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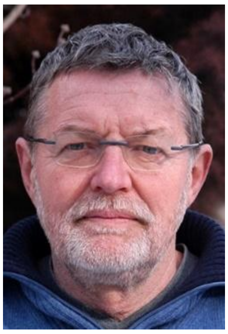


Publisher, web design
Dr Mario Wick
mario.wick@schuetziana.org

Editor
Wolfgang Papsch
wolfgang.papsch@schuetziana.org

Reader
Holger Lunau
holger.lunau@gmx.de

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Cover picture: *Gymnocalycium tucavocense*, west of Santo Corazon, Bolivia, VoS 2174 (photo: V. Schädlich)

Contents

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

Editorial

Dear Gymnocalycium friends

Wolfgang Papsch

The leading article of this issue deals with *Gymnocalycium taningaense.* With the proverbial accuracy of a Swiss precision clock the author was engaged in those plants he assigns to this species. His research was based on large-scale field studies on the one hand in order to be able to define the distribution area. On the other hand he refers to intensive observations of his plants in cultivation with respect to care and reproduction as well as to an abundance of pictures, which were obtained and evaluated during these studies. As the saying goes: one picture can tell more than a thousand words. In case of the number of pictures added to this paper it would amount to the unimaginable amount of information of around 200.000 words. Additionally, the author could receive helpful and continuative information through intensive exchange of thoughts with friends within and outside our project group, either during expert conferences or via social media, which have come to stay.

As early as in 2024, during the meeting in the Botanical Gardens in Linz we were confronted with results – at that time still preliminary – of molecular investigations of certain taxa of the subgenus *Muscosemineum*. It became clear then that these results might have a huge impact on changes in nomenclature. Now, one year later, the authors present a first study on this project.

No matter if the study is carried out privately as in the case of the leading article or with the help of scientific facilities, both amounts to considerable costs. In the first case the author bears the expenses himself. In the second case, however, the scientific institutes' expenses arising from equipment and labour time must be remunerated. Kindly and not as a matter of course the authors provide the findings obtained by these studies for free. In order to facilitate further cost-intensive molecular investigations we ask you to consider if you could also possibly make a financial donation.

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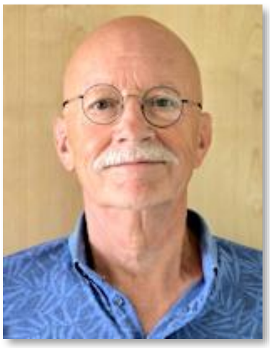
First, new findings based on molecular-genetic studies and the re-evaluation of morphological characteristics within the genus *Gymnocalycium,* subgenus *Muscosemineum*

Michael H. J. Barfuss & Volker Schädlich



Abstract

The first, new findings of the most extensive DNA studies to date of the genus *Gymnocalycium,* subgenus *Muscosemineum* are published. For this purpose, more than 250 specimens of material from verified origin were examined and more than 5,500 base pairs of the *ycf1* maker gene were sequenced. In a first step, three taxonomic changes (new combination and status change of *Gymnocalycium roboreanum*, *G. tucavocense* and *G. multiproliferum*) will be made based on these molecular-genetic studies and the reassessment of morphological features.

Keywords: ***Cactaceae, Gymnocalycium, Muscosemineum,* DNA, *roboreanum, tucavocense, multiproliferum, ycf1***

In the course of our molecular-genetic studies (comparative analysis of DNA sequences) to investigate the evolutionary history (phylogeny) and molecular-genetic determination and taxonomy (DNA barcoding) of the genus *Gymnocalycium*, new and very surprising findings have emerged. In order to reconstruct the evolutionary relationships between species or even within a species, the plastid genome is often selected, as particular regions of this genome can be sequenced and analysed relatively easily using the classical laboratory method of Sanger's dideoxy method (also known simply as Sanger sequencing or chain termination synthesis). The low information content of standardly sequenced DNA barcoding regions of the maker genes *rbcL* and *matK* has proven to be a challenge (e.g. CBOL Plant Working Group 2009). Based on several published complete plastid genome sequences of cacti in the GenBank: https://www.ncbi.nlm.nih.gov/genbank/ and their comparison, the entire coding region of the *ycf1* maker gene region and its flanking, non-coding intergenic spacer regions with more than 5,500 sequenced base pairs has proven to be particularly informative (e.g. Franck *et al.* 2012, Dong *et al.* 2015). A publication on the development and detailed description of the method is currently being prepared and will be published soon. Using common phylogenetic analysis methods such as maximum parsimony and maximum likelihood, more than 250 specimens of material from verified origin were examined in these first results of the most comprehensive DNA analyses of the genus *Gymnocalycium,* subgenus *Muscosemineum* to date. For better visualisation, the number of samples analysed was reduced to 65 (see the phylogenetic tree in fig. 1, rooted with two species of subgenus *Pirisemineum* based on previous results of Demaio *et al.* 2011) and also includes specimens from the type populations relevant to the group (from the type collections themselves or from collections from the type localities) in order to be able to draw reliable taxonomic and nomenclatural conclusions. Details of individual plants (DNA

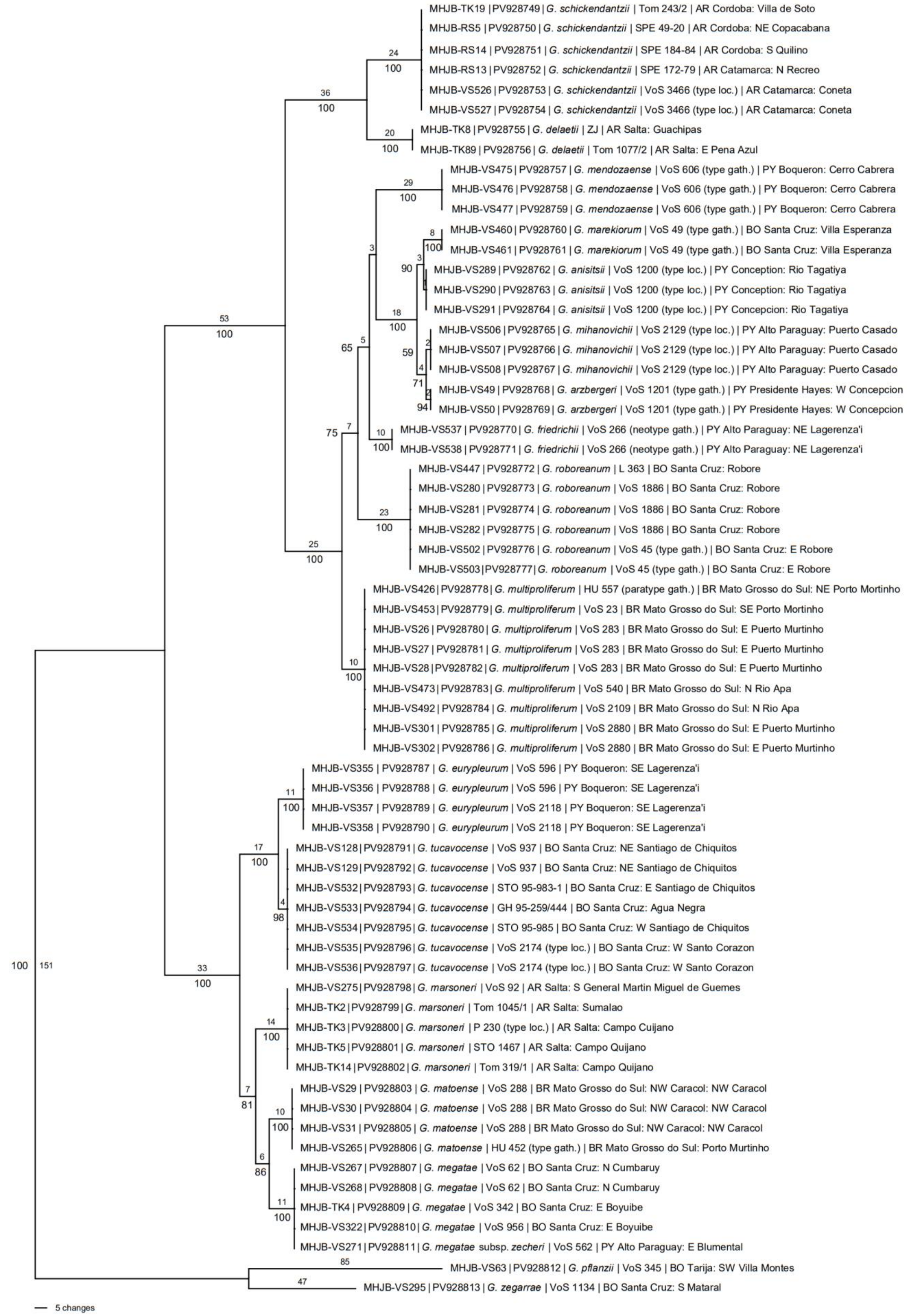


Fig. 1: Phylogenetic tree, displayed as a phylogram, calculated with maximum parsimony and based on more than 5,500 base pairs sequenced from the *ycf1* marker gene. Branch lengths inferred by the number of nucleotide changes along each branch are indicated above or on the right beside of each branch. Maximum parsimony bootstrap values ≥ 50% are indicated below or on the left beside of each branch, missing values indicate support values less than 50%. Sample details shown are the DNA number, GenBank number (*ycf1*), taxon name, field number and the field origin.

number, taxon name, field number, country, department/province and approximate locality) can be found in the phylogenetic tree. The DNA sequences of the *ycf1* marker gene are deposited in the GenBank under the numbers PV928749 bis PV928813. The first three taxonomic changes based on these molecular-genetic studies and the re-evaluation of morphological characteristics are described below.

In 2021, the second author presented plants from the vicinity of Roboré as a variety of *G. marekiorum* Milt in Schütziana 12(3) in the article ‘Eine altbekannte *Gymnocalycium*-Sippe aus dem Tiefland von Ost-Bolivien neu betrachtet.’ (Schädlich 2021b). The plants grow near the small town and south of it. They have light green, shiny bodies and soft, yellowish spination. These characteristics make it easy to distinguish the seedlings from *Gymnocalycium* seedlings of the same age found in eastern Bolivia. A constant characteristic of the entire clan is the style, which always stands above the stamens.

As a result of the investigations, this taxon must be re-evaluated.

Fig. 2–3: *Gymnocalycium roboreanum*, the plants always flower white to pale pink, a constant feature is the style which always protrudes above the stamens.

Gymnocalycium roboreanum (Schädlich) Barfuss & Schädlich, ***comb. et stat. nov.***

Basionym:—*Gymnocalycium marekiorum* var. *roboreanum* Schädlich, Schütziana 12(3): 19 (2021), **type:—** *V. Schädlich VoS 03-45* (**holo** WU 0169777, http://wu.jacq.org/WU0169777).

= *Gymnocalycium damsii* var. *centrispinum* Backeb. ex H. Till & Amerh., Gymnocalycium 17(1): 555 (fig. 22–23) (2004), **type:—***H. Amerhauser HA 95-981a* (**holo** LPB).
= *Gymnocalycium damsii* var. *centrispinum* Backeb., ***nom. inval.***, Descr. Cact. Nov. [Backeberg] 3: 6 (1963).

Another taxon from eastern Bolivia that is being re-evaluated comes from the Tucabaca Valley. The valley lies between two mountain ranges: the Serranía de Santiago and the Serranía de Sunsas. The known locations are at the beginning and end of the valley. "Plants from the Tucabaca Valley were collected for the first time by Father Hammerschmid. He sent plants to the Uhlig company in Germany. Backeberg described these plants in 1963 as *G. damsii* var. *tucavocense*. In

2002, plants from the Tucabaca Valley (STO 95-983, location near the Rio Tucavaca) were described by Halda, Horácek & Milt as *G. damsii* subsp. *evae*." (Schädlich 2021a: 25). Two years later, in 2004, Hans Till and Helmut Amerhauser described plants (STO 95-984) from the Tucabaca Valley as *G. anisitsii* subsp. *holdii* var. *tucavocense* (Till & Amerhauser 2004). The second author newly combined the taxon to *G. anisitsii* subsp. *tucavocense* in 2021 (Schädlich 2021a). The *Gymnocalycium* from the Tucabaca Valley have a shiny epidermis and are often dark on the underside of the body. The plants remain flat and reach a size of up to 130 mm in diameter in their habitat.

Here, too, the taxonomic rank needs to be reassessed.

Fig. 4–5: *Gymnocalycium tucavocense* from the Tucabaca Valley has a characteristic appearance: the epidermis is shiny with a mostly distinct reddish-brown coloration below the areoles.

Gymnocalycium tucavocense (Backeb. ex H. Till & Amerh.) Barfuss & Schädlich, ***comb. et stat. nov.***

Basionym:—*Gymnocalycium anisitsii* var. *tucavocense* Backeb. ex H. Till & Amerh., Gymnocalycium 17(1): 559 (2004) illus. fl., **type:—***H. Amerhauser HA 95-984* (**holo** LPB).

≡ *Gymnocalycium anisitsii* subsp. *tucavocense* (H. Till & Amerh.) Schädlich, Schütziana 12(2): 25 (2021).
= *Gymnocalycium damsii* var. *tucavocense* Backeb., ***nom. inval.***, Descr. Cact. Nov. [Backeberg] 3: 6 (1963).
= *Gymnocalycium damsii* subsp. *evae* Halda, Horácek & Milt, Acta Mus. Richnov., Sect. Nat. 9(1): 58(–59; fig. 69) (2002), **type:—***J. J. Halda & L. Horácek*, 20.11.1999 (**holo** PR 11.701).

Note: The orthographic spelling variant “tucavocense” of the first description must be retained and cannot be changed to “tucabacense” in a new combination.

In 1991, Pierre J. Braun described *Gymnocalycium damsii* var. *multiproliferum* from the Brazilian Chaco in the southwest of Mato Grosso do Sul, east of Porto Murtinho (Braun 1991). In 1995 P. J. Braun and Eddie Esteves recombined the plants to *Gymnocalycium anisitsii* subsp. *multiproliferum* (Braun & Esteves 1995). Our investigations have shown that this taxon cannot be assigned to *G. anisitsii*.

The investigations showed that this taxon should be raised to the rank of a species.

Fig. 6–7: *Gymnocalycium multiproliferum*, there are plants in the distribution area of the species with an extreme tendency to sprout and others without.

Gymnocalycium multiproliferum (P. J. Braun) Barfuss & Schädlich, ***comb. et stat. nov.***

Basionym:—*Gymnocalycium damsii* var. *multiproliferum* P. J. Braun, Kakteen And. Sukk. 41(10): 230, 5 figs. (1991), **type:—***P. J. Braun 230* (**holo** ZSS, **iso** ZSS, B).

≡ *Gymnocalycium anisitsii* subsp. *multiproliferum* (P. J. Braun) P. J. Braun & Esteves, Succulenta (Netherlands) 74(3): 131 (1995).

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Michael H. J. Barfuss
University of Vienna
Department of Botany and Biodiversity Research
Rennweg 14
1030 Vienna
(Austria)
✉ michael.h.j.barfuss@univie.ac.at

Volker Schädlich
Bergstraße 1
03130 Spremberg
(Germany)
✉ volker@gymnos.de

Plants of the subgenus *Gymnocalycium* from the west side of the Sierras Grandes / Sierra de los Comechingones

Thomas Strub

Part 1: *Gymnocalycium taningaense*

ABSTRACT

This article gives an overview of the subgenus *Gymnocalycium*'s plants, which grow on the western side of the Sierras Grandes as well as the Sierra de los Comechingones. The focus lies on the species *Gymnocalycium taningaense* (described in part 1 on hand) as well as *Gymnocalycium gaponii* (scheduled to be published in part 2), which can be found in the Argentinian province Córdoba. Photographs of the locality, of plants in their habitat and in cultivation, too, are presented and pictures of flower sections and seeds are added. Apart from that, flowering periods in cultivation are graphically depicted and the ploidy of the plants identified.

KEYWORDS: ***Cactaceae, Gymnocalycium, bruchii*** **subsp.** ***brigittae, capillense, gaponii, papschii, parvulum, parvulum*** **subsp.** ***amoenum, taningaense***

INTRODUCTION

Gymnocalycium taningaense and *Gymnocalycium gaponii* were the main topic of the 2024 Conference in Coschütz.

On the occasion of the 2023 Conference it was demonstrated that *Gymnocalycium monvillei* from the subgenus Scabrosemineum is little variable despite its vast distribution area, which has a northeast-southwest extent of around 250 km. The topic of the 2024 meeting included a presentation of plants belonging to the subgenus *Gymnocalycium* (Ovatisemineum, Schütz) from a relatively small distribution area (see centre of the map section in fig. 1, shaded yellow). The subgenus *Gymnocalycium* comprises plants which are still not very much consolidated and do not have a uniform appearance. It is therefore not surprising that several species, respectively subspecies, have been described.

The author travelled the area west of the Sierras Grandes several times. The cultivated offspring originate from seeds taken from nature, collected at a time when importing seeds was still allowed.

The map of the distribution area (fig. 1) predominantly shows plants from the author's own localities. Exceptions are the pictures of *G. papschii* and the offspring of the *G. gaponii* type locality.

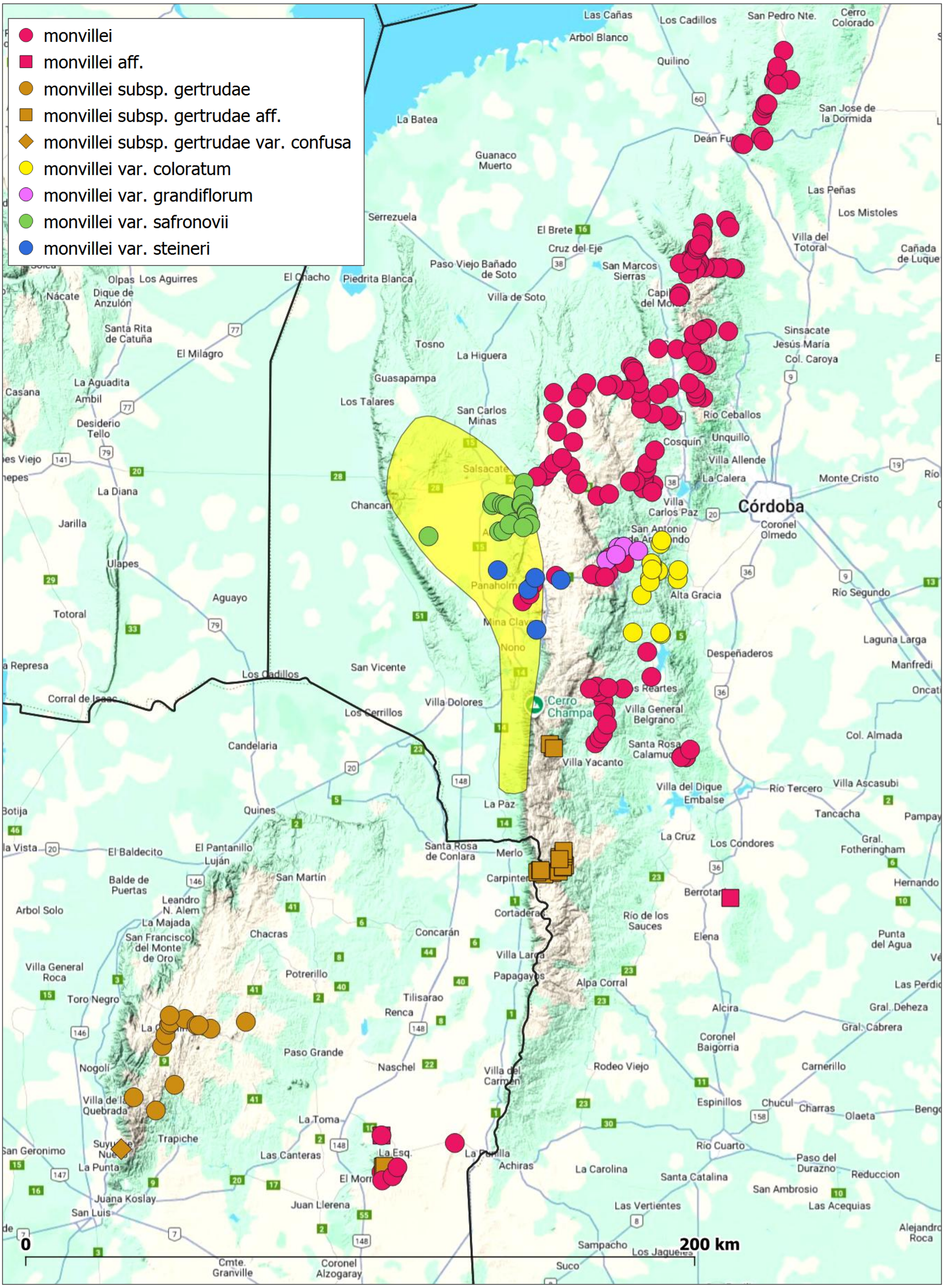

Fig. 1: Distribution area of *G. monvillei* in contrast to distribution area of the subgenus *Gymnocalycium's* species from the western side of the Sierras Grandes / Sierra de los Comechingones (shaded yellow) (all maps by Mario Wick, map background by Google).

In the introduction further species of the subgenus *Gymnocalycium* from the western slope of the Sierras Grandes / Sierra de los Comechingones are going to be presented, apart from *Gymnocalycium taningaense* and *Gymnocalycium gaponii.* This provides clear differences between the species. When comparing *Gymnocalycium taningaense* with *Gymnocalycium gaponii,* the differences become partly less obvious.

The focus will neither be put on *G. taningaense* var. *lukasikii* and *G. taningaense* subsp. *fuschilloi,* nor on *G. gaponii* subsp. *macrocarpum, G. gertii* and *G. victorii,* which do not occur in the same region as *G. gaponii* and *G. taningaense*.

In first descriptions only plants of the type population are often described and sometimes a few additional populations may be added. Slightly differing features occurring in plants which do not originate from the type locality are mostly ignored. First descriptions also often only focus on few plants, flower sections or seeds. Thus the variability of plants originating from the same locality does not become apparent.

This makes it difficult for field researchers to assign the species' names correctly. Humans have the tendency to impose an "orderly" system on nature, however, nature mostly does not stick to these rules.

In ideal circumstances the distribution areas would be geographically separated between the species, which would allow us to identify them clearly. In reality – and especially with the species dealt with in this article – the features of many populations cannot be assigned to the one or the other species unambiguously, based on their first descriptions. There are "mixed" populations. In this article the species *Gymnocalycium taningaense* and *Gymnocalycium gaponii* (in part 2 of this paper) are going to be presented according to their first descriptions and also the "mixed" populations. To illustrate their variability several plants and flower sections originating from the same locality are going to be showcased.

G. taningaense and *G. gaponii* both populate a geographically similar area. Both species belong to the subgenus *Gymnocalycium*.

The same area also houses further species from the subgenus *Gymnocalycium*:

- *G. bruchii* subsp. *brigittae*
- *G. capillense*
- *G. parvulum* (sensu Till)
- *G. parvulum* subsp. *amoenum*
- *G. papschii*

In the northwest of the Argentinian province Córdoba the Sierras Grandes as well as the Sierra de los Comechigones bordering in southern direction rise in the centre of the map section (fig. 2). The species presented in this article grow on promontories situated west of the Sierras Grandes and in the Sierra Pocho. Various species of the subgenus *Gymnocalycium* grow in a small area with a north-south extent of around 120 km.

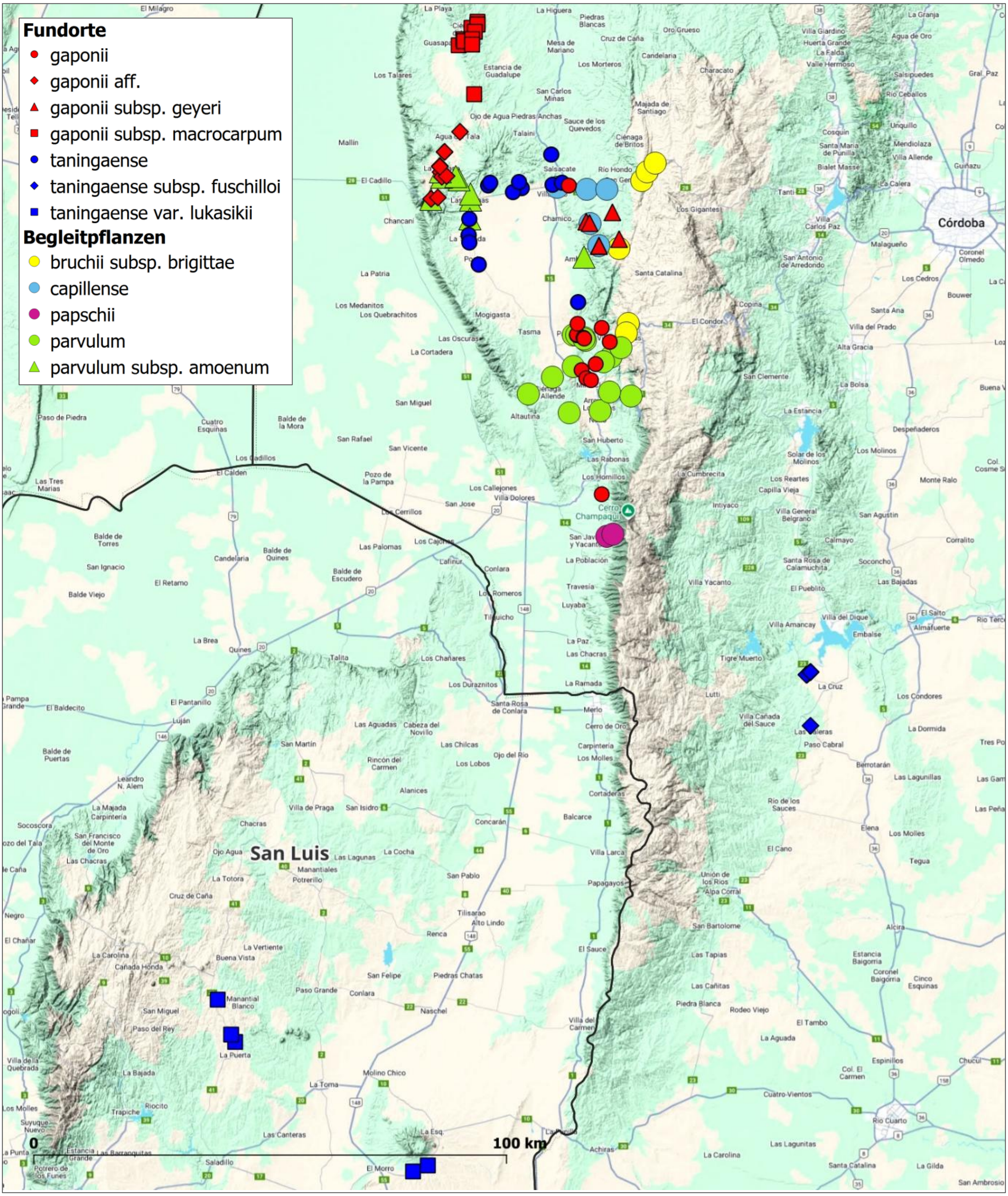

Fig. 2: Distribution area of the subgenus *Gymnocalycium's* species from the western slopes of the Sierras Grandes / Sierra de Comechingones.

Gymnocalycium taningaense are going to be presented in this paper, while a closer look is going to be taken at *Gymnocalycium gaponii* in one of the Schütziana editions to come. This article merely depicts the type plant of *G. gaponii* for reasons of comparison.

The type forms of *G. gaponii* (fig. 3) and *G. taningaense* (fig. 4) can be clearly distinguished based on the **plant's body**. Whereas the body of *G. gaponii* is dark green, that of *G. taningaense* is greyish green. The spines of *G. gaponii* rest on the body, they are horn-coloured with a darker base. The spines of *G. taningaense* are needle-like, greyish brown and mostly protruding from the body. *G. taningaense* starts forming offsets at older age while *G. gaponii* grows solitary and offsets at older age only as an exception.

The number of chromosomes of both *G. gaponii* and *G. taningaense* is **diploid = 2n**.

G. bruchii subsp. *brigittae* and *G. capillense* cannot be told apart easily from *G. gaponii*, especially at their localities. Both species offset abundantly, as opposed to *G. taningaense / G. gaponii*. The chromosome number of *G. bruchii* subsp. *brigittae* and *G. capillense* is **tetraploid = 4n** (fig. 5–6).

The plant body of *G. parvulum* is lighter green, the multitude of marginal spines is needle-like and unicoloured, the ribs are more numerous (fig. 7). Both *G. parvulum* and *G. parvulum* subsp. *amoenum* (fig. 8) offset abundantly. The chromosome set of *G. parvulum* is **hexaploid = 6n** and that of *G. parvulum* subsp. *amoenum* is **tetraploid = 4n**. The question arises whether a subspecies can possess a ploidy different from that of the species.

The body of *G. papschii* is dark green (fig. 9). Its spine colour is grey with a reddish brown base. Central spines are formed at older age. The differences in appearance are small when compared with *G. gaponii*, body colour, spine colour and position of spines are similar. The spines are of a more needle-like type. *G. papschii* has the same **diploid = 2n** chromosome set as *G. gaponii* and *G. taningaense*. Thus the three species can**not** be told apart by their ploidy.


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Fig. 3–4: GN 850/2784 *G. gaponii,* San Lorenzo (type locality). The body is dark green (3). P 212 *G. taningaense*, Taninga (type locality). The body is greyish green (4).

Fig. 5–6: TS 843 *G. bruchii* subsp. *brigittae,* San Gerónimo. The plants offset abundantly (5). TS 734 *G. capillense,* Jaime. The plants often offset at old age (6).

Fig. 7–8: TS 261 *G. parvulum,* Panaholma. The number of ribs is large (7). TS 246 *G. parvulum* subsp. *amoenum,* Las Palmas. The plants offset at old age (8).

Fig. 9: WP 83/111 *G. papschii,* San Javier (type locality). The spines are more needle-like than with *G. gaponii* (photo: Wolfgang Papsch).

The **petals** of *G. gaponii* (fig. 10) have a slightly rose-coloured shimmer, those of *G. taningaense* (fig. 11) are purely white. The **pericarp** of *G. gaponii* is more intensively rose-coloured than that of *G. taningaense*, which could be described as washed-out rose-coloured. The filaments of *G. taningaense* are yellowish and the style is greenish yellow. The filaments of *G. gaponii* are yellow with a rose-coloured base. The ovary of *G. gaponii* is slightly wide, that of *G. taningaense* is more slender.

The flower structure of *G. bruchii* subsp. *brigittae* differs strongly from the other species with its markedly smaller flower and its short ovary (fig. 12).

G. capillense, too, exhibits another flower structure, respectively a wider, succulent flower with a clearly wide ovary (fig. 13).

Flower and ovary of *G. parvulum* are large and wide (fig. 14).

The pericarp of *G. parvulum* subsp. *amoenum* has a tendency to be wide. The petals recurve at the peak of anthesis (fig. 15).

G. papschii's ovary structure resembles that of *G. gaponii* and differs from *G. taningaense* (fig. 16).

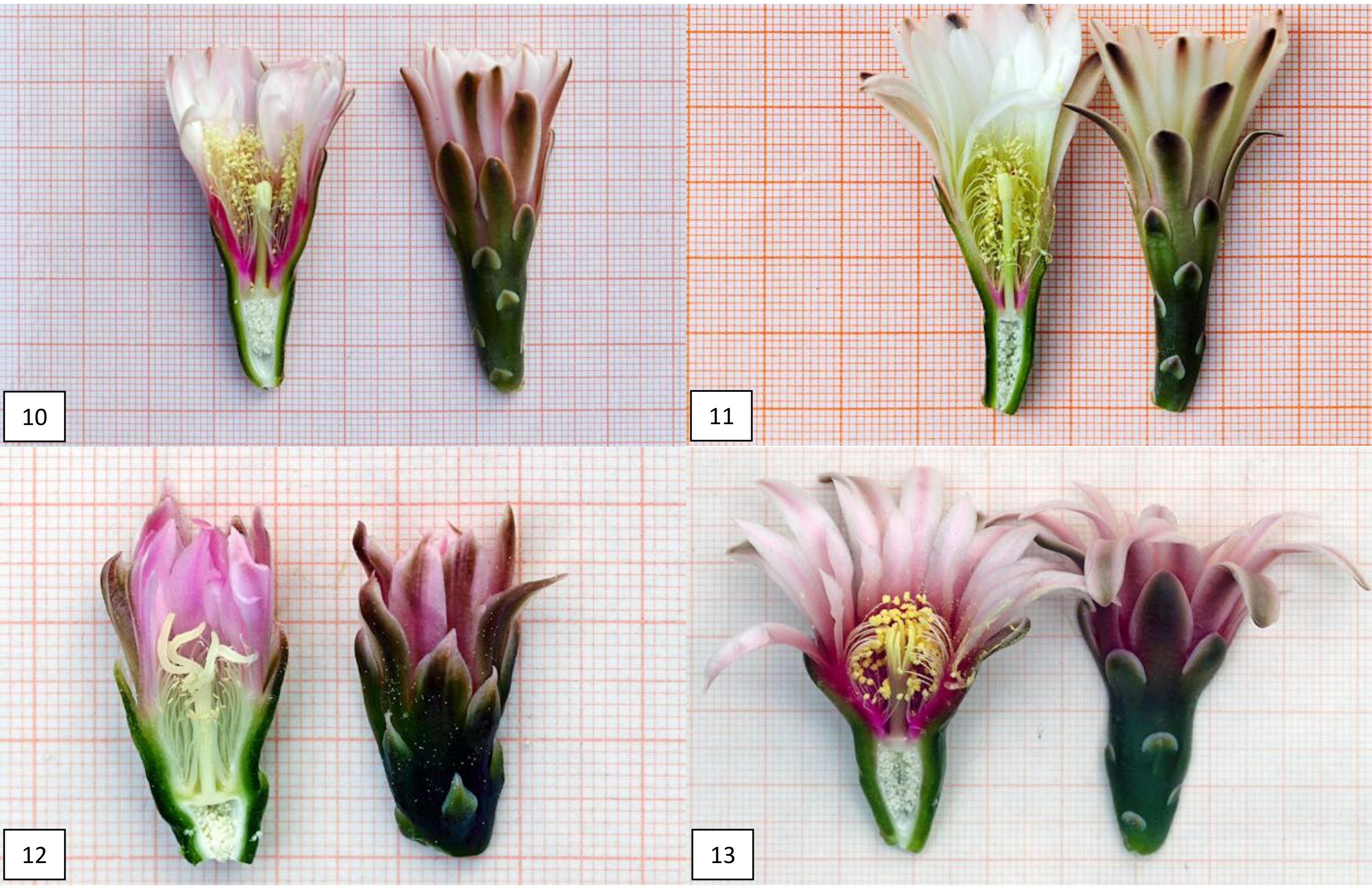

Fig. 10–13: GN 850/2784 *G. gaponii* type, flower with **intensively rose-coloured pericarp** and wide ovary (10). P 212 *G. taningaense* type, flower with **washed-out rose-coloured pericarp** and slender ovary (11). TS 843 *G. bruchii* subsp. *brigittae*, with smaller flower and short ovary (12). TS 734 *G. capillense*, with large flower and markedly wide ovary (13).


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Fig. 14–16: TS 261 *G. parvulum*, with large flower and wide ovary (14). TS 246 *G. parvulum* subsp. *amoenum*, with large flower (15). WP 83/111 *G. papschii* with wide ovary (16) (photo: Wolfgang Papsch).

The hilum of *G. gaponii's* and *G. taningaense's* **seeds** as well as those of *G. bruchii* subsp. *brigittae* is constricted in such a way as to resemble drop-shape. Not only *G. gaponii*, but also *G. taningaense* and *G. bruchii* subsp. *brigittae* possess a cuticula which comes off in parts and large, up to 1.3 mm long seeds (fig. 17–19).

G. capillense does not possess a cuticula which comes off in parts, for this reason the seed has a uniformly black appearance. The hilum of *G. capillense* is wider, almost round and the seeds are also smaller, merely about 1 mm long (fig. 20).

Neither *G. parvulum* nor G. *parvulum* subsp. *amoenum* have a cuticula which comes off in parts and their seeds therefore appear black. The hilum of *G. parvulum* and *G. parvulum* subsp. *amoenum* has the tendency to be wide and the seeds are smaller than those of *G. taningaense* and *G. gaponii* (fig. 21–22).

G. papschii also possesses a cuticula which comes off in parts and large seeds together with a hilum with a tendency to be constricted, forming a drop shape. The hilum is also slightly extended. No substantial differences in comparison with *G. taningaense* resp. *G. gaponii* can be noticed (fig. 23).


17


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Fig. 17–20: GN 850/2784 *G. gaponii*, with large seeds and a cuticula which comes off in parts as well as a drop-shaped hilum (17) (all seed photos by Volker Schädlich). P 212 *G. taningaense*, with large seeds and a cuticula which comes off in parts as well as a drop-shaped hilum (18). TS 843 *G. bruchii* subsp. *brigittae*, large seeds and a drop-shaped hilum. The cuticula, which comes off in parts, is hard to recognize (19). TS 734 *G. capillense*, seeds without a cuticula that comes off in parts as well as a larger hilum and smaller seeds (20).


21


22

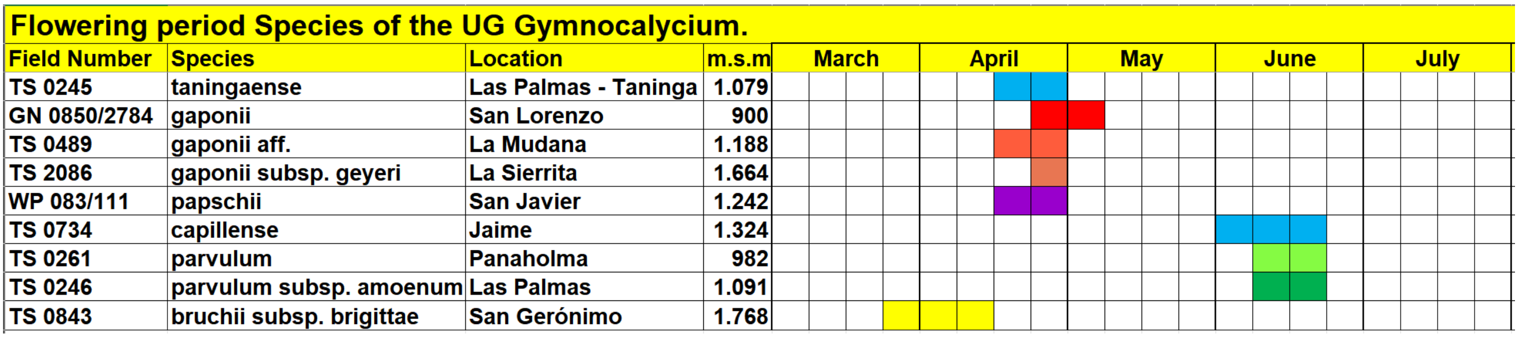
Fig. 21–22: TS 261 *G. parvulum*, seeds without a cuticula that comes off in parts as well as a rounded hilum and smaller seeds (21). TS 246 *G. parvulum* subsp. *amoenum*, seeds without a cuticula which comes off in parts as well as a rounded hilum and smaller seeds (22).


23

Fig. 23: WP 83/111 *G. papschii*, large seeds and a cuticula which comes off in parts as well as drop-shaped hilum.

The annual **flowering period** of *G. bruchii* subsp. *brigittae* starts before that of all the other species of the subgenus *Gymnocalycium*, followed by *G. gaponii* aff., *G. taningaense* and *G. papschii, G. gaponii* subsp. *geyeri* and *G. gaponii* type plants. The latest flowering periods to start are those of

G. parvulum, *G. parvulum* subsp. *amoenum* and *G. capillense.* That is why not only *G. bruchii* subsp. *brigittae,* but also *G. capillense, G. parvulum* and *G. parvulum* subsp. *amoenum* can be definitely told apart from the other representatives of the subgenus *Gymnocalycium* by their flowering patterns. The species *G. taningaense* and *G. gaponii* remain to be taken a closer look at. The respective details are going to be revealed in the following chapters as well as in part 2 of this article.



Flowering period Species of the UG Gymnocalycium.																							
Field Number	**Species**	**Location**	**m.s.m**	**March**				**April**				**May**				**June**				**July**			
TS 0245	**taningaense**	**Las Palmas - Taninga**	**1.079**							🟦	🟦												
GN 0850/2784	**gaponii**	**San Lorenzo**	**900**								🟥	🟥											
TS 0489	**gaponii aff.**	**La Mudana**	**1.188**							🟧	🟧												
TS 2086	**gaponii subsp. geyeri**	**La Sierrita**	**1.664**								🟧												
WP 083/111	**papschii**	**San Javier**	**1.242**							🟪	🟪												
TS 0734	**capillense**	**Jaime**	**1.324**													🟦	🟦	🟦					
TS 0261	**parvulum**	**Panaholma**	**982**														🟩	🟩					
TS 0246	**parvulum subsp. amoenum**	**Las Palmas**	**1.091**														🟩	🟩					
TS 0843	**bruchii subsp. brigittae**	**San Gerónimo**	**1.768**				🟨	🟨	🟨														

Tab. 1: Flowering period, Basel 2025.

Gymnocalycium taningaense

The first description originates from 1990 and was established by Jörg Piltz. The location is on a high plateau, which stretches out west of the Sierras Grandes. *G. taningaense* grow in the middle of the extended *G. gaponii* area in the region north and above all west, southwest and south of the town Taninga (fig. 24).

Gymnocalycium taningaense sensu stricto (s.s.)

The plants which correspond with the first description of *G. taningaense* are going to be dealt with first. There are several volcanoes north of *G. taningaense's.* distribution area (fig. 26). West of Taninga, respectively south of the volcanoes, there is the small distribution area. It is on small hills which are situated on the edge of a high plateau (fig. 25, shaded violet). Neither on the high plateau nor at higher altitudes do *G. taningaense* in the stricter sense occur any longer. Plants similar to *G. gaponii* grow in the north-western region of the map section (fig. 25, shaded red).

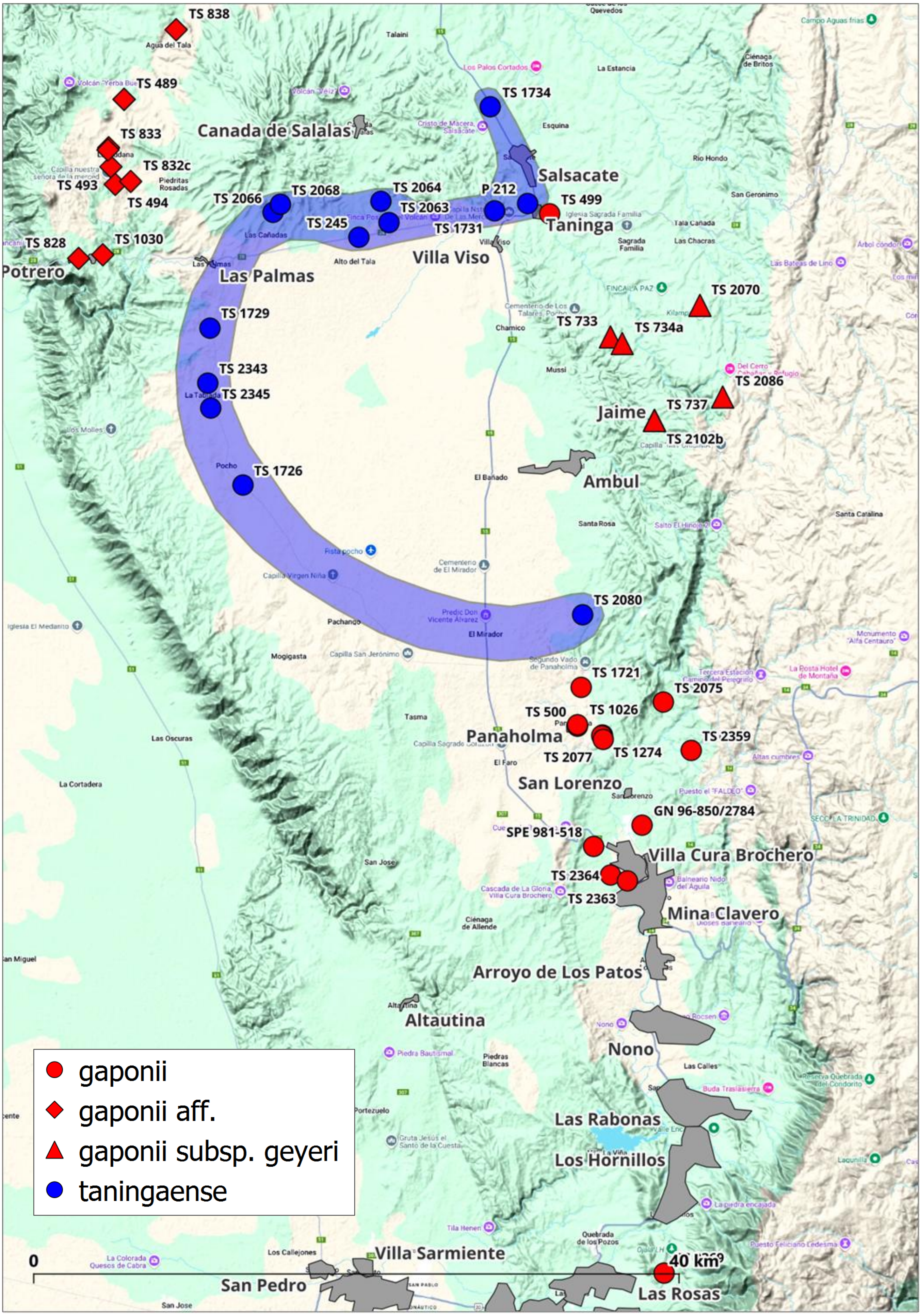


Fig. 24: Distribution area of *G. taningaense* (blue area).

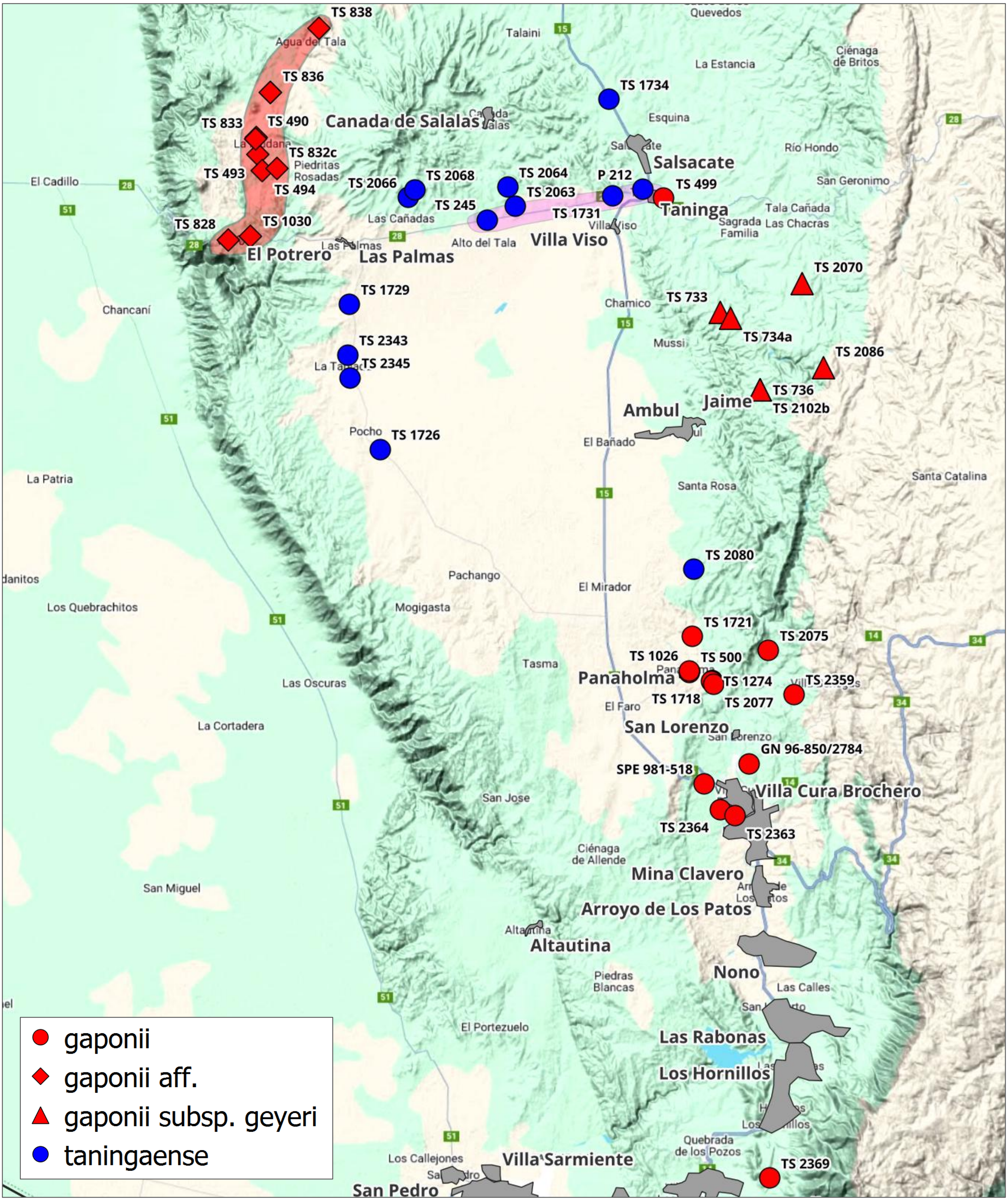


Fig. 25: Distribution area of *G. taningaense* sensu stricto (west of Taninga) and *G. gaponii* aff. (in the north-western area).

Fig. 26: Viewing the volcanoes from the north.

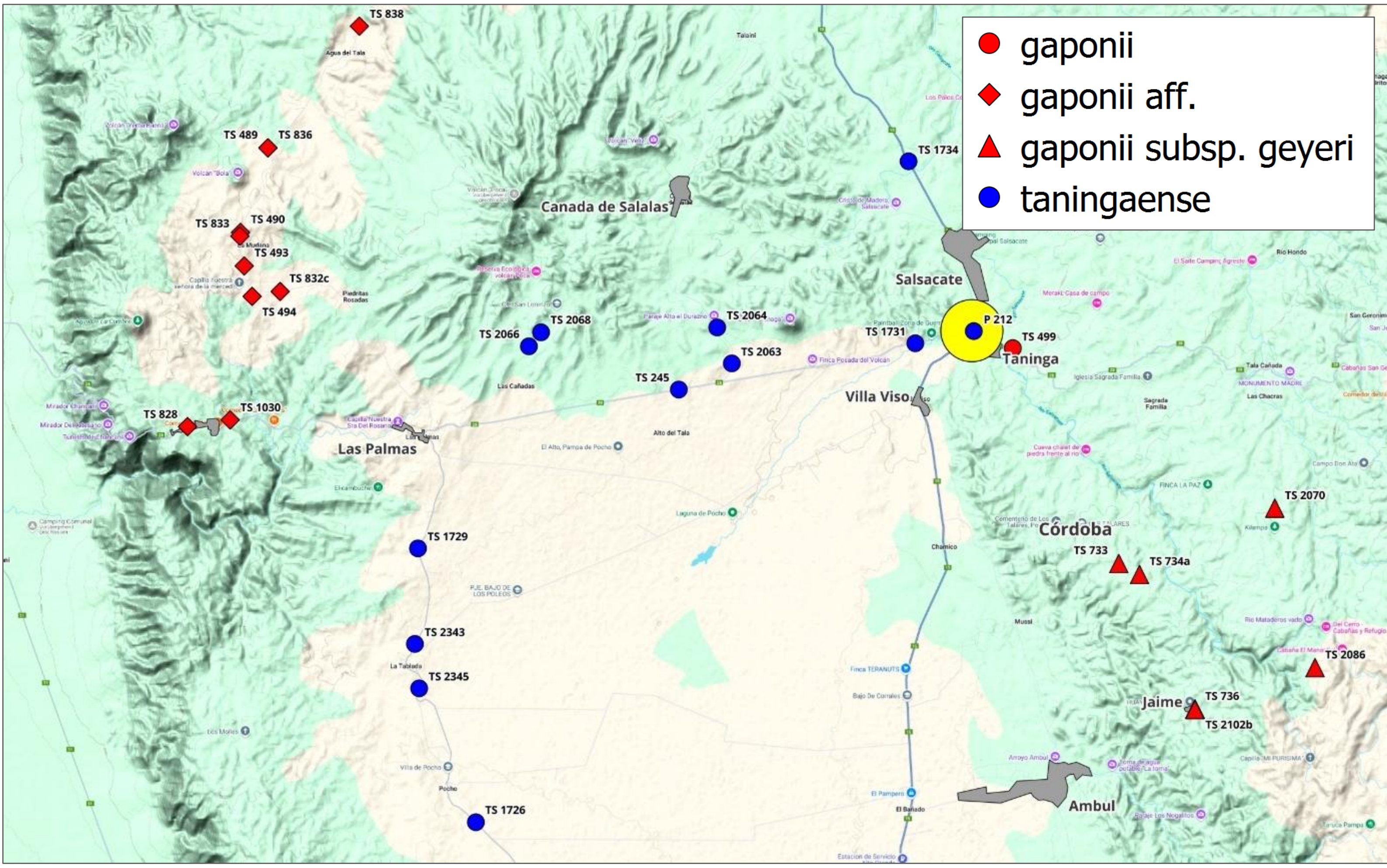


Fig. 27: Yellow shaded area = type locality of P 212, *G. taningaense,* Taninga, 950 m a.s.l.

G. taningaense's type locality is situated near the village Taninga (P 212) (fig. 27). The first description considers merely plants from this population, surrounding localities were not taken into account. Thus it is not surprising that slightly differing features of plants not originating from the type locality are not mentioned. In his differentiating analysis Jörg Piltz compares *G. taningaense* to *G. calochlorum*, which is called *G. parvulum* (in Hans Till's sense) by the author in this article. At the time when the fist description was established no further species from the subgenus *Gymnocalycium* were known from this area.

The plant depicted in fig. 28 descends from an offset of a plant imported by Jörg Piltz. The colour of the body remains **greyish brown** even during the vegetation period. The same applies to seedlings. The plants possess grey to greyish brown, **needle-like, thin spines,** which have a darker base. **Central spines** are mostly formed at older age, the ribs are numerous. The distances between the areoles are narrow. Older plants have a tendency to offset (fig. 28–30).

The ploidy of the plants is **diploid = 2n**.


28


29


30

Fig. 28–30: P 212 *G. taningaense* type. **Grey-green** body with **grey to greyish brown**, needle-like, thin spines. Central spines are missing (28). P 212 *G. taningaense* type. Grey-green to brown body with **grey to greyish brown,** needle-like, thin spines. Central spines are present (29). P 212 *G. taningaense* type. **Grey-green** body with **grey to greyish brown**, needle-like, thin, slightly protruding spines as well as central spines (30)**.**

The **flowers** of type locality plants are homogeneously structured and coloured. The **filaments** are **yellow,** the style is **greenish yellow**.

The pericarp is **pale rose-coloured** respectively washed-out rose-coloured. The ovary is slender and of medium length to slightly elongated (fig. 31–33).

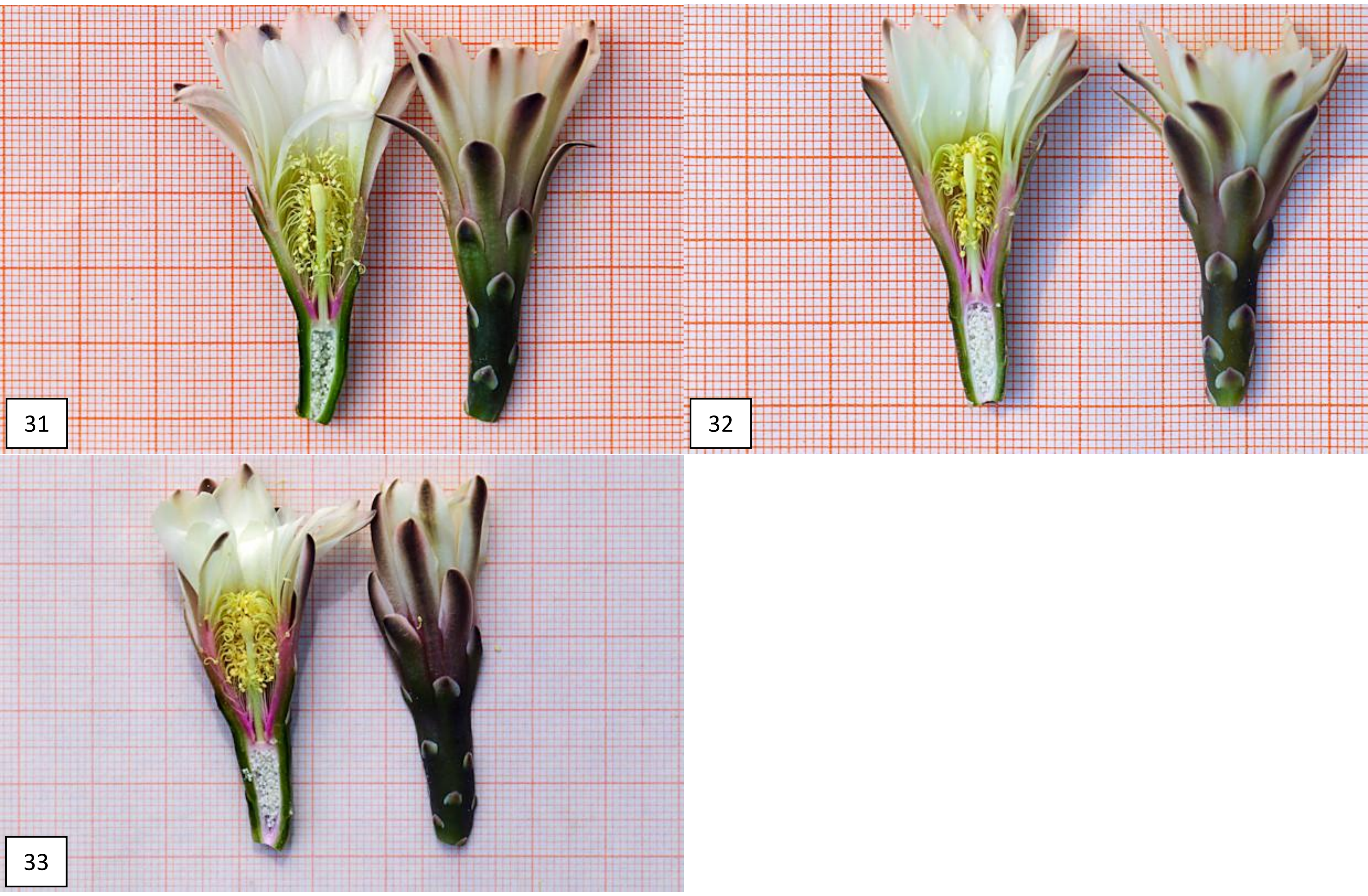


Fig. 31–33: P 212 *G. taningaense* s.s., flowers with greenish yellow style and pale rose-coloured pericarp as well as a slender ovary.

Further representatives of *G. taningaense* sensu stricto can be found west of the type locality (fig. 34). The locality is a rocky hill grown over with acacia (fig. 35). The plants' ploidy is **2n = diploid**.

Fig. 34: Habitat of TS 1731 with a view of the Sierras Grandes in the background.

The plants in cultivation conform to the typical *G. taningaense* appearance with **greyish brown-green body colour** and **greyish, thin spines** with a brown base. The spines are needle-like and slightly protruding from the body. Young plants already form **central spines** (fig. 36–37), even seedlings possess the entire features of the adult plants (fig. 38–39).

The ploidy of these plants is **diploid = 2n**.

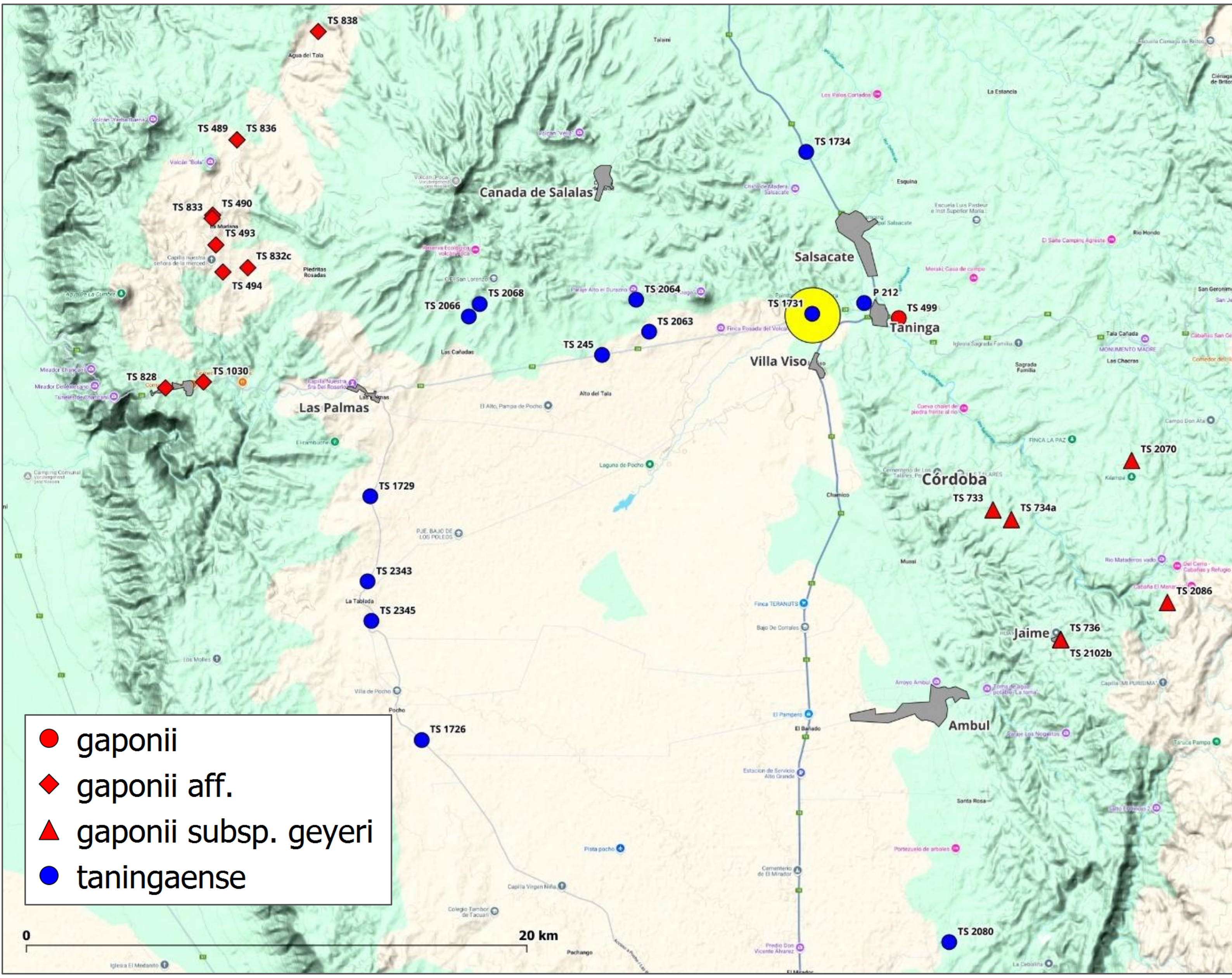


Fig. 35: Yellow shaded area = locality of TS 1731, 3 km west of Taninga, 974 m a.s.l.

Fig. 36–37: TS 1731 *G. taningaense* s.s., **greyish green** body with needle-like, greyish brown, thin and protruding spines as well as **central spines**.


38


39

Fig. 38–39: TS 1731 *G. taningaense* s.s., seedlings already possess the typical **grey-green** body and the needle-like, grey-brown, thin and protruding spines as well as **central spines**.

The **flower** features already start to change slightly and deviate somewhat from the flowers of the type plant. The pericarp is **pale rose-coloured** to **intensively rose-coloured**. Structure and colour of the flowers essentially correspond with the type. The filaments are yellow and the style is greenish yellow. The ovary varies, it is delicate to somewhat wide (fig. 40–43).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42


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Fig. 40–43: TS 1731 *G. taningaense* s.s., flower with slightly **more intensively rose-coloured** pericarp and slender ovary (40). TS 1731 *G. taningaense* s.s., flower with slightly **more intensively rose-coloured** pericarp and slightly **wide ovary** (41). TS 1731 *G. taningaense* s.s., flower with **pale rose-coloured** pericarp and slender ovary (42). TS 1731 *G. taningaense* s.s., flower with slightly **more intensively rose-coloured** pericarp and slender ovary (43).

The **fruit colour** corresponds with the body colour, it is always **grey-green to dark green** (fig. 44–45).

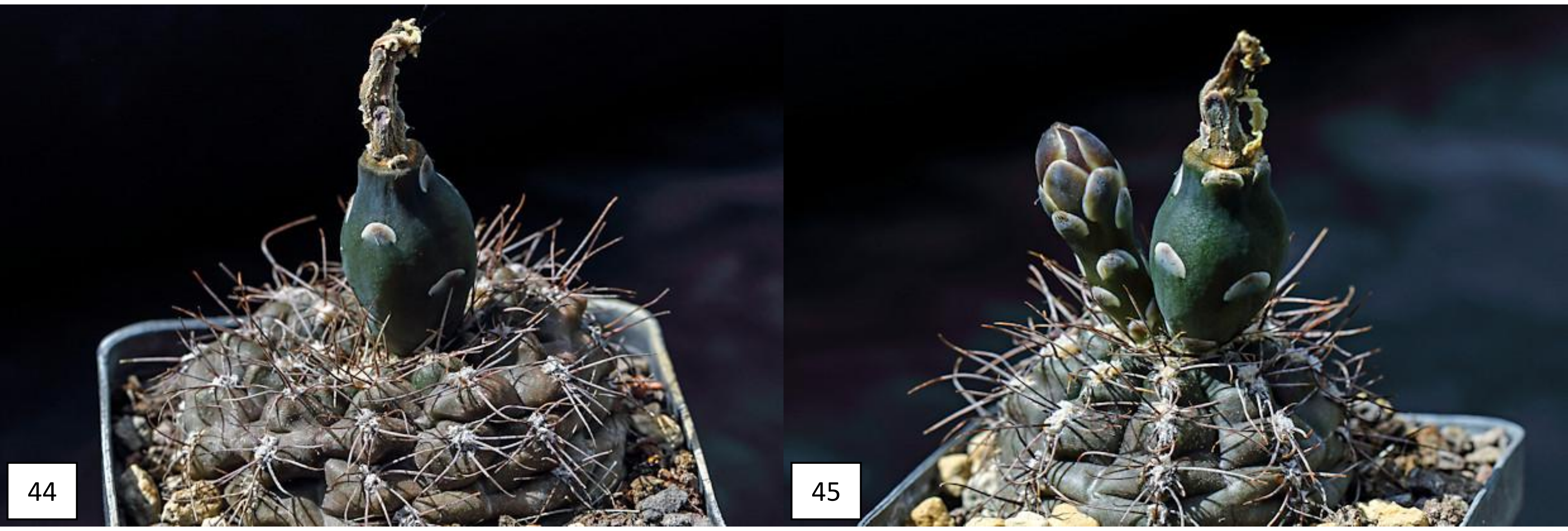


Fig. 44–45: TS 1731 *G. taningaense* s.s., the fruit colour is grey-green to dark green.

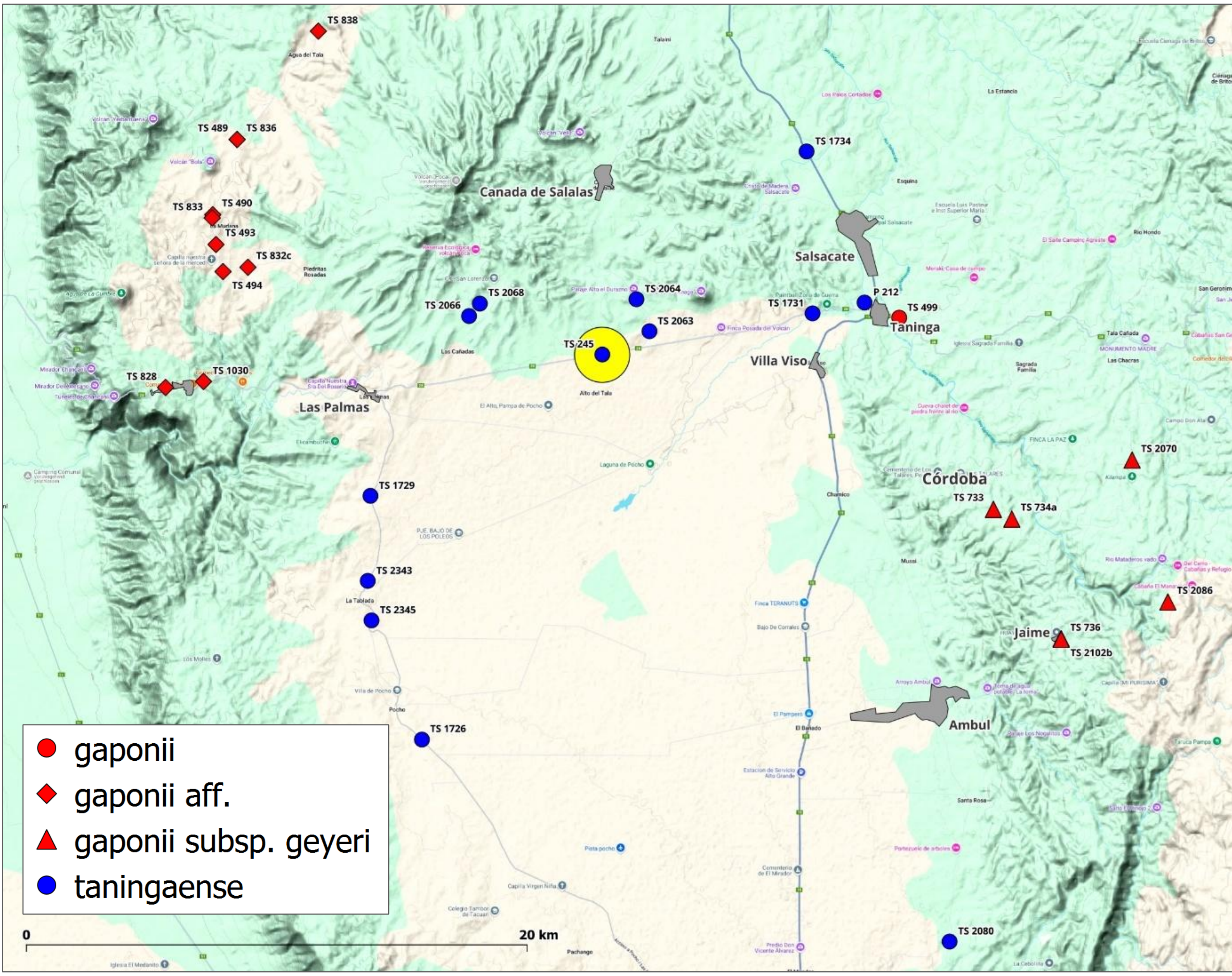


Fig. 46: Yellow shaded area = locality of TS 245, 12 km west of Taninga, 1,079 m a.s.l.

Fig. 47: Habitat of TS 245. The plants grow sheltered by acacia bushes.

At another locality which is located around 12 km west of the type locality the features of the plants already begin to change slightly (fig. 46). The plants grow on rocky hills in volcanic sediments, mostly sheltered by acacia bushes (fig. 47).

The plants suffer when exposed to the blazing sun, which causes their epidermis to become brownish (fig. 48). Otherwise their epidermis is greyish green, central spines are rarely present (fig. 49–51). In nature the plants are not easy to find. In spring they are more easily recognizable from their flowers or fruits. In midsummer the plants are sunken into the ground and often covered with sand.

48

49

Fig. 48–49: TS 245 *G. taningaense* s.s., the plant body is brownish or greyish-green when exposed to full sun.

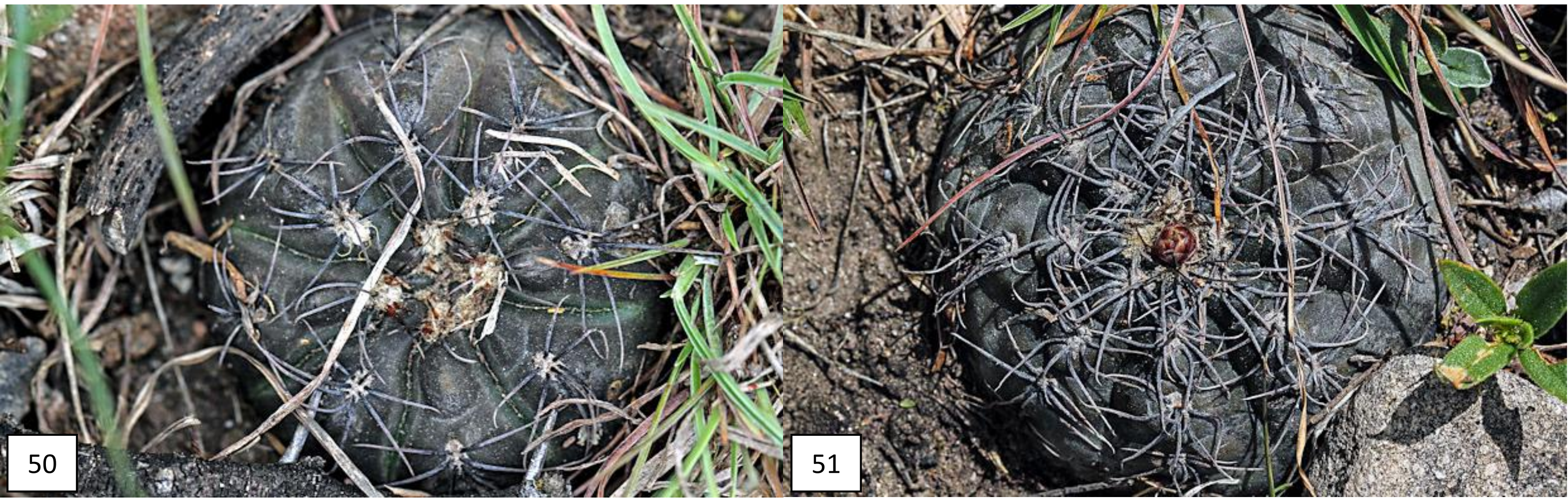


Fig. 50–51: TS 245 *G. taningaense* s.s., the plant body is brownish or greyish-green when exposed to full sun.

The offspring from this locality are somewhat variable. The bodies are **greyish green**, the spines are needle-like and protruding from the body. The colour of spines is **greyis**h to **horn-coloured with a brownish to yellowish base**. **Central spines** are often present (fig. 52–55).

As with all *G. taningaense* plants the ploidy is **2n = diploid**.

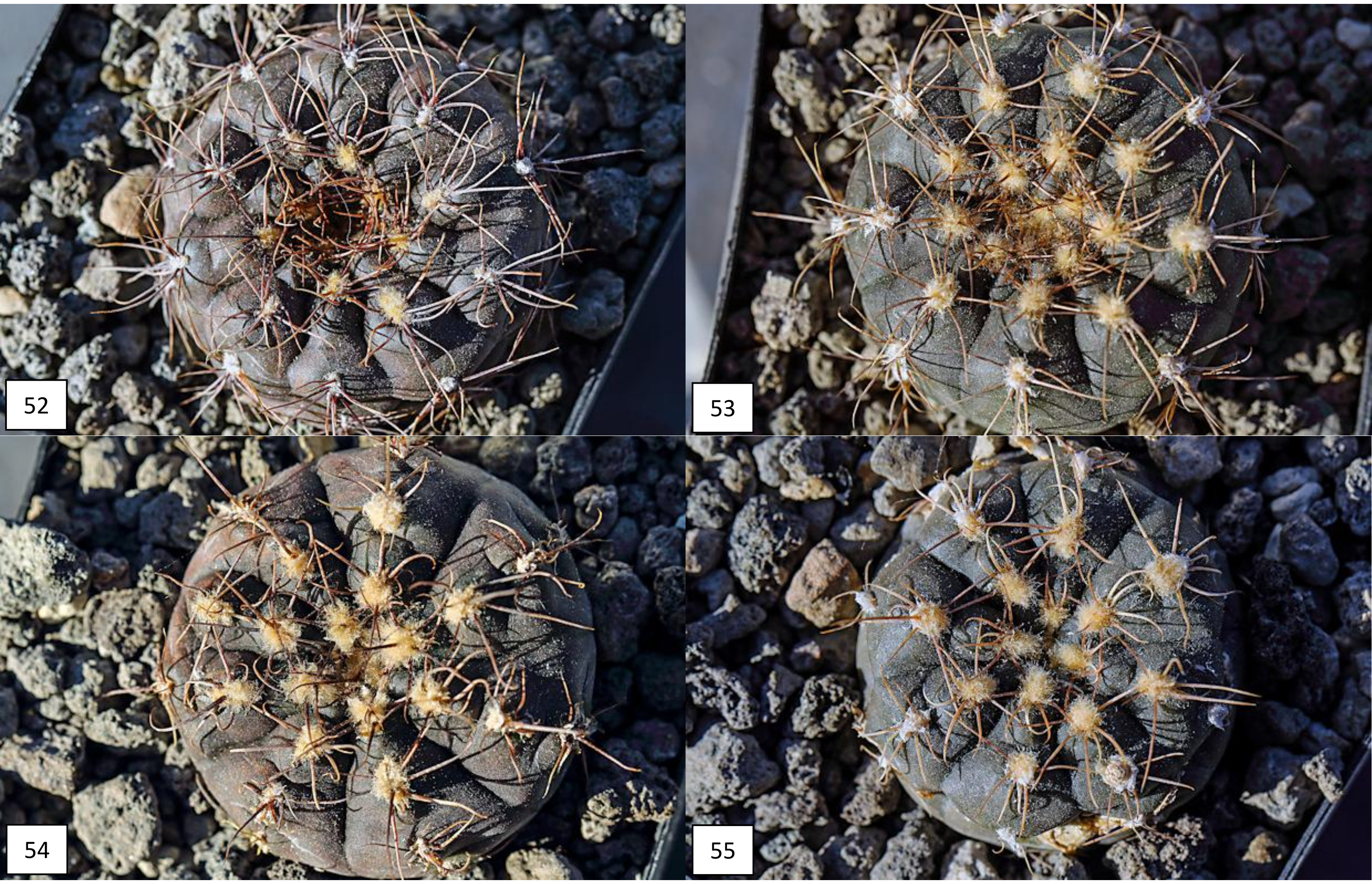


Fig. 52–55: TS 245 *G. taningaense* s.s., greyish-green epidermis and greyish to horn-coloured spines with a brownish base. Central spines are present (fig. 52–54). TS 245 *G. taningaense* s.s., greyish to grey-greenish epidermis and greyish to horn-colored spines with brownish base. Central spines are not (yet?) present (55).

The **flowers** of plants from this locality essentially correspond with the *G. taningaense* type. The petals are purely white, the pericarp is **pale rose-coloured to intensively rose-coloured**. The filaments are yellow, the style greenish yellow. The ovary is somewhat variable, slender to **slightly thickened** (fig. 56–59).


56


57

Fig. 56–57: TS 245 *G. taningaense* s.s., flower with **pale rose-coloured** pericarp and slender ovary (56). TS 245 *G. taningaense* s.s., flower with **slightly more intensively rose-coloured p**ericarp and slender ovary (57).


58


59

Fig. 58–59: TS 245 *G. taningaense* s.s., flower with **slightly more intensively rose-coloured** pericarp and **slightly wide ovary** (58). TS 245 *G. taningaense* s.s., flower with **slightly more intensively rose-coloured** pericarp and slender ovary (59).

The **fruit colour is grey to grey-green**. The spines are needle-like. Central spines are mostly present. No differences can be discerned when compared to the type plant (fig. 60–63).

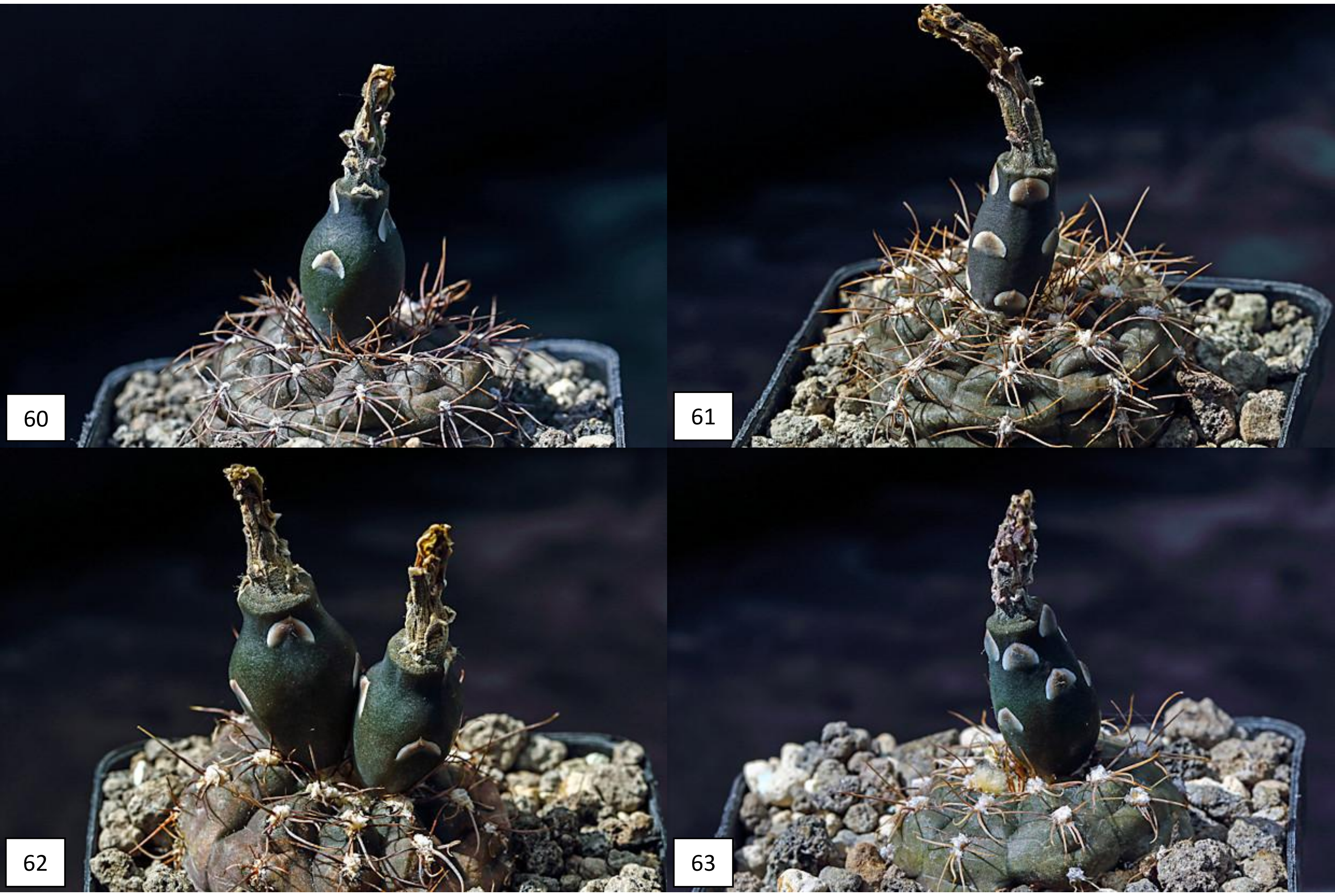


Fig. 60–63: TS 245 *G. taningaense* s.s., the fruit colour is grey-green to dark green.

Comparison of *G. taningaense* sensu stricto

D The plant body of all *G. taningaense* sensu stricto is **grey-green to greenish grey**. The numerous spines are thin, grey with a brownish base as well as protruding from the body. Central spines are mostly present (fig. 64–66).

The style is greenish-yellow, the filaments are yellow. The ovary is slender and slightly elongated. The interior of the pericarp is **pale rose-coloured to slightly more intensively rose-coloured** (fig. 67–69).

When older, that is beginning at around ten years of age, the plants start offsetting from old areoles located close to the base (fig. 70–71).


64


65


66

Fig. 64–66: P 212 *G. taningaense* s.s., **grey-green-brown** body with **grey to greyish brown** needle-like thin spines (64). TS 1731 *taningaense* s.s., **grey-green** body with **needle-like, grey-brown,** thin spines (65). TS 245 *G. taningaense* s.s., the epidermis is greyish green, the spines are **greyish to horn-coloured** with a brownish yellow base (66).


67


68

Fig. 67–68: P 212 *G. taningaense* s.s., the flower has a greenish yellow style and a pale rose-coloured pericarp as well as a slender ovary (67). TS 1731 *G. taningaense* s.s., the flower has a greenish yellow style and a slightly **more intensively rose-coloured** pericarp as well as a slender ovary (68).

Fig. 69: TS 1731 *G. taningaense* s.s., the flower has a greenish yellow style and a slightly **more intensively rose-coloured** pericarp as well as a slender ovary.

Fig. 70–71: P 212 *G. taningaense* s.s., the plants start offsetting at old age.

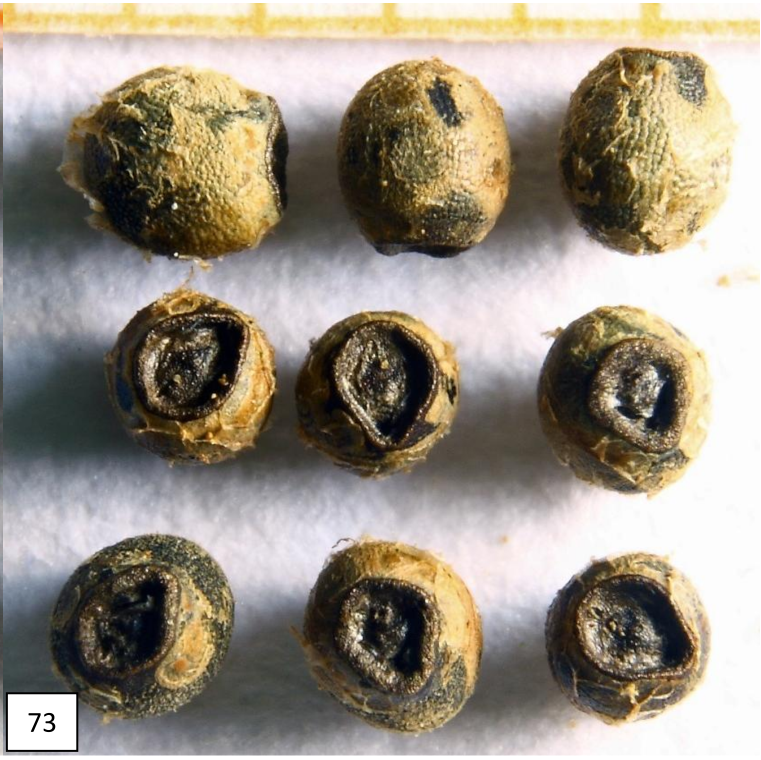


Fig. 72–73: P 212 *G. taningaense* s.s., the seeds are large and covered with a cuticula that comes off in parts. The hilum is drop-shaped (72). TS 1731 *G. taningaense* s.s., the seeds are large and covered with a cuticula that comes off in parts. The **hilum** is **very small** (73).

Fig. 74: TS 245 *G. taningaense* s.s., the seeds are large and covered with a cuticula that comes off in parts. The hilum is drop-shaped and slightly wide. The edge of the hilum is black-brown.

The seeds are about **1.3 mm long**. The hilum is **drop-shaped**, constricted to slightly wide. **The cuticula comes off heavily** and the seeds thus have a brownish, not a black appearance (fig. 72–74).

The ploidy of all investigated plants is **2n = diploid**.

G. taningaense sensu stricto are typical early bloomers. The flowering period is uniform.

Flowering Period *Gymnocalycium taningaense* sensu stricto.

Field Number	Species	Location	m.s.m	March				April				May				June				July			
P 212	*taningaense* sensu stricto.	Taninga	950							■	■	■											
TS 1731	*taningaense* sensu stricto.	Taninga	940							■	■												
TS 0245	*taningaense* sensu stricto.	Taninga - Las Palmas	1.079							■	■	■											

Tab. 2: Flowering period of *G. taningaense* sensu stricto, Basel 2025.

Gymnocalycium taningaense sensu lato (s.l.)

This chapter is going to present plants which do not correspond with the *G. taningaense* type in every feature. However, they do not match *G. gaponii* sensu stricto either.

The habitat is interspersed with slabs and lined with acacia (fig. 75).

North of the *G. taningaense* type locality further plants occur which can be assigned to *G. taningaense* sensu lato (fig. 76).

Fig. 75: The habitat of TS 1734 is interspersed with rock slabs (photo: Horst Kallenowsky).

The plants populate rock terraces or meadowy terrain. The body colour is **green-grey**. The spines are grey with a slightly reddish base, they are **close to the body**. **No central spines** are present (fig. 77–80).

The cultivated plants do not correlate with *G. taningaense* in its closer sense. The **greener** body colour and the spine position, which is **close to the body**, as well as the **horn-coloured and longer spines** deviate. **No central spines** are present (fig. 81).

Both **flower structure** and colour of the flower match the *G. taningaense* type to the greatest possible extent. The petals are **purely white**. The style is greenish yellow, the filaments are yellow with a **slightly rose-coloured base**. The pericarp is pale rose-coloured and the ovary is slender (fig. 82).

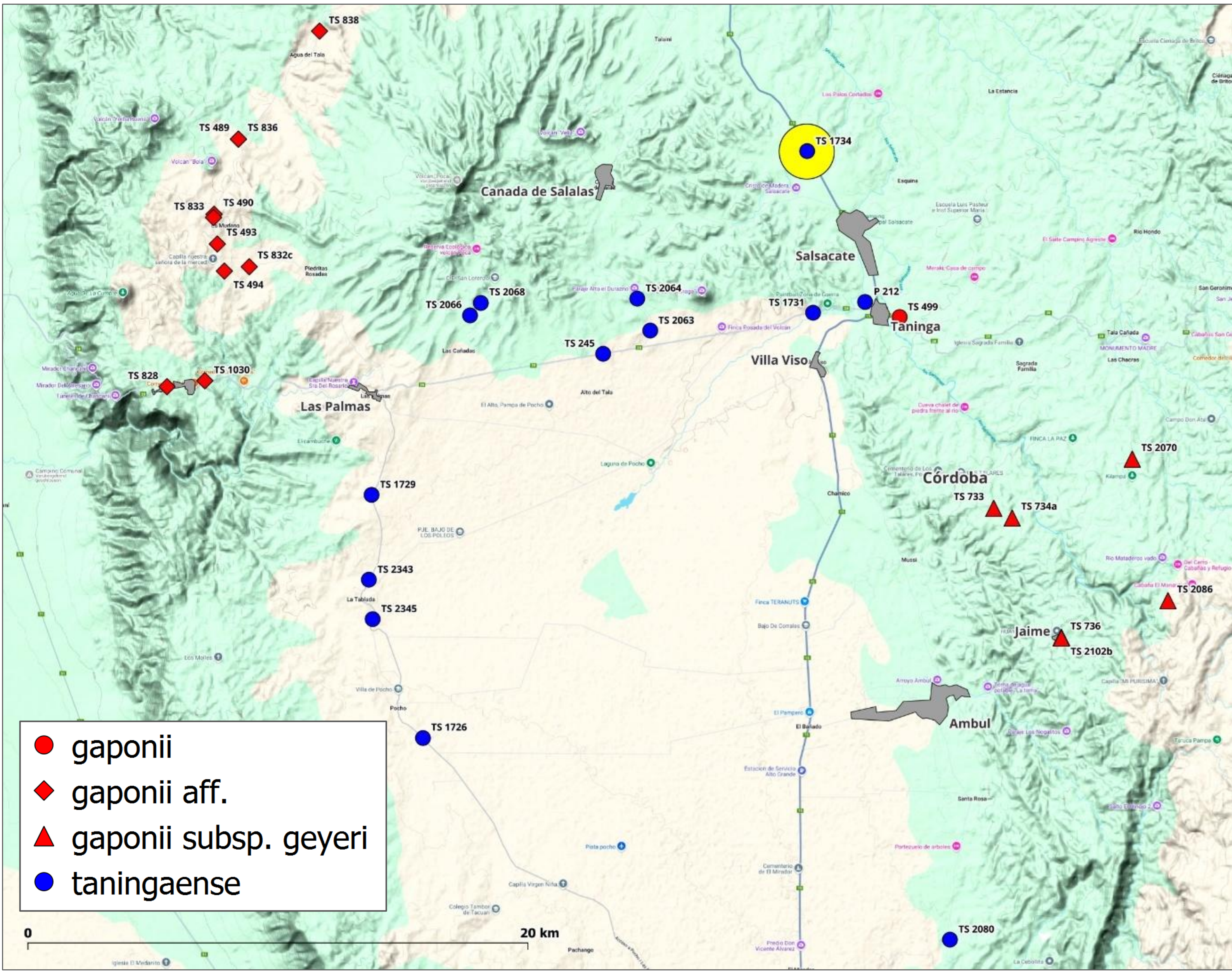


Fig. 76: Yellow shaded area = locality of TS 1734, 9 km north of Taninga, 924 m a.s.l.

Fig. 77–78: TS 1734 *G. taningaense* s.l., the plants populate rock terraces and grow in meadowy terrain.


79


80

Fig. 79–80: TS 1734 *G. taningaense* s.l., the spines are grey with a slightly reddish brown base and **close to the body** (79). TS 1734 *G. taningaense* s.l., central spines are **not** present (80).

The cultivated plants do not correlate with *G. taningaense* in its closer sense. The **greener** body colour and the spine position, which is **close to the body**, as well as the **horn-coloured and longer spines** deviate. **No central spines** are present (fig. 81).

Both **flower structure** and colour of the flower match the *G. taningaense* type to the greatest possible extent. The petals are **purely white**. The style is greenish yellow, the filaments are yellow with a **slightly rose-coloured base**. The pericarp is pale rose-coloured and the ovary is slender (fig. 82).


81


82

Fig. 81–82: TS 1734 *G. taningaense* s.l., plant with a **green** epidermis, **spine position close to the body**, grey to **horn-coloured** longer spines with a reddish brown base. **No central spines** are present (81). TS 1734 *G. taningaense* s.l., the petals are purely white. The ovary is slender. The pericarp is pale rose-coloured. The style is greenish yellow, the filaments are yellow with a **slightly rose-coloured base** (82).

West of the type locality on a dirt road in the direction of the volcanoes there are additional localities of *G. taningaense* sensu lato (fig. 83).

The dense tangle of acacia shaded the cacti excessively (fig. 84). Two years later heavy forest fires had raged and the accompanying vegetation had totally burnt down. These bush fires are beneficial for cacti, which are usually only slightly damaged by the fire. The exceedingly shading bushes, yet, burn down completely (fig. 85).

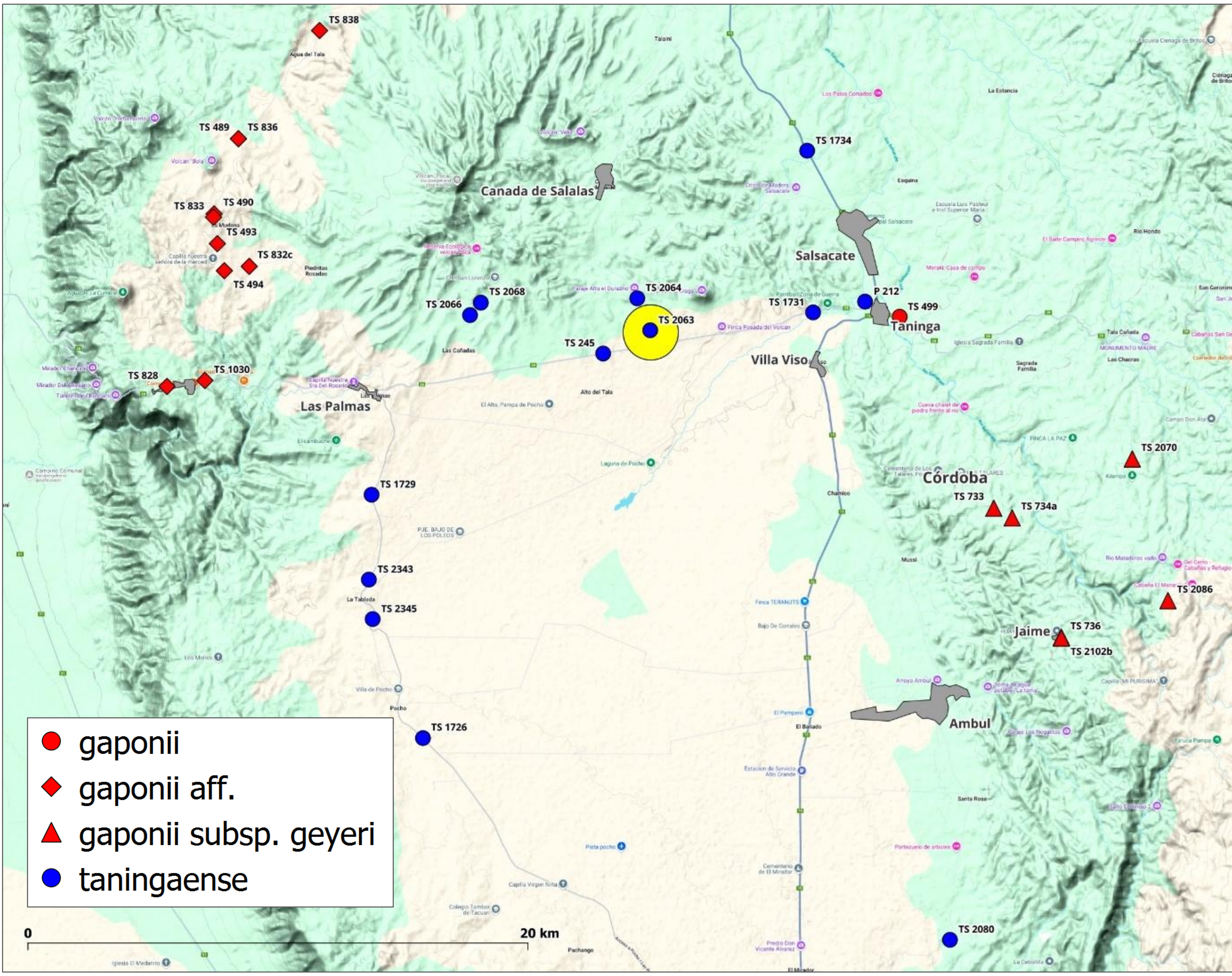


Fig. 83: Yellow shaded area = locality of TS 2063, 7.5 km south of Cañada de Salas, 1,036 m a.s.l.

Fig. 84: Habitat of TS 2063 with dense acacia covering (photo: Horst Kallenowsky).

Fig. 85: Habitat of TS 2063 after severe bush fires (photo: Maja Strub).

The appearance of the plants in nature somewhat diverges from the typical habitus. The body is grey-green, the spines are grey-brown and **close to the body**. There are **no** central spines. The plants grow in meadowy terrain with few rocks (fig. 86–88).


86


87


88

Fig. 86–88: TS 2063 *G. taningaense* s.l., plants with grey-green body and grey-brown spines which are close to the body. There is no central spine (photos: Horst Kallenowsky).

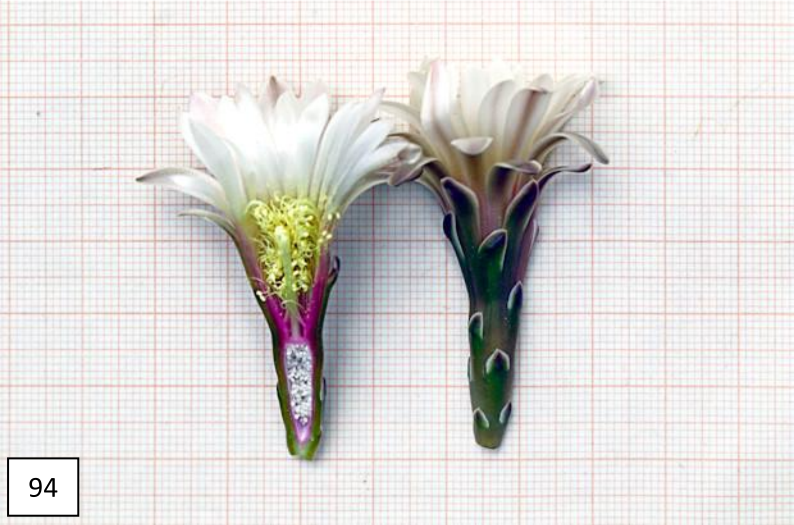
The appearance of the seedlings is somewhat variable. Noticeable is the **tendency towards a greener body** and the position of spines, which is close to the body to slightly intertwined as well as the greyish to **horn-coloured spines** with their reddish brown base, which differ from the type. **Central spines** are mostly formed. The seedling depicted in fig. 90 top right-hand side rather corresponds with the *G. taningaense* type, the others' habitus rather reminds of *G. gaponii* sensu lato (fig. 89–92).

Fig. 89–92: TS 2063 *G. taningaense* s.l., the epidermis is green-grey. The spines are close to the body and slightly **intertwined**, the spine colour is greyish to **horn-coloured** with a reddish brown base. **Central spines** are present (89). TS 2063 *G. taningaense* s.l., the seedlings' spine position is variable (90). TS 2063 *G. taningaense* s.l., plant with greyish to **horn-coloured, slightly thickened** spines with a reddish brown base (91). *G. taningaense* s.l., plant with **central spines** (92).

The **petals** are purely white. The pericarp is **more intensively rose-coloured** than with the *G. taningaense* type. The filaments are yellow. The style is greenish yellow, sometimes **turning into rose-colour** near the base. The ovary is slender, compressed to somewhat elongated. The flower does not correspond with the *G. taningaense* type in all features, although it merely matches *G. gaponii* with respect to colour of pericarp and only partly in its flower structure (fig. 93–95).

The predominantly **green fruit colour** does **not** match *G. taningaense* sensu stricto (fig. 96–97).


93


94


95

Fig. 93–95: TS 2063 *G. taningaense* s.l., the flower is slender and possesses a **rose-coloured pericarp** (93). TS 2063 *G. taningaense* s.l., both the **pericarp** and the **lower part of the style** are **intensively rose-coloured** (94). TS 2063 *G. taningaense* s.l., the flower has a slightly wide ovary (95).


96


97

Fig. 96–97: TS 2063 *G. taningaense* s.l., the fruit colour is mainly green.

Another locality is situated in the direction of the small village Cañada de Salas (fig. 98–100).

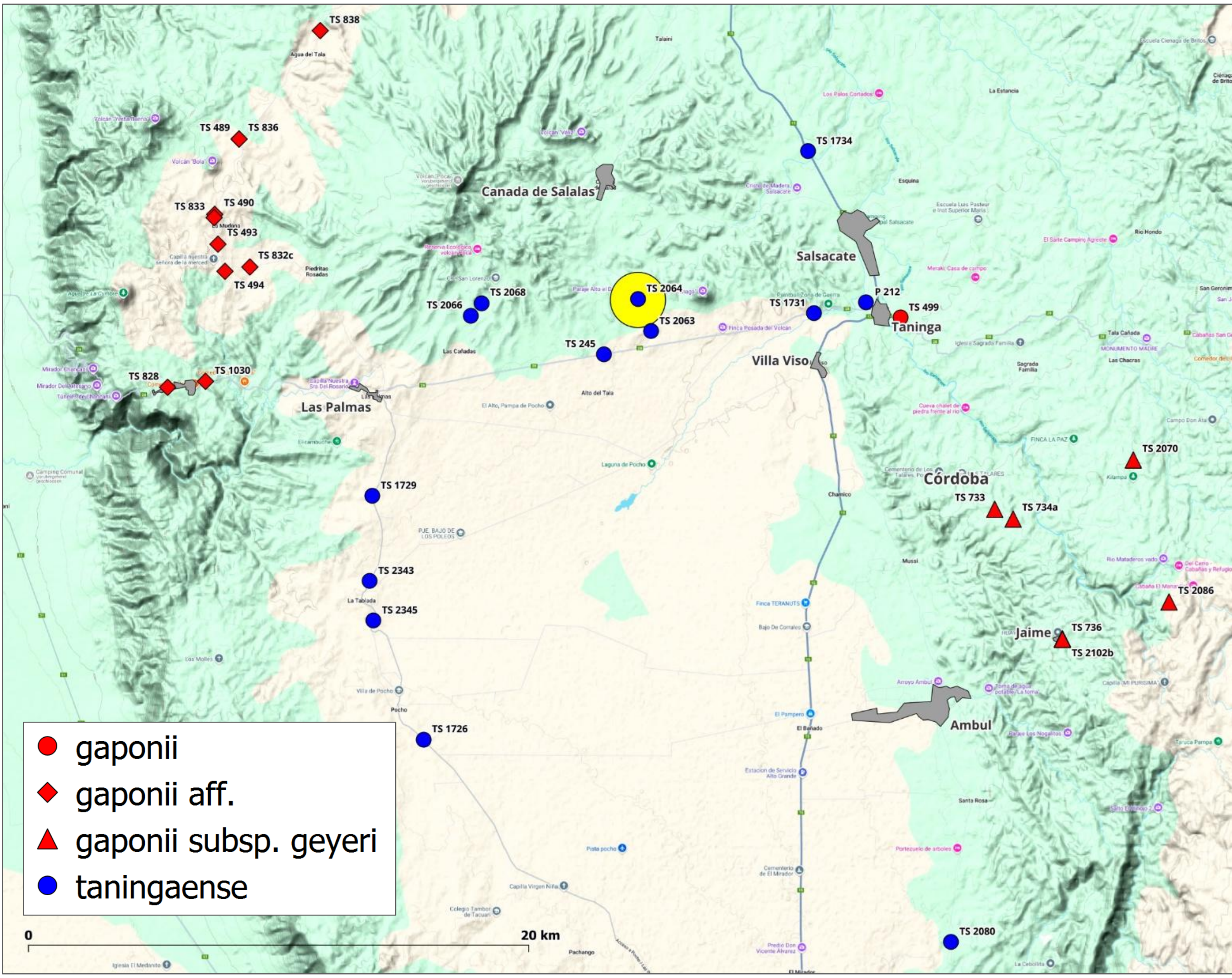


Fig. 98: Yellow shaded area = locality of TS 2064, 5.7 km south of Cañada de Salas, 1,052 m a.s.l.

Fig. 99: The habitat of TS 2064 is covered with brittle bushes (photo: Horst Kallenowsky).

Fig. 100: TS 2064, the bushes have burnt to the ground (photo: Maja Strub).

The plants in nature possess on the one hand the typically greyish green *G. taningaense* epidermis, on the other hand they are **more greenish** and somewhat more column-like. Their spine colour is greyish, central spines are partly present (fig. 101–104).

Fig. 101–102: TS 2064 *G. taningaense* s.l., the plant grows to a slightly column-like shape and has a greenish epidermis (101). TS 2064 *G. taningaense* s.l., the plant possesses a greyish green epidermis (102) (photos: Horst Kallenowsky).

Fig. 103–104: TS 2064 *G. taningaense* s.l., the plants possess greyish spines, central spines are present (103) (photo: Horst Kallenowsky). TS 2064 *G. taningaense* s.l., the plant is singed by a bush fire (104).

The epidermis of the plants in cultivation is **green-grey**. The spines are needle-like and close to the body as well as **greyish to horn-coloured** with a reddish brown base. Central spines are not formed (yet?). The plants' appearance reminds of *G. taningaense*, but influenced by *G. gaponii* (fig. 105–108).

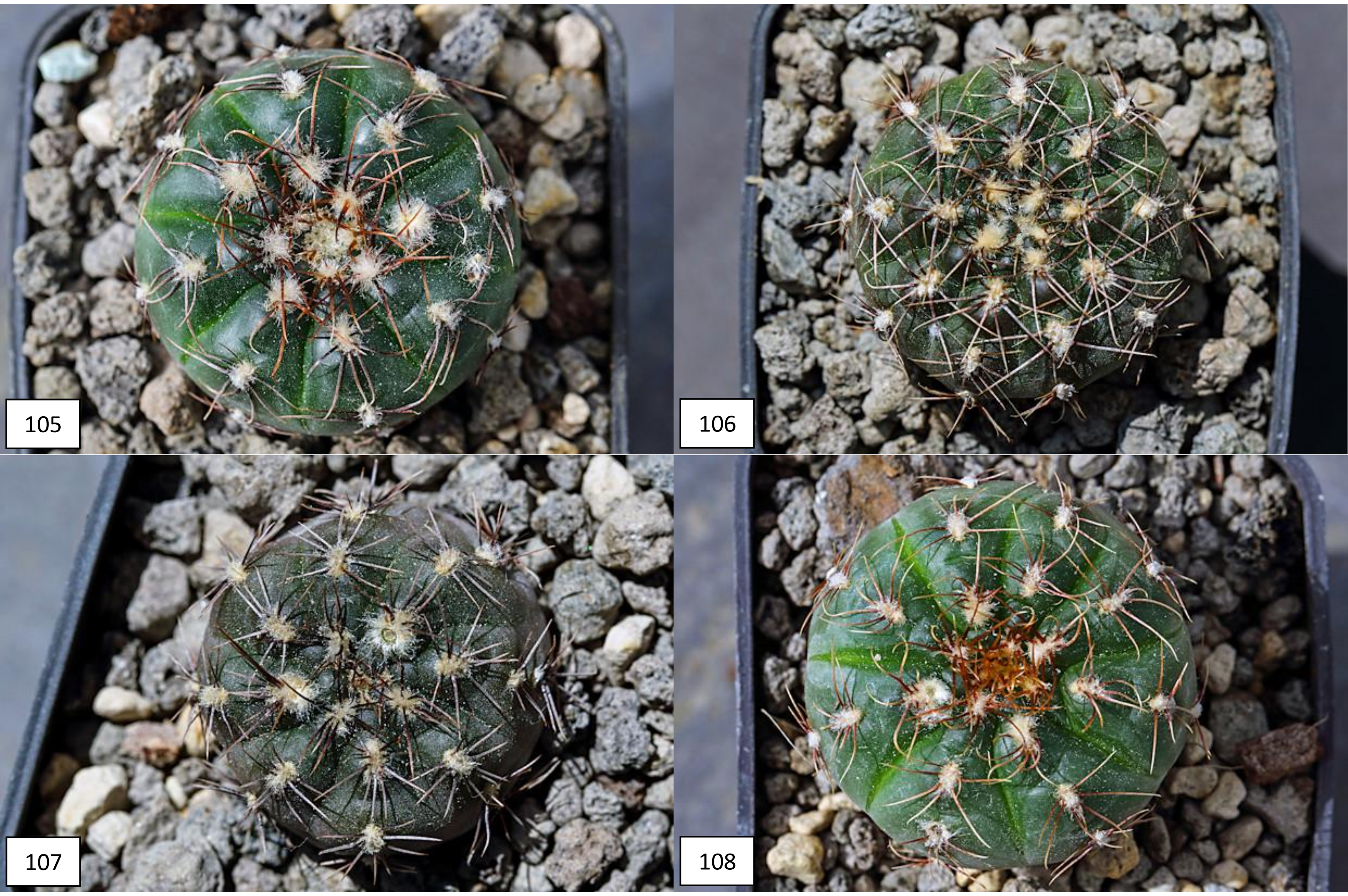


Fig. 105–108: TS 2064 TS 2064 *G. taningaense* s.l., plants with a **grey-green** epidermis, greyish to horn-coloured, thin spines with a reddish brown base.

The **petals** are purely white. The **pericarp** is **slightly to more intensively rose-coloured**. The **filaments** are yellowish with a **slightly rose-coloured base**. The style is greenish yellow. The ovary is slender and of varying length. The flower structure reminds of *G. taningaense* (fig. 109–111).


109


110

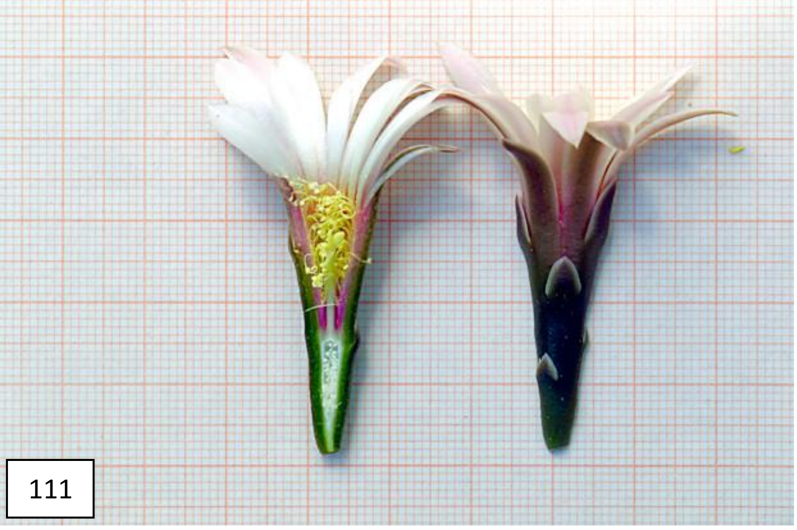

111

Fig. 109–111: TS 2064 *G. taningaense* s.l., the flower has a **rose-coloured** pericarp. The **filaments** are **slightly rose-coloured at the base** (109). TS 2064 *G. taningaense* s.l., the flower possesses an **intensively rose-coloured** pericarp (110). TS 2064 *G. taningaense* s.l., the flower is slender and delicate (111).

Both the bodies and the fruit colour are greyish green and remind of the *G. taningaense* type. However, the **tumbled protruding marginal spines** as well as the **central spines are missing** (fig. 112–113).


112


113

Fig. 112–113: *G. taningaense s.l., the fruit colour is greyish green.*

Another locality is situated near the farm Las Cañadas, which is located about 10 km east of the next *G. gaponii* aff. locality known to the author. It is again hilly terrain populated by acacia, situated at the foot of the Caldera (fig. 114–115).

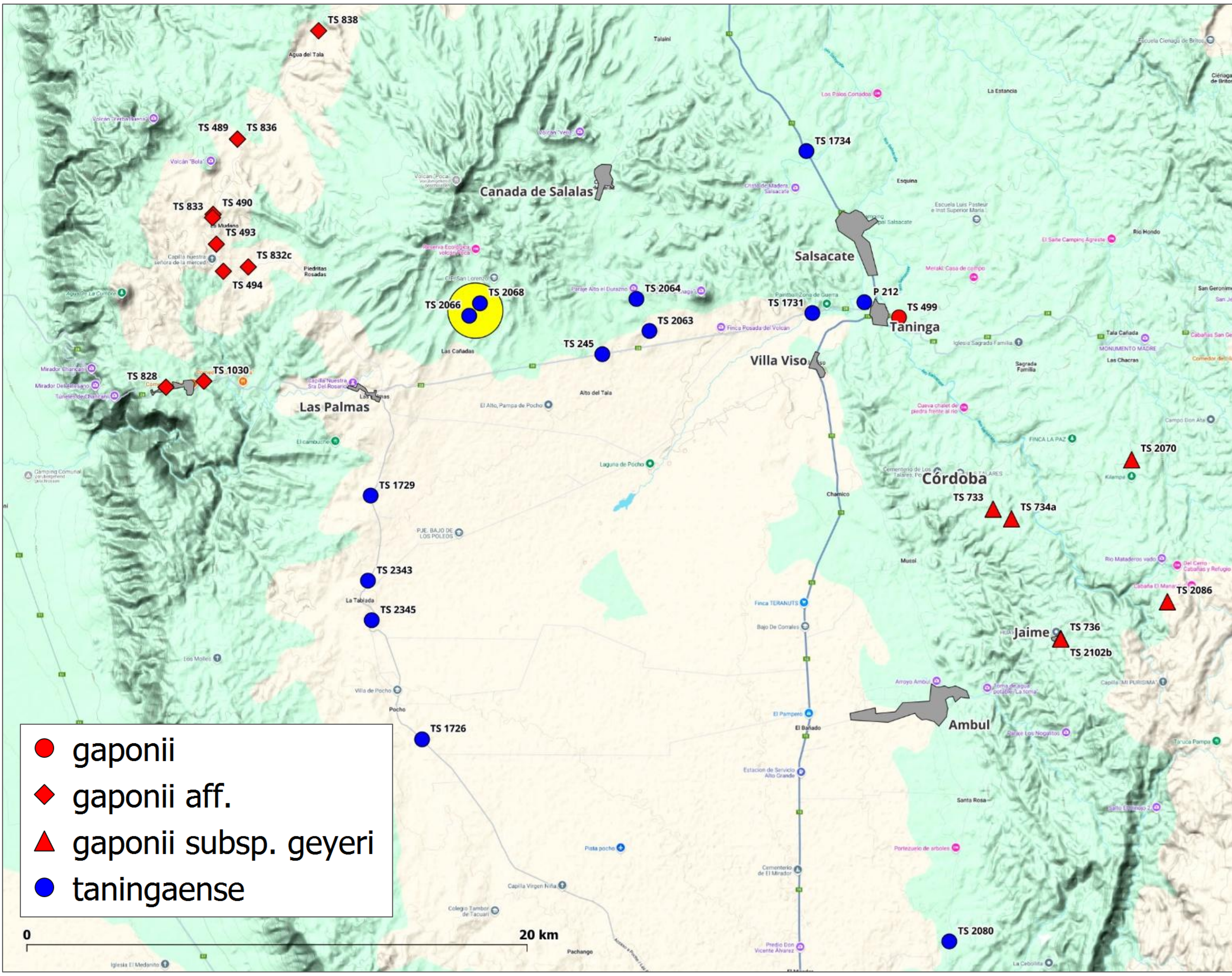


Fig. 114: Yellow shaded area = locality of TS 2068, 3 km north of Las Cañadas, 1,140 m a.s.l.

Fig. 115: Habitat TS 2068 at the foot of the Caldera (photo: Horst Kallenowsky).

The grey-green body colour exhibited in nature reminds of the typical *G. taningaense* s.s. Yet, the colour of fruit is greener than with the *G. taningaense* type. The spines are grey and close to the body. Central spines do often not exist (fig. 116–119).


116


117


118


119

Fig. 116–119: TS 2068 *G. taningaense* s.l.? the plants possess a grey-green epidermis (photo: Horst Kallenowsky) (116). TS 2068 *G. taningaense* s.l.? the plant has grey spines which are close to the body, as well as central spines (photo: Horst Kallenowsky) (117). TS 2068 *G. taningaense* s.l.? the plant possesses light green fruits (photo: Horst Kallenowsky) (118). TS 2068 *G. taningaense* s.l.? central spines are not present (photo: Horst Kallenowsky) (119).

The body colour of the seedlings is variable, **greenish grey to greyish green** and reminds only remotely of the *G. taningaense* type, with the exception of one plant shown in fig. 123, top.

The **spine colour** varies from **greyish to horn-coloured** and brownish base to **purely greyish**. Central spines are not formed. The **spine position close to the body** does not match the *G. taningaense* type. The appearance of the seedlings is not uniform (fig. 120–123).

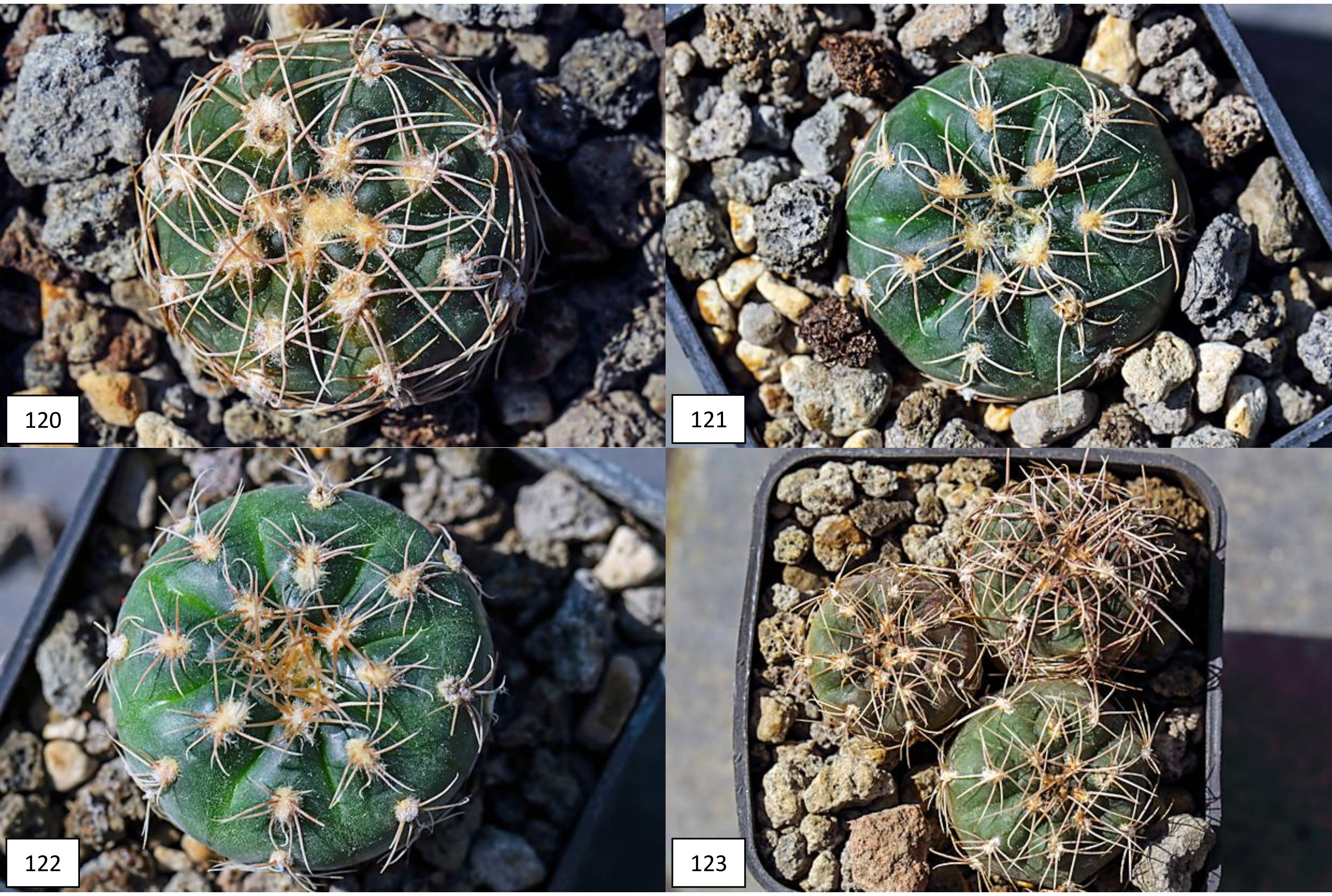


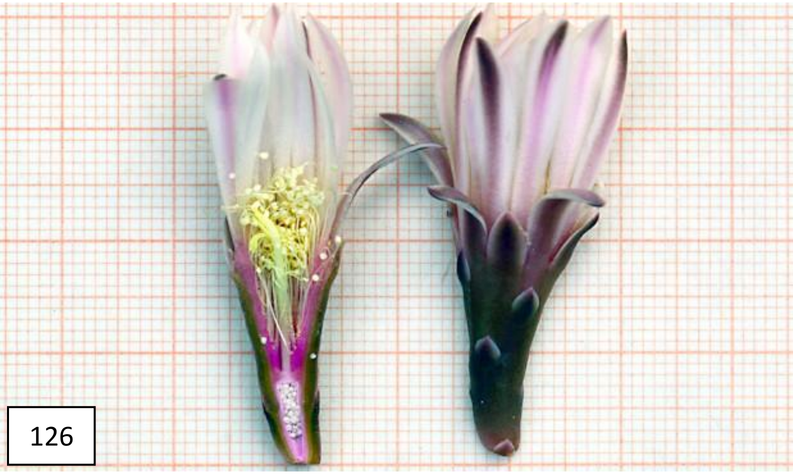
Fig. 120–123: TS 2068 *G. taningaense* s.l.? the plant possesses a **greenish grey** epidermis, **greyish to horn-coloured spines** with a **brownish base** (120). TS 2068 *G. taningaense* s.l.? the plant has a greenish epidermis and purely greyish spines (121). TS 2068 *G. taningaense* s.l.? the plant's spine position is slightly intertwined (122). TS 2068 *G. taningaense* s.l.? the appearance of the seedlings is not uniform. The plant top right reminds of a typical *G. taningaense* (123).

The flower structure is not uniform. The petals are purely white to **slightly rose-coloured.** The interior of the **pericar**p is **rose-coloured in different intensities**, but never pale rose-coloured. The style is greenish yellow to slightly rose-coloured towards the base. The filaments are yellow with a **rose-coloured base**. The flower structure rather reminds of *G. taningaense,* the flower colour of *G. gaponii* (fig. 124–127).


124


125

Fig. 124–125: TS 2068 *G. taningaense* s.l.? ovary with a slender form. The pericarp is **intensively rose-coloured** (124). TS 2068 *G. taningaense* s.l.? the ovary has a slender form. The **pericarp** is **rose-coloured** (125).


126


127

Fig. 126–127: TS 2068 *G. taningaense* s.l.? the **petals** have a **rose-coloured** shimmer. The **pericarp, the lower part of the style** as well as the **filaments** are **rose-coloured** (126). TS 2068 *G. taningaense* s.l.? the **pericarp** is **intensively rose-coloured**. **The lower part of the filaments** is **rose-coloured** (127).

Another locality of *G. taningaense* sensu lato is situated between the villages of La Palmas and La Tablada. The plants grow in rocky, meadowy, slightly hilly terrain, which is lined by acacia (fig. 128–129).

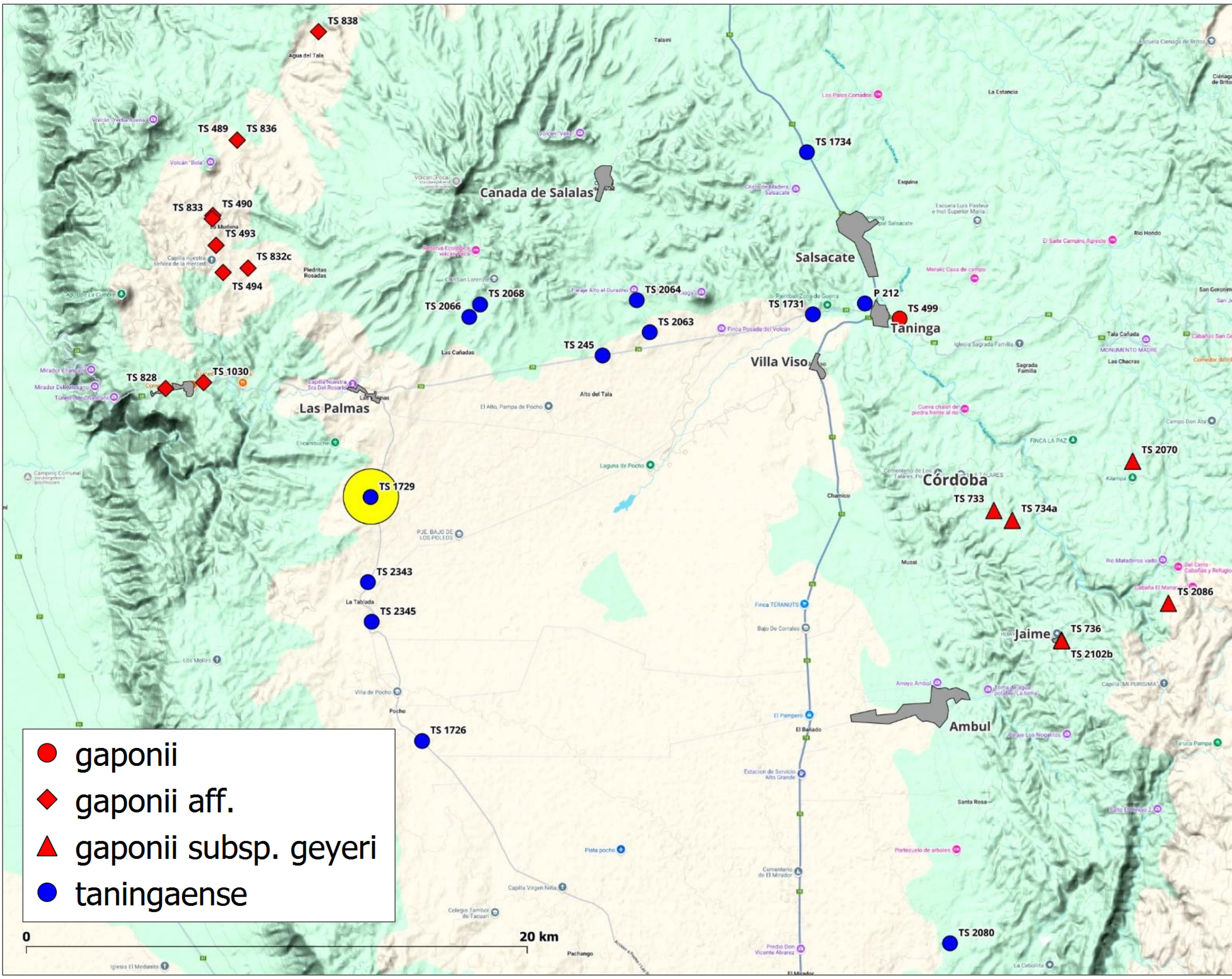


Fig. 128: Yellow shaded area = locality of TS 1729, La Tablada – Las Palmas, 1,077m.

Fig. 129: The habitat of TS 1729 is interspersed with rocks and lined by acacia.

The plants grow protected by rock terraces. They do not show a typical *G. taningaense* appearance. The epidermis and the fruit colour are greenish grey. Central spines have not been observed. The spines are greyish with a reddish brown base (fig. 130–131).

130

131

Fig. 130–131: TS 1729 *G. taningaense* s.l., the plants grow protected by rock terraces (130). TS 1729 *G. taningaense* s.l., the epidermis is greenish grey. Central spines have not been observed. The spines are greyish with a reddish brown base (131).

The plants in cultivation have a **greenish to slightly greyish** body colour. The spines are greyish to **horn-coloured** with a **brownish base**. Central spines are partly formed, the **spine position is close to the body**. The kind of spines is **less needle-like** than with the type (fig. 132–135).

The ploidy of the plants is **2n = diploid**.

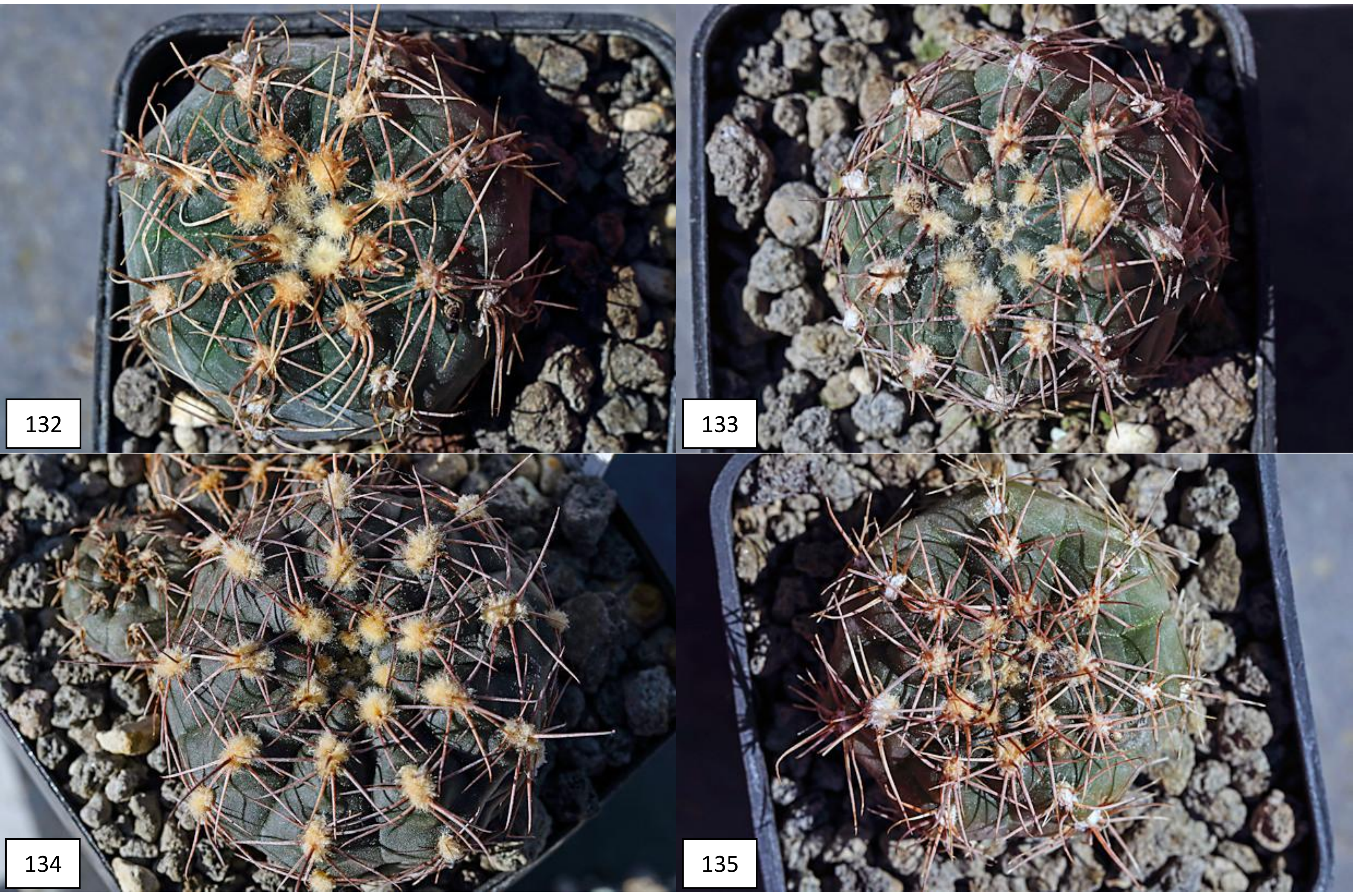


Fig. 132–135: TS 1729 *G. taningaense* s.l., plant with a greenish epidermis, greyish to horn-coloured spines with a brownish base (132). TS 1729 *G. taningaense* s.l., the spines are close to the body (133). TS 1729 *G. taningaense* s.l., plant with a greenish grey epidermis and central spines (134). TS 1729 *G. taningaense* s.l., the marginal spines are greyish to horn-coloured with a brownish base (135).

The **petals** are **purely white**, **never displaying a rose-coloured shimmer**. The pericarp is **pale rose-coloured**. The length of the ovary varies **between compressed to slightly elongated**. The style colour is greenish yellow and the filaments are yellow. The pericarp colour matches that of the *G. taningaense* type. The flower structure is variable and matches the *G. taningaense* type only partly (fig. 138). Influences of *G. gaponii* cannot be recognized (fig. 136–139).


136


137

Fig. 136–137: TS 1729 *G. taningaense* s.l., the flower colour is white, the pericarp is washed-out rose-coloured. The ovary is **compressed** and slender (136). TS 1729 *G. taningaense* s.l., the ovary is very short (137).


138


139

Fig. 138–139: TS 1729 *G. taningaense* s.l., flower with rose-coloured pericarp and slender, slightly elongated ovary. The lower part of the filaments turns into rose-colour (138). TS 1729 *G. taningaense* s.l., flower with short, slender ovary (139).

The body and fruit colour is dark green to greyish green and resembles the *G. taningaense* type (fig. 140–143).


140


141

Fig. 140–141: TS 1729 *G. taningaense* s.l., with a dark green fruit and greyish green epidermis (140). TS 1729 *G. taningaense* s.l., with a dark green fruit and greyish epidermis (141).


142


143

Fig. 142–143: TS 1729 *G. taningaense* s.l., with a dark to greyish green fruit, greyish epidermis and central spines (142). TS 1729 *G. taningaense* s.l., the spines are horn-coloured and slightly protruding from the body (143).

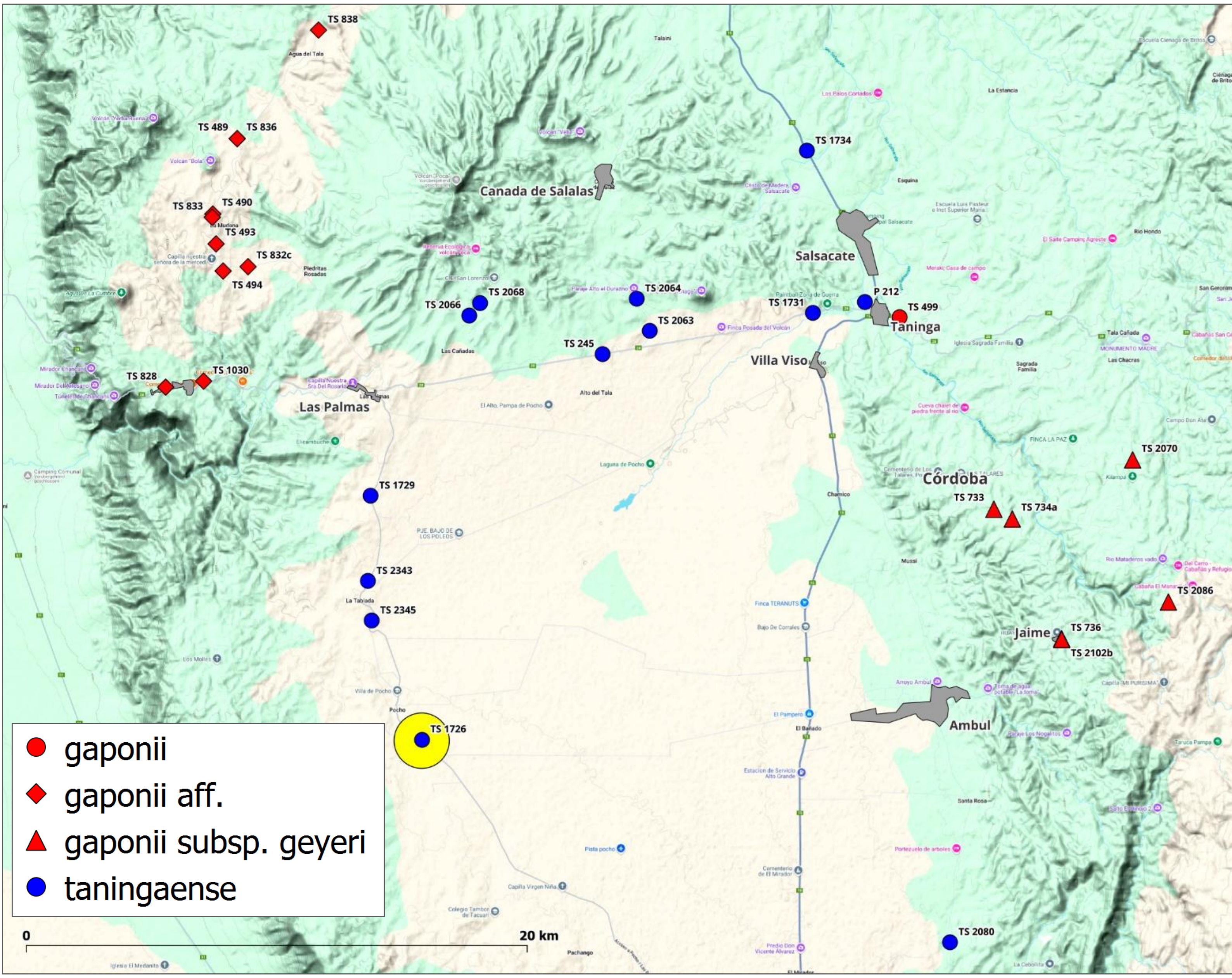


Fig. 144: Yellow shaded area = locality of TS 1726, south of Villa de Pocho, 1,077 m a.s.l.

Fig. 145: Habitat of TS 1726 with the palm *Trithrinax campestris* as accompanying vegetation (photo: Horst Kallenowsky).

Situated to the south of the village Villa de Pocho there is another locality of *G. taningaense* sensu lato.

The locality is an extensively used pasture on a flattened, rocky hill. Apart from acacia, Trithrinax campestris grow there again (fig. 144–145).

The plants grow in granite gravel in meadowy terrain. Above all body colour as well as the number of ribs remind of *G. taningaense*. The prominent **chins**, however, do not occur with the *G. taningaense* type (fig. 146–147).

146

147

Fig. 146–147: TS 1726 *G. taningaense* s.l., the epidermis is grey-green, there are numerous ribs and the **chins** are prominent (146). TS 1726 *G. taningaense* s.l., the plant is concealed by grass (147).

The seedlings do not possess a typical appearance. The **body colour** is **green-grey**, the long, **greyish to horn-coloured** marginal spines, which have a brownish base and are close to the body, do not match the *G. taningaense* type. Central spines are sometimes present. An influence of *G. gaponii* cannot be recognized (fig. 148–150).


148


149


150

Fig. 148–150: TS 1726 (Tom 915/1) *G. taningaense* s.l., the epidermis is green-grey (148). TS 1726 (Tom 915/1) *G. taningaense* s.l., central spines are present (149). TS 1726 (Tom 915/1) *G. taningaense* s.l., the marginal spines are long, close to the body and greyish to horn-coloured with a brownish base (150).

The **petals** are purely white. The ovary is slightly wide and slender. The interior of the pericarp is **more intensively rose-coloured** than with the *G. taningaense* type. The **filaments** are **yellow**, turning rose-coloured towards the base. The style is greenish yellow. Flower structures match the *G. taningaense* type to the greatest possible extend (fig. 151–153).


151


152


153

Fig. 151–153: TS 1726 (Tom 915/1) *G. taningaense* s.l., the petals are purely white, the pericarp is **rose-coloured** (151). TS 1726 (Tom 915/1) *G. taningaense* s.l., the filaments are yellow with a **rose-coloured base**. The style is greenish yellow (152). TS 1726 (Tom 915/1) *G. taningaense* s.l., the ovary is slender and slightly elongated. The colour of the lower part of the filaments **turns into rose-colour** (153).

The **body** and **fruit colour** are **green-grey** and not grey-green. Spine position and spine colour deviate from the *G. taningaense* type (fig. 154–155).


154


155

Fig. 154–155: TS 1726 (Tom 915/1) *G. taningaense* s.l., the colour of the fruit is green-grey (154). TS 1726 (Tom 915/1) *G taningaense* s.l., the marginal spines are close to the body and greyish to horn-coloured. Central spines are not present (155).

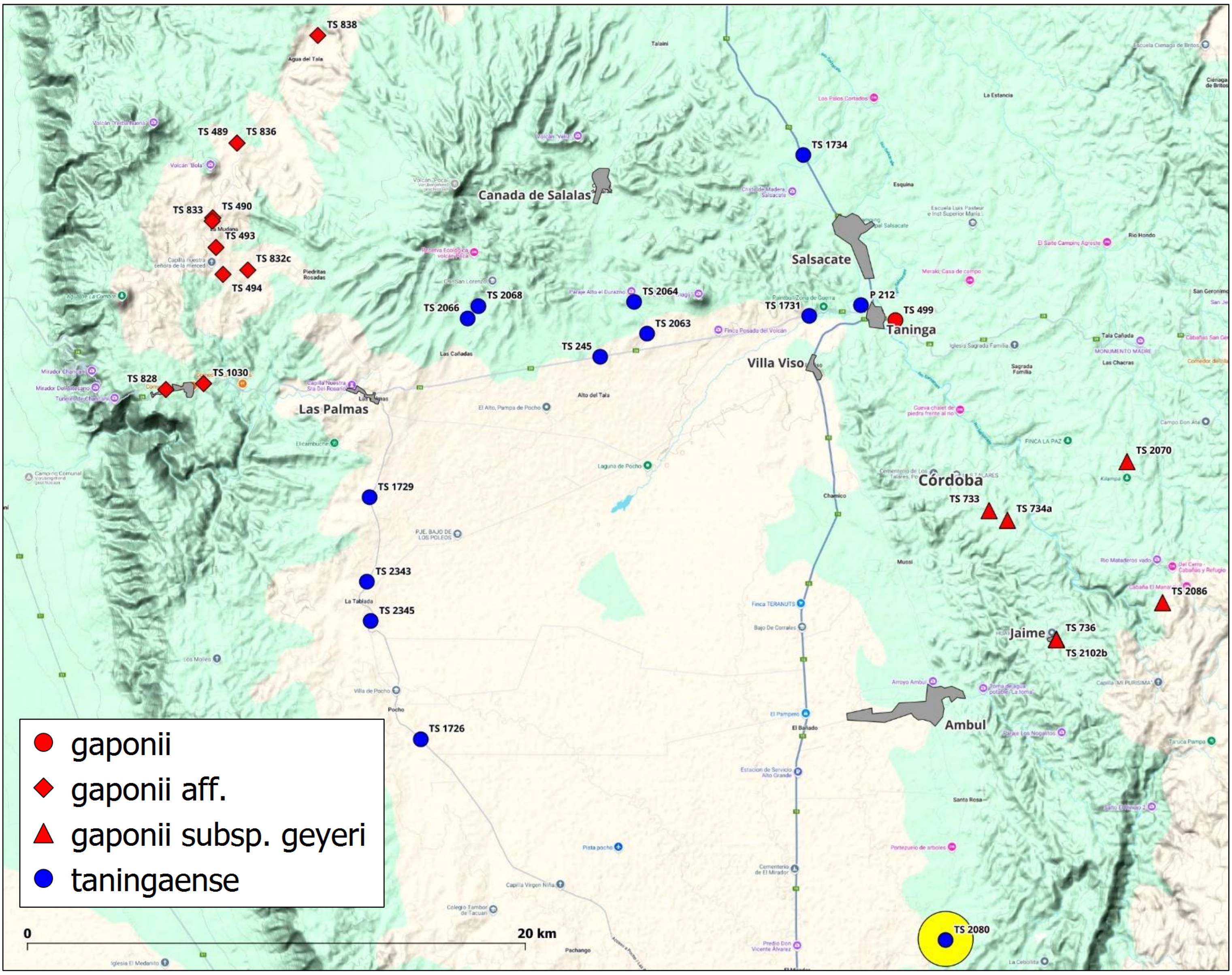


Fig. 156: Yellow shaded area = locality of TS 2080, north of Los Morteritos, 1,086 m a.s.l.

Fig. 157: Habitat of TS 2080 is affected by a bushfire.

Los Morteritos is located around 35 km south of the *G. taningaense* type locality as well as about 7 km south of a *G. gaponii* s.l. locality. This is the south-easternmost locality of *G. taningaense* s.l. known to the author (fig. 156).

This locality, too, was affected by forest fires. The ash density was remarkable. The smoke of the bush fires is still visible in the background (fig. 157).

The seedlings cannot be assigned unambiguously to *G. taningaense.* The body colour is primarily **dark green**, only slightly **greyish**. The spines, on the other hand, are **yellow-brown to horn-coloured** with a **brownish base,** central spines have not (yet?) been formed. Influences by *G. gaponii* s.l. are visible (fig. 158–161).

The chromosome set of the plants is **diploid = 2n**.

158

159

Fig. 158–159: TS 2080 (Tom 565/2) *G. taningaense* s.l.? plant with a **dark green to grey** epidermis (158). TS 2080 (Tom 565/2) *G. taningaense* s.l.? plant with **yellow-brown to horn-coloured marginal spines and light brownish base** (159).


160


161

Fig. 160–161: TS 2080 (Tom 565/2) *G. taningaense* s.l.? the marginal spines are close to the body and somewhat intertwined (160). TS 2080 (Tom 565/2) *G. taningaense* s.l.? the marginal spines are relatively short (161).

The **petals** are purely white. The style is greenish yellow with a slightly **rose-coloured** base. The filaments are yellow with a **rose-coloured base**. The pericarp is **intensively rose-coloured.** The ovary varies in length. The flower structure corresponds with *G. taningaense*, the colour of the pericarp and the filaments remind of *G. gaponii* (fig. 162–165).


162


163

Fig. 162–163: TS 2080 (Tom 565/2) *G. taningaense* s.l.? the pericarp is **rose-coloured** (162). TS 2080 (Tom 565/2) *G. taningaense* s.l.? the style is greenish yellow. The filaments are yellow with a **slightly rose-coloured base**. The ovary is narrow and slightly elongated (163).


164


165

Fig. 164–165: TS 2080 (Tom 565/2) *G. taningaense* s.l.? the flower shape is slender (164). TS 2080 (Tom 565/2) *G. taningaense* s.l.? the pericarp is **matt rose-coloured**. The ovary is of middle length (165).

The colour of the fruit is **greenish grey**, the body colour is **dark green to grey** (fig. 166–168).


166


167


168

Fig. 166–168: TS 2080 (Tom 565/2) *G. taningaense* s.l.? the fruit colour is **greenish grey** (166). TS 2080 (Tom 565/2) *G. taningaense* s.l.? the plant body is **dark green to grey** (167). TS 2080 (Tom 565/2) *G. taningaense* s.l.? the marginal spines are purely greyish to horn-coloured (168).


169


170

Fig. 169–170: P 212 *G. taningaense* s.s. from the type locality with a **grey-green** body, **grey to greyish brown**, needle-like, thin marginal spines and **central spines** (169). TS 1734 *G. taningaense* s.l. from Salsacate with a **green** body colour, spine arrangement close to the body, **grey to horn-coloured** longer spines with a **reddish brown base**, no central spine (170).

Comparison of *G. taningaense* sensu stricto with *G. taningaense* sensu lato

G. taningaense sensu stricto never lose their grey-brown epidermis in cultivation. Their spine colour is grey-brown, the spines are needle-like and often protruding from the body. Central spines are mostly formed (fig. 169).

G. taningaense sensu lato, on the other hand, have a greener body during their period of growth. The spines have a tendency towards being lighter grey to horn-coloured and they are mostly close to the body. Central spines are rarely formed (fig. 170–176).


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Fig. 171–174: TS 2063 *G. taningaense* s.l. from Cañada de Salas with **green-grey** body colour, **greyish to horn-coloured** marginal spines with a **brownish red** base close to the body (171). TS 2064 *G. taningaense* s.l. from Cañada de Salas with **green-grey** epidermis, **greyish to horn-coloured spines** with **brownish red base** (172). TS 2068 *G. taningaense* s.l.? from Las Cañadas. The plant possesses a **greenish-grey** epidermis, **greyish to horn-coloured spines** with a **brownish base** (173). TS 1729 *G. taningaense* s.l. from La Tablada with **greenish grey** epidermis, **grey to horn-coloured spines** with a **brownish base close to the body** (174).


175


176

Fig. 175–176: TS 1726 (Tom 915/1) *G. taningaense* s.l. from Villa de Pocho with **green-grey** epidermis and long, **grey to horn-coloured** marginal spines with a **brownish base** close to the body. Central spines are present (175). TS 2080 (Tom 565/2) *G. taningaense* s.l.? from Los Morteritos, with **green-grey** epidermis and **yellow-brown to horn-coloured** marginal spines with a **brownish base**. Central spines are not present (176).

The pericarp of *G. taningaense* sensu stricto is **pale rose-coloured** as a rule. The ovary is slender, the **style colour greenish yellow**. The **filaments are uniformly yellow** (fig. 177).

The flower structure of *G. taningaense* sensu lato largely corresponds with the *G. taningaense* type (fig. 178–184). The partly **intensive rose-colour** of the **flower pharynx** and the rose-coloured base of the filaments as well as the style show a tendency towards *G. gaponii* (fig. 179–181, fig. 183).


177


178

Fig. 177–178: P 212 *G. taningaense* s.s. from the type locality. Flower with greenish yellow style and **pale rose-coloured pericarp** as well as slender ovary (177). TS 1734 *G. taningaense* s.l. from Salsacate. Flower with slender ovary, purely white petals and **filaments with slightly rose-coloured base** (178).

Fig. 179–180: TS 2063 *G. taningaense* s.l. from Cañada de Salas. P**ericarp** and the **lower part of the style** are **intensively rose-coloured** (179). TS 2064 *G. taningaense* s.l. from Cañada de Salas. Flower **with rose-coloured pericarp** (180).

Fig. 181–184: TS 2068 *G. taningaense* s.l.? from Las Cañadas. Ovary has a slender form. The **pericarp** is **intensively rose-coloured** (181). TS 1729 *G. taningaense* s.l. from La Tablada. The flower possesses a **rose-coloured pericarp** and a slender, slightly elongated ovary (182). TS 1726 (Tom 915/1) *G. taningaense* s.l. from Villa de Pocho. The ovary is slender and slightly elongated. **The lower part of the filaments turns into rose-colour** (183). TS 2080 (Tom 565/2) *G. taningaense* s.l.? from Los Morteritos. **The lower part of the style and the filaments** are **slightly rose-coloured**. The ovary is narrow and slightly elongated (184).

No relevant differences can be discerned concerning the **form of seeds** or the form of the hilum. All the **seeds** are **large** and the **hilum** is constricted to a **drop-shape**. **The cuticula comes off** in parts (fig. 185–192).

Fig. 185–186: P 212 *G. taningaense* s.s. from the type locality, with large seeds and a cuticula that comes off in parts as well as a **drop-shaped hilum** (185). TS 1734 *G. taningaense* s.l. from Salsacate with large seeds and a cuticula which comes off in parts as well as a **drop-shaped to wide hilum** (186).

Fig. 187–188: TS 2063 *G. taningaense* s.l. from Cañada de Salas with large seeds and a cuticula which comes off in parts as well as a **drop-shaped hilum** (187). TS 2064 *G. taningaense* s.l. from Cañada de Salas with large seeds and a cuticula which comes off in parts as well as a **hilum constricted to drop-shape** (188).

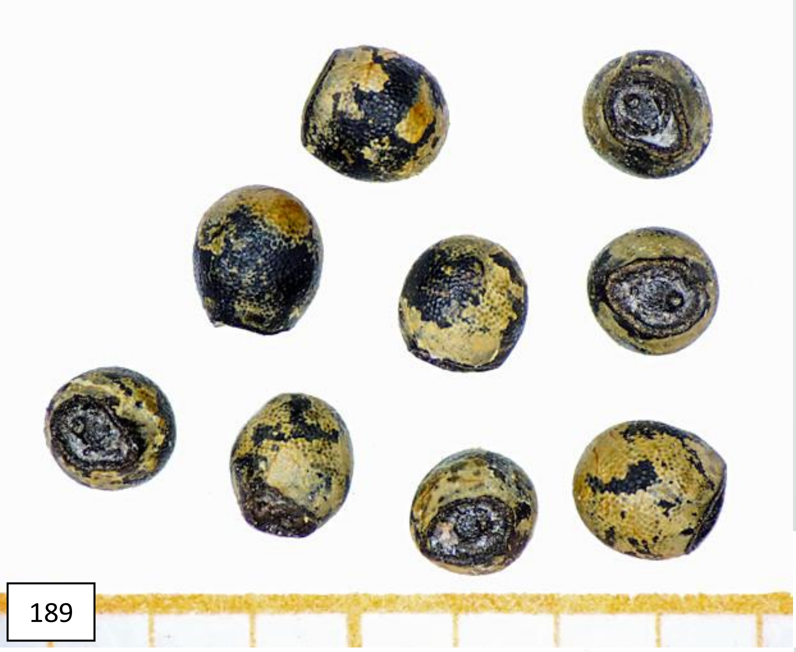
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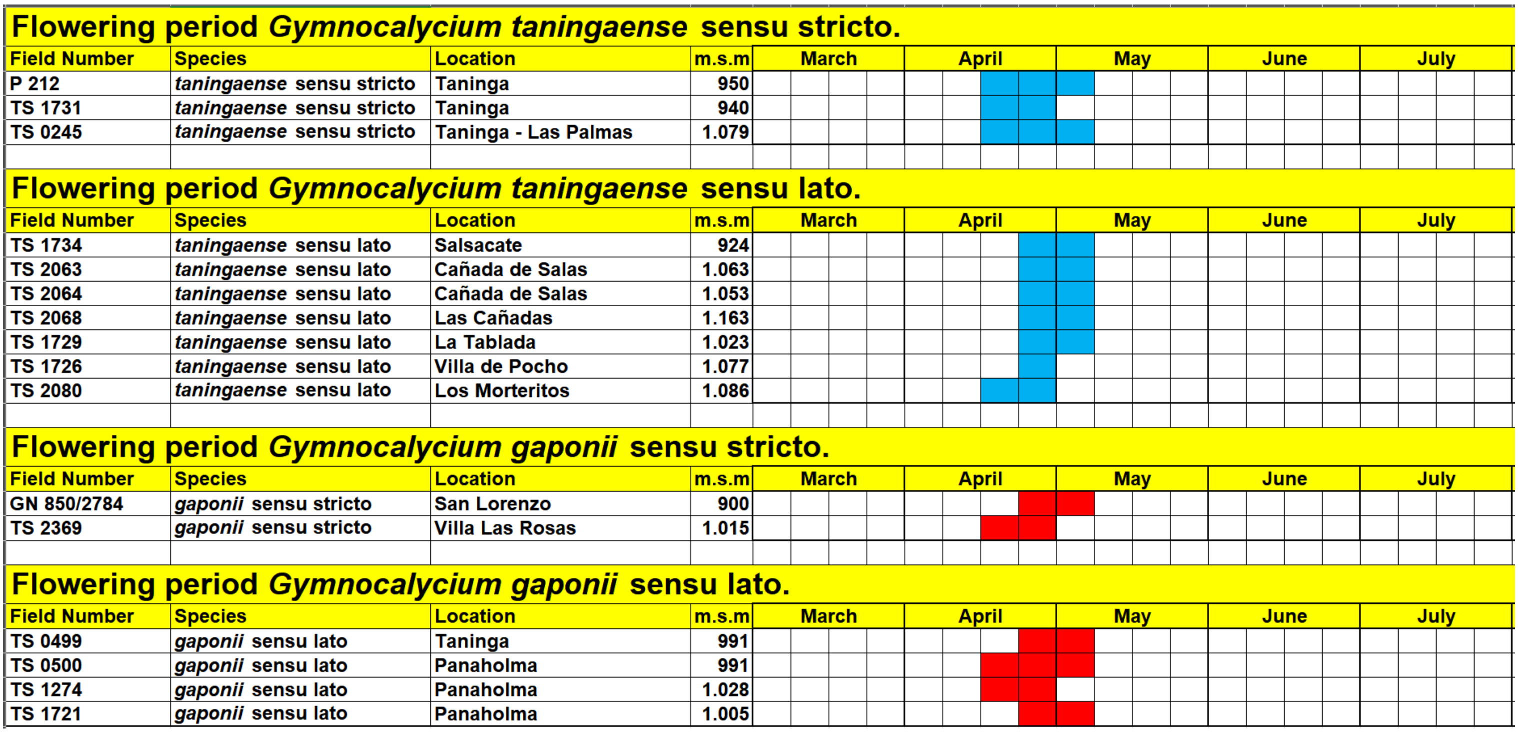
Fig. 189–192: TS 2068 *G. taningaense* s.l.? from Las Cañadas with large seeds and a cuticula which comes off in parts as well as a **hilum distinctly constricted to drop-shape** (189). TS 1729 *G. taningaense* s.l. from La Tablada with large seeds and a cuticula which comes off in parts as well as a **slightly wide drop-shaped hilum** (190). TS 1726 (Tom 915/1) *G. taningaense* s.l. from Villa de Pocho with large seeds and a cuticula which comes off in parts as well as a **hilum somewhat constricted to drop-shape** (191). TS 2080 (Tom 565/2) *G. taningaense* s.l., from Los Morteritos with large seeds and a cuticula which comes off in parts as well as a **hilum constricted to drop-shape** (192).

***G. taningaense* sensu stricto** and ***G. taningaense* sensu lato** are typical early bloomers. The flowering period matches that of *G. gaponii* sensu stricto and *G. gaponii* sensu lato.



Flowering period *Gymnocalycium taningaense* sensu stricto.

Field Number	Species	Location	m.s.m	March				April				May				June				July			
P 212	*taningaense* sensu stricto	Taninga	950							🟦	🟦	🟦											
TS 1731	*taningaense* sensu stricto	Taninga	940							🟦	🟦												
TS 0245	*taningaense* sensu stricto	Taninga - Las Palmas	1.079							🟦	🟦	🟦											

Flowering period *Gymnocalycium taningaense* sensu lato.

Field Number	Species	Location	m.s.m	March				April				May				June				July			
TS 1734	*taningaense* sensu lato	Salsacate	924								🟦	🟦											
TS 2063	*taningaense* sensu lato	Cañada de Salas	1.063								🟦	🟦											
TS 2064	*taningaense* sensu lato	Cañada de Salas	1.053								🟦	🟦											
TS 2068	*taningaense* sensu lato	Las Cañadas	1.163								🟦	🟦											
TS 1729	*taningaense* sensu lato	La Tablada	1.023								🟦	🟦											
TS 1726	*taningaense* sensu lato	Villa de Pocho	1.077								🟦												
TS 2080	*taningaense* sensu lato	Los Morteritos	1.086							🟦	🟦												

Flowering period *Gymnocalycium gaponii* sensu stricto.

Field Number	Species	Location	m.s.m	March				April				May				June				July			
GN 850/2784	*gaponii* sensu stricto	San Lorenzo	900								🟥	🟥											
TS 2369	*gaponii* sensu stricto	Villa Las Rosas	1.015							🟥	🟥												

Flowering period *Gymnocalycium gaponii* sensu lato.

Field Number	Species	Location	m.s.m	March				April				May				June				July			
TS 0499	*gaponii* sensu lato	Taninga	991								🟥	🟥											
TS 0500	*gaponii* sensu lato	Panaholma	991							🟥	🟥	🟥											
TS 1274	*gaponii* sensu lato	Panaholma	1.028							🟥	🟥												
TS 1721	*gaponii* sensu lato	Panaholma	1.005								🟥	🟥											

Tab. 3: Flowering period of *G. taningaense* sensu stricto and sensu lato and *G. gaponii* sensu stricto and sensu lato (Basel 2025).

Field number	Species	Plant body	Type of spine	Spine position	Spine colour	Central spines	Petals	Pericarp	Filaments	Style	Ovary	Seed	Cuticula	Hilum
P 212	*taningaense* s.s (type)	greyish green to brown	needle-like, thin	slightly protruding	grey to grey-brown with a darker base	0-1	purely white	pale rose-coloured	yellowish	greenish yellow	slender	large	coming off in parts	constricted to drop-shape
TS 1731	*taningaense* s.s.	greyish green	needle-like, thin	protruding	grey-brown with brownish base	1	purely white	pale rose-coloured to rose-coloured	yellowish	greenish yellow	slender to wide	large	comingoff in parts	constricted to drop-shape
TS 0245	*taningaense* s.s.	greyish green	needle-like, thin	protruding	greyish to horn-coloured with brownish yellow base	(0-)1	purely white	pale rose-coloured to rose-coloured	yellowish	greenish yellow	slender to wide	large	coming off in parts	slightly wide and drop-shaped
TS 1734	*taningaense* s.l.	greenish	elongated	close to the body	grey to horn-coloured with reddish brown base	0	purely white	pale rose-coloured to rose-coloured	yellowish with slightly rose-coloured base	greenish yellow	slender	large	coming off in parts	drop-shaped to wide hilum
TS 2063	*taningaense* s.l.	green-grey	slightly thickened	close to the body, slightly intertwined	grey to horn-coloured	0-1	purely white	intensively rose-coloured	yellowish (with slightly rose-coloured base)	greenish yellow with rose-coloured base	slender, compressed to slightly elongated	large	coming off in parts	drop-shaped
TS 2064	*taningaense* s.l.	green-grey	needle-like	close to the body	grey to horn-cloured with reddish brown base	0	purely white	rose-coloured	yellowish (with slightly rose-coloured base)	greenish yellow	slender to slightly widened	large	coming off in parts	drop-shaped to narrow
TS 2068	*taningaense* s.l.?	green-grey to grey-green	needle-like	close to the body	grey to horn-coloured with reddish brown base to purely greyish	0	purely white to rose-coloured	rose-coloured to intensively rose-coloured	yellowish with rose-coloured base	greenish yellow with rose-coloured base	slender	large	coming off in parts	markedly narrow and drop-shaped
TS 1729	*taningaense* s.l.	greenish grey to greyish green	somewhat needle-like	close to the body	grey to horn-coloured with brownish base	0-1	purely white	pale rose-coloured	yellowish	greenish yellow	slender, compressed to slightly elongated	large	coming off in parts	slightly wide and drop-shaped
TS 1726	*taningaense* s.l.	green-grey	elongated	close to the body	grey to horn-coloured with brownish base	0-1	purely white	rose-coloured	yellowish with rose-coloured base	greenish yellow	slender to slightly widened	large	coming off in parts	slightly narrow and drop-shaped
TS 2080	*taningaense* s.l.?	dark green to greyish	somewhat needle-like, short	close to the body	grey to horn-coloured with brownish base	0	purely white	rose-coloured	with rose-coloured base	greenish yellow	slender to slightly elongated	large	coming off in parts	constricted to drop-shape

Tab. 4: Different features of *G. taningaense* sensu stricto and sensu lato.

The features of G. *taningaense* sensu lato from various localities, which do **not** coincide with the plants from the type locality, are accentuated in table 4 by red lettering. It is interesting to note that the farther the respective locality is away from the type locality, the bigger the differences become. As to the localities TS 2068 and TS 2080 the differences become so big that a classification as *G. taningaense* is doubtful. That is the reason why the plants from these two localities in fig. 193–200 are compared with the type plants of *G. gaponii* and *G. taningaense.*

The **grey-green** epidermis colour of TS 2068 and TS 2080 reminds rather of *G. gaponii* than of *G. taningaense.* The type of spines and spine colour do not match either of these species (fig. 195–196).

The flower structure of TS 2068 and TS 2080 is similar to *G. taningaense.* The **intensively coloured pericarp** rather matches that of *G. gaponii* (fig. 199–200).

Conclusion: TS 2068 and TS 2080 can neither be attributed clearly to *G. taningaense* nor to *G. gaponii*. The features of the plants from both localities are intermediate between the type plants.


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Fig. 193–194: GN 850/2784 *G. gaponii* s.s., San Lorenzo (type locality). The body is **dark green.** The spines are slightly elongated, greyish with a **reddish brown** base (193). P 212 *G. taningaense* s.s., type locality of Taninga. The plant body is **grey-green.** The spines are **grey to grey-brown**, needle-like and thin (194).


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Fig. 195–196: TS 2068 *G. taningaense* s.l.? from Las Cañadas. The plant possesses a **greenish grey** epidermis, **greyish to horn-coloured spines** with a **brownish base** (195). TS 2080 (Tom 565/2) *G. taningaense* s.l.? from Los Morteritos, with **green-grey** epidermis and **yellow-brown to horn-coloured** marginal spines with a **brownish base**. Central spines are not present (196).

Fig. 197–200: GN 850/2784 *G. gaponii* s.s., type locality of San Lorenzo. Flower with **intensively rose-coloured pericarp** and **wide ovary** (197). P 212 *G. taningaense* s.s., type locality of Taninga. Flower with greenish yellow style and **pale rose-coloured pericarp** as well as **slender ovary** (198). TS 2068 *G. taningaense* s.l.? ovary with a slender form. The **pericarp** is **intensively rose-coloured** (199). TS 2080 (Tom 565/2) *G. taningaense* s.l.? the **pericarp is rose-coloured**. The ovary is slender (200).

SUMMERY

The ploidy of the plants from all investigated *G. taningaense* sensu stricto and *G. taningaense* sensu lato localities is **2n = diploid** and thus differs from other representatives of the subgenus *Gymnocalycium* (*Ovatisemineum*, Schütz) from the area west of the Sierras Grandes / Sierra de los Comechingones, which have a ploidy of **4n = diploid** or **6n = hexaploid**.

The **epidermis** colour of **G. *taningaense* sensu stricto** remains **greyish green to greyish brown,** even throughout the whole vegetation period. The same applies to seedlings. The fruits, too, possess a greyish green colour.

The **epidermis** of **G. *taningaense* sensu lato** tends towards appearing **greener** during the whole vegetation period. Even within the same population the appearances of the plants deviate heavily,

G. *taningaense* sensu stricto have **greyish spines with a brown base** on young areoles. The **spines are fine** and **slightly protruding from the body**. **Central spines** are often formed by young plants already.

***G. taningaense* sensu lato's spine position** is mostly **close to the body**, the **spine colour** is predominantly **greyish to horn-coloured** with a **brownish red base**. The spine type is variable, but never fine and needle-like. Central spines are rarely present.

The outer petals of ***G. taningaense* sensu stricto** are purely white. **The filaments are yellow.** The style is greenish yellow. The **pericarp is pale rose-coloured**. The **ovary is slender**, of medium length to slightly elongated.

The flowers of ***G. taningaense* sensu lato** mostly possess an **intensively rose-coloured pericarp.** The style is yellow greenish and sometimes **turning into rose-colour** towards the base. The **filaments** are yellow, sometimes with a **rose-coloured base**.

The **seed form** respectively the form of the hilum do not display any relevant differences. The seeds are large and the hilum is constricted to a drop-shape and the cuticula comes off in parts.

CONCLUSION AND PROSPECT

***G. taningaense* sensu lato** do not possess a uniform appearance. The plants from some localities remind of ***G. taningaense* sensu stricto** concerning the most important flower features. Others, however, are closer to ***G. gaponii* sensu lato** when judging from **colour of epidermis** and **colour of pericarp**.

Part 2 of this article, which is going to be published in one of the oncoming Schütziana editions, ***G. gaponii* sensu stricto** and **sensu lato** will be presented in more detail. In addition, the **results of DNA analysis** obtained at the University of Vienna will be shown and accordingly the relationships of *G. taningaense* and *G. gaponii* depicted in a cladogram.

EXPLANATION OF TECHNICAL TERMS

Ovary:	Bulging part of the pistil in which the seed is developed
Hilum:	Place where the seed is attached to the seed-bearing device respectively the fruit
Pericarp:	Cup-shaped encasement of the ovary
Ploidy level:	Number of chromosome sets in one nucleus
sensu stricto:	in a narrow sense
sensu lato:	in a wider sense

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Thomas Strub
Hölzlistraße 23
4102 Binningen
(Switzerland)
✉ thomas.strub@kabelbinningen.ch