



# A NEW *GYMNOCALYCIUM* SPECIES (CACTACEAE) FROM VALLE FÉRTIL, SAN JUAN, ARGENTINA

UNA NUEVA ESPECIE DE *GYMNOCALYCIUM* (CACTACEAE) DE VALLE FÉRTIL, SAN JUAN, ARGENTINA

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## SUMMARY

**Background and aims:** Although the flora of the Argentine Province of San Juan is, on the whole, well researched and documented, the distribution of plant species in more inaccessible areas is not yet fully known. This is particularly true of small herbaceous species, even those belonging to the Cactaceae family, which, due to their horticultural interest, are generally already among the better-studied species. A few years ago, an unknown population of the genus *Gymnocalycium* was discovered.

**M&M:** The plants were studied *in situ* during several field trips, and specimens were collected for the herbarium and for further *ex situ* studies. For comparison purposes, specimens of other species were examined both in their natural habitat and in cultivation, and the relevant literature was consulted.

**Results and Discussion:** The new finding belongs to *Gymnocalycium* subg. *Gymnocalycium*, for which no representative was previously known in the flora of San Juan. Due to morphological characteristics differs from other species of this subgenus found in neighbouring but clearly isolated mountain ranges in the provinces of Córdoba and La Rioja. The plants are therefore described here as a species new to science, *Gymnocalycium justomarquezii* sp. nov. An updated key to the identification of the genus *Gymnocalycium* in the Province of San Juan is presented. Two further cactus species, *Denmoza rhodacantha* and *Cereus hankeanus*, are here for the Sierra del Valle Fértil for the first time.

**Conclusions:** The new species *Gymnocalycium justomarquezii* is endemic to the Sierra del Valle Fértil, emphasising the importance of this biodiversity hotspot. More field research is needed to determine the distribution area and conservation status of this species.

## KEY WORDS

Cacti, *Gymnocalycium justomarquezii*, San Juan Province, taxonomy.

## RESUMEN

**Introducción y objetivos:** Aunque la flora de la provincia argentina de San Juan está, en general, bien investigada y documentada, aún no se conoce del todo la distribución de las especies vegetales en las zonas más inaccesibles. Esto es especialmente cierto en el caso de las especies herbáceas de pequeño tamaño, incluso las pertenecientes a la familia Cactaceae, que, debido a su interés horticola, suelen figurar ya entre las especies mejor estudiadas. Hace unos años se descubrió una población desconocida del género *Gymnocalycium*.

**M&M:** Las plantas se estudiaron *in situ* durante varias excursiones de campo y se recolectaron especímenes para el herbario y para futuros estudios *ex situ*. A efectos comparativos, se examinaron especímenes de otras especies tanto en su hábitat natural como en cultivo, y se consultó la bibliografía pertinente.

**Resultados y discusión:** El porte de la planta y sus semillas indican que se trata de una especie del género *Gymnocalycium* subg. *Gymnocalycium*, del que no se conocía hasta ahora ningún representante en la flora de San Juan. Debido a sus características, se diferencia de las otras especies del mismo subgénero que se encuentran en montañas vecinas, pero claramente aisladas, de las provincias de Córdoba y La Rioja. Las plantas se describen aquí como una especie nueva para la ciencia, *Gymnocalycium justomarquezii* sp. nov. Se presenta una clave actualizada para la identificación de las especies del género *Gymnocalycium* en la provincia de San Juan. Se registran aquí por primera vez otras dos especies de cactus en la Sierra del Valle Fértil: *Denmoza rhodacantha* y *Cereus hankeanus*.

**Conclusiones:** La nueva especie *Gymnocalycium justomarquezii* es endémica de la Sierra del Valle Fértil, lo que pone de relieve la importancia de este centro de biodiversidad. Es necesario realizar más investigaciones de campo para determinar el área de distribución y el estado de conservación de esta especie.

## PALABRAS CLAVE

Cactus, *Gymnocalycium justomarquezii*, provincia de San Juan, taxonomía.

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## INTRODUCTION

*Gymnocalycium* Pfeiffer ex Mittler is a genus of mainly globular cacti with a distribution area extending east of the Andes, from Patagonia in the South to southern Bolivia in the North, as well as to Uruguay and southern Brazil in the East. The main centre of species diversity is in the Chaco region of North-western and Central Argentina (Barthlott *et al.*, 2015). Since the genus was established in 1844 with three species, more than 200 names have been published at specific rank, and many more at infraspecific level, partly due to horticultural interest and the popularity of the genus among cactus enthusiasts. However, more recent treatments of the genus usually accept about 50–60 species (Kiesling *et al.*, 2008; Charles, 2009; Demaio *et al.*, 2011; Kiesling & Demaio, 2018).

Several infrageneric classifications have been proposed, based mainly on size, form and surface characters of the seeds, but corresponding with flowers and fruits characters, too (see Metzinger *et al.*, 1995 for an overview). Seven subgenera have been accepted by Demaio *et al.* (2011). One of these is the subgenus *Gymnocalycium*, that includes the type of the genus, *Gymnocalycium gibbosum* (Haw.) Pfeiffer ex Mittler.

A molecular phylogenetic analysis has shown that this subgenus is the youngest clade within the genus (Demaio *et al.*, 2011). Specific delimitation within the subgenus is difficult due to the high morphological similarity. This is supported by a remarkable homogeneity of the molecular data, which may be the result of a rapid and recent radiation (Demaio *et al.*, 2011).

*Gymnocalycium* subg. *Gymnocalycium* has a disjunct distribution pattern, stretching from the Argentinean provinces of La Rioja and Santiago del Estero in the north to Chubut in the south, with a centre of diversity in the provinces of Córdoba and San Luis; only one species (*G. schroederianum* Osten) grows in the Espinal on the border of eastern Argentina and western Uruguay.

To date, no member of *Gymnocalycium* subg. *Gymnocalycium* has been recorded from the Province of San Juan, although the occurrence of *Gymnocalycium gibbosum* (Haw.) Pfeiff. ex Mittler (= *G. borthii* Koop ex H. Till) in the southeastern part of the province has been considered possible (Kiesling & Meglioli, 2003).

In about 2007 Justo Marquez found a *Gymnocalycium* population during a field trip in the Sierra de Valle Fértil, Province of San Juan, and later showed and gave the only specimen collected to Roberto Kiesling (RK). According to stem morphology, they were identified as belonging to *G.* subg. *Gymnocalycium*. Subsequently, two further excursions were made to this locality, one by RK in 2010, and another together with Detlev Metzinger (DM) in 2019. During these excursions, plant material was collected for the herbarium as well as for cultivation in the greenhouse of the Instituto Argentino de las Zonas Áridas (IADIZA-CONICET), Mendoza, Argentina. Based on our observations of the plants in their habitat and in cultivation, we have decided to describe this *Gymnocalycium* as a new species for science.

Due to the geographic isolation and therefore lack of transitions to populations of similar or related species (especially *G. uebelmannianum* Rausch and *G. kroenleinii* R. Kiesling *et al.*), as well as differences in stems, spination and flowers, we consider it justified to describe this taxon at species rank.

## MATERIALS AND METHODS

In order to classify the single specimen obtained by Justo Márquez, the authors made two successful trips to collect additional plant material and to study the variation and ecology of the species in the field. Some 40 plants, as well as flowers, fruits, and seeds were examined both in their natural habitat and four specimens of each locality in cultivation and compared with data from the literature as well as with material from related species, which we also studied in their natural habitat and in cultivation.

## RESULTS

*Gymnocalycium justomarquezii* R. Kiesling & Metzinger, sp. nov. TYPE: ARGENTINA. San Juan Province, Valle Fértil Department, Las Juntas, Afloramiento de feldespatos potásico, 1725 m, X-2010, *R. Kiesling 10405* (*Holotype*, MERL, 65929). ARGENTINA. San Juan Province, Valle Fértil Department, Las Juntas, Camino a Sierra de Chavez, 1815 m, 3-XII-2021, *R. Kiesling 10674* (*Paratype*: MERL, 67192).

**Diagnosis.** This species is distinguished from *Gymnocalycium uebelmannianum* (its characters in brackets) mainly by reddish brown base of the spines (vs. spines completely chalk white), spines mostly not adpressed to the body but radiating, slightly arched or straight (recurved and mostly adpressed to the body), slightly stronger spination, pericarpel and floral tube brownish red or green dull (shiny green), whitish to pinkish inner perianth segments (pale yellow to whitish), and the red flower throat (pale yellow to pinkish). It is distinguished from *Gymnocalycium kroenleinii* (characters in brackets; incl. *G. kroenleinii* subsp. *funettae* Mereg.) by radiating spines of adult plants (porrect or distinctly curved upwards), spine length up to 1.2 cm (up to 2.5 cm) and less prominent tubercles. *Gymnocalycium andreae* (Boed.) Backeb. & F. M. Knuth has bright yellow flowers and is therefore clearly distinguishable from *G. justomarequezi*, in addition the stems of *G. andreae* are smaller than those of the new species.

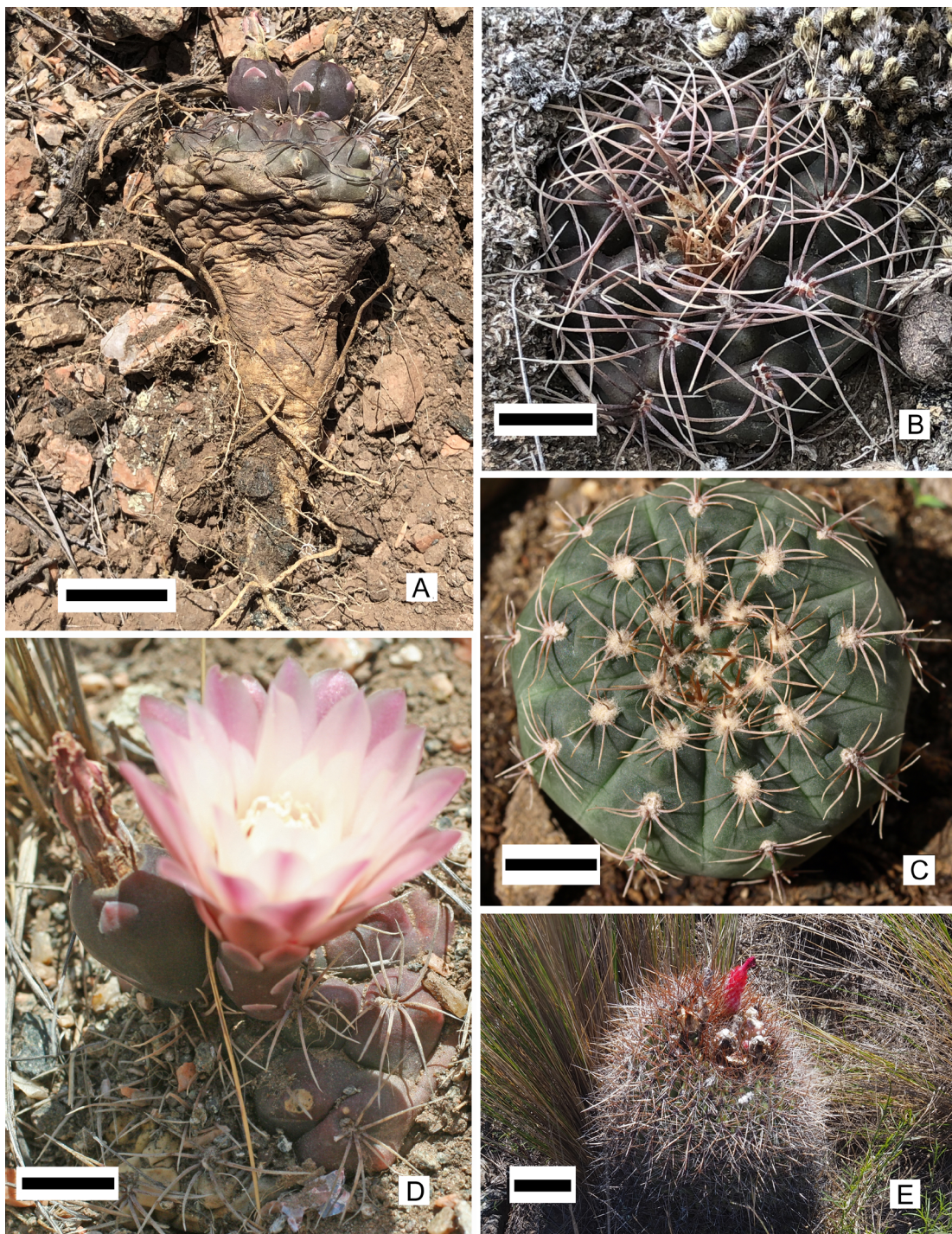
**Description.** Underground part with a thick carrot-like root up to 7 cm long and 4 cm in diameter, continuing in an also obconical stem about 4 cm high, with some obsolete areoles and spines at almost indistinguishable ribs. Upper part of the stem flat or convex, simple, dull grey-green or reddish at full sun, up to 6 cm in diameter, with 8 to 10 ribs, rarely 12, continuous or separated in aligned tubercles. Furrows between the ribs slightly to strongly undulated. Tubercles very prominent when dehydrated, the lower ones about 2 cm wide, 1 cm high, nearly rectangular, limited by transverse and more or less deep furrows; with the areole at the upper part and a “chin” below. Areoles elliptic, 2 to 3 mm long, 1 mm wide, with little dirty whitish felt, slightly sunken into the epidermis, sometimes continuing in a small furrow at the upper end. Spines slightly flexible or rigid, reddish-brown when fresh, later greyish to whitish with darker reddish-brown base, spines on older areoles darkening and becoming grey-black, 0.4 to 1.2 cm long, radial spines straight to arched or rarely twisted or hooked, sometimes adpressed to the stem, 2–3 (–4) pairs and a basal one, rarely one straight central spine. Flowers arising from young areoles at the stem crown, 5–6 cm long when closed, 4–5 cm long and wide during anthesis. Pericarpel and floral tube (hypanthium) brownish red or green, dull, slightly conical, 10 mm in diameter; with a few (some 6) near semi-round or

triangular separate scales with white-pink margins. Outer perianth segments elliptical, also reddish-green or brownish with more clear border (pink to whitish), gradually becoming longer towards to the top, inner perianth segments forming the conical perianth, pink to white, with clearest borders, spatulate, 20–30 mm long, sometimes mucronate, flower throat (inner hypanthium) reddish-pink, with a short (2 mm) nectary chamber. Stamens many, curved towards the style, arising from the inner hypanthium wall above the nectary, in a zone of 1.5 cm length, the filaments are curved toward the style, 10–15 mm long, tips of the anthers reach almost to the tip of the stigma lobes and are shorter than the perianth segments. Ovary elongated, 7–11 mm long, 3–5 mm in diameter, conical to ovate, funiculi branched, these and the ovules translucent whitish. Style cylindrical, white, 20 mm long, reaching the upper stamens, ending in about 8–10 cream-coloured stigma lobes, almost 6 mm long and overtopping the stamens. Fruit with persistent perianth, often spherical, but also pyriform or obpyriform, dehiscent along a single longitudinal furrow; 15–18 mm in diameter, 15–20 mm long, dark purple, the scales paler towards their margins. Seeds ovoid-truncate, 1.2–1.4 mm long, 1.2 mm diameter, testa black, covered with coarsely folded, detaching light brown cuticle, hilum-micropylar region enclosing the hilum and micropyle, round ovoid, black to dark brown. (Figs. 1–4).

**Etymology.** The species is named after Licenciado Justo Márquez, biologist in San Juan, who has collaborated with RK in preparing the “Flora de San Juan” during the past 20 years. He was the first who recorded this *Gymnocalycium* species.

**Ecology.** The Sierra del Valle Fértil (Fig. 4C) with the distribution area of *G. justomarequezi* belongs biogeographically to the northern part of the Monte province (Distrito Septentrional, Arana *et al.*, 2021). The climate of the “Reserva Natural de Valle Fértil”, which includes the Sierra del Valle Fértil, is semi-arid temperate, with an average annual temperature of 16.5 °C and an annual precipitation of 250 mm (Saint Esteven *et al.*, 2021). *Gymnocalycium justomarequezi* grows only on the highest peaks of the mountains of the Sierra del Valle Fértil, as known today, at South of Las Juntas, at about 1700 m a.s.l. The annual mean temperature there is lower than in lower-lying areas due to the relative higher altitude and stronger winds, compared to the lower





**Fig. 1.** **A:** *Gymnocalycium justomarequezii* R. Kiesling & Metzling, complete plant, showing the fruiting overground part, as well the underground part of the stem with obsolete areoles (corrugated zone), and the conical main root and its ramifications. **B:** Very spiny specimen surrounded by *Selaginella*. **C:** Another plant after a couple of years in cultivation at Mendoza. **D:** Plant with a flower covering the fruit and part of the stem with its shade. **E:** *Denmoza rhodacantha* at the same hill. Photos= A-C: Roberto Kiesling; D-E: Detlev Metzling. Scale bars= A: 2 cm; B-D: 1 cm; E: 10 cm.





**Fig. 2.** A: *Gymnocalycium justomarquezii* R. Kiesling & Metzger, two specimens flowering abundantly at cultivation. B: Top view of a nearly pink flower. C: Inner part of the flower in longitudinal section. In this case the ovary chamber is ob-conic and surely the fruit would be piriform. D: Lateral view of two cut buds. Photos= Roberto Kiesling. Scale bars= A-D: 1 cm.





**Fig. 3.** A: Seeds of *Gymnocalycium justamarquezii* R. Kiesling & Metzging. B: Seeds of *G. uebelmannianum*. C: Seeds of *G. kroenleinii* subsp. *kroenleinii*. D: *Gymnocalycium justamarquezii* R. Kiesling & Metzging, specimen with two typical nearly spherical fruits. E: Specimen with obconic fruit, slightly damaged, plausible by ants. Photos= Detlev Metzging. Scale bars= A-C: 1 mm; D-E: 1 cm.





**Fig. 4.** **A:** *Gymnocalycium justomarquezii* R. Kiesling & Metzging, plant very damaged by some fungus, but still alive. **B:** Another plant, slightly damaged, but for fire, the fruit partly damaged, plausible by ants. **C:** Sierra del Valle Fértil. Photos= Detlev Metzging. Scale bars= A-B: 1 cm.

altitudes, the annual precipitation there is likely to exceed 400 mm (*cf.* Martínez *et al.*, 2015). While at lower altitudes of the Sierra del Valle Fértil

xerophytic woodland occur, the sparse vegetation at the high altitudes is dominated by small scrubs, grasses and partly bromeliads.

*Gymnocalycium justomarequezii* does not grow on the lower slopes, but mostly on the borders of outcrops of granitic, pinkish rocks. We suspect that it occurs in many similar outcrops at similar altitudes in the south and north of this area. In 2021 we found a second population at an altitude of above 1800 m, ca. 8 km southeast of the type locality, in the Sierra de Chávez, a minor sierra at the southern part of the Sierra del Valle Fértil.

Sympatric with *G. justomarequezii* at the type locality is *Gymnocalycium castellanosi* Backeb. subsp. *acorrugatum* (J. G. Lamb.) R. Kiesling & Metzing, but that species has a greater altitude range than *G. justomarequezii* here, from below 800 to over 1700 m a.s.l.

**Conservation status.** Although the area is lightly grazed, we did not observe any significant changes between 2010 and 2019 at the type locality with regard to the general condition of the site, vegetation, and the approximate abundance of the here described species. At present, we do not see any relevant threats that could lead to a decline in the species and there is no hint that the populations of *G. justomarequezii* face extinction in the near future (criteria A, C, and E according to IUCN, 2024). Even though we found a few specimens damaged by fire, it is known that globular cacti, unlike arborescent species, can have high survival rates despite rare sporadic fires. The sparse vegetation on the rocky outcrops and the greater belowground biomass of the globose cacti likely facilitates survival and post-fire resprouting (Zupichiatti, 2021; Aliscioni *et al.*, 2025). Due to the difficult terrain, the distribution and abundance of the species is currently poorly known. If we assume that the entire area above 1700 m altitude in the Sierra del Valle Fértil and the Sierra de la Huerta is a possible habitat for *G. justomarequezii*, which is certainly an overestimate, the extent of occurrence (EOO) is significantly less than 1500 km<sup>2</sup>. We know two populations up to now (with less than 250 adult plants), but expect there to be more. We can't currently estimate with certainty, how many populations and adult plants are there and whether the EOO is larger or smaller than 100 km<sup>2</sup> (criteria B and D). Therefore, we would currently propose the conservation status to the category "Data Deficient" (DD). More field research is needed to determine the distribution area and population status of this species but new shoes are necessary to that.

## DISCUSSION

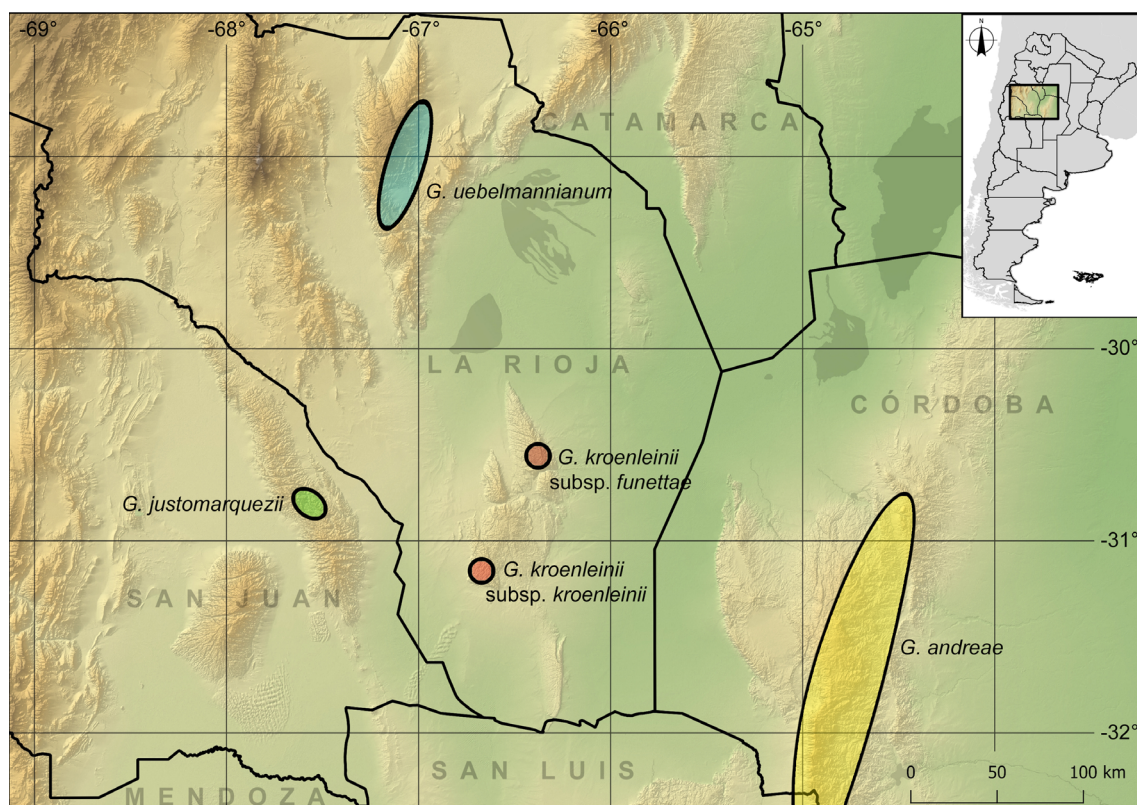
In San Juan Province, according to previous knowledge (Kiesling & Meglioli, 2003; Trevisson & Perea, 2009), the genus *Gymnocalycium* was represented by four taxa from four subgenera: *G. saglionis* (F. Cels) Britton & Rose (*G. subg. Microsemineum* Schütz), *G. castellanosi* subsp. *acorrugatum* (*G. subg. Scabrosemineum* Demaio *et al.*), *G. bodenbenderianum* (Hosseus ex A. Berger) A. W. Hill (*G. subg. Trichomosemineum* Schütz), and *G. schickendantzii* (F. A. C. Weber) Britton & Rose (*G. subg. Muscosemineum* Schütz).

Within *G. subg. Gymnocalycium*, three small species are related to the new species from a morphological and biogeographical point of view: *G. uebelmannianum* (Rausch, 1972), *G. andreae* (Charles, 2009) and *G. kroenleinii* (Kiesling *et al.*, 2000; Meregalli, 2014), all occurring in the Sierras Pampeanas (Fig. 5).

However, the distributional ranges of these species are clearly separated. The mentioned, biogeographically closest species occur as endemics at edaphic islands, in different mountain systems with rocky grounds, which are separated from each other by large flat areas with entisoles: *G. justomarequezii* in the southern Sierra del Valle Fértil (San Juan), *G. uebelmannianum* in the Sierra de Velasco (La Rioja), *G. kroenleinii* subsp. *kroenleinii* in the Sierra de Chepes (La Rioja), *G. kroenleinii* subsp. *funettae* in the Sierra de los Quinteros (La Rioja) and *G. andreae* in the Sierras de Córdoba (Sierra Grande, Sierra Chica, Sierra de Comechingones). Whereas *G. justomarequezii* is found in the Monte Region, *G. uebelmannianum* and *G. kroenleinii* have their distribution areas in the Chaco area, Distrito Chaqueño Occidental; while *G. andreae* occurs in the Distrito Comechingones (according to the classification of Arana *et al.*, 2021). The type population of *G. justomarequezii* is located at an altitude of 1725 m, the second population found by us Sierra de Chávez at above 1800 m, while *G. uebelmannianum* is reported to grow at altitudes of approximately 1950 to 2800 m; *G. kroenleinii* grows at altitudes of approximately 1250 to 1450 m and *G. andreae* at 1500 to 2300 m.

Like *G. uebelmannianum*, *G. andreae* and *G. kroenleinii*, *G. justomarequezii* is one of the few





**Fig. 5.** Map of the distribution of *Gymnocalycium justomarquezii* Kiesling & Metzger and related species in NW-Argentina.

species of *G.* subg. *Gymnocalycium* with mostly spherical fruits.

Future molecular studies of the subgenus *Gymnocalycium* and possibly other findings from previously unexplored mountainous regions could provide a clearer picture of the evolutionary radiation and phylogenetic relationships within this group of species. We consider it justified, to classify the here described taxon at the rank of species. This also takes into account the taxonomic equivalence of *G. justomarquezii* and the mentioned, morphologically similar but distinguishable taxa accepted at species rank in recent treatments (Kiesling *et al.*, 2008; Charles, 2009).

The establishment of *G. justomarquezii* brings the number of cactus species found in the San Juan Province from 35 to 36, which is approximately one sixth of the cactus species

found in Argentina (*cf.* Kiesling & Meglioli, 2003). The distribution area of *G. justomarquezii* is located in the “Parque Natural Provincial Valle Fértil”. The cactus richness of this area, which harbours many endemic plant species, has been studied by Saint Esteven *et al.* (2021), who recorded nine species of Cactaceae there. So, we can add a further endemic species now. Immediately adjacent to the type locality of *G. justomarquezii*, we also found *Denmoza rhodacantha* (Salm-Dyck) Britton & Rose (Fig. 1E), a species not listed by Saint Esteven *et al.* (2021), as well as *Cereus haenkeanus* F. A. C. Weber ex K. Schum., which can rarely be found near the town Villa San Agustín and in the woodland. Therefore, we can add three further species to this biodiversity hotspot, one of which, *G. justomarquezii*, is endemic to the Sierra del Valle Fértil.

**Table 1.** Morphological differences between *Gymnocalycium justomarezeii* Kiesling & Metzger and *G. uebelmannianum* Rausch.

|           | <i>G. justomarezeii</i>                                                                                                                                                                                                                            | <i>G. uebelmannianum</i>                                                                                                                                 |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Flower    | Inner perianth segments pale: whitish-pink<br>Red inside the floral tube                                                                                                                                                                           | Inner perianth segments pale yellow<br>Yellow inside the floral tube                                                                                     |
| Spines    | Strong, slightly flexible to rigid, larger, mostly slightly arched, reddish brown when young, later greyish to whitish, with darker base; rarely chalk-white and twisted<br>Not or rarely adpressed<br>7–9 marginal spines, rarely a central spine | Soft, flexible, shorter, twisted, chalk-white, without darker base<br>Very adpressed<br>5–7 spines, rarely a central spine                               |
| Epidermis | Mauve or brown under sun (at the mountain), and grey-green with tendency to have mauve areas in cultivation                                                                                                                                        | Mostly grey-green under full sun (at the mountain), or only slightly reddish (except when very dehydrated). Dark green, near bluish green in cultivation |

**Key for *Gymnocalycium* species in San Juan Province**  
(after Kiesling & Meglioli, 2003, updated and extended)

- 1. Adult plants with woolly (felty) crowns (due to young areoles merging). Seeds 1.1 mm long, reddish brown to black.  
*G. castellanosi* subsp. *acorrugatum*
- 1'. Plants without woolly crowns.
- 2. Stems up to 4 cm in diameter. Seeds covered with coarsely folded, detaching light brown cuticle, therefore appearing light brown.  
*G. justomarezeii*
- 2'. Stems larger than 4 cm in diameter. Seeds black (partly with detaching light brown cuticle) or, if reddish brown, of different shape and size.
- 3. Large spherical stems: up to 50 cm high and in diameter (or more). Small seeds: up to 0.9 mm long, shiny brown to blackish brown.  
*G. saglionis*
- 3'. Smaller stems, up to 10 (-15) cm high and in diameter.
- 4. Stems applanate, partially underground. Radial spines flattened against the stem surface or slightly porrect. Seeds hat-shaped, reddish brown, glossy, with small trichomes (papillae).  
*G. bodenbenderianum*
- 4'. Stems ± spherical, not underground. Radial spines curved outwards or radiating ± away from the body. Seeds oval, black or brown, without trichomes.
- 5. Stems light green; flowers on the side of the stem. Seeds yellowish-brown, with blistered, sometimes collapsed seed coat cells.  
*G. schickendantzii*
- 5'. Stems dark green or purple to brown; flowers on the upper part of the stem. Seeds black (sometimes partially dull brown due to detaching light brown cuticle).  
*G. gibbosum*\*

\* Not yet confirmed for San Juan.

**AUTHOR CONTRIBUTION**

RK designed the study. RK and DM jointly and equally carried out the fieldwork, data collection, data analysis and drafting of the manuscript.

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