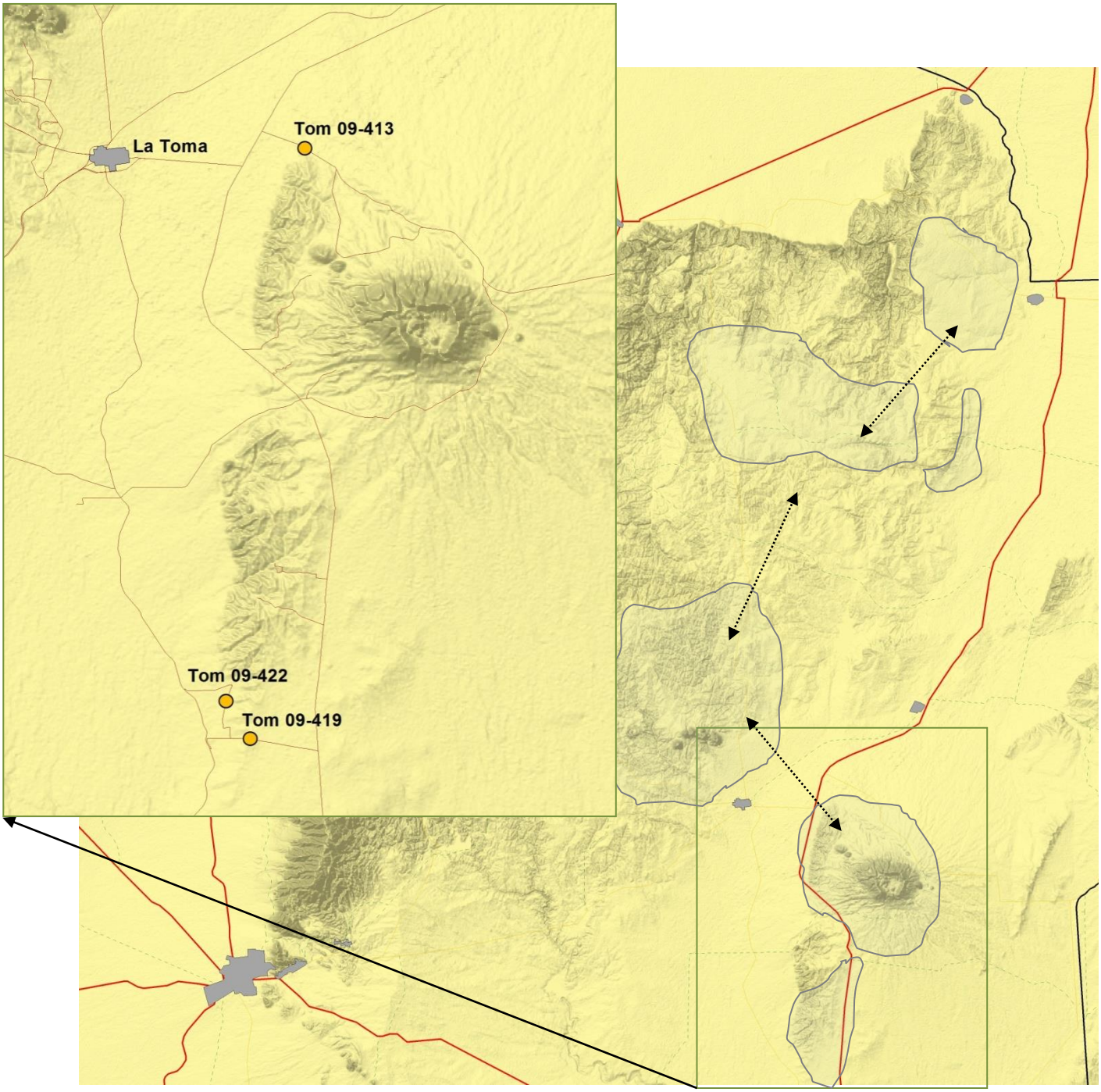

Fig. 60: Localities of interspecific populations of *G. morroense* - *G. nataliae* by Sa. del Morro and Sa. del Yulto

Fig. 61-65: *G. nataliae* - *morroense* aff., Tom 413, La Toma → Los Morillos, 963 msm.

Fig. 66-68: G. nataliae - morroense aff., Tom 413, La Toma → Los Morillos, 963 msm.

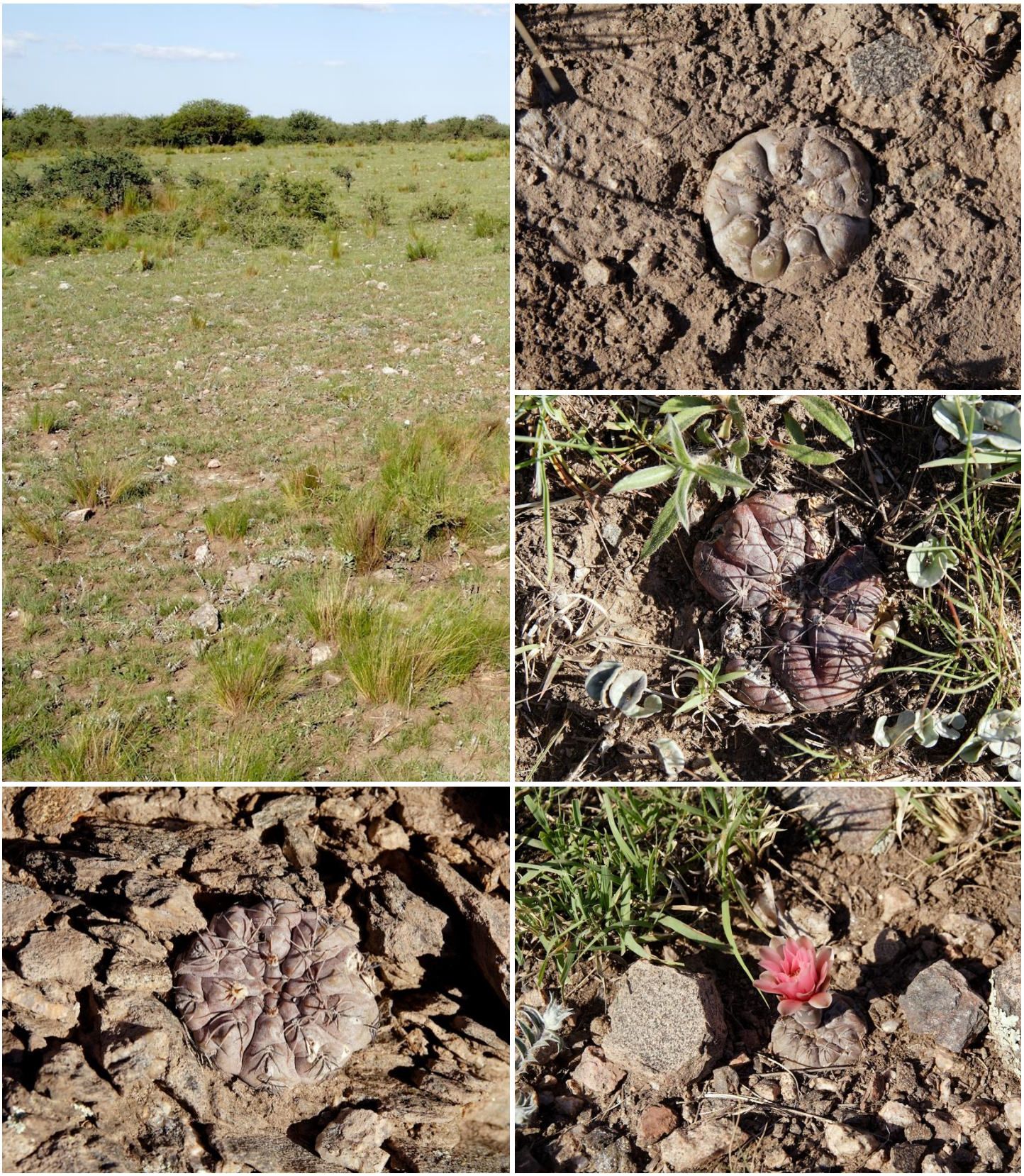

Fig. 69-73: *G. nataliae* - *morroense* aff., Tom 419, Sierra del Yulto, Coronel Alzogaray, 750 msm.


Fig. 74-75: *G. nataliae* - *morroense* aff., Tom 419, Sierra del Yulto, Coronel Alzogaray, 750 msm.



Fig. 76-78: *G. nataliae* - *morroense* aff., Tom 422, Sierra del Yulto, Est. San Antonio, 740 msm.

Fig. 79-82: *G. nataliae* - *morroense* aff., Tom 422, Sierra del Yulto, Est. San Antonio, 740 msm.

To be continued.

Gymnocalycium of the subgenus *Gymnocalycium* with naked, black seeds

Thomas Strub

Hölzlistrasse 23, CH-4102 Binningen (Basel, Switzerland)
e-mail: tm.strub@intergga.ch

ABSTRACT. The main subject of the annual meeting of the Working Group GYMNOS (Niftrik, 3-5 September 2010) was about the subgenus *Gymnocalycium* with seeds whose testa is not covered with a brownish film. This article provides a summary of the presentation given.

1. Introduction

The aim of this article is the presentation of the First Descriptions and plants of the subgenus *Gymnocalycium* that have naked, black seeds.

In addition, the distribution area of these plants, similarities and differences based on the following criteria will be shown:

- the appearance (habit) of the plants,
- the structure of the flowers and the seeds,
- the flowering period of plants in culture.

Both, the appearance of the plants and the characteristics of the flowers are dependent on external conditions (e.g. climate and soil). However, the seeds are much less influenced by external conditions and hence are much more stable in their structure and appearance.

Consequently, seed criteria are best qualified to indicate relationships between plants.

Differences of seeds within subgenus *Gymnocalycium*:

- Testa of seed is naked, black = seed with no cuticula (not covered with brownish film).
- Testa of seed is fully or partially covered with a brownish film.

Fig. 1: Example of naked, black seeds:
TS 121 – *Gymnocalycium parvulum subsp. huettneri* (San Pedro Norte)

Fig. 2: Example of non-naked, black seeds:
TS 002 – *Gymnocalycium spec.*
*(*Almafuerte – North of Berrotáran)

2. First descriptions

2.1 Historical overview of the first descriptions relating to the taxon *Gymnocalycium capillense*

Name of the taxon	Year of publication	Indication of location	Type-Record
Echinocactus capillensis *Schick* spec. nov.	1923	Córdoba, Capilla del Monte	
Echinocactus sigelianus *Schick* spec. nov.	1923	Córdoba, Capilla del Monte	
Gymnocalycium capillensis (Schick) Hosseus	1926	Córdoba, Capilla del Monte	
Gymnocalycium capillaense *(Schick) Oehme* comb. nov.	1938	Córdoba, Capilla del Monte	
Gymnocalycium deeszianum *Dölz* spec. nov.	1943	-	
Gymnocalycium capillense (Schick) Hosseus var. capillense *(Schick) H. Till*	2003	Córdoba, Capilla del Monte	HT 54 (Import Fechser)
Gymnocalycium capillense (Schick) Hosseus var. sigelianum (*Schick) H. Till* comb. et stat. nov.	2003	Eastern slopes of the Sierra Chica	HT 58
Gymnocalycium capillense var. sigelianum fa. deeszianum (*Dölz) H. Till* comb. et stat. nov.	2003	Eastern slopes of the Sierra Chica	
Gymnocalycium capillense *(Schick) Hosseus* var. mucidum *(Oehme)* H. Till, comb. et stat. nov.	2003	South of the Sierra de Guasapampa	HT 3501

2.2 Historical overview of the first descriptions relating to *Gymnocalycium parvulum / calochlorum*

Name of the taxon	Year of publication	Indication of location	Type-Record
Echinocactus platensis Speg. *v. parvula* Speg. var. nov.	1905	-	-
Gymnocalycium parvulum (Speg.) Speg. = *Echinocactus platensis* Speg. *v. parvula* Speg.	1925	sierra de San Luis	-
Echinocactus calochlorus Böd. spec. nov.	1932	North-Western Argentina	-
Echinocactus prolifer Bckbg. spec. nov.	1932	Prov. Córdoba, Argentina	-
Gymnocalycium proliferum (Bckbg.) Bckbg. comb. nov.	1936	-	-
Gymnocalycium calochlorum (Böd.) Yto	1952	-	-
Gymnocalycium calochlorum v. proliferum (Bckbg.) Bckbg. comb. nov.	1959	Prov. Córdoba, Argentina	-
Gymnocalycium parvulum (Speg.)Speg. Basionym: *Echinocactus platensis* Speg. *v. parvula* Speg. Syn: *Gymnocalycium proliferum* Bckbg. Syn: *Gymnocalycium calochlorum v. proliferum* (Bckbg.)	1994	Villa San Luis (Córdoba West)	
Gymnocalycium quehlianum subsp. leptanthum var. calochlorum (Böd.) H. Till & Amerhauser stat. et comb. nov.	2007	-	-
Gymnocalycium parvulum (Speg.) Speg. *var. amoenum* H. Till var. nov.	1994	Las Palmas	Till 88-199
Gymnocalycium amoenum (H. Till) Lambert stat. nov.	2002	Las Palmas	Till 88-199
Gymnocalycium parvulum (Speg.) Speg. *subsp. amoenum* (H. Till) F. Berger stat. nov.	2008	Las Palmas	Till 88-199
Gymnocalycium parvulum (Speg.) Speg. subsp. agnesiae F. Berger subsp. nov.	2010	Ojo de Agua	Be 00-175/752

2.3 General comments related to the first descriptions

- The brief descriptions established in the 18th and early 19th century were sufficient for the differentiation from the few other known plants of the genus *Gymnocalycium*.
- Considering the latest standards, many of the first descriptions are incomplete and less meaningful.
- For many of the species no type material was deposited and no exact location was indicated.
- Later botanists tried to prove what plants may match with the species described in the first descriptions.

2.4 Specific comments with regard to *Gymnocalycium parvulum*

In particular the interpretation related to *Gymnocalycium parvulum* seems to be problematic.

First description of *Echinocactus platensis var. parvula*

Spegazzini C. (1905): Cactacearum Platensium Tentamen. - Anales Museo Nàcional Buenos Aires. 3(4), 504-505.

Body elongated globose, small to very small, (10-30 mm in diameter and height) dirty greyish-green; ribs often 13, straight, with flat humps; spines 5-7, stiff, strong, flexible, adpressed. (2-4 mm long), greyish-white, all radiating; flowers erect, larger than the plant, (45-60 mm long), flower tube thin, petals white, moderately long.

Amended first description (*Gymnocalycium parvulum*)

Spegazzini C. (1925): Nuevas Notas Cactológicas. – Anales Sociedad Cientifica Argentina. 141.
Gymnocalycium parvulum Speg. = *Echinocactus platensis* Speg. *v. parvula* Speg.
Habitat: in very rocky and dry hills of the **s**ierra de San Luis

“Having carefully reviewed my notes, and descriptions of this species, I am convinced that it is not a variety of *Gymnocalycium platense* Speg., even though it is associated with, and closely resembles the external characteristics of *Gymnocalycium platense*. It is a good distinct species because of the following characteristics of the flowers: It differs by having uniform and clearly distinct scales, the style terminating in 10-12 stigma lobes and being much shorter. Also it differs in the way the stigma lobes project beyond the lower series of anthers, but only reach the filaments of the outer stamens.”

Interpretation by Hans Till:

Based on the first description and amended first descriptions of C. Spegazzini, Hans Till has concluded that plants from the area of Villa San Luis (Prov. Córdoba, close to Panaholma) match *Gymnocalycium parvulum* with the following main reasons:

- Spegazzini has indicated the location ‘**si**erra de San Luis’ in non capital letters. Hans Till concluded that it is not equal to the ‘**S**ierra de San Luis’ in the province of San Luis as no similar plants grow there, but that it must be the place named Villa San Luis in western province Córdoba.
- The criteria of the plants described as *Gymnocalycium parvulum* best match the plants of the region of Villa San Luis.

3. Plants with naked, black seeds

The first challenge was to identify what plants of the subgenus *Gymnocalycium* have naked, black seeds. It is common knowledge that the seeds of *Gymnocalycium parvulum, calochlorum* and *capillense* are naked and black. But what is the colour and structure of the seeds of plants where their distribution area is connected and where the appearance of the plants is similar to the ones with naked, black seeds? What is the seed structure of the plants that have been described as subspecies or varieties of the plants with naked, black seeds?

To provide clarification of the above questions, the seeds of the following species have been examined:

3.1 Species where type material has been deposited:

Species	**Field Number of Type**
Gymnocalycium capillense	HT 54
Gymnocalycium capillense var. sigelianum	HT 58
Gymnocalycium capillense var. mucidum	HT 3501
Gymnocalycium parvulum subsp. amoenum	STO 88-199
Gymnocalycium parvulum subsp. huettneri	Be 03-351/1693
Gymnocalycium parvulum subsp. agnesiae	Be 00-175/752
*Gymnocalycium robustum *)*	FK 120

*) *Gymnocalycium robustum* was considered, because Till & Amerhauser have associated *Gymnocalycium calochlorum* with the taxon of *Gymnocalycium robustum*.

3.2 Species where no type material has been deposited:

Species
Gymnocalycium calochlorum
Gymnocalycium parvulum

3.3 Species that have been additionally considered:

Species
Gymnocalycium gertii
Gymnocalycium affine
Gymnocalycium capillense aff. (from distribution area north of Berrotáran*)*

Material originating from HT (Hans Till) field numbers is not common in the collections. This is also true for FK 120 (Ferrari/Kiesling) that is not widespread in European collections.
To enable comparison between the different species with plants sharing the identical distribution area, ‘pseudo types’ have been designated, when no ‘type material’ was available.

4. Preliminary investigations

To identify which species have naked, black seeds, the following plants have been selected for preliminary investigations.

Species	**Location**	**Plants selected for comparison:**
calochlorum	Villa Carlos Paz	SH 9001
capillense	Capilla del Monte	SH 9205
capillense var. mucidum	Las Palmas	GN 91-383/1281
parvulum	Villa Cura Brochero	P 109b
parvulum subsp. agnesiae	Ojo de Agua	Be 00-175/752
parvulum subsp. amoenum	Las Palmas	STO 90-199
parvulum subsp. huettneri	San Pedro Norte	Be 03-351/1693
robustum	Quilino	VS 139
gertii	Loma Bola	STO 92-521
spec.	Sauce Punco	LB 1134
affine	Pozo del Tigre	GN 91-431/1396
spec.	Almafuerte	TS 002

4.1 Plants without naked, black seeds

Fig. 3-6: *Gymnocalycium capillense var. mucidum* GN 91-383/1281 (Las Palmas)

Gymnocalycium capillense var. mucidum does not possess naked, black seeds. Since the seeds are best qualified to indicate relationships between plants, the association as subspecies to *Gymnocalycium capillense* is herewith rejected.

The plants referenced as *Gymnocalycium capillense var. mucidum* seem to belong to the variable taxon of *Gymnocalycium gaponii*.

Fig. 7-10: *Gymnocalycium affine* GN 91-431/1396 (Pozo del Tigre)

The appearance of *Gymnocalycium affine* is vaguely reminiscent of the habit of the plants discussed in this article and it also tends to freely produce offsets. But *Gymnocalycium affine* does not possess naked, black seeds and is therefore not investigated any further.

Gymnocalycium affine seems to belong to the taxon of *Gymnocalycium robustum* sensu lato.

Fig. 11-12: *Gymnocalycium spec. Sauce Punco* LB 1134 (Sauce Punco)

Fig. 13-14: *Gymnocalycium spec. Sauce Punco* LB 1134 (Sauce Punco)

Gymnocalycium spec. Sauce Punco has been selected for comparison as the plants produce offsets and the appearance of the plants looks similar to Gymnocalycium parvulum.

However, it does not possess naked, black seeds and hence is disregarded as not associated with the taxa investigated in this article.

Gymnocalycium spec. Sauce Punco seems to belong to the taxon Gymnocalycium erinaceum sensu lato.

Fig. 15-16: *Gymnocalycium gertii* STO 92-521 (Loma Bola)

Fig. 17-18: *Gymnocalycium gertii* STO 92-521 (Loma Bola)

Gymnocalycium gertii appears to be very similar to *Gymnocalycium parvulum* that has its distribution area north of Loma Bola.

However, in contrast to *Gymnocalycium parvulum*, *Gymnocalycium gertii* remains solitary and its seeds have no black and naked testa.

Gymnocalycium gertii seems to have enough specific characteristics to be considered as a separate species. Further detailed investigations in the field and culture need to be conducted to better understand this taxon.

Fig. 19-20: *Gymnocalycium spec.* TS 002 (Almafuerte)

Gymnocalycium spec. Almafuerte located north of Berrotáran is similar in appearance to the species discussed in this article.

However, it remains solitary and does not possess black and naked seeds and hence is not considered further in this article.

A close relationship to *Gymnocalycium sutterianum* (growing east and west of the Sierra de Comechingones) is likely.

Fig. 21-24: *Gymnocalycium robustum* VS 139 (Quilino)

Gymnocalycium robustum does not possess naked, black seeds. As a consequence of this the relationship to *Gymnocalycium calochlorum* is not acknowledged.

4.2 Species further investigated in this article

The preliminary investigations have proven that the following species have naked, black seeds:

Species
Gymnocalycium calochlorum
Gymnocalycium capillense
Gymnocalycium parvulum • *Gymnocalycium parvulum subsp. parvulum* • *Gymnocalycium parvulum subsp. agnesiae* • *Gymnocalycium parvulum subsp. amoenum* • *Gymnocalycium parvulum subsp. huettneri*

Gymnocalycium capillense *var. sigelianum* is not further investigated since only minor differences from *Gymnocalycium capillense* *var. capillense* exist.

Even though *Gymnocalycium parvulum* is a name of uncertain application, *Gymnocalycium parvulum* is used to better differentiate the plants growing west of the Sierra Grande de Córdoba (area of Mina Clavero) from *Gymnocalycium calochlorum* growing to the southeast of the Sierra Grande de Córdoba.

The name *Gymnocalycium calochlorum* is used as its relation to the taxon *Gymnocalycium robustum* could not be confirmed.

4.4 Distribution area of the plants investigated

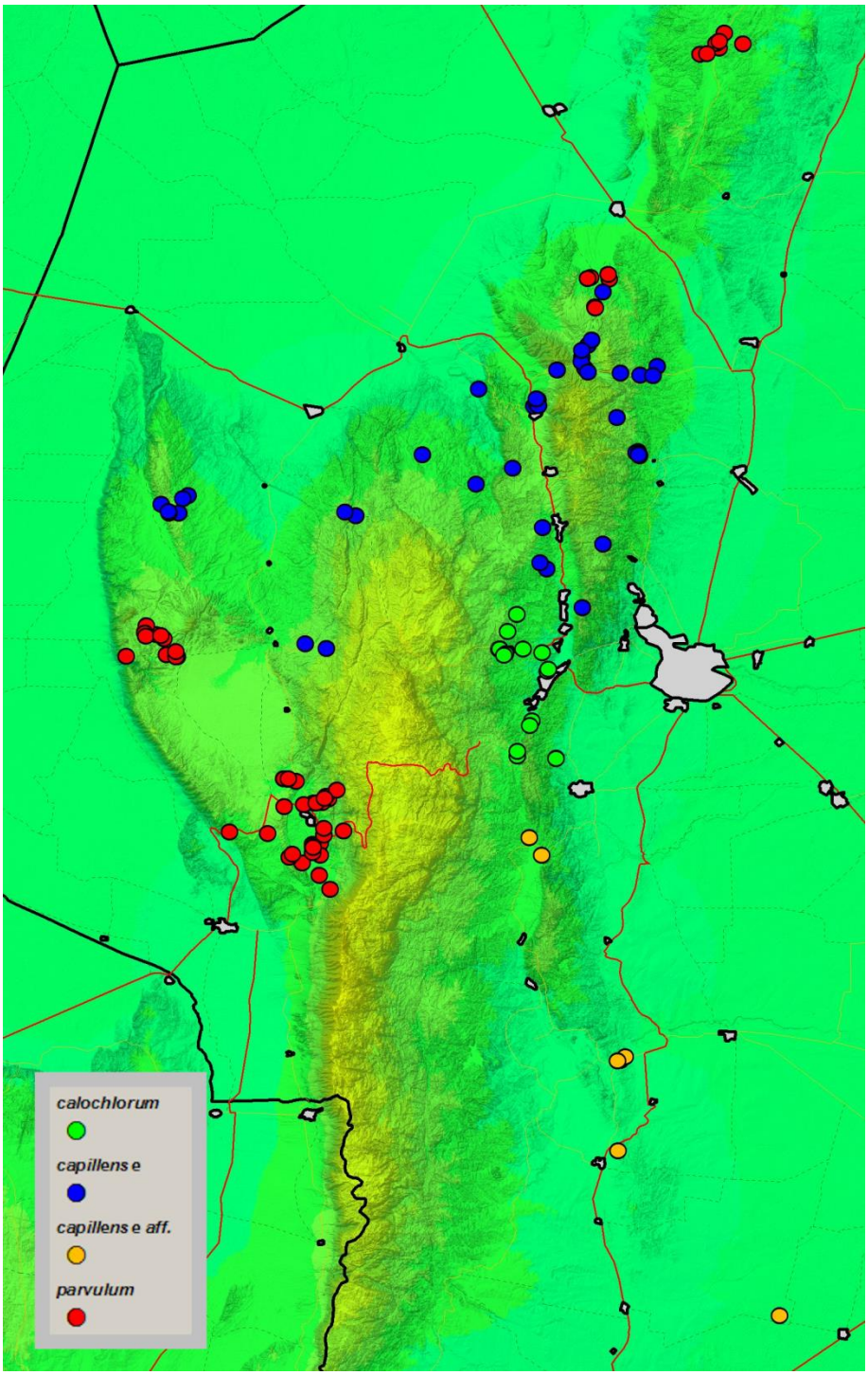

Fig. 25: General map of distribution of the investigated area

The distribution area of the plants identified as having naked, black seeds is restricted to the province of Córdoba, Argentina.

The related species can be found west and east of the Sierra Grande de Córdoba. Further distribution areas are located in the Sierra Chica de Córdoba and its sierras to the north (e.g. Sierra de Ischilin, Sierra de Ambargasta).

In addition, plants possessing naked, black seeds can be found in the area of Tanti and Villa Carlos Paz down to Villa Ciudad de America.

5. Gymnocalycium calochlorum

5.1 Overview of the distribution area of *Gymnocalycium calochlorum*

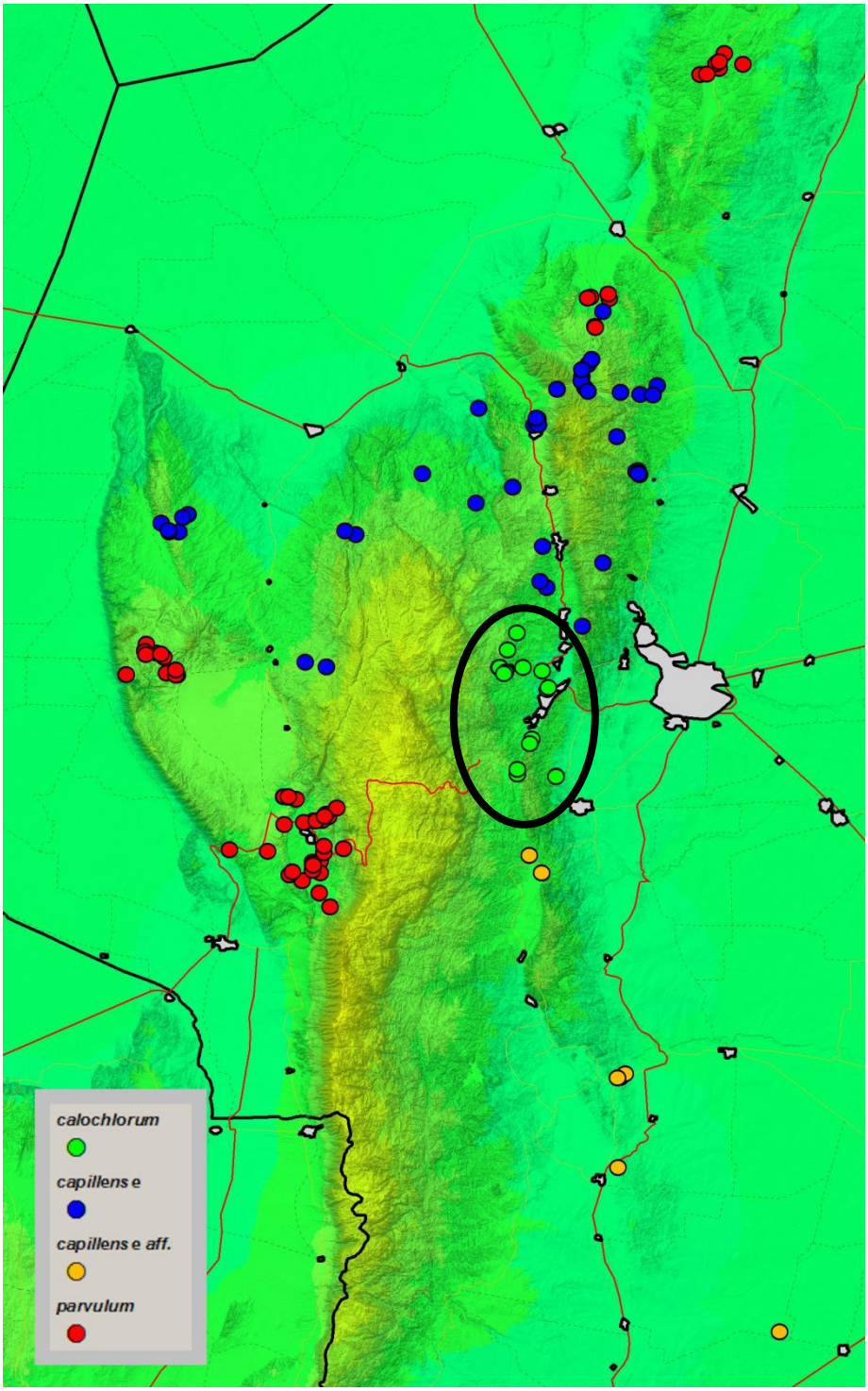

Fig. 26: Map of distribution of *Gymnocalycium calochlorum*

The distribution area of the species *Gymnocalycium calochlorum* is restricted from the area of Tanti to south of Villa Carlos Paz.

To the north of the distribution area of *Gymnocalycium calochlorum,* representatives of the taxon *Gymnocalycium capillense* grow.

5.2 Detailed distribution area of *Gymnocalycium calochlorum*

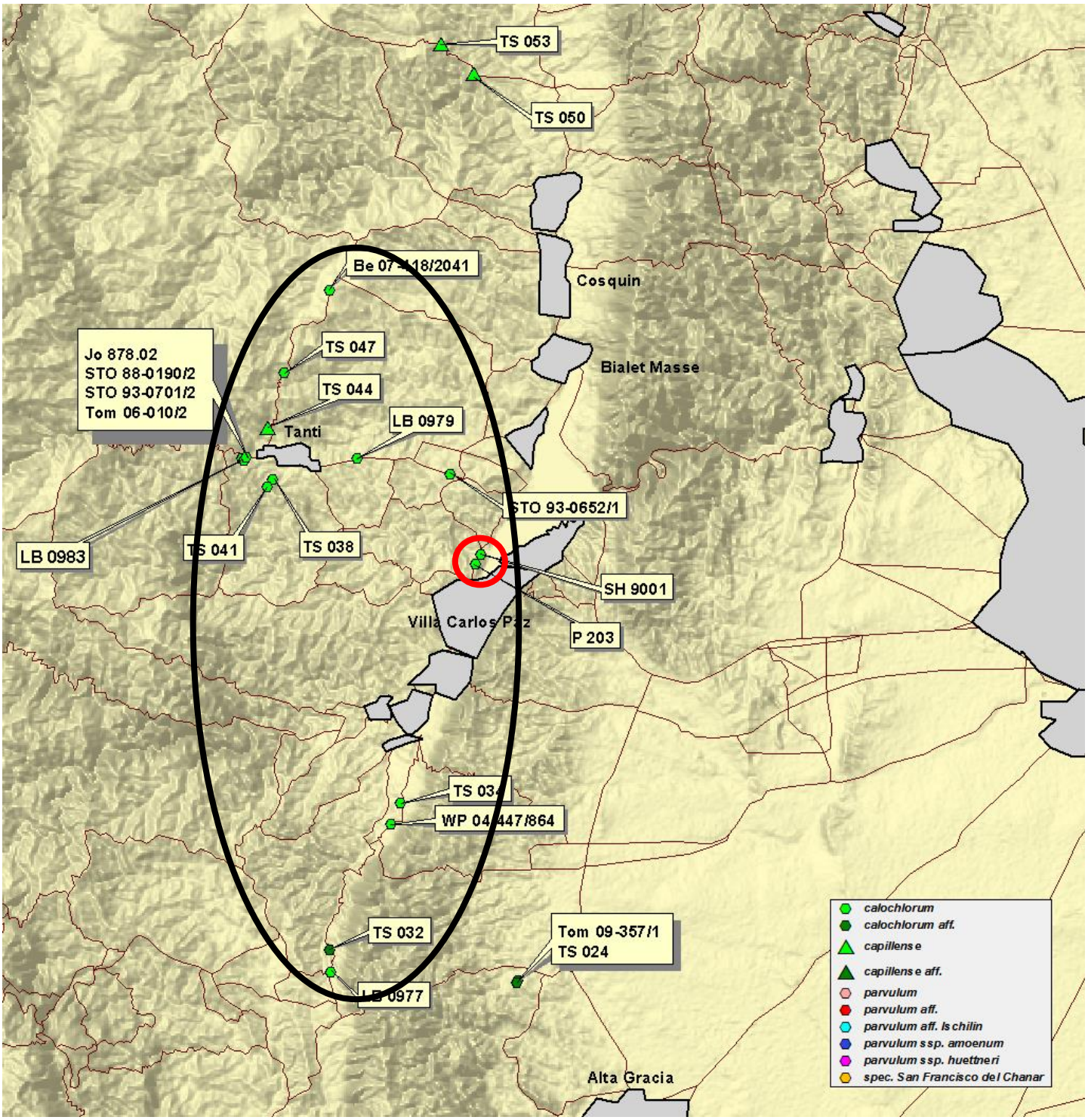

Fig. 27: Detailed distribution area of *Gymnocalycium calochlorum*

The red circle represents the location of SH 9001, the plant selected for comparison with the other species investigated.

5.3 Presentation of *Gymnocalycium calochlorum*

Fig. 28-31: *Gymnocalycium calochlorum* SH 9001 (Villa Carlos Paz)

The plants of the species *Gymnocalycium calochlorum* at the most northern and most southern locations are identical in their appearance.

Fig. 32-33: *Gymnocalycium calochlorum* LB 979 (Tanti)

Fig. 34-35: *Gymnocalycium calochlorum aff.* WP 04-447/864 (San Antonio de Arredondo)

5.4 Flowering period in culture (Basel, year 2010)

Field Number	Species	Location	Height	April				May				June				July				August			
Jo 878.02	calochlorum	Tanti	855m										■	■	■								
LB 0979	calochlorum	Tanti	710m									■	■										
LB 0983	calochlorum	Tanti	950m								■												
SH 9001	calochlorum	Villa Carlos Paz									■	■	■	■	■	■	■						
STO 88-190	calochlorum	Tanti	900m									■	■	■	■	■	■						

Fig. 36: Flowering period of *Gymnocalycium calochlorum* in culture (Basel, year 2010)

Gymnocalycium calochlorum has its main flowering period in culture in June.

6. *Gymnocalycium parvulum*

6.1 Overview of the distribution area of *Gymnocalycium parvulum subsp. parvulum*

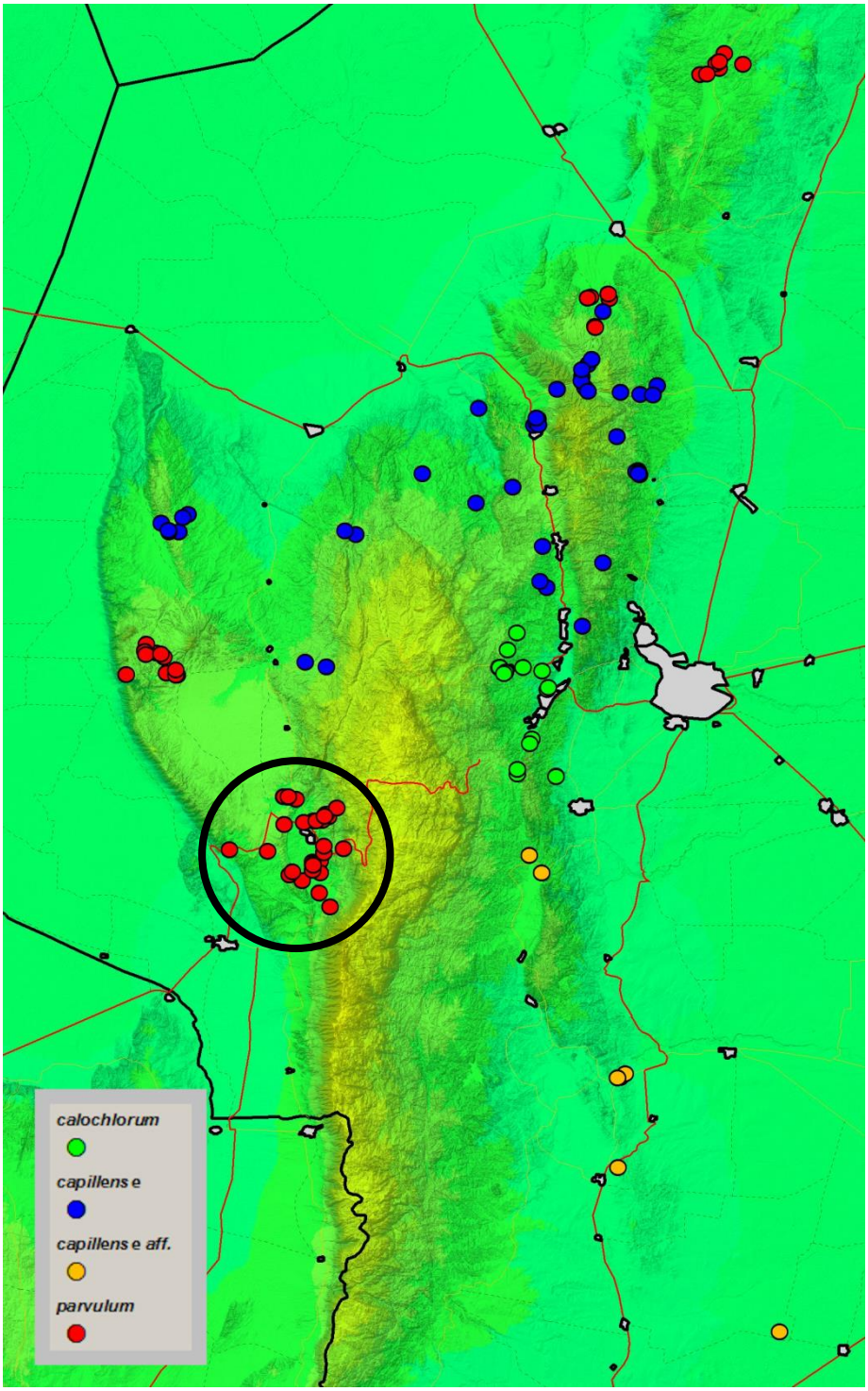

Fig. 37: Map of distribution of *Gymnocalycium parvulum*

Gymnocalycium parvulum is located west of the Sierra Grande de Córdoba, distinctly separated from its subspecies (*amoenum, agnesiae, huettneri*).

6.2 Detailed distribution area of *Gymnocalycium parvulum subsp. parvulum*

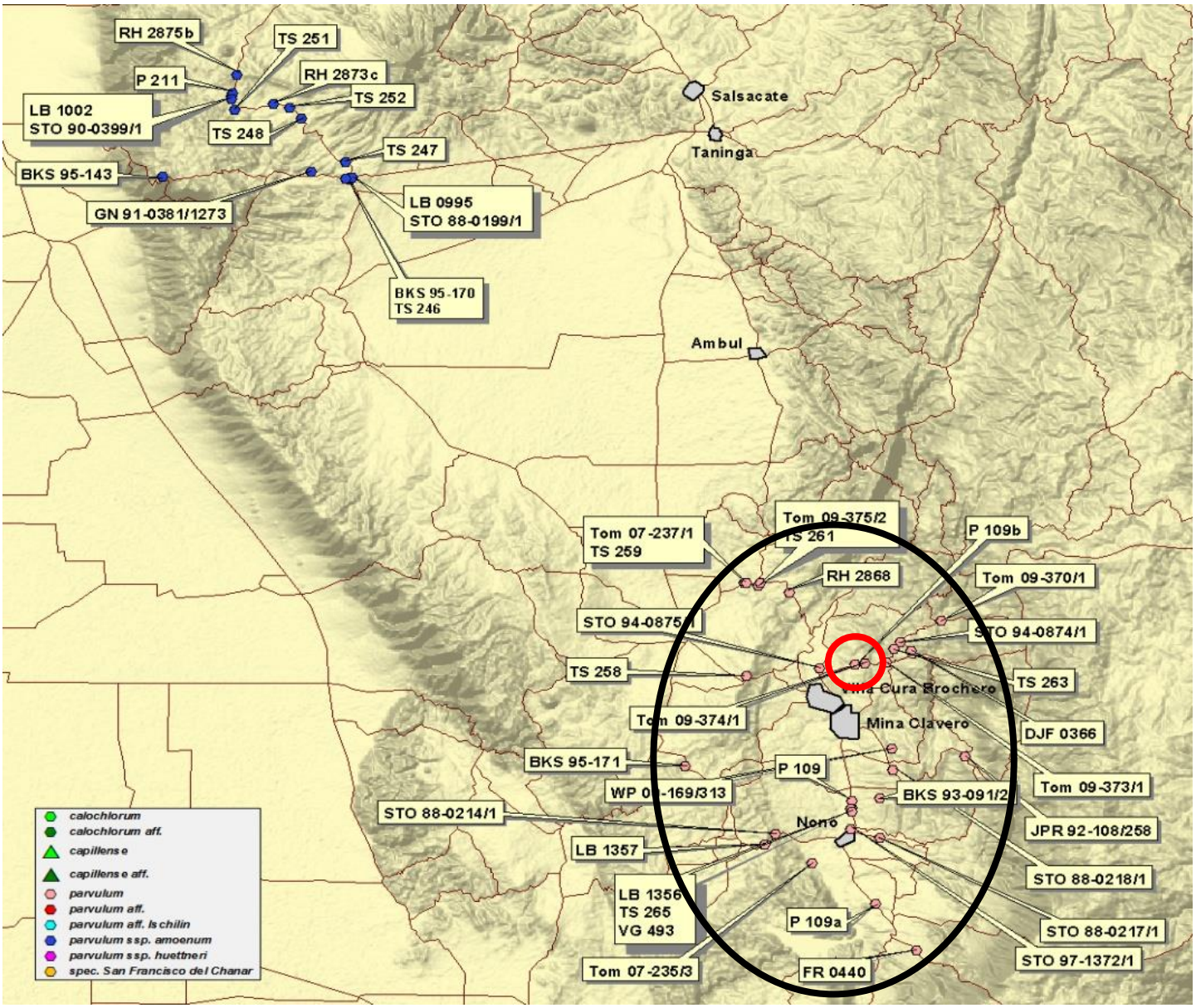

Fig. 38: Detailed distribution area of *Gymnocalycium parvulum*

The red circle represents the location of P 109b, the plant selected for comparison with the other taxa concerned.

6.3 Presentation of *Gymnocalycium parvulum subsp. parvulum*

Fig. 39-42: *Gymnocalycium parvulum* P 109b (Villa Cura Brochero)

The plants of the species *parvulum* growing across its whole distribution area do not differ considerably.

Fig. 43-44: *Gymnocalycium parvulum* STO 88-214 (Nono)

Fig. 45-46: *Gymnocalycium parvulum* BKS 95-171 (Ciénaga de Allende)

Fig. 47-48: *Gymnocalycium parvulum* P 109a (Las Rabonas)

6.4 Flowering period in culture (Basel, year 2010)

Field Number	Species	Location	Height	April	May	June	July	August
BKS 95/171	parvulum	Ciénaga del Allende	980m			■		
DJF 366	parvulum	Mina Clavero	-1'200m		■	■		
FR 0440	parvulum	Las Rabonas			■	■	■	
JL 109	parvulum	Nono - Mina Clavero,	900m			■		
LB 1357	parvulum	Pozo del Algarrobo	1000m		■	■		
P 109	parvulum	Nono	1000m			■	■	
P 109a	parvulum	Las Rabonas	900m		■	■	■	
P 109b	parvulum	Villa Cura Brochero	1'000m		■	■	■	
STO 88-214	parvulum	Nono	950m			■		
STO 88-218	parvulum	Mina Clavero	1'100m			■		
STO 90-413/1	parvulum	Mina Clavero			■	■		
STO 94-874	parvulum	Mina Clavero	1'150m			■		
STO 94-875	parvulum	Villa Cura Brochero	950m			■		
STO 97-1372	parvulum	Nono				■		
WO 062	parvulum	Nono				■	■	

Fig. 49: Flowering period of *Gymnocalycium parvulum* in culture (Basel, year 2010)

Gymnocalycium parvulum has its main flowering period in culture in June and July.

7. *Gymnocalycium parvulum subsp. amoenum*

7.1 Overview of the distribution area of *Gymnocalycium parvulum subsp. amoenum*

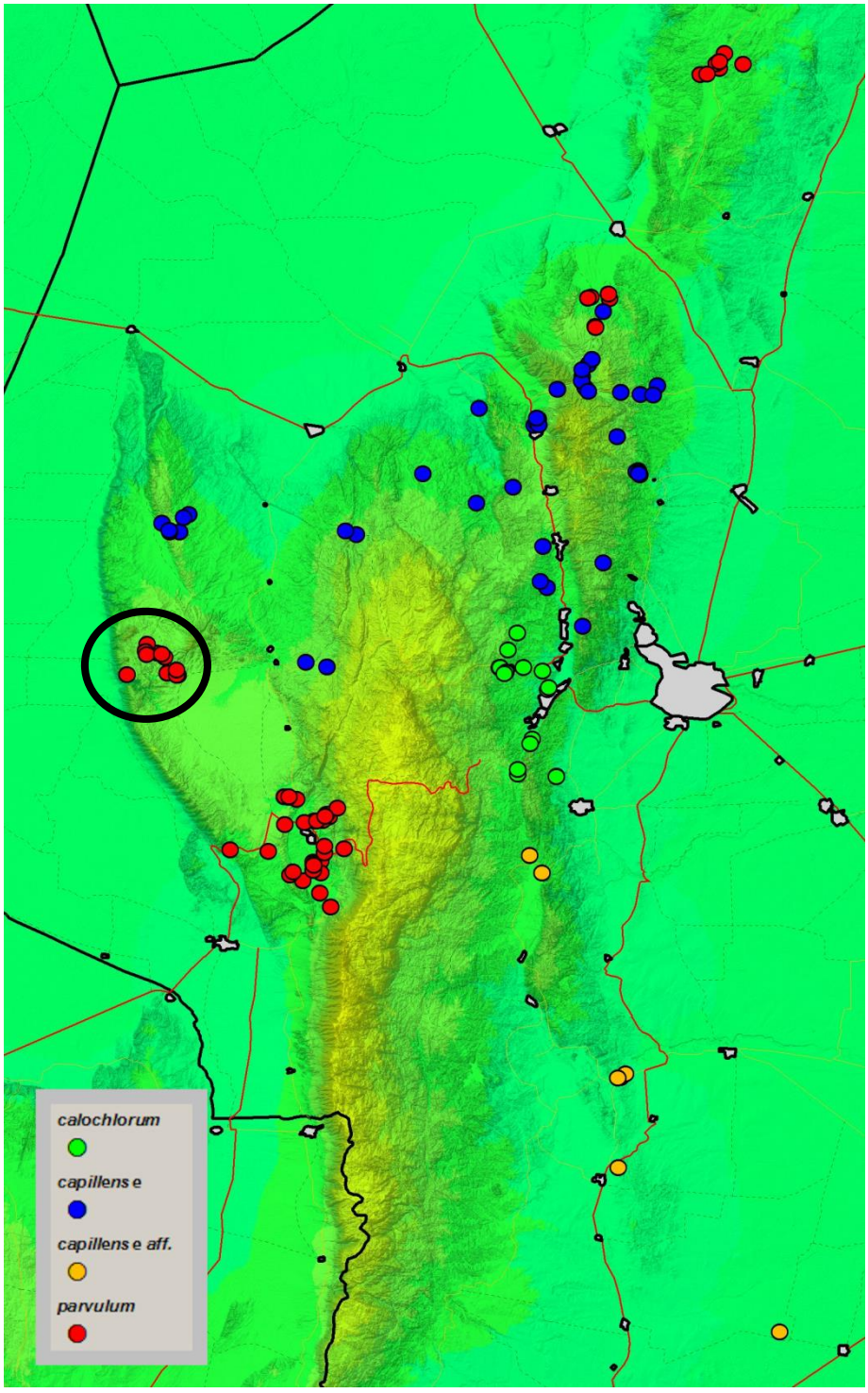

Fig. 50: Map of distribution of *Gymnocalycium parvulum subsp. amoenum*

Gymnocalycium parvulum subsp. amoenum grows in the Sierra de Pocho. Its distribution area may extend further to the south (Ambul). However, the standing of the plants located in Ambul is not entirely clear.

7.2 Detailed distribution area of *Gymnocalycium parvulum subsp. amoenum*

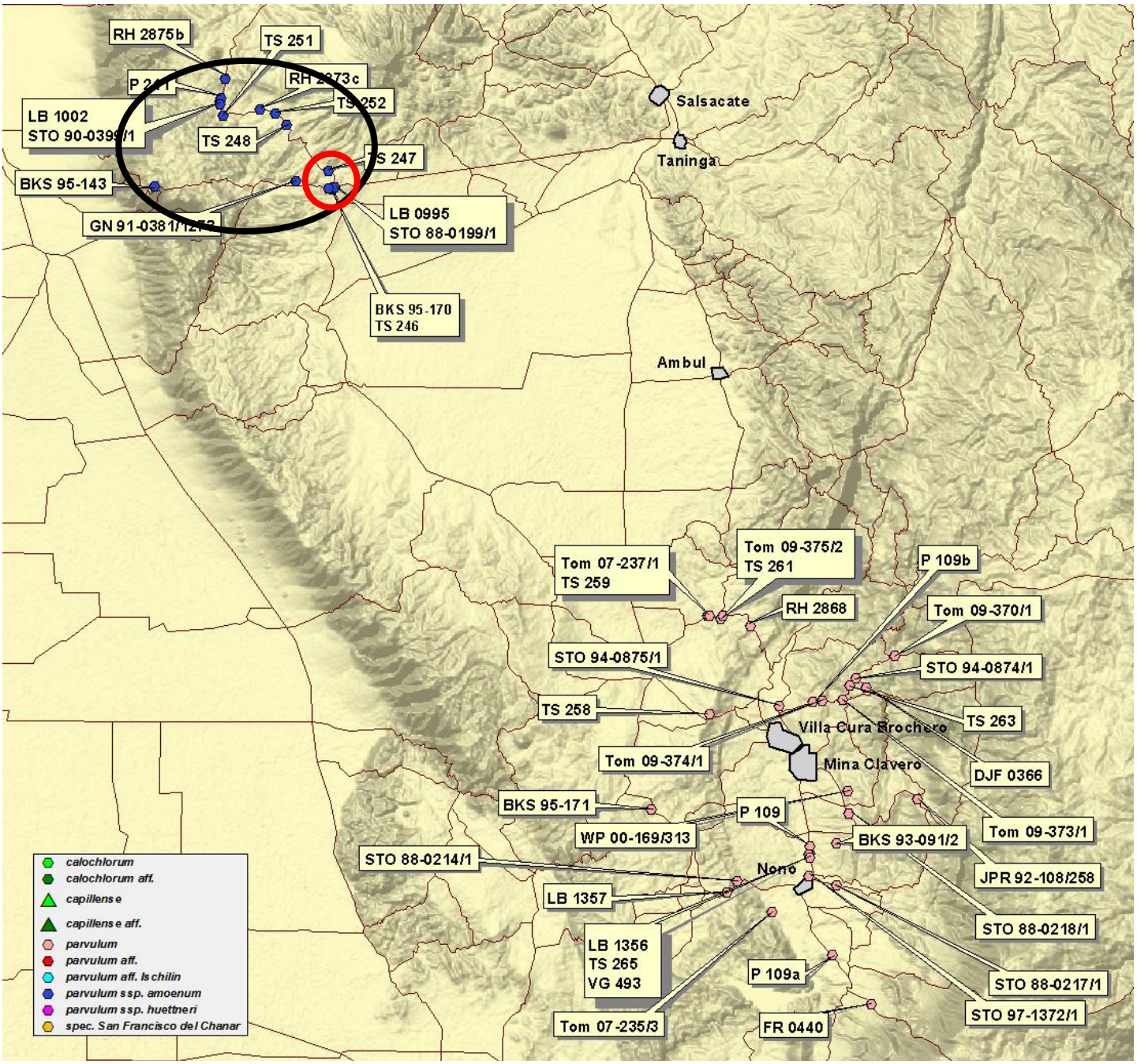

Fig. 51: Detailed distribution area of Gymnocalycium parvulum subsp. amoenum

The red circle represents the type location of STO 88-199.

7.3 Presentation of *Gymnocalycium parvulum subsp. amoenum*

Fig. 52-55: *Gymnocalycium parvulum subsp. amoenum* STO 88-199 (Las Palmas)

The plants of the species *Gymnocalycium parvulum subsp. amoenum* across its complete distribution area do not particularly vary.

Fig. 56-57: *Gymnocalycium parvulum subsp. amoenum* LB 1002 (La Mudana)


Fig. 58-59: *Gymnocalycium parvulum subsp. amoenum* LB 995 (Las Palmas)

7.4 Flowering period in culture (Basel, year 2010)

Field Number	Species	Location	Height	April	May	June	July	August
LB 0995	parvulum subsp. amoenum	Las Palmas	1'020m			■■■		
LB 1002	parvulum subsp. amoenum	La Mudana	1'070m			■■■■		
STO 90-399/1	parvulum subsp. amoenum	La Mudana	1'140m		■	■■■■		
STO 88-199	parvulum subsp. amoenum	Las Palmas	1'200m			■■■■	■	

Fig. 60: Flowering period of *Gymnocalycium parvulum subsp. amoenum* in culture (Basel, year 2010)

Gymnocalycium parvulum subsp. amoenum has its main flowering period in culture in June.

8. *Gymnocalycium parvulum subsp. huettneri*

8.1 Overview of the distribution area of *Gymnocalycium parvulum subsp. huettneri*

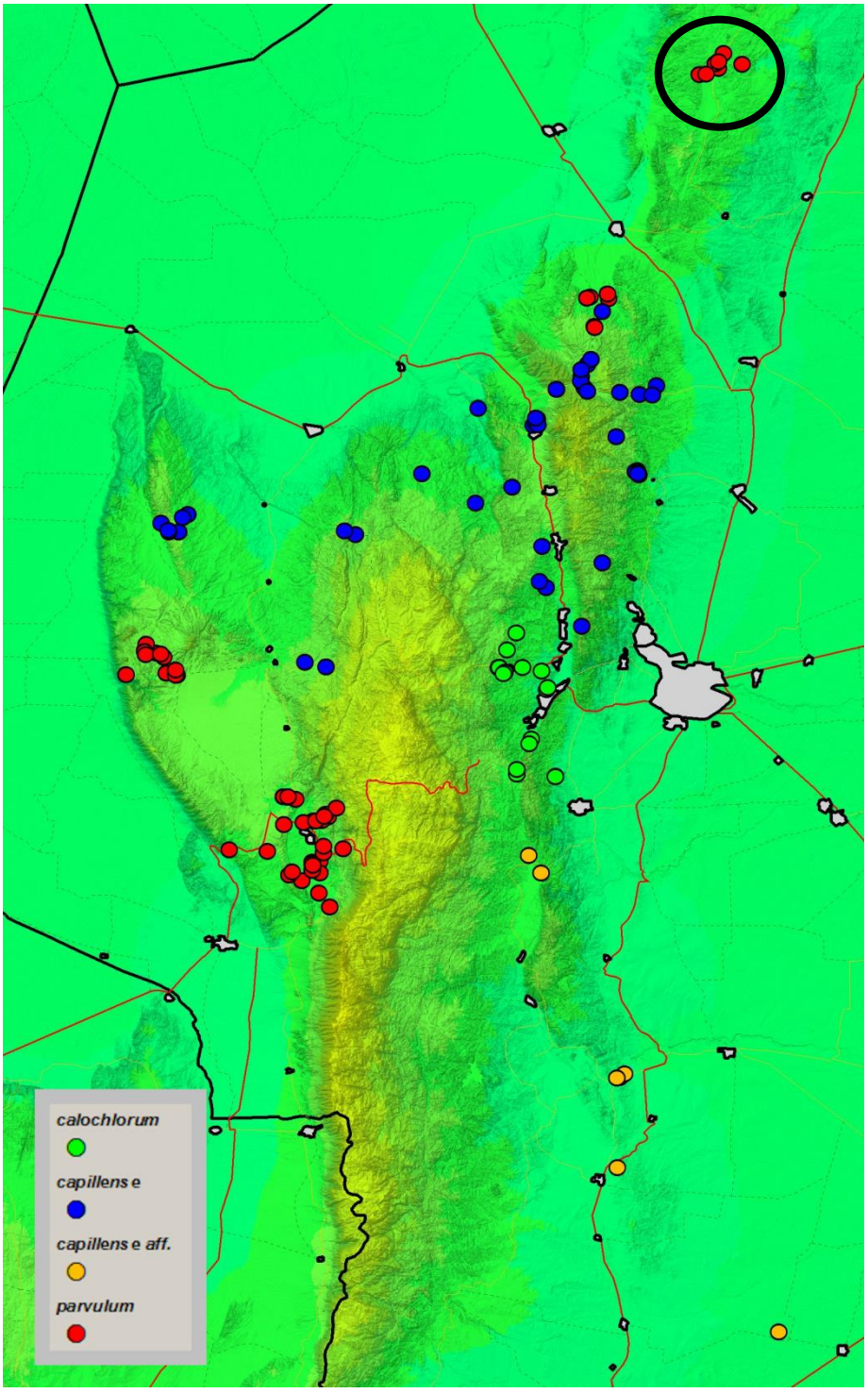

Fig. 61: Map of distribution of *Gymnocalycium parvulum subsp. huettneri*

Gymnocalycium parvulum subsp. huettneri is the most northerly species with naked, black seeds. It grows in the surroundings of San Pedro Norte.

8.2 Detailed distribution area of *Gymnocalycium parvulum subsp. huettneri*

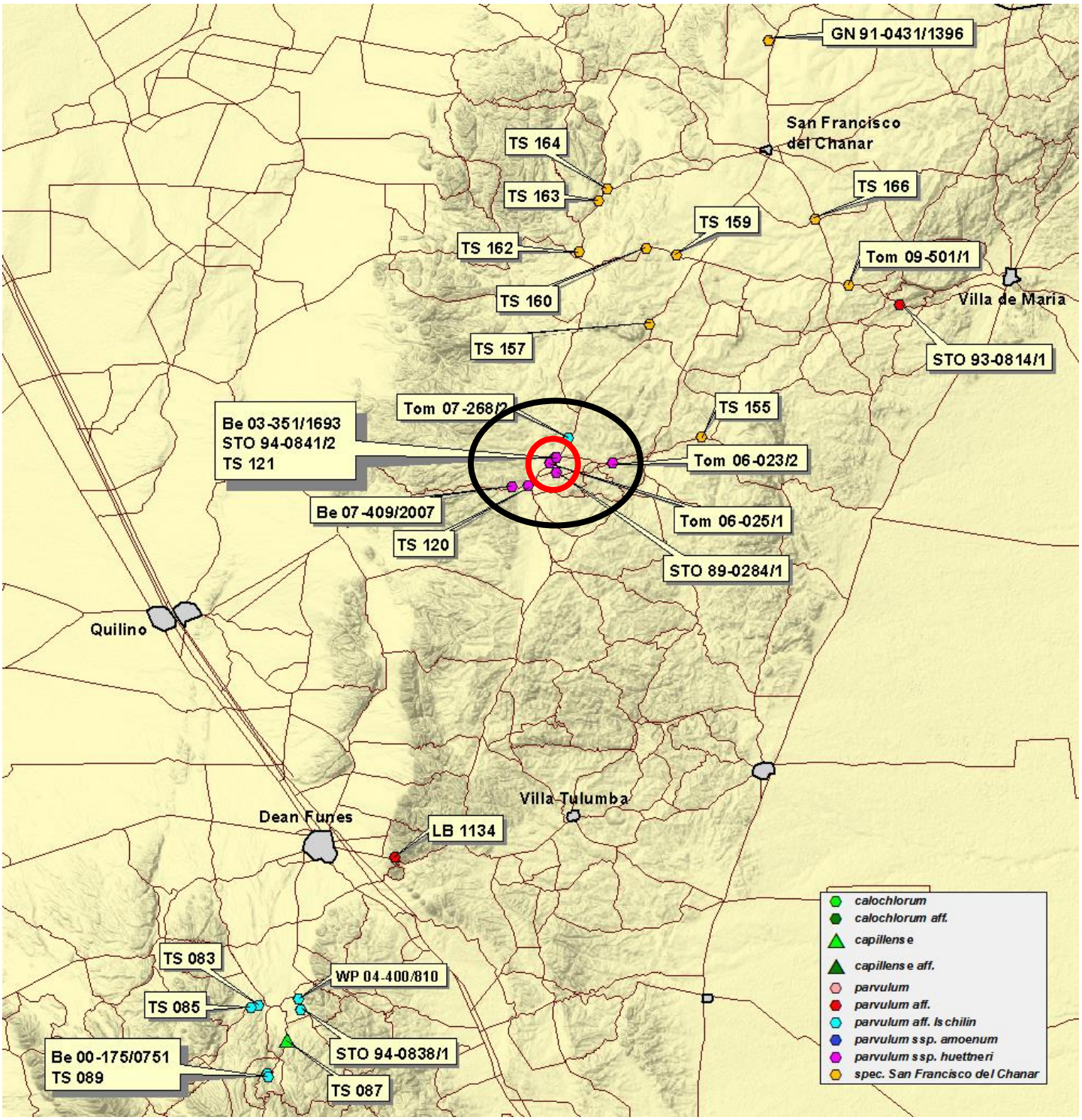

Fig. 62: Detailed distribution area of *Gymnocalycium parvulum subsp. huettneri*

The red circle represents the type location of *Gymnocalycium parvulum subsp. huettneri*; Be 03-351/1693.

8.3 Presentation of *Gymnocalycium parvulum subsp. huettneri*

Fig. 63-66: *Gymnocalycium parvulum subsp. huettneri* Be 03-351/1693 (San Pedro Norte)

Representatives of the subspecies *Gymnocalycium parvulum subsp. huettneri* are similar in appearance across their whole distribution area.

Fig. 67-68: *Gymnocalycium parvulum subsp. huettneri* STO 89-284/1 (San Pedro Norte)


Fig. 69-70: *Gymnocalycium parvulum subsp. huettneri* Tom 07-268/2 (Chuña Huasi)

8.4 Flowering period in culture (Basel, year 2010)

Field Number	Species	Location	Height	April				May				June				July				August			
STO 89-284/1	parvulum subsp. huettneri	San Pedro Norte																					
Be 03-351/1695	parvulum subsp. huettneri	San Pedro Norte	900m																				

Fig. 71: Flowering period of *Gymnocalycium parvulum subsp. huettneri* in culture (Basel, year 2010)

Gymnocalycium parvulum subsp. huettneri has its main flowering period in culture in June.

9. *Gymnocalycium parvulum subsp. agnesiae*

9.1 Overview of the distribution area of *Gymnocalycium parvulum subsp. agnesiae*

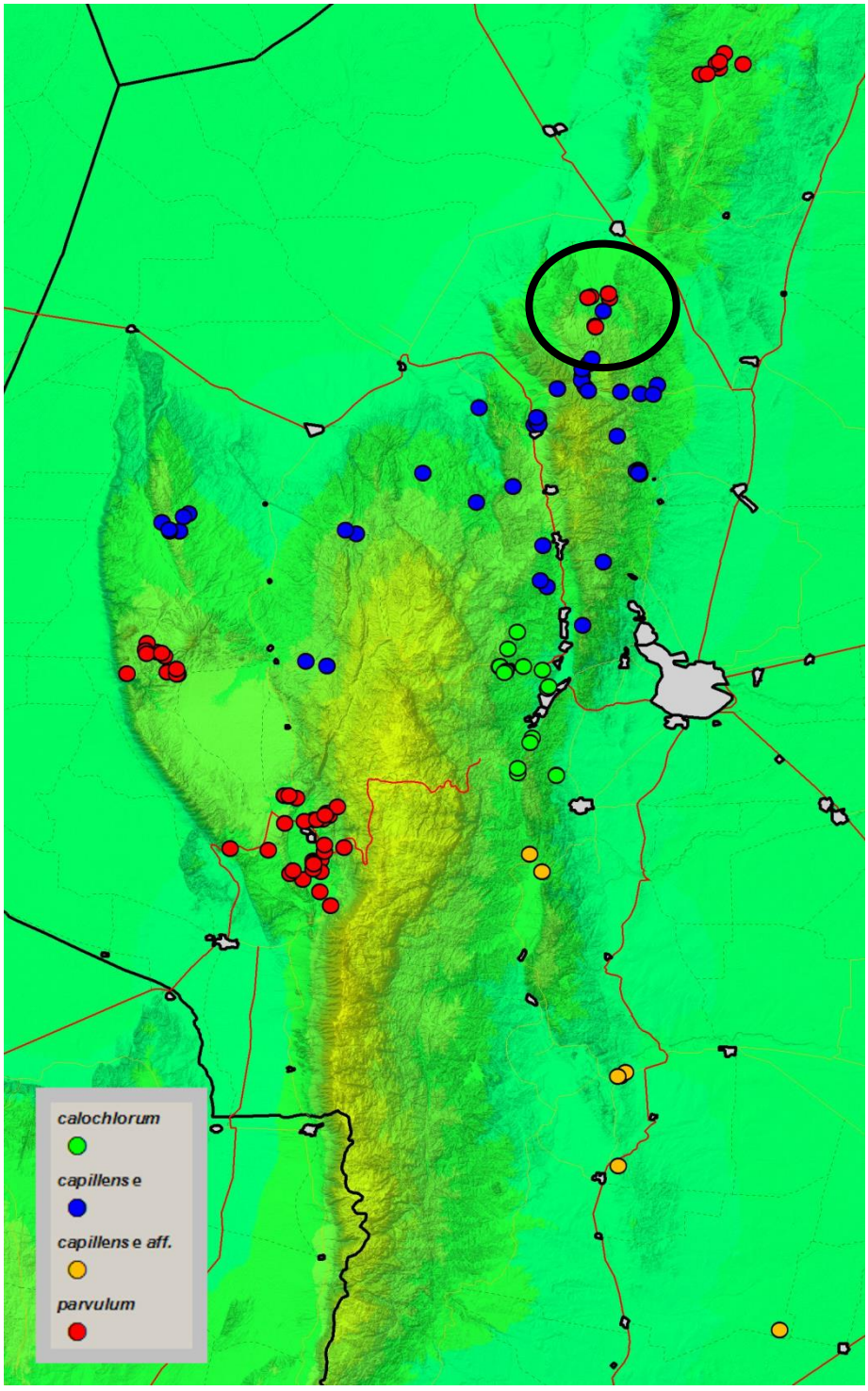

Fig. 72: Map of distribution of *Gymnocalycium parvulum subsp. agnesiae*

Gymnocalycium parvulum subsp. agnesiae is located in the Sierra de Ischilin. It grows together with *Gymnocalycium capillense*, another representative with naked, black seeds. In nature, the two species can easily be distinguished.

9.2 Detailed distribution area of *Gymnocalycium parvulum subsp. agnesiae*

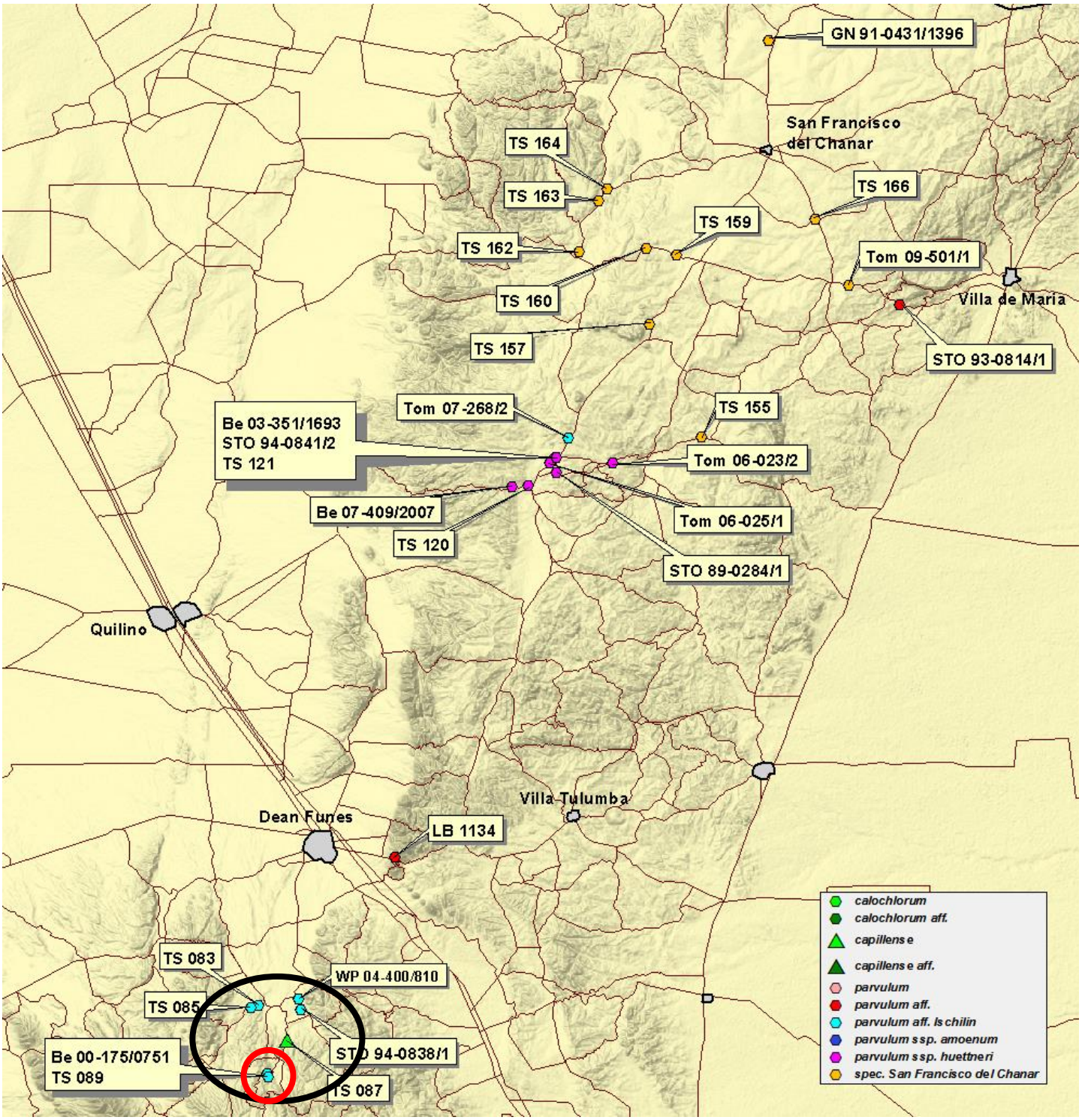

Fig. 73: Detailed distribution area of *Gymnocalycium parvulum subsp. agnesiae*

The red circle represents the type location of *Gymnocalycium parvulum subsp. agnesiae*; Be 00-175/752.

9.3 Presentation of *Gymnocalycium parvulum subsp. agnesiae*

Fig. 74-77: *Gymnocalycium parvulum subsp. agnesiae* Be 00-175/752 (Ojo de Agua)

The plants of the *subspecies agnesiae* do not differ in habit across their whole distribution area.

Fig. 78-79: *Gymnocalycium parvulum subsp. agnesiae* TS 085 (Ischilin)

9.4 Flowering period in culture (Basel, year 2010)

Field Number	Species	Location	Height	April				May				June				July				August			
Be 00-175/752	parvulum subsp. agnesiae	Ojo de Agua	950m																				
STO 94-838	parvulum subsp. agnesiae	Ischilin																					

Fig. 80: Flowering period of *Gymnocalycium parvulum subsp. agnesiae* in culture (Basel, year 2010)

Gymnocalycium parvulum subsp. agnesiae has its main flowering period in culture in June.

10. Gymnocalycium capillense

10.1 Overview of the distribution area of *Gymnocalycium capillense / capillense aff.*

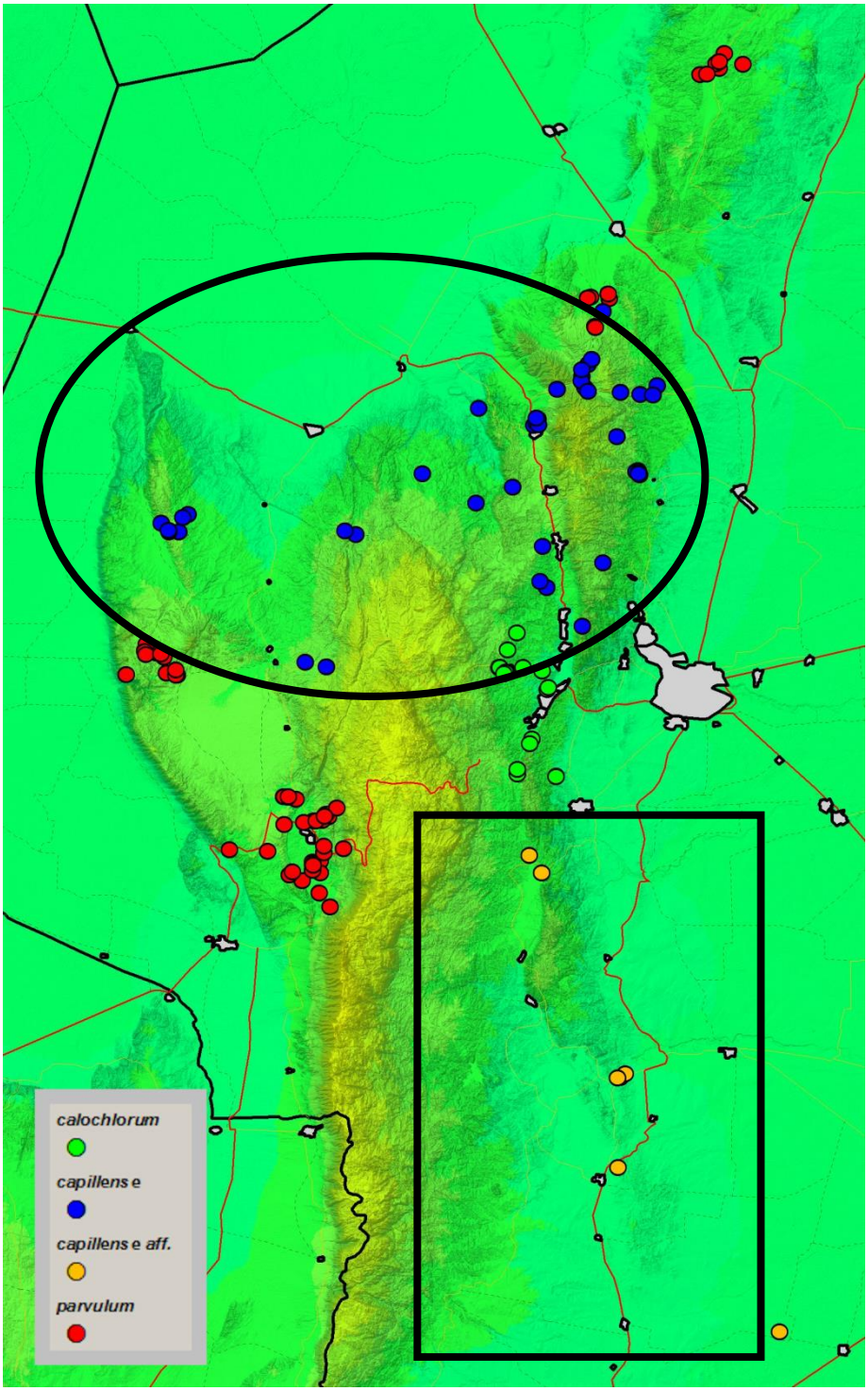

Fig. 81: Map of distribution of *Gymnocalycium capillense and Gymnocalycium capillense aff.*

Gymnocalycium capillense has the most widespread distribution area of the species investigated. It grows in different areas that do not seem to be connected to each other.

10.2 Detailed distribution area of *Gymnocalycium capillense*

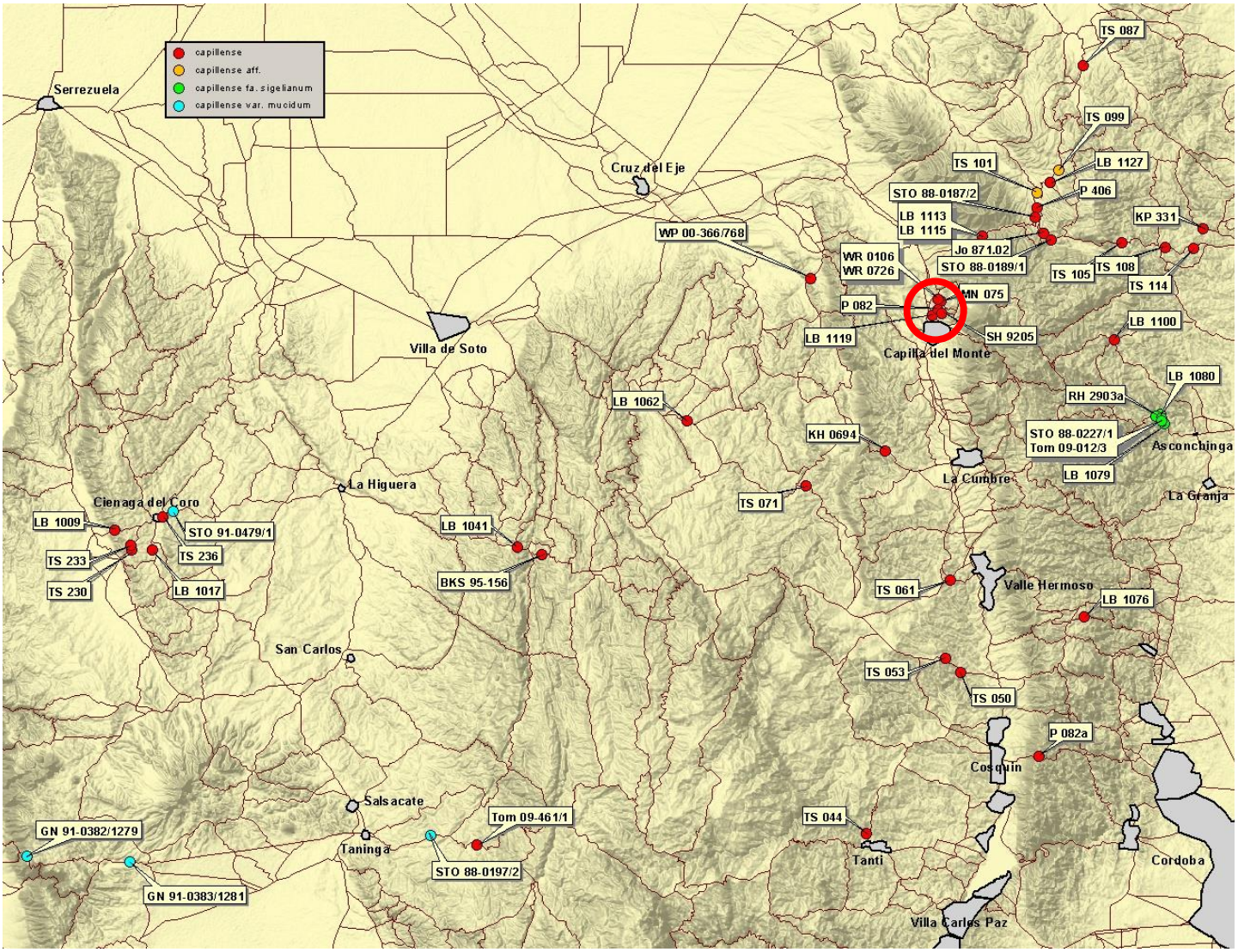

Fig. 82: Detailed distribution area of *Gymnocalycium capillense*

The red circle represents the location of SH 9205, the plant selected for comparison with the other species.

10.3 Detailed distribution area of *Gymnocalycium capillense aff.*

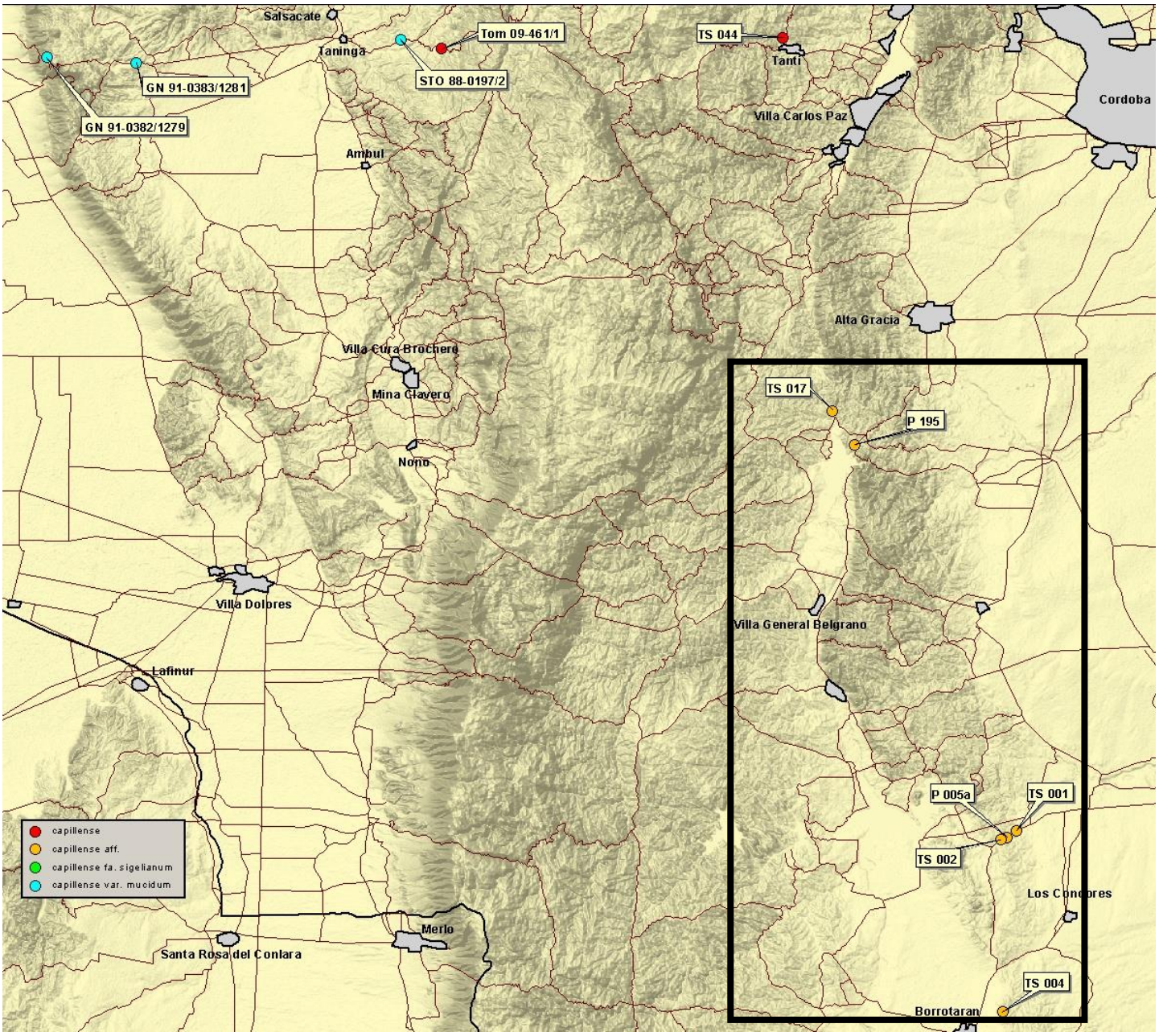

Fig. 83: Detailed distribution area of *Gymnocalycium capillense aff.*

The most southern representatives of plants possessing naked, black seeds grow south of Alta Gracia (TS 017 = La Estancia / P 195 = Villa C. de America). The plants growing north of Berrotáran do not have naked, black seeds and are considered to belong to the taxon of *Gymnocalycium sutterianum*.

10.4 Presentation of *Gymnocalycium capillense*

Fig. 84-87: *Gymnocalycium capillense* SH 9205 (Capilla del Monte)

Even though the different parts of the distribution area do not seem to be connected, the individual representatives of the separated areas cannot be differentiated from each other, neither in appearance, seeds nor flowers.

Fig. 88-89: *Gymnocalycium capillense* LB 1097 (Ciénaga del Coro)


Fig. 90-91: *Gymnocalycium capillense* Jo 871.02 (Ongamira)


Fig. 92-93: *Gymnocalycium capillense aff.* P 195 (Villa Ciudad de America)

Gymnocalycium capillense aff. are slightly reminiscent of *Gymnocalycium sutterianum,* but they have naked, black seeds.

10.5 Flowering period in culture (Basel, year 2010)

Field Number	Species	Location	Height	April				May				June				July				August			
LB 1007	capillense	Ciénaga del Coro	980m											■	■								
LB 1009	capillense	Ciénaga del Coro	980m											■	■								
LB 1017	capillense	Ciénaga del Coro	950m											■	■								
LB 1113	capillense	Quebrada de Luna	970m										■	■									
MN 075	capillense	Capilla del Monte	915m											■	■	■	■	■	■				
P 005a	capillense aff.	Rio Tercero	600m												■								
P 082	capillense	Capilla del Monte	1'100m											■	■	■	■	■	■				
P 082a	capillense	Cosquin	1'100m									■	■	■	■	■	■	■	■				
P 195	capillense aff.	Villa C. de America	800m													■	■						
SH 9205	capillense	Capilla del Monte											■	■	■	■	■	■					
STO 88-189	capillense	Ongamira	1'000m										■	■									
STO 88-197	capillense	Taninga	950m												■								
WP 2000-366/768	capillense	Sierra de Cuniputo	600m														■	■					
WR 726	capillense	Capilla del Monte															■						

Fig. 94: Flowering period of *Gymnocalycium capillense* in culture (Basel, year 2010)

Gymnocalycium capillense has its main flowering period in culture in June and July.

11. Comparison of species examined

11.1 Body and spines

11.1.1 Common Characteristics

All representatives having naked, black seeds:

- Are off-setting and clustering once becoming adult.
- Have a light to dark green body.
- Have a flattened-globular body, 2,5-4 cm high, 3,5-6,0 cm diam.
- Have greyish-white to brownish-white spines.
- Produce no central spines.
- Are slightly sunken in the centre.
- Have 9-13 (occasionally up to 16) ribs.
- Have stake-like roots.

11.1.2 Different Characteristics

9-12 fine radial spines with length of 4-9 mm, lying close to the body are exhibited by the following species:

- *Gymnocalycium calochlorum*
- *Gymnocalycium parvulum*
- *Gymnocalycium parvulum subsp. agnesiae*
- *Gymnocalycium parvulum subsp. amoenum*
- *Gymnocalycium parvulum subsp. huettneri*

5-7 robust, stiff radial spines, with length up to 15 mm, are only exhibited by:

- *Gymnocalycium capillense*

11.2 Flower

11.2.1 Common Characteristics

Flowers of all representatives with naked, black seeds:

- Are arising from near the crown.
- Are funnel to bell-shaped.
- Have whitish petals with a darker mid-stripe.
- Have a reddish base.

11.2.2 Different Characteristics

A compact flower is exhibited by the following species:

- *Gymnocalycium calochlorum*
- *Gymnocalycium capillense*
- *Gymnocalycium parvulum*

A rather more slender flower is exhibited by:

- *Gymnocalycium parvulum subsp. agnesiae*
- *Gymnocalycium parvulum subsp. amoenum*
- *Gymnocalycium parvulum subsp. huettneri*

11.3 Fruit

11.3.1 Common Characteristics

The fruit of the species examined:

- Is spindle to club-shaped.
- Bluish-green.

No significant differences in the characteristics of the fruit have been identified.

11.4 Seeds

11.4.1 Common Characteristics

The seeds of the species examined:

- Belong to the Subgenus *Gymnocalycium.*
- Have 0,6 mm up to 1,0 mm diam.
- Have a length of 0,7 mm to 1,1 mm.
- Are nearly spherical to hat-shaped.
- Are without cuticula.
- Have a dull blackish testa.
- Have a variable large hilum that is drop-shaped and slightly sunken.

No significant differences in seed characteristics have been identified.

11.5 Flowering Period in culture (Basel, year 2010)

Field Number	Species	Location	Height	April	May	June	July	August
SH 9001	calochlorum	Villa Carlos Paz						
SH 9205	capillense	Capilla del Monte						
P 109b	parvulum	Villa Cura Brochero	1'000m					
Be 00-175/752	parvulum subsp. agnesiae	Ojo de Agua	950m					
STO 88-199	parvulum subsp. amoenum	Las Palmas	1'200m					
Be 03-351/1695	parvulum subsp. huettneri	San Pedro Norte	900m					

Fig. 95: Flowering Period in culture (Basel, year 2010)

The flowering period in culture of all the species examined is in June and July.

11.6 Comparison of the juvenile to the adult stage

Fig. 96: juvenile stage

Fig. 97: adult stage

Gymnocalycium capillense LB 1007 (Ciénaga del Coro)

In general *Gymnocalycium capillense* has a juvenile stage that differs considerably from its adult stage.

This fact is not true for *Gymnocalycium parvulum* and all of its subspecies, nor for *Gymnocalycium calochlorum*.

Fig. 98: juvenile stage of *Gymnocalycium capillense*
LB 1007 (Ciénaga del Coro)

Fig. 99: juvenile stage of *Gymnocalycium calochlorum* Tom 06-10/2 (Tanti)

The juvenile stages of *Gymnocalycium capillense* and *Gymnocalycium calochlorum* do not differ considerably from each other.

Does *Gymnocalycium calochlorum* keep its juvenile stage as an adult plant?

12. Summary

12.1 Comparison of the main characteristics of the plants examined

Field Number	Species	Location	Height	Radial spines stiff?	Off-Setting?	Seed Group	Flower Group	Main flowering period in culture (Basel)
SH 9001	calochlorum	Villa Carlos Paz		No	Yes	A	I	June/July
SH 9205	capillense	Capilla del Monte		Yes	Yes	A	I	June/July
P 109b	parvulum	Villa Cura Brochero	1'000m	No	Yes	A	I	June/July
Be 00-175/752	parvulum subsp. agnesiae	Ojo de Agua	950m	No	Yes	A	II	June
STO 88-199	parvulum subsp. amoenum	Las Palmas	1'200m	No	Yes	A	II	June
Be 03-0351/1693	parvulum subsp. huettneri	San Pedro del Norte	900m	No	Yes	A	II	June

Fig. 100: Comparison of the main characteristics of the plants examined

12.2 Final Remarks

The representatives of the species with naked, black seeds are closely related since only small differences exist in both seed and flower morphology as well as in their flowering period.

- Even though *Gymnocalycium capillense* only significantly differs in the development of strong spines, the ranking as species can be sustained, as the plants can visually be easily differentiated.
- The taxon *Gymnocalycium parvulum* and its subspecies are primarily determined by their different distribution areas.
- The body colour of both *Gymnocalycium calochlorum* and *Gymnocalycium capillense* (shiny dark green) differ mostly from the body colour of the species belonging to the *Gymnocalycium parvulum* taxon.

Without considering taxonomy or insignificant differences, the classification of the species examined is considered as follows:

Group 1:

- *Gymnocalycium capillense*
- *Gymnocalycium calochlorum*

Group 2:

- *Gymnocalycium parvulum*

12.3 Distribution Area of the species examined and their assumed relationship

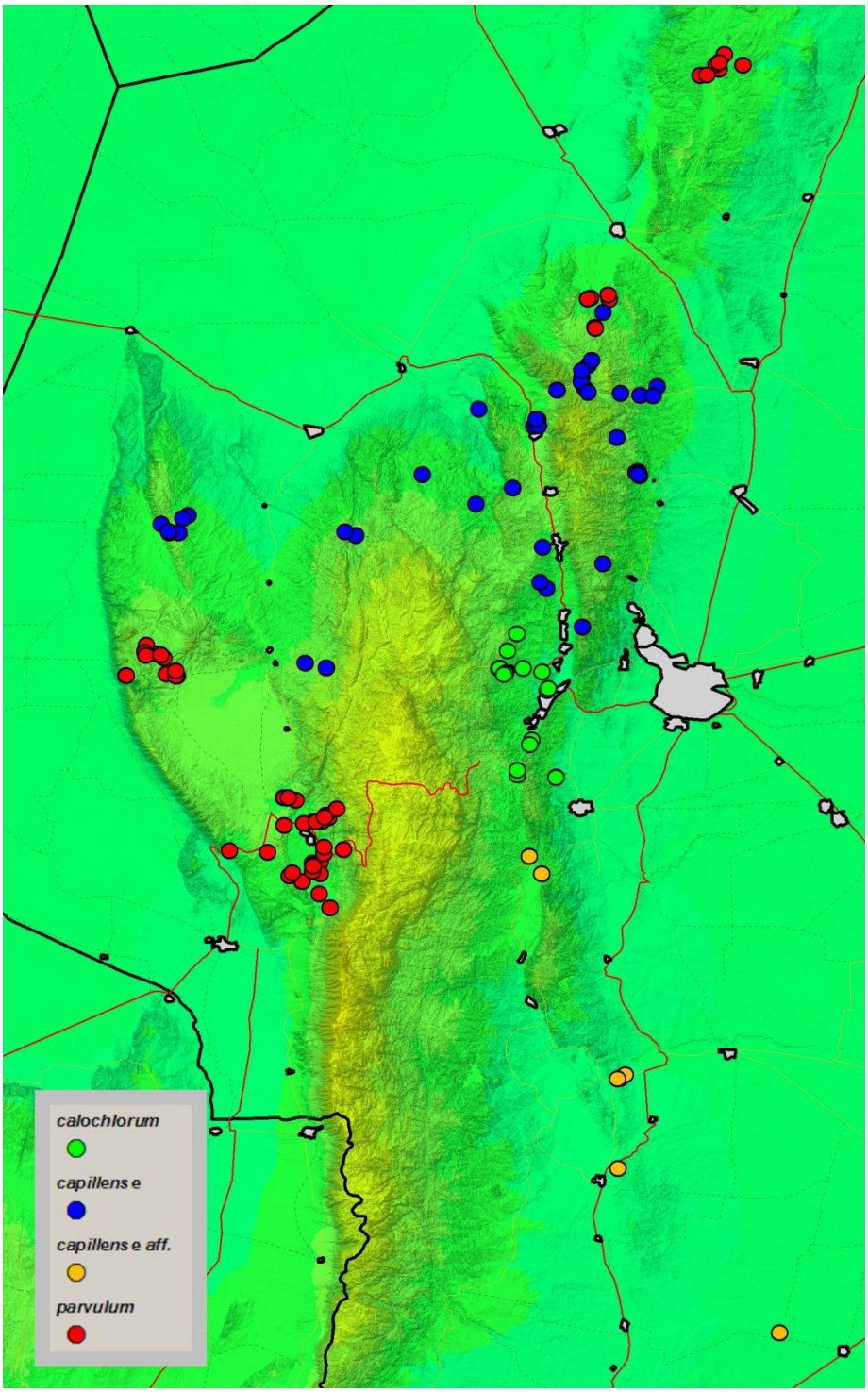

Fig. 101: Distribution area of the species examined

The distribution area of *Gymnocalycium parvulum* and *Gymnocalycium calochlorum* is separated by high mountain ranges. A close relationship is not probable.

The distribution area of *Gymnocalycium parvulum* is distinct from all of its subspecies. Interestingly enough the flower structure of *Gymnocalycium parvulum subsp. parvulum* differs from all its described subspecies whereas the flower structure of all subspecies is rather similar.

North of the distribution area of *Gymnocalycium calochlorum,* plants belonging to *Gymnocalycium capillense* are located. Furthermore, both species have a shiny dark green epidermis. The major difference is that *Gymnocalycium capillense* has much more robust spines.

List of acronyms used:

Acronym	Person
Be	Franz Berger
FK	Omar Ferrari / Roberto Kiesling
GN	Gert Neuhuber
HT	Hans Till
JO	Josef Odehnal
LB	Ludwig Bercht
P	Jörg Piltz
SH	Heinz Schmid
STO	Group of Austrian cactus collectors
Tom	Tomáš Kulhánek
TS	Thomas Strub
VS	Vladimír Šorma
WP	Wolfgang Papsch

References of Pictures:

- All pictures of seeds by Volker Schädlich.
- All maps by Mario Wick.
- Fig. 5: Picture by Volker Schädlich.
- Fig. 34, Fig. 75, Fig. 76: Pictures by Reiner Sperling.
- Fig. 39: Picture by Christian Hefti.
- All other pictures by the author.

Thanks to:

- Volker Schädlich for the numerous pictures of seeds and plants,
- Mario Wick for the creation of the various maps,
- Ludwig Bercht for offering scions,
- Reiner Sperling for pictures of the plants,
- Christian Hefti for the picture,
- All members of the Working Group GYMNOS for their valuable input and the lively discussions.

References:

Backeberg C. & Knuth F.M. (1936): Gymnocalycium proliferum Bckgb. - Kaktus – ABC: 294-295

Backeberg C. (1932): Echinocactus (Gymnocalycium Br. u. R.) prolifer Bckbg. n. sp. – Der Kakteenfreund, 1 (12): 132-133.

Berger F. (2008): Charakterisierung, Verbreitung und geografische Differenzierung von Gymnocalycium parvulum (Speg.) Speg. – Gymnocalycium 21(2): 761-766

Berger F. (2008): Gymnocalycium parvulum subsp. agnesiae: eine neue Sippe aus der Sierra de Ischilin, Provinz Córdoba, Argentinien – Gymnocalycium 23(3): 955-958

Bödeker F. (1932): Echinocactus calochlorus Böd. sp.n. - Monatsschrift der Deutschen Kakteen-Gesellschaft, Band IV.11: 260-262.

Dölz B. (1943): Gymnocalycium deeszianum Dölz spec. nov. – Kakteenkunde 3: 54-55

Hosseus C. (1926): Gymnocalycium capillensis – Apuntes sobre las Cactáceas - Revista del Centro Estudianteo de Farmacia 2. Córdoba 2(6): 16

Lambert J. (2002): Gymnocalycium parvulum speg.: Eindelijk teruggevonden - Succulenta 81(5): 227-231

Schick C. (1923): Neue Kakteen aus der Sierra de Córdoba – Möllers Deutsche Gärtner-Zeitung, 38 (26): 201-202.

Spegazzini C. (1905): Cactacearum Platensium Tentamen. - Anales Museo Nàcional Buenos Aires. 3(4): 504-505.

Spegazzini C. (1925): Nuevas Notas Cactológicas. – Anales Sociedad Cientifica Argentina, page 141.

Till H. (2003): Die Verwandtschaft von Gymnocalycium capillense - Gymnocalycium 16(1): 489-498.

Till H., (1994): Zur Identität und Verbreitung von Gymnocalycium parvulum (Spegazzini) Spegazzini - Gymnocalycium 7(2): 121-126

Till, H. & Amerhauser, H: (2007) Gymnocalycium leptanthum (Speg.) Speg. und Gymnocalycium frankianum Rausch n.n. – Zwei Taxa aus dem Quehlianum Aggregat – Gymnocalycium 20(3): 725-732.