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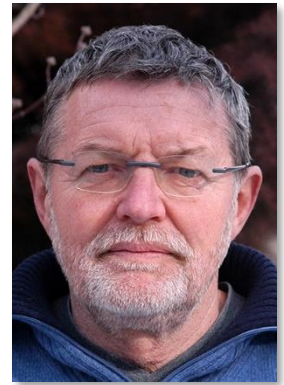
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Cover picture: *Gymnocalycium sibalii* WP 29-37 La Pampa, Sierra Chica, in cultivation (Photograph: W. Papsch).

Editorial

Dear *Gymnocalycium* friends

Wolfgang Papsch



In the previous months travelling activities, not only those of lovers of Latin American cacti, have had to succumb to a tiny virus. Thus, certainly many a *Gymnocalycium* lover has had to cancel or at least postpone their scheduled journey for some time. Instead of spending hours on planning routes in Argentina, Bolivia, Paraguay or Uruguay more time was dedicated to dealing intensively with the plants in collections.

Watching, measuring, comparing, verifying and realizing are the integral parts which lead to scientific findings. Science relies on the fact that results of studies must be well-founded and reproducible. When studying modern cactus literature, however, this prerequisite seems to have got lost to no small extent. These days apparently only few botanists are interested in how a species is characterised by its individual morphological features, how their offspring react, which demands the plant makes on the soil or how reproduction is influenced by potential pollinators. Everything is subordinate to bio-molecular research and its results, as well as to mathematical algorithms. In addition, there seems to exist a downright ignorant attitude of scientists towards verifiable results produced by “non-scientific” editors who do not only invest considerable sums, but also a significant amount of time in habitat studies. Much can be said against such “non-professionals”, but it is they who deal with the living plants, their physical appearance and their stories – and above all, they know these plants.

The hope remains that we will soon be able to resume studies at our *Gymnocalycium* localities. Then the knowledge gained could be presented here to all *Gymnocalycium* friends.

We would like to express our warmest thanks to Mrs Iris Blanz (Austria) who supports us with the translation into English, to Mrs Larisa Zaitseva (Russia) for the translation into Russian, to Mr Victor Gapon (Russia) for the content corrections of the Russian edition, 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 <http://www.cactuspro.com/biblio/>.

The *Gymnocalycium* Species of the Sierras Lihuel Calel in the Argentinian Province La Pampa

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ABSTRACT

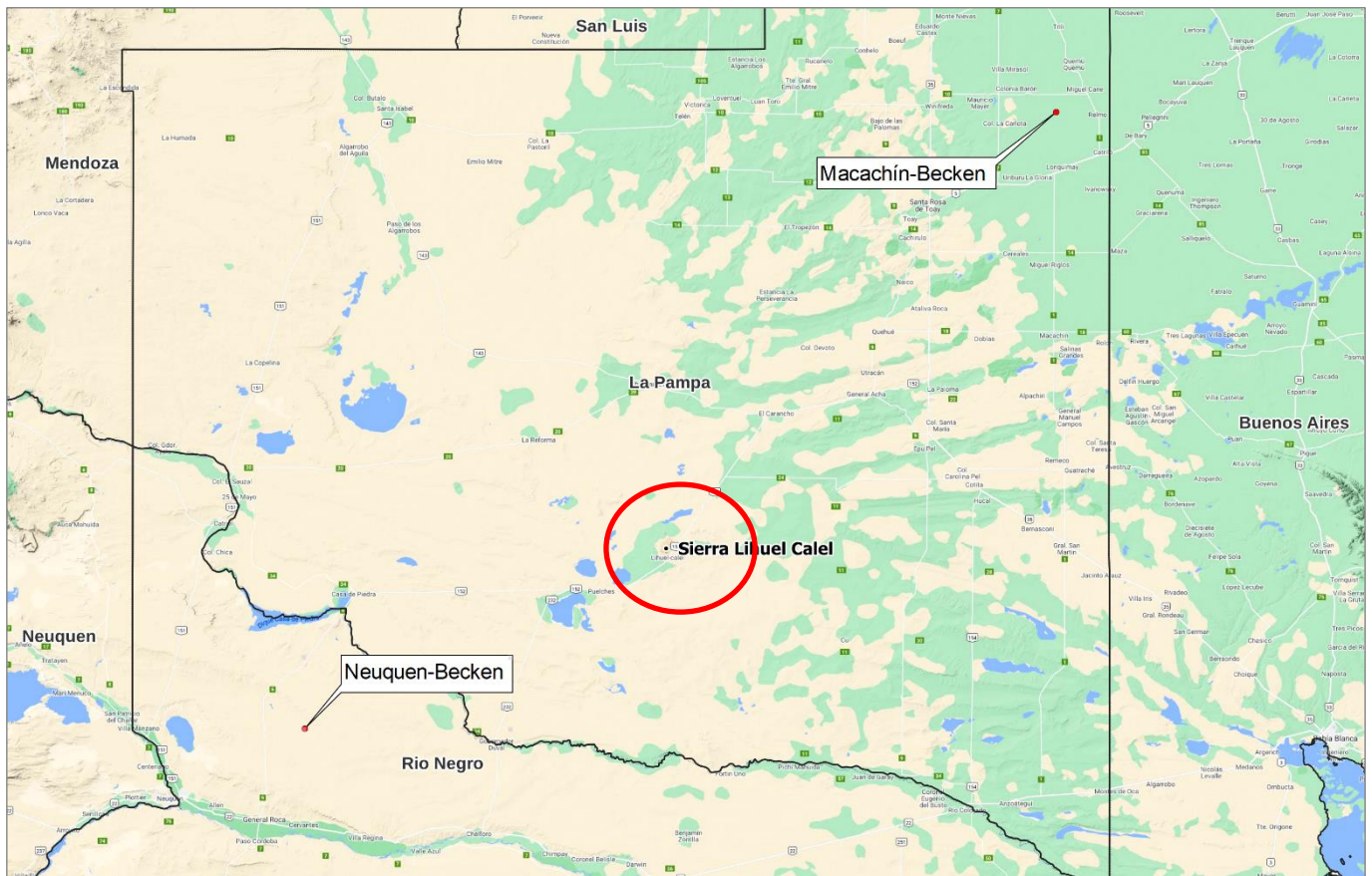
The identification of the *Gymnocalycium* species from the flat, alluvial surroundings of the Sierras de Lihuel Calel (Province La Pampa) as a local form of *Gymnocalycium gibbosum* Pfeiffer ex Mittler (var. *brachypetalum*) is beyond dispute. The systematic status of the plants originating from the Sierra Lihuel Calel itself and the Sierra Chica is rated differently. First described as *Gymnocalycium sibalii* Halda & Kupčak, they are assigned by the respective editors to very different, diverging *Gymnocalycium* taxa. By means of comparing morphological features and geological conditions of the habitat the status of *Gymnocalycium sibalii* is going to be discussed in this study.

KEYWORDS: Province La Pampa, Sierra Lihuel Calel, Sierra Chica, *Gymnocalycium*, *gibbosum*, *reductum*, *sibalii*.

INTRODUCTION

Province La Pampa is not a particularly attractive destination for cacti lovers due to its topography and its climatic conditions. This vast region offers only few attractive sights unless the traveller is just interested in studying succulent plants. One of these destinations is Lihué Calel National Park, one of the most unspoilt reservations in Argentina. Rock paintings and a varied wildlife can be found in the low, rocky mountainous ridge.

According to Argentinian botanists La Pampa is the driest and hottest province in Argentina. Its largest part is flat, only the Sierra del Nevado (a promontory of the Andes, up to 1,200 m high) is formed by prominent mountain ranges in the northwest. The same applies to the Sierra Lihuel Calel in the central part of the south (up to 600 m). Rainfall decreases more and more from east to west. The west is characterised by steppe landscape including numerous larger and smaller salt lakes, with an almost desertic climate in the utmost west. The central as well as the south-western parts belong to the dry pampa, the Pampa seca. The hilly terrain is overgrown with thorn bushes, scattered dunes are often completely devoid of vegetation. The climate is likewise dry and windy in the extremely sparsely populated southwest. Here the Patagonian climate with its continuous, very dry south-western winds, the “pamperos” already has an impact.



Map 1: Geographic position of the Sierras de Lihuel Calel between the Macachín Basin in the north-east and the Neuquen Basin in the south-west.

The National Park Lihué Calel is situated between General Acha and Puelches on Ruta Nacional 152. The name Sierras de Lihuel Calel must be seen as a general term referring to a belt of remains from old rocks between 36° and 39° southern latitude. They are of volcanic origin and hardly project above the terrain. This mountain range is part of the so-called Chioque-Mahuida formation and consists of epithermal volcanic rock, such as tuff, breccia and ignimbrite (Llambias 1975). The range borders on the somewhat more humid Macachín Basin in the north-east and the dry Neuquén Basin in the south-west. Both are tectonic depressions.

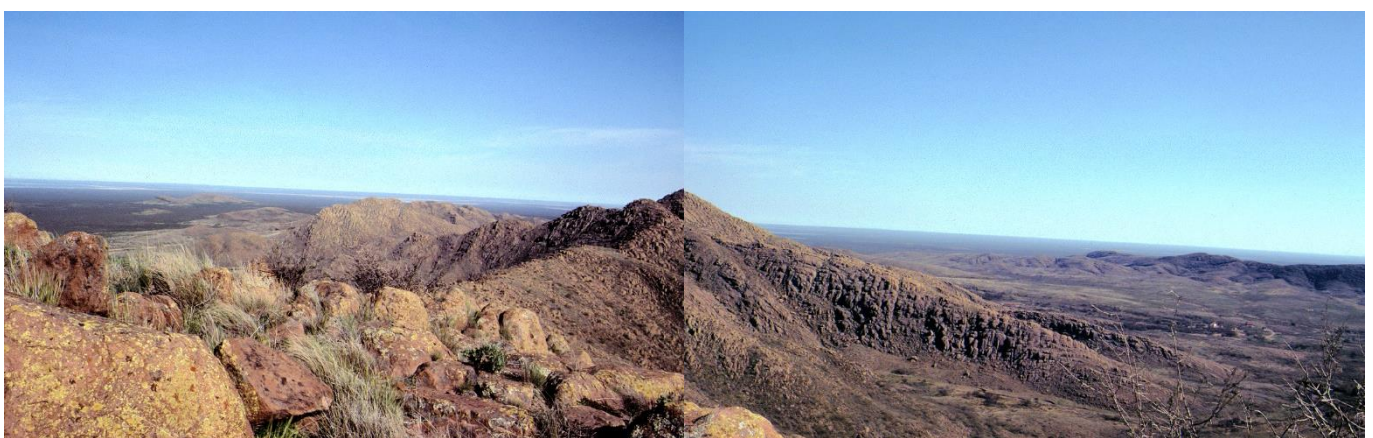


Fig. 1: Sierra Lihuel Calel, Province La Pampa.

The core area of the Sierra is north-south aligned. This square area with a side length of around 15 kilometres is made up of several small ridges separated by valleys. The ridges are aligned in different geographic directions, though mainly from north-west to south-east. The highest peak, the Cerro de la Sociedad Científica Argentina, is 589 m high (fig.1). There is a connection in north-

western direction to the hills of the Sierras Carapacha Grande and Carapacha Chica south of La Reforma. The connection runs across Cerro Negro (300 m), which is in an isolated position on the north-eastern side of the Laguna La Leona. The Sierra Chica hill crest is situated in the east and north-east, separated by Ruta 152 (map 2).

The geologic unit of the Sierras de Lihuel Calel is considered by some geologists as a continuation in south-eastern direction of the San Rafael block in the province Mendoza. Moreover, Lihuel Calel is assumed to be a rest of the former Gondwana surface, just like further mountain ranges in Argentina (Sierras de Córdoba, Sierra de San Luis and others).



Map 2: Geographic division of the Sierras de Lihuel Calel.

The undulating sand and rubble regions in the south and south-west of the Sierra Lihuel Calel are sparsely covered with bushes. Representatives of the legume family (*Fabaceae*) are predominant, such as “espinillo” *Vachellia caven* (Molina) Seigler & Ebinger (syn. *Acacia caven*), Chañar brea *Parkinsonia praecox* (Ruiz. ex Pav.) Hawkins (syn. *Cercidium praecox*), Chañar *Geoffroea decorticans* (Gillies ex Hook. & Arn.) Burkart and Algorabo *Prosopis flexuosa* DC. In the way of cacti *Opuntia sulphurea* Gillies ex S.-D., *Cereus aethiops* Haworth, *Echinopsis melanopotamica* Spegazzini (= *Echinopsis leucantha* (S.-D.) Walp.), *Parodia mammulosa* (Lemaire) Taylor (syn. *Parodia submammulosa*), *Pterocactus tuberosus* (Pfeiffer) Britton & Rose and *Gymnocalycium gibbosum* (Haworth) Pfeiffer ex Mittler can be found. The latter must certainly be considered as belonging to the *Gymnocalycium gibbosum* form, which is widespread throughout the whole Rio Negro Valley. The distribution area of this form extends via Chelforo in northern direction as far as Sierra Lihuel Calel. These plants were described by Carlos Spegazzini as a species named *G. brachypetalum* (Spegazzini 1925) and later on downgraded by the author as a variety of *G. gibbosum*, which is rich in forms (Papsch 1996). This variety is characterised

by an almost spherical to hemispherical appearance. The body tapers out conically, anchoring in the soil like an acuminate pole.



Fig. 2: Laguna Amarga, Province La Pampa.

Puelches with its huge salt pans such as Laguna Urre Lanquen and Laguna La Amarga is situated only slightly further west of the Sierra Lihuel Calel (fig.2). On the Espinal Islands at the edge of the lagoons *G. gibbosum* var. *brachypetalum* can frequently be found. In the flat, partly undulating sandy to rocky alluvial regions these prominent plants often grow in the shelter of shrubs or in shady tufts of grass. They can grow to a considerable height with the diameter of the grey to grey-green body being able to reach a diameter of 9-10 cm. Some individuals displayed a maximum height of 12 cm (fig. 3-4) when measured.



Fig. 3-4: *G. gibbosum* var. *brachypetalum* WP 30/39, Laguna Amarga, Province La Pampa.

The Sierras Carapacha Grande and Carapacha Chica, only few kilometres south of La Reforma, are formed by hills with a surface of gravel and broken rock. These are positioned to the left and right of the road RP 15 and are separated by the mostly dry Rio Salado o Chadileuvu. On the one hand they form the northernmost foothills of the Sierra Lihuel de Calel, on the other hand they suggest a possible past connection to similar geological areas, such as the Cerro Centinela south of Algarrobo del Aguilar in the north-west of the province and further mountain ranges in the Province Mendoza. With an altitude of maximum 300 m they only slightly project above the plain, which is here abundantly covered with shrubs (Fig. 5).



Fig. 5: Sierras Carapacha Grande, Province La Pampa.

The *Gymnocalycium* species are extremely difficult to discover below the dense bush covering and they are also very rare. Not only do they show many *G. gibbosum* var. *brachypetalum*, features, but they also have morphological conformity with plants from La Tosca in the province Mendoza, which also grow in alluvial terrain covered with shrubs and which could already be considered as *G. borthii* Koop ex H. Till. On average, the bodies are smaller than those of the Rio Negro form of *G. gibbosum* var. *brachypetalum*, darker and their spination is stronger. They can possibly be considered as a link to the former species (fig. 6-7).



Fig. 6-7: *G. gibbosum* var. WP 27/30, Sierra Carapacha Grande, Province La Pampa.

The geo-morphological conditions of the Sierra Lihuel Calel influence the special microclimate in the mountains, which is more humid and less continental than that of the flat areas because its annual precipitation is up to 400 mm. Thus, the flora differs when compared with that of the alluvial plains around the Sierra. The vegetation in the national park is dominated by tufts of grass, so-called tussocks (fig. 8). Small populations of Caldén (a special tree population) are interspersed in the valleys. The higher degree of humidity is reflected especially in the vegetation on rocks, consisting of lichens, ferns and tillandsia such as *Tillandsia gilliesii* Backer and *T. pedicellata* (Mez) Castellanos.



Fig. 8: Tussock tufts and *Soehrensia candicans* in the summit region of Cerro de la Sociedad Científica Argentina.



Fig. 9: Lichen vegetation on rocks on Cerro de la Sociedad Científica Argentina.



Fig. 10: *Parodia erinaceae* Sierra Lihuel Calel.



Fig. 11: *Tillandsias* growing over rock at Cerro de la Sociedad Científica Argentina.



Fig. 12: *Tillandsia gilliesii* WP 28/35 Sierra Lihuel Calel.

The cacti flora, too, is different from that of the Sierra's surroundings. In the rocky areas large groups of *Soehrensia candicans* (Gillies ex S.-D.) Schlumpberger (syn. *Echinopsis candicans* (Gillies ex S.-D.) Hunt, *Trichocereus candicans* (Gillies ex S.-D.) Br. & R.) are predominant. As to spherical cacti, *Parodia erinaceae* (Haworth) Taylor (syn. *Wigginsia sessiliflora* (Hook.) D. M. Porter) can be found. It is also remarkable that *Cylindropuntia tunicata* (Lehmann) Knuth (syn. *Opuntia puelchana* Castellanos) grows in large quantities here.

The *Gymnocalycium* species in and on the Sierra differ markedly from those in the alluvial regions ahead of the Sierra. They are small, brown plants with strong tap roots. It is especially striking that the plants were in continuous a stage of budding when they were investigated in November. In contrast, the plants from the flat regions did not show any state of budding and thus must be supposed to have a considerably later anthesis. After more than thirty years in cultivation the small body size is particularly striking and there is a rare tendency to a slightly elongated shape, as can be noticed in some specimens at their locality (fig. 13-16).



Fig. 13-16: *G. sibalii* WP 28/32, Sierra Lihuel Calel, Province La Pampa.

An elongated, up to 320 m high hill ridge called Sierra Chica is situated in the east ahead of the Sierra Lihuel Calel. These foothills, which are sparsely vegetated and gravelly, turn eventually into rocky terrain in the summit region. Apart from *G. sibalii*, already familiar from the Sierra Lihuel Calel, there are *E. leucantha*, *P. tuberosus* and occasionally *C. aethiops* as far as cacti are concerned (fig. 17).

On the gently inclined hill ridges a vital *Gymnocalycium* population can be found which resembles *G. sibalii* from the Sierra Lihuel Calel in all its features. The mostly small, brown plants were here in their state of budding, too. The taxonomic position of these *Gymnocalycium* species has been seen very differently in the past.



Fig. 17: Sierra Chica, Province La Pampa.



Fig. 18-21: *G. sibalii* WP 29/37, Sierra Chica, Province La Pampa.

DISCUSSION

The Argentinian botanist Alberto Castellanos visited the Sierra Lihuel Calel in 1927. In 1928 he describes *Opuntia puelchana* from this area but does not mention any *Gymnocalycium* species (Castellanos 1928). Walter Rausch, together with Ernst Zecher, visited among other places the little Sierras in the provinces Buenos Aires and La Pampa during his fifth expedition in 1972. Apart from *P. tuberosus* (R 540), two *Gymnocalycium* species were also collected in Lihuel Calel. The collection R 539 is listed as *G. gibbosum* var. *klein* (means little) and R 539a as *G. gibbosum* var. *platense* Speg. in Rausch's list of field numbers (Rausch 1975).

In 1989 and 1992 the Sierra Lihuel Calel and the Sierra Chica area was intensively searched by the author with various companions. In 1996 the author tried to classify the plants from the Sierra Lihuel Calel and the Sierra Chica taxonomically in a first paper. Based on morphological features

a relationship with *G. gibbosum* var. *brachypetalum* was considered as unlikely, rather a proximity to *G. strigianum* Jeggel and *G. borthii*, which originate from the northwest, was assumed (Papsch 1996).

J. Prochazka's collections from the Sierra Chica JPR 92-77/173 and from the Sierra Lihuel Calel JPR 92-76/166 were spread under the temporary name *G. friedlii* nom nud. via Czech seed lists.

The collection JPR 77/173, acquired during a journey together with the author, was described by J. J. Halda as *Gymnocalycium sibalii* Halda & Milt. The altitude of the finding is erroneously stated as 1,000 m and thus almost 700 m too high. But if this altitude referred to feet, it would be correct. The new species is placed in the taxonomic vicinity of *G. lukasikii* Halda & Kupčák subsp. *lukasikii*, which is not comprehensible from our point of view. It is said to differ from the latter in its larger bodies, larger flowers and smaller seeds (Halda 2006).

Two years later G. Neuhuber deals with these plants. He collected in and around the Sierra Lihuel Calel in 1990. His findings GN 278 Puelches, GN 279 Lihuel Calel, GN 281 Sierra Chica and GN 282 Carapacha Chica are all listed as *G. reductum* (Link) Pfeiffer ex Mittler in his list of field numbers (Neuhuber 1991). In later field lists he divides the originally five *Gymnocalycium* species collected near Puelches in *G. reductum* GN 278-0911 and *G. gibbosum* GN 278-0912 to 0915. In the mentioned paper the findings from the Sierra Carapacha Grande (then no longer Chica) and near Puelches are specified as *G. gibbosum* var. *brachypetalum* (Neuhuber 2008). Likewise, his altitude concerning the Sierra Chica (430 m) is too high. Based on his morphological investigation of body and flower of the Sierra Chica plants he also rules out a relationship with *G. gibbosum* var. *brachypetalum*. Just as surprisingly, but unlike Halda, he assigns these plants to the relationship of *G. reductum*. He supports his assumption with flower features of his plants, however, he does not quote any of his field numbers with the respective pictures of flowering plants and flower sections. As he originally regarded all his collections from the area around the Sierra Lihuel Calel as *G. reductum* and later corrected this opinion, it would be helpful to learn of which collections the pictures were taken.

Neuhuber regards *G. sibalii* merely as a subspecies of *G. reductum* (Neuhuber 2008). In an article on his website Milt vehemently contradicts some of Neuhuber's claims, using fierce expressions (Milt 2010). Charles (2009) adopts Neuhuber's view without further comment. In the Cactaceae 1_core checklist of the Caryophyllales network's data portal *G. sibalii* is attributed to the synonyms of *G. reductum* (Metzing 2021).

SHORT CHARACTERISATION OF *G. sibalii* AND COMPARISON WITH PLANTS FROM THE FARTHER SURROUNDINGS

The bodies of *G. sibalii* WP 28/32 are not sprouting and spherical as a rule. They reach a diameter of up to 5 cm and have a tendency to a slightly cylindrical form at an advanced age. Its body colour is olive-brown.



Fig. 22-23: *G. sibalii* WP 28-32, Sierra Lihuel Calel, La Pampa, at locality (left) and in cultivation (right).



Fig. 24: *G. sibalii* WP 28-32 Sierra Lihuel Calel, Province La Pampa.



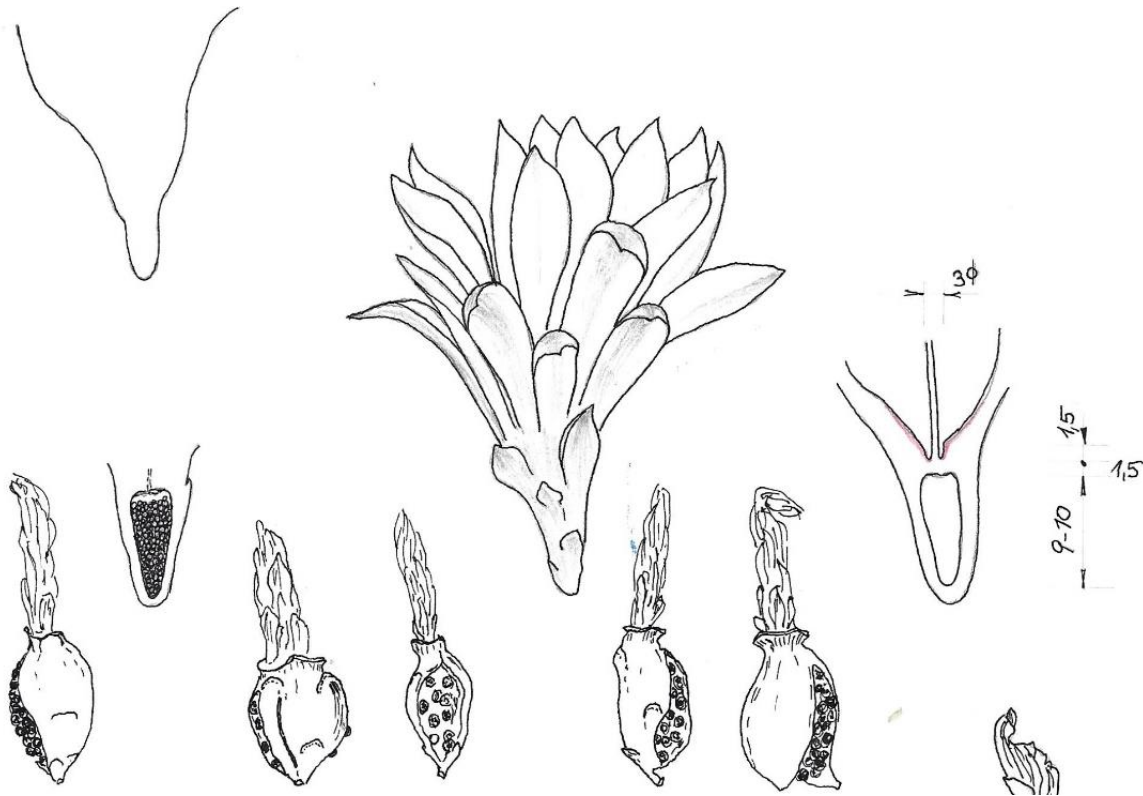
Fig. 25: flower section of *G. sibalii* WP 28-32 (field number erroneously 28-33).

The funnel-shaped, shiny white flowers reach a diameter of 75 mm at a length of 60 mm. sometimes a distinct smell of lilac can be noticed.

Further flower features in detail: Ovary elongated, 9 mm long, 4 mm in diameter. Nectary wide, 1.5 mm deep, at the top extended to 3 mm in diameter, rose-coloured. Few scales, triangular, green with reddish-brown tips and light edges, 3 mm wide, 2 mm high. Pericarp 20 mm long, at the top extending to 10 mm in diameter, dark green, getting lighter towards the top; sepals lanceolate, 23 mm long, 8 mm wide, white with a broad, green-brown central stripe which gets darker towards the tip; petals lanceolate, 35 mm long, 8 mm wide, outer ones with a fine brownish green central line, inner ones narrower and with a finer tip, all shiny white.

Two series of stamina hard to distinguish, primary ones arching towards the style, 14 mm long, secondary ones inserting all over the receptacle, 11-12 mm long, greenish; anthers flat, 0.8-1 mm long, yellow, style including stigmata 26 mm long, 21 mm without stigmata, at the base 1.5 mm in diameter, greenish; stigmata 10, cylindrical, 5 mm long, off-white.

Size of the fruit: 22 mm high, 10-14 mm in diameter. Fruit form ovoid to more elongated with a short peduncle (up to 2 mm), the upper part moderately everted, matt blue-green, somewhat frosty grey coating, in ripeness turning matt moss- to blackish green.



The upper part constricted to a vase-like shape, overlap little bent outside, wide, sharp edges, light brown. Few scales (6-7), semi-circular- to triangle-shaped, pinkish brown, light edges, rest of perianth drying and remaining on top. Opening in ripeness longitudinally in 2-3 places, pulpa white. Towards the wall of the fruit delicate rose-coloured, little sticky.

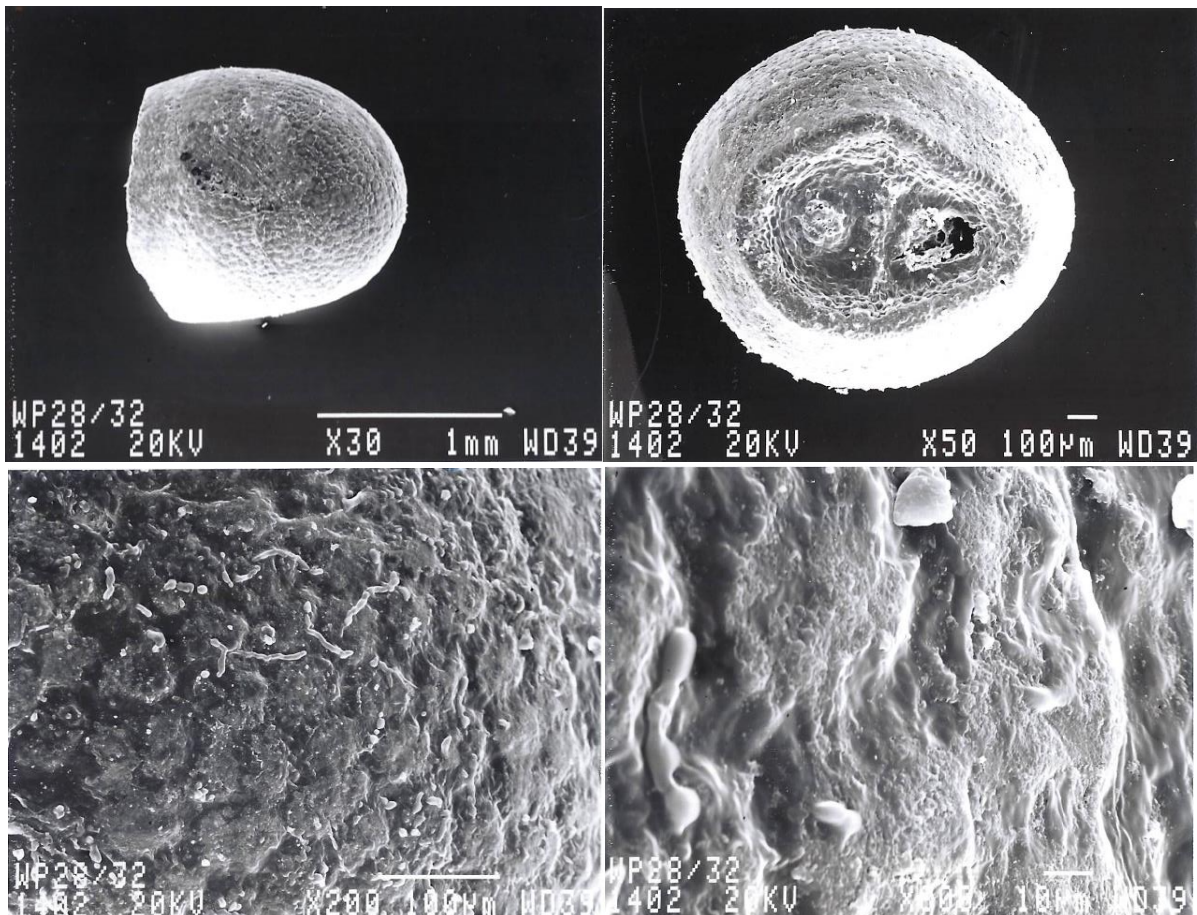


Fig. 26: Seeds of *G. sibalii* WP 28/32.

Size of seeds 1.4x1.5 mm, number of grains 310 on average, black, HMR wide drop-shaped, indented; cuticula partly occurring in patches, partly covering the whole surface of the seed (fig. 26).

G. sibalii WP 29/37 from Sierra Chica differs in only few details from the plants in Sierra Lihuel Calel (fig. 27-30).



Fig. 27: *G. sibalii* WP 29/37 Sierra Chica.



Fig. 28: *G. sibalii* WP 29/37 in cultivation.



Fig. 29: *G. sibalii* WP 29/37 in cultivation.



Fig. 30: *G. sibalii* WP 29/37 flower section.

Flower size 70 mm long, 55 mm in diameter, narrow funnel-shaped; ovary 19 mm long, 5 mm in diameter; nectary 2 mm deep, extending to a diameter of 4 mm at the top, up to just above the last circle of stamens bold pink. Scales 6-10, semi-circular, black-green, towards the tip brownish purple with light edges, 5 mm wide, 3 mm high. Pericarp 30 mm long, extending to 10 mm in diameter at the top, matt dark green; sepals wide lanceolate, 22 mm long, 10 mm wide, white with a broad, olive green central stripe which gets darker towards the top, shiny rose-coloured at the base; outer petals spatula-shaped, 33 mm long, 10 mm wide, white with central line, rose-coloured at the base, inner ones spatula-shaped, 31 mm long, 6-7 mm wide, shiny white, rose-coloured at the base.

Stamens in two series, primary ones in two lines arching towards the style and enclosing it, 8 mm long, white; secondary ones inserting all over the receptacle without gap, 6-8 mm long, leaning inside, all off-white; anthers 1.1 mm long, flattened, yellow; style with stigmata 28 mm long, 22 mm without stigmata, at the base 2.2 mm in diameter, light green; stigmata 12, 6 mm long, light yellow.

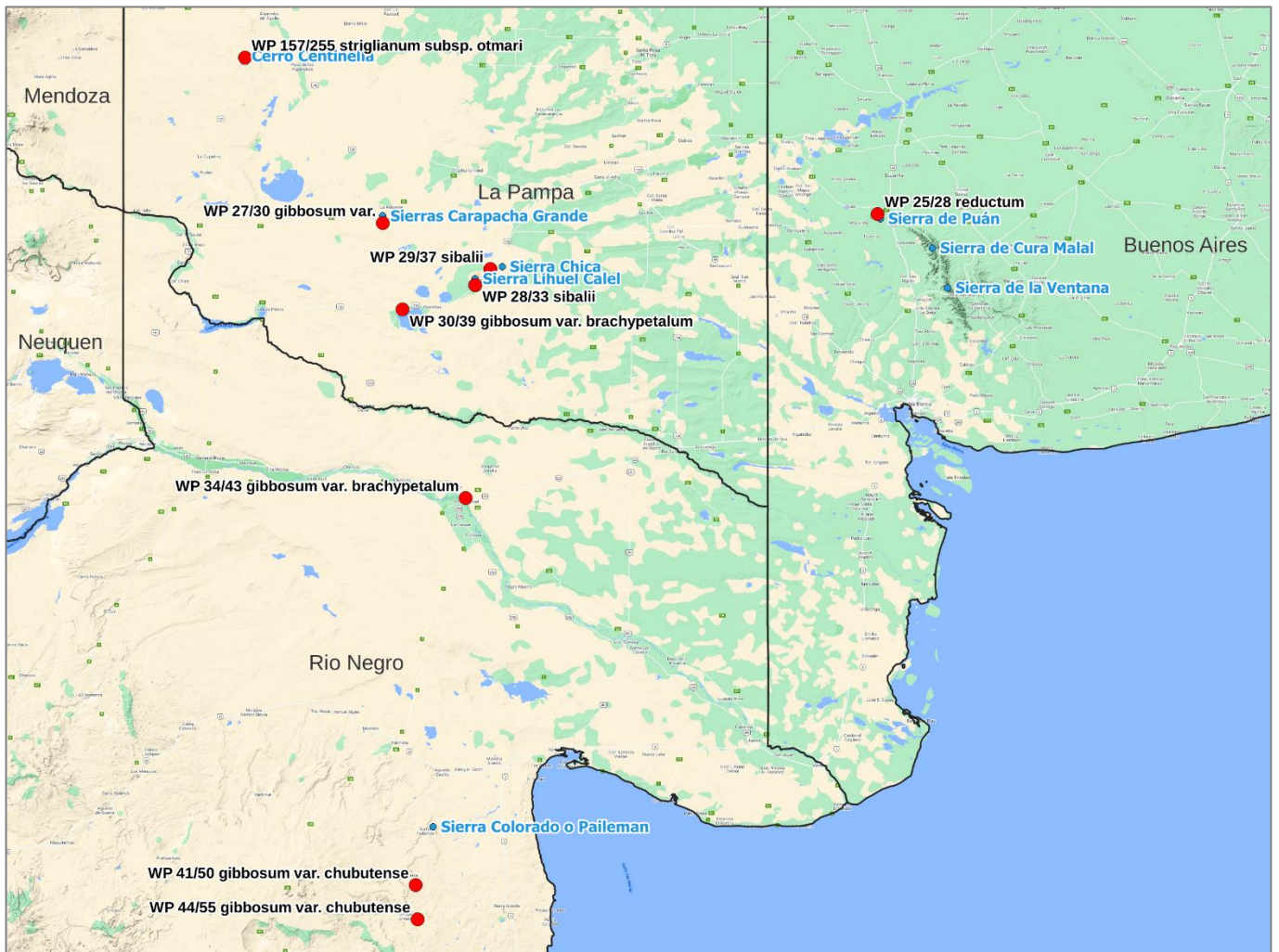


Fruit 17-28 mm high, 13-16 mm in diameter; fruit form ovoid to more elongated, with short peduncle, the upper part constricted to a vase-like shape, overlap little bent outside, dark brown with light edges. Fruit colour matt dark blue-green, darker at the top, matt black-green when dry, slight frosty grey coating. Scales flat, semi-circular, carinate, light edges, stretching horizontally when ripe up to 5x2 (to 6x3 mm), reddish brown, pointed. Rest of perianth drying and remaining on top. Opening in state of ripeness 1-2(-3) times longitudinally. Pulpa white, seed cords white, thick, succulent.

Seed size 1.2 x 1.5 mm, number of grains 280 on average. HMR indented, edges folded in a V-shape, not everted, black; cuticle covering the whole surface of the seed.

Till und Lambrou specify for collection GN 279/918 a ploidy level of $2n$, diploid (Lambrou & Till 1983). As Neuhuber only mentions Lihuel Calel as locality it must be asked if this is really *G. sibalii* from the Sierra or if it is rather a *G. gibbosum* var. *brachypetalum* from the surroundings of the Sierra. The analysis of *G. sibalii* WP 29/37 from the Sierra Chica resulted in a ploidy level of $4n$, tetraploid.

For a comparison of morphologic features plants from more distant localities around the Sierra Lihuel Calel should also be included. All mountain ridges mentioned here are located within a circle of 300 km in diameter, in whose centre the Sierra Lihuel Calel has an isolated, island-like position (map 3).



Map 3: Geographic position of the localities investigated.

Cerro Centinella is geographically the closest. It is situated about 140 km north-west of the Sierra Carapacha Grande. The huge drainage basin of Rio Salado forms a natural geographic barrier in between (fig. 31).



Fig. 31: Cerro Centinella, Province La Pampa.

Gymnocalycium species were discovered in 1992 which were first regarded as a local form of *G. strigianum* (fig. 32-33). Halda and Milt consider them as a subspecies and describe them as *G. strigianum* subsp. *otmari* Halda & Milt (Halda & Milt 2007).

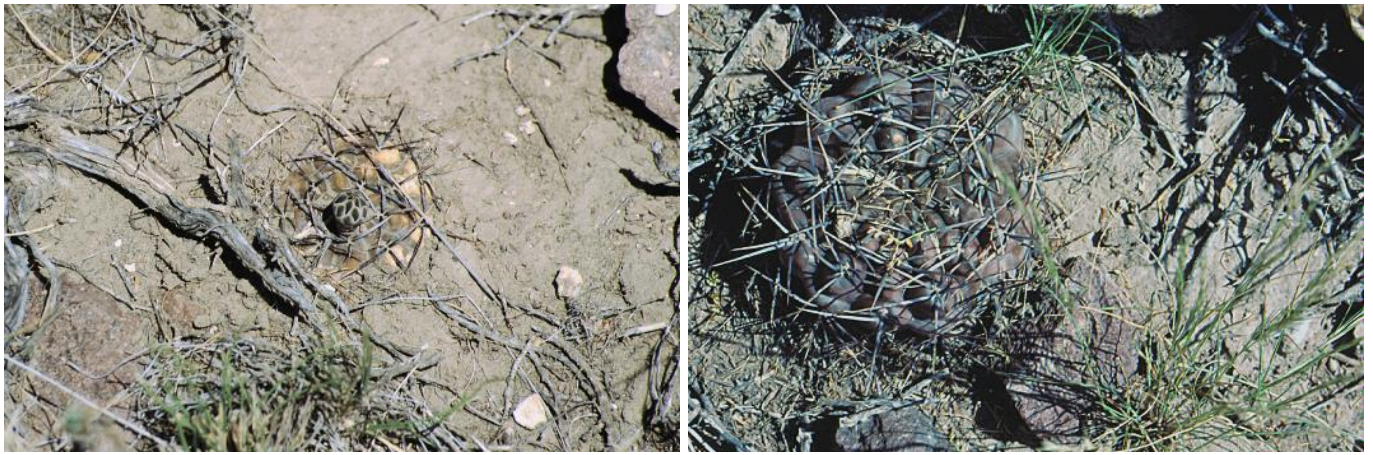


Fig. 32-33: *G. strigianum* subsp. *otmarii* WP 157/255, Cerro Centinella, Province La Pampa.

Flowers 60 mm long, 40 mm in diameter, narrow funnel-shaped, ovary 20 mm long, 3.5 mm in diameter, delicate rose-coloured. Nectary 3 mm deep, extending to 2.5 mm in diameter at the top, bold pink as far as just above the last circle of stamina. Scales triangular, with light edges, rose-coloured, pointed, 3.5 mm wide, 2 mm high.

Pericarp 25 mm long, extending to 7mm in diameter at the top, blackish green; sepals wide lanceolate, 17 mm long, 9 mm wide, gleaming white with a rose-coloured glint, wide olive-green central stripe, red at the base; outer petals spatula-shaped, 29 mm long, 9 mm wide, white with a brown central line, delicate rose-coloured, red at the base: inner ones narrow lanceolate, 26 mm long, 7 mm wide, white with delicate rose-coloured central line, red at the base, stamina indistinctly separated, primary ones 8 mm long, greenish; secondary ones inserting all over the receptacle without gap, 12 mm long, all arching inwards towards the style, enclosing it in a roof-like fashion; stamina 1x0.4x0.2 mm, flat, light yellow; style with stigmata 21 mm long, without 17-18 mm, at the base 1-1.2 mm in diameter, off-white; stigmata 8,4 mm long, cylindric, light yellow.



Fruit 25-28 mm high, 10 mm in diameter; fruit form spindle-shaped, narrowly elongated with an up to 12 mm long peduncle, the upper part mostly constricted in a vase-like shape, overlap-like little bent outside, dark brown with light edges.

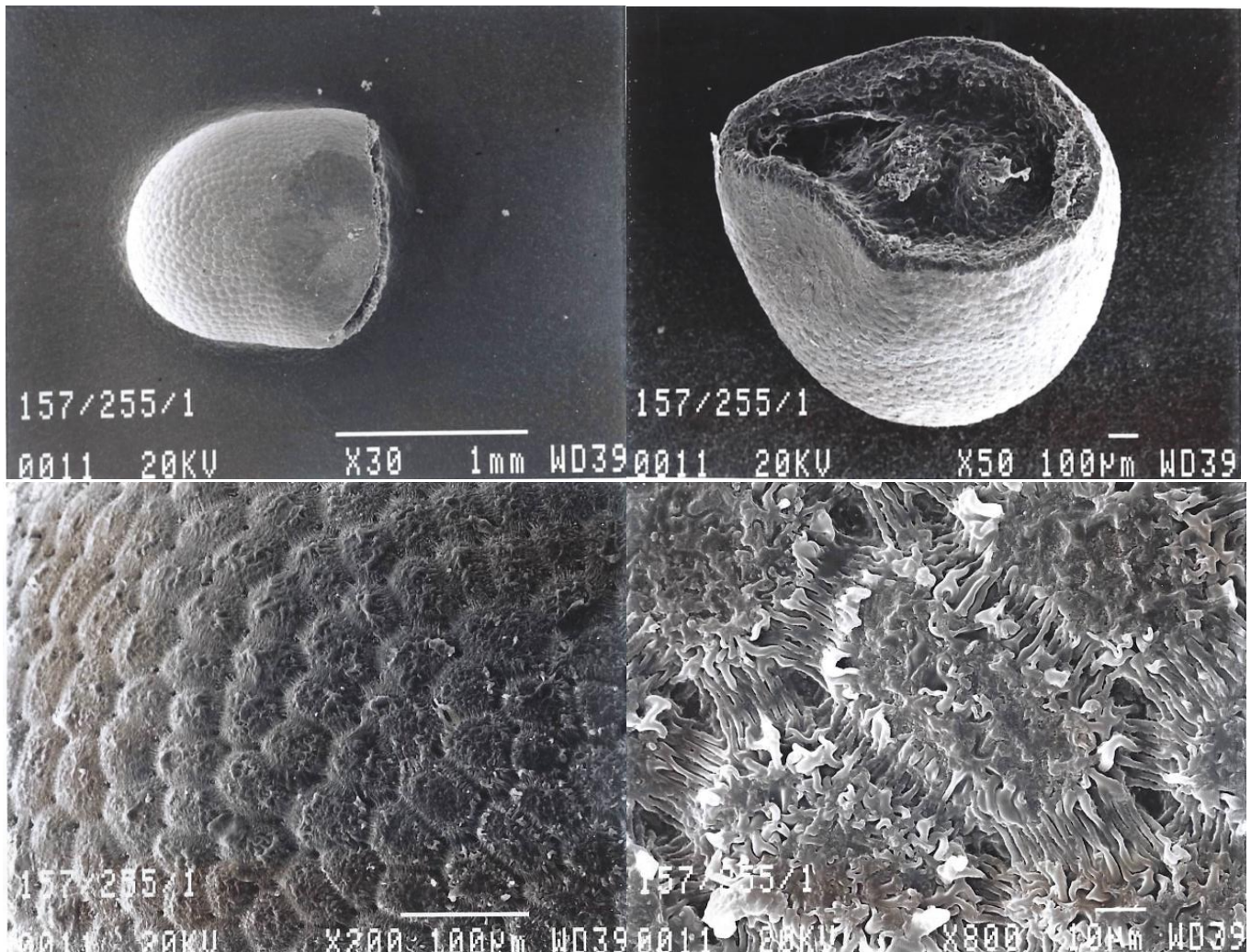


Fig. 34: Seeds von *G. strigianum* subsp. *otmari* WP 167/255, Cerro Centinella, Province La Pampa.

Fruit colour matt dark greyish green, upper part darker, matt blackish green in dry state; scales flat, triangular with light edges, up to 4x2 mm, reddish brown, pointed, rest of perianth drying, remaining on top. Ripping open longitudinally in one line in state of ripeness, pulpa white.

Size of seeds 1.4 x1.2 mm, number of grains 80 on average, black; HMR wide drop-shaped, indented: cuticle covering the seed surface in parts (fig. 34).

The ploidy level of *G. strigianum* GN 54/123 from Lujan de Cuyo is specified as diploid $2n=22$ by Lambrou and Till.

A 300 km wide lowlands strip of ground, which is interspersed with innumerable salt lagoons in the east, separates the Sierra Lihuel Calel and the Sierra Chica from the northernmost foothills of the Sierra de la Ventana. These foothills are called Sierra de Puan and Sierra de Pigüe (fig. 35) and they are already situated in the Province Buenos Aires. This lowland strip also forms a prominent geographic division and is intensively used for agriculture.



Fig. 35: Province Buenos Aires, Sierra de Puan and Sierra de Pigüe.

The Sierra de la Ventana is regarded as a remain of the former Gondwana surface in geological respect. Just like in the entire central region of the Sierra de la Ventana, *G. reductum* populations can be found here in the peripheral mountains (fig. 36-37).



Fig. 36-37: *G. reductum* WP 25/28, Sierra de Puan, Province Buenos Aires.

G. reductum has mostly cylindric bodies which often form large groups of several heads with increasing age. The sprouts are divided into straight ribs with protuberances (up to 22 ribs), spines occur in clusters, mostly with several central spines.



Fig. 38: *G. reductum* WP 25/28 Sierra de Puan.

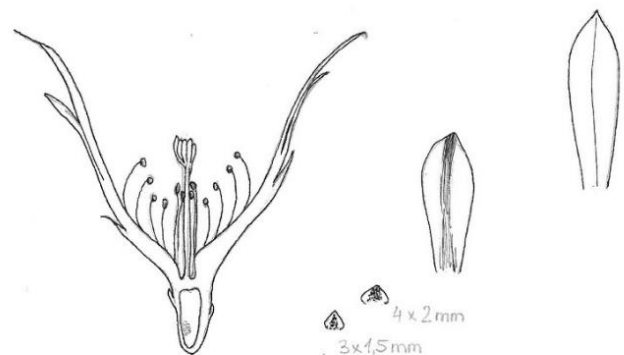


Fig. 39: Schematic diagram of the flower section of *G. reductum* WP 25/28.

Flowers 55 mm long, 50-55 mm in diameter, wide funnel-shaped; ovary spherical to slightly elongated, 10 mm long, 4 mm in diameter; nectary: 2.5 mm deep, extending to a diameter of

3.5 mm at the top, delicate rose-coloured as far as just above the first circle of stamina. Scales 6-8, pointed, triangular, dark moss-green, brownish violet towards the top, white edges, 2.5 mm wide, 2.2 mm high (fig. 38-39).

Pericarp 15 mm long, extending to 11 mm in diameter at the top, shiny moss-green; sepals spatula-shaped, 22-24 mm long, 7 mm wide, white with a broad greenish brown central stripe which becomes brownish violet towards the tip; petals lanceolate, in two rows, 25 mm long, 8 mm wide, ending in a delicate tip, white with delicate pinkish brown tip at the exterior, inner ones more narrow and more delicate; stamina in two series, primary ones in 2-3 rows, arching towards the style and enclosing it, 16 mm long, white; secondary ones inserting all over the receptacle, 12-13 mm long, white; anthers 0.8-1 mm long, yellow; Style with stigmata 22 mm long, 18-19 mm without, at the base 1.8-2 mm in diameter, off-white; stigmata 9, 4 mm long, off-white. Scent: not perceptible.



Fruit size 10-12 mm in diameter, up to 16 mm long; fruit form spherical to slightly ovoid, upper part everted, sharp-edged, light brown bent outside, arching across the fruit in a saddle-like fashion. Fruit colour dull moss-green to matt dark blackish green, upper third light purple. Scales pointed triangular, dentate, light edges with purple-red tip, often the entire scale purple, 2-2.5x1-2 mm. Rest of the perianth drying, remaining on top. Opening longitudinally in 2(-3) lines when ripe. Pulpa bold rose-coloured, rarely white, somewhat sticky.

Seed size 1-1.2 mm in diameter, number of grains: 180 on average; cuticle partly covering large areas.

When chromosomes of *G. reductum* WP 89-022/025 from the Sierra Bravard were counted, they amounted to a diploid set of chromosomes $2n=22$. Lambrou and Till establish a ploidy level of $2n$ (diploid) for the collecting GN 285 from the Sierra Cura Malal and $4n$ (tetraploid) for GN 287 from the Sierra de la Ventana.

In the south and south-east of the Sierra Lihuel Calel the alluvial regions extend along Rio Negro and beyond it far into the south, near the coast as far as Peninsula Valdes (fig. 40). As already

briefly touched upon above, numerous populations of *G. gibbosum* var. *brachypetalum* can be found at a minor height of between 20 m and 180 m in equal soil conditions. Interestingly, no corresponding plants were found during excursions to the Sierra Chica.



Fig. 40: RN 250, west of Choele Choel, Province Rio Negro.



Fig. 41-42: *G. gibbosum* var. *brachypetalum* WP 34/43, Choele Choel, Province Rio Negro.

G. gibbosum var. *brachypetalum* has solitary, spherical bodies with up to 15 ribs. 6-7 marginal spines are arranged at the bottom third of the areole, sometimes a central spine is formed. The flowers are narrow funnel-shaped with oblong ovary, fruits spindle-shaped, ripping open longitudinally (fig. 41-42).

A chromosome count of the collecting GN 90-278 from Puelches by Lambrou and Till specified $2n=22$ (diploid).

Plants from the Sierra Colorado o Pailemann in the Province Rio Negro are also included in this study. It is situated about 20 km south of Aguado Cecilia. The northern tip of this line of mountains, which extends from here in southern direction, is about 320 away from the Sierra Lihuel Calel and separated geologically by the wide valley of Rio Negro (fig. 43).



Fig. 43: Sierra Colorado o Paileman, Province Rio Negro.

These mountain ranges, too, are of volcanic origin and are also counted among the Gondwanan mountainous areas. On the eastern edge there grow numerous *Gymnocalycium* populations at an altitude of 300 to 600 m. They can be regarded as *Gymnocalycium gibbosum* subsp. *chubutense* (Spegazzini) Papsch (fig. 44-49).



Fig. 44-45: *G. gibbosum* var. *chubutense* WP 40/50b, Sierra Colorado o Paileman, Province Rio Negro.

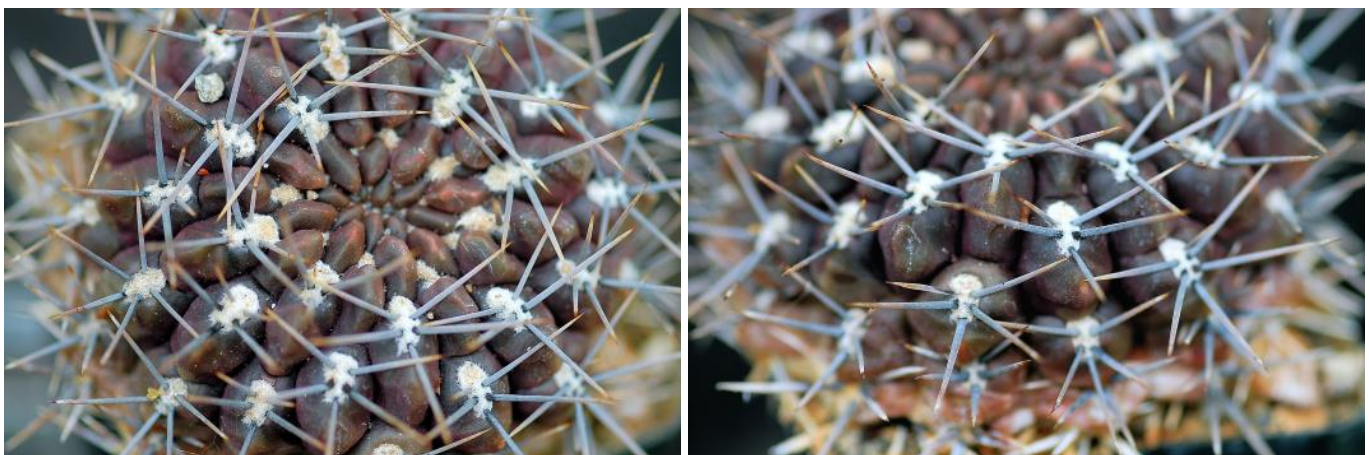


Fig. 46-47: *G. gibbosum* var. *chubutense* WP 40/50b, Sierra Colorado o Paileman, Province Rio Negro.



Fig. 48-49: *G. gibbosum* var. *chubutense* TS 1821, Arroyo de los Berros (photos: T. Strub).

Flower size 60 mm long, 40 mm in diameter, funnel-shaped; ovary 13 mm long, 6 mm in diameter, bottom part without any ovules: nectary 3 mm deep, extending to 3.5 mm at the top, bold pink up to just above the last circle of stamina. Scales triangular, bright edges, indistinctly rose-coloured, pointed, 5 mm wide, 4 mm high.

Pericarp 12 mm long, extending to a diameter of 15 mm at the top, blackish green; sepals wide lanceolate, up to 16 mm long, 9 mm wide, gleaming white with a rose-coloured glint, wide olive-green central stripe, red at the base; outer petals spatula-shaped, 25 mm long, 8 mm wide, white with a brown central line, delicate rose-coloured, red at the base; inner ones narrow lanceolate, 26 mm long, 7 mm wide, white with delicate rose-coloured central line, red at the base; stamina distinctly separated in primary and secondary ones, primary stamina 10 mm long, enclosing the style, greenish; secondary ones inserting all over the receptacle without any gap, 8 mm long, all arching inwards toward the style; anthers 1x0.4x0.2 mm, flat, light yellow; style including stigmata 45 mm long, without stigmata 40 mm, at the base 4.5 mm in diameter, off-white; stigmata 8-10, 8 mm long, cylindric, bold yellow (fig. 49, 50).



Fig. 50: *G. gibbosum* var. *chubutense* TS 1821, Arroyo de los Berros (photo: T. Strub).

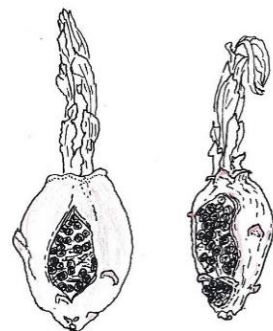


Fig. 51: *G. gibbosum* var. *chubutense* WP 40/50b, Sierra Colorado o Paileman.



Fig. 52: Seeds of *G. gibbosum* var. *chubutense* WP 40/50, Arroyo de la Los Berros, Province Rio Negro (photo: F. Fuschillo).

Fruit size 18-26 mm long, 12-17 mm in diameter; fruit form spherical to ovoid, little everted at the top, often merely indented, when cuff exists it is turned outside only little, sharp edges, light brown, fruit colour shiny dark green, sometimes a little frosted, in state of ripeness matt moss-green and often with a reddish hue. Scales arranged in two indistinct spiral rows of 5-6 each, hemispherical to triangular, rose-coloured, with light edges, 3x2 mm. Rest of perianth drying, remaining on top. In ripeness ripping open longitudinally in one or two places. Pulpa white, a little sticky; drying out (fig. 51).

Seed size 1.3-1.4 mm in diameter, 1.5 mm long, number of grains 210 on average, black; cuticle covering the entire surface (fig. 52).

The chromosomes count of *G. gibbosum* var. *chubutense* WP 89-44/55 Sierra de la Ventana resulted in $2n=44$.

SUMMARY

- The two localities of *G. sibalii* known so far are situated centrally within an area of 300 km radius where other *Gymnocalycium* taxa occur.
- Apart from the populations of *G. gibbosum* var. *brachypetalum* which can be found around the Sierra Lihuel Calel, the habitats of *G. striglianum* subsp. *otmari* and *G. borthii* in the north and north-west as well as those of *G. reductum* in the west and the localities of *G. gibbosum* var. *chubutense* in the south are geographically distinctly separated. Genetic exchange by pollination of these species with *G. sibalii* is unlikely due to the large distance.
- The flowering period of *G. sibalii* and *G. reductum* is clearly before that of all the other species mentioned here. This feature is preserved in cultivation, too. The spines of *G. sibalii* and *G. reductum* are all radially arranged. *G. reductum*, however, usually forms several central

spines. The spine pattern of the other taxa compared recall a dragonfly-like shape because they grow laterally and downwards with the upper part of the areole remaining bare.

- At their localities *G. strigianum* and *G. gibbosum* var. *chubutense* have similar conditions as *G. sibalii*, growing in heavily eroded volcanic soil.
- *G. gibbosum* var. *brachypetalum* and *G. borthii* prefer flat, alluvial sandy terrain. These species form larger spherical bodies without taproot. The localities of *G. sibalii* in the Sierra Lihuel Calel are situated within an ignimbrite landscape. Ignimbrite's features are similar to those of granite and it is also called pseudo-granite. The localities of *G. reductum* consist of granite, granodiorite and amphibolite.
- *G. reductum* clearly differs from *G. sibalii*'s morphology in its spherical to cylindrical, partly heavily sprouting bodies and spines arranged in clusters as well as in flower morphology and form of fruit.
- *G. strigianum* is similar to *G. sibalii* in growth habit but differs from it in having greatly elongated flowers and fruits with conspicuous pedicels. The seeds are also distinctly different with the broadly drop-shaped depressed HMR region.
- *G. gibbosum* var. *chubutense* also shows greater agreement in growth habit with *G. sibalii*. However, the flower is coarser in all parts and the seeds have a broadly rounded HMR region.
- The results concerning chromosome counts on hand so far can hardly be compared at present due to their incompleteness. However, they are still interesting. Thus, *G. strigianum*, *G. borthii*, *G. reductum* and *G. gibbosum* var. *brachypetalum* have a diploid chromosome set $2n=22$, whereas *G. sibalii* and *G. gibbosum* var. *chubutense* have a tetraploid one, namely $2n=44$.

The assumption that *G. sibalii* can be regarded as a subspecies of or synonymous to *G. reductum* has been clearly proved wrong here for morphological reasons as well as based on the result of the chromosome count. Due to the studies carried out so far *G. sibalii* is regarded here as a taxon of its own at the rank of a species.

***Gymnocalycium sibalii* Halda & Milt 2006.**

Type: no 061135; Hortus Miltianus; leg. I. Milt 20.5.2006, e seminibus eneatus J. Prochazka JPR 77/173, Argentinien, Prov. La Pampa, Sierra Chica, 1000 m s.m. (Herbarium Haldianum).

Synonym: *Gymnocalycium reductum* subsp. *sibalii* (Halda & Milt) Neuhuber 2008

Gymnocalycium friedlii nom. nud.

It is possible that *G. sibalii* is more closely related to *G. gibbosum* var. *chubutense*. The different ploidy level of *G. gibbosum* var. *chubutense* (tetraploid) compared to *G. gibbosum* var. *brachypetalum* (diploid) would support Spegazzini's description on species rank of the former. This theory is also supported by morphological differences and different habitat conditions. Further investigations in the species complex discussed here will provide clarity.

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LITERATURE

Cabrera, A. L (1976): Regiones fitogeográficas Argentina.-Enciclopedia Argentina de Agricultura y Jardinería, Tomo 2. 2^o edición. Acme. Buenos Aires.

Cabrera, A. L. (1994): Regiones fitogeográficas argentinas.-Enciclopedia *Argentina* de Agricultura y Jardinería, Tomo II, fascículo 1. Acme. Buenos Aires.

Castellanos, A. (1928): Algunos árboles y arbustos de interés florístico regional. - *Physis* 9: 98 ff.

Charles, G. (2009): *Gymnocalycium* in Habitat and Culture. - Selbstverlag Charles, Stamford.

Halda, J. J. & Milt, I. (2006): Nové popisy v rodu *Gymnocalycium* Pfeiffer. - *Acta Musei Richnoviensis, Sect. Natur.* 13(1): 7-8.

Lambrou, M. & Till, W. (1993): Zur Karyologie der Gattung *Gymnocalycium*. - *Gymnocalycium* 6(1): 85-88.

Llambias, E. J. (1975): Geología de la provincia de La Pampa y su aspecto minero. Informe inédito, 38 pp. - Dirección de Minas de La Pampa. Santa Rosa.

Metzing, D. (2021) in: A global synthesis of species diversity in the angiosperm order Caryophyllales (<https://caryophyllales.org/>).

Milt, I. (2010): website (https://www.carciton.cz/kaktusy/clanky14_7.htm).

Neuhuber, G. (1991): Feldnummernliste. - Eigenverlag Neuhuber, Wels.

Neuhuber, G. (2008): Eine kritische Betrachtung des *Gymnocalycium sibalii* Halda & Milt. - *Gymnocalycium* 21(1): 758.

Papsch, W. (1996): *Gymnocalycium gibbosum* (Haworth) Pfeiffer ex Mittler und seine Varietäten. - *Gymnocalycium* 9(4): 201.

Prina, A. et al. (2015): Guía de Plantas del Parque Nacional Lihué Calel., 1a ed. - Santa Rosa, La Pampa, Argentinien.

Rausch, W. (1975): Verzeichnis der Sammelnummern 1962-1974. - Selbstverlag GÖK-Wien.