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Content

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Cover picture: *Gymnocalycium carminanthum* WP 97-303/659, pass at Los Ángeles, Cuesta de Los Ángeles, Province Catamarca, Argentina, 1270 m (photo: W. Papsch).

Editorial

Dear Gymnocalycium enthusiasts

34.th International Gymnocalycium Meeting - 31. August to 2. September 2018 in Radebeul (Deutschland) Topic: "Red-flowering Gymnocalyciums of subgenus Scabrosemineum"

Holger Lunau

If you look around the various cactus clubs and local groups nationwide, then the interest in the large genus *Gymnocalycium* usually remains within narrow limits. Also, with the foreign cactus friends it does not look any different. Inconspicuous plants, mostly small white flowers, confusion of names - these are some of the prejudices of the plant lovers. The 34th International Gymnocalycium Conference from 31 August to 2 September 2018 in Radebeul near Dresden showed once again that there are in the background still many enthusiastic followers of this beautiful genus. Traditionally, many of the more than 40 participants met in the beer garden of the Hotel "Goldener Anker", wonderfully situated on the river Elbe in the district of Altkötzschenbroda, for an exchange of opinions and information before the official start of the conference. Many of them reported from their recent travels to South America or talked shop about the latest new descriptions of the genus.

Fig. 1: Friday evening welcome in the beer garden.

After dinner we really got going. Volker Schädlich (Spremberg, Germany) welcomed the participants as a proven organizer of the conference. This time they came from Germany, Italy, the Netherlands, Austria, Poland, Switzerland and the Czech Republic. Then he presented together with the conference leader Ludwig Bercht (Eck en Wiel, Netherlands) the well filled program. As in all previous years, Ludwig Bercht led the discussion during the three days with a refreshing sense of humour and a great deal of expertise.

Reiner Sperling (Salzkotten-Niederntudorf, Germany) provided the first professional serving. For two hours, he reported entertainingly about his most recent trip to Argentina at the beginning of 2018. Together with Ludwig Bercht and Volker Schädlich, he had travelled especially in the northern provinces of this huge country. Wonderful habitat photos of different cactus species from different genera, breathtaking scenes in nature, streaks of light from the life of the natives and funny travel pictures let the evening pass quickly. During the following obligatory beer all travel highlights were again intensively evaluated.

The next day the conference started punctually at 9 am. Early appearance ensured the best view, because the hall was fully occupied to the last seat. Therefore, in the end even additional chairs had to be brought in quickly.

Fig. 2: View into the meeting room.

As usual, Wolfgang Papsch (Karlsdorf, Austria) introduced the conference topic "Red-flowering Gymnos of the subgenus Scabrosemineum" with an excellent analysis. Based on the question "What is red?" he presented different Scabrosemineum taxa which flower red or at least reddish. The photographs showed red-flowering plants from the Argentinian province of Catamarca, *G. carminanthum*, *G. montanum*, *G. tillianum*, *G. oenanthemum*, *G. nigriareolatum* fa. *carmineum*, but also *G. ambatoense* subsp. *plesnikii* and *G. catamarcense* with different subspecies, which all are well known species and are present in many collections. The only

question that remained was whether the mentioned taxa were good species or whether duplicate descriptions or even only invalid descriptions were available. A lively discussion was thus opened.

Next, Bernhard Schweitzer (Glattbach, Germany) tried to shed light on the darkness of taxonomy with an extensive literature show. He presented the history of the first descriptions of red-flowering plants from the seed group Scabrosemineum and illuminated the background of the first descriptions. It quickly became clear that many of today's taxonomic problems were due to the first description of *Gymnocalycium oenanthemum* in 1934. It is still unclear where exactly the plant that Backeberg used for the first description came from. This means that botanists, professional and amateur alike are still faced with the actually impossible task of distinguishing *G. oenanthemum* from plants with a similar flower shape, colour and habit that grow along the Sierra de Ambato in the province of Catamarca. Every experienced cactus lover knows that plants can be very variable in terms of spines and flower colour according to their age, altitude and site conditions.

Fig. 3: Gert Neuhuber and Tomáš Kulhánek in lively discussion.

Ludwig Bercht also commented on the state of affairs. In his opinion, *G. oenanthemum* WR 720 corresponds exactly to the first description of Backeberg. This plant belongs to the group of *G. nigriareolatum*.

Nevertheless - *G. oenanthemum* remains a mystery. In view of the valid description, the name *G. oenanthemum* is also valid. Against this background, Wolfgang Papsch asked whether it would not make sense to neotype *G. oenanthemum* using plants with the field number WR 720 - and immediately harvested contradiction. Counterargument was: Nobody could put their hand on their heart that WR 720 actually corresponds to *G. oenanthemum* in the sense of Backeberg. Finally, the conference participants agreed to discuss the topic again next year.

With great interest the participants also followed the other lectures. Thomas Strub (Binningen, Switzerland) presented *Gymnocalycium alenae* described by Tomáš Kulhánek in 2017 in detail. In addition to habitat photos, there were pictures of cultivated plants as well as numerous statistics on flowering behaviour and the delimitation of related species.

This was followed by two exciting travel reports. First, Reiner Sperling, who travelled to Argentina in January 2018 together with Volker Schädlich and Ludwig Bercht, reported on the successful search for the red-flowering *Gymnocalycium schreiteri* Till in the Sierra de Candelaria in the Argentine province of Salta. Wonderful photos of *Gymnocalycium bayrianum* completed the lecture. Wolfgang Papsch followed with impressions of a trip through northern Argentina.

A real highlight was the report by Volker Schädlich about the rediscovery of *Gymnocalycium cabreraense* at Cerro Cabrera from the Chaco of Paraguay. Schädlich, Bercht and Melojer published the first description of this taxon in 2018. The audience learned about the accidental discovery of the plants, the multiple exhausting attempts to get back to the place of discovery and the successful propagation of the plants.

A lecture by Uwe Lehmann (Radeburg, Germany) on "Mexico - A round trip through the state of San Luis Potosi" rounded off the evening.

Before Ludwig Bercht took stock of the conference on the third on Sunday afternoon, it was Holger Lunau‘s (Berlin, Germany) turn to give a lecture on *Gymnocalycium* sites in Bolivia to mark the technical conclusion of the conference. For two hours, all participants again listened attentively to what the speaker had experienced and discovered together with Volker Schädlich in 2017 in this South American country. Among other things, the participants saw locations of plants from the *G. anisitsii*-group, *G. pflanzii* and *G. zegarrae*, *G. chiquitanum*, *G. armatum* and *G. cardenasianum*. Finally, there was applause again for the excellent organisation and management of the conference. And everyone was in agreement at the end - we will meet again in Radebeul from 13-15 September 2019.

Enjoy reading!

We would like to express our warmest thanks to Mrs Iris Blanz (Fernitz, Austria), to Mr Brian Bates (Bolivia) and to Mr Graham Charles (United Kingdom), who support us with the translation into English, to Mrs Larisa Zaitseva for the translation into Russian (Tscheljabinsk, Russia), to Mr Takashi Shimada (Japan) for the translation into Japanese and to Mr Daniel Schweich (France), who has mirrored our publications under http://www.cactuspro.com/biblio/.

About the nomenclatural status of *Gymnocalycium carminanthum*

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ABSTRACT

The topic chosen for the last Gymnocalycium conference in Radebeul was the subgenus Scabrosemineum, of which the plants possess red flowers. The range of plants was limited by focusing on those specimens growing in an area around the Cordón de Ambato in the province Catamarca. During the discussion the taxonomic status of *Gymnocalycium carminanthum* turned out to be obscure. Thus, the nomenclature of *Gymnocalycium carminanthum* is to be corrected in this paper.

KEYWORDS: Cactaceae, nomenclature, *Gymnocalycium carminanthum*, *Gymnocalycium oenanthemum*, *Gymnocalycium tillianum*.

INTRODUCTION

The species *Gymnocalycium oenanthemum* Backeberg, *G. tillianum* Rausch, *G. carminanthum* Borth & Koop and its variety *montanum* from the southern region of the Sierra de Ambato were considered as possessing red flowers in the sense of their first description. They were subject to discussion and, in doing so, the following questions were debated:

1. Taxonomic status
2. Where does *G. oenanthemum* come from?
3. In which way are the species with red flowers related?
4. Which relationship could exist with white-blossom plants like *G. ambatoense* Piltz, *G. nigriareolatum* Backeberg and *G. catamarcense* subspec. *acinacispinum* Till?
5. How the forms of *G. catamarcense* and its subspecies *ensispinum* with their bluish-red respectively ruby-coloured flowers from the northern region of the Sierra de Ambato we must classify?

Taxonomic status

A first step towards evaluating the nomenclatural status of the red-blossomed taxa under discussion is the contemplation of their names.

Gymnocalycium oenanthemum Backeberg 1934, validly published name.

Titled “Gymnocalycium”, Curt Backeberg describes a *Gymnocalycium oenanthemum* specimen for the first time in the Czech magazine “Kaktusář” in 1934 (Backeberg 1934a). This description is invalid for formal reasons. In the same year the valid description by Backeberg was published in “Blätter für Kakteenforschung” (Backeberg 1934b).

Fig. 1: *G. carminanthum* BO 130, plant from the original import.

Gymnocalycium tillianum Rausch 1970, validly published name, ranked as a species.

In 1970 Walter Rausch described, with some doubt, the finding of a plant with red flowers from the west-facing side of the Sierra de Ambato as *G. tillianum* (Rausch 1970) in accordance with the rules.

> ***Gymnocalycium oenanthemum*** var. ***tillianum*** (Rausch) Slaba 2011, validly published name, ranked as a variety.
>
> Rudolf Slaba classifies *Gymnocalycium tillianum* as a variety of *G. oenanthemum* (Slaba 2011). This combination is also in accordance with the rules and the name *G. oenanthemum* var. *tillianum* is consequently correct with respect to nomenclature.

Gymnocalycium carminanthum Borth & Koop 1976, invalidly published name.

In 1986, Hans Borth and Helmut Koop also described a plant with red flowers from Los Ángeles as *Gymnocalycium carminanthum* (Borth & Koop 1976). In doing so, the authors expressively mention that one plant of the collection, called a holotype, was taken to the type- and conservation collection of the Linz Botanical Garden. Originally the name was considered valid in RPS 27

(1976) and Urs Eggli, too, regarded the name as validly published (Eggli 1987). Section 8.4 of ICN, however, requires the deposit of a type specimen in a permanently preserved state. Thus, the description must be considered as formally not in accordance with the rules and as a result the name of this taxon is invalid.

Gymnocalycium oenanthemum subspec. ***carminanthum*** (Borth & Koop) H. Till 2008, invalidly published name.

This combination is based on the invalidly published name *G. carminanthum* and is therefore invalid according to sec 43.1 of ICN. See also remarks on *G. carminanthum*.

Gymnocalycium carminanthum var**.** ***minimum*** Slaba 1999 nom. nud.

First used as a catalogue name for the collection SL 35a and therefore irrelevant as far as nomenclature is concerned, this name is, according to Slaba, a synonym of his *Gymnocalycium carminanthum* var. *montanum* Slaba (Slaba 1999).

Gymnocalycium carminanthum var. ***montanum*** Slaba 1999, invalidly published name.

This taxon from the higher altitudes around Los Ángeles (sic. Los Engeles) is described in the Czech journal 'Kaktusy' 1999 by Slaba. This very detailed description, combined with the statement of the nomenclature type in herbarium PRC is, however, also invalid as the name *Gymnocalycium carminanthum* was not validly published (ICN sec 43.1) and the description is based on it.

The nomenclatural situation of the taxa mentioned under items 4 and 5 shall be sorted out in another paper.

Fig. 2: *G. carminanthum* BO 130, plant from the original import.

DISCUSSION

As mentioned above, the nomenclatural situation of *G. oenanthemum* and *G. tillianum* is unambiguous. The situation of *G. carminanthum* is to be elaborated in more detail. The "holotype" referred to in the description was definitely a living plant which was added to the type- and conservation collection of the Linz Botanic Garden.

Investigation as to the whereabouts of the plant in Linz yielded further information. The garden in Linz does not run a herbarium of its own, but material that is to be preserved is passed on to Vienna (WU). Being a type- and conservation collection of IOS, material of the plants present in the collection had to be delivered to IOS. This took place in the form of an index of the type- and conservation collection of succulent plants. Regrettably, this conservation collection does not exist any longer as the IOS's requirements were not followed. It is doubtful whether at the time of description in 1976 an index was still published. What emerges from the garden's records, nowadays continued in the form of a database, is that in 1974 three plants labelled "G. spec. BO 130, Cat., Los Angeles, 1700 m" and having the file numbers AR-0-LI-2216, AR-0-LI-2217 und AR-0-LI-2218 were incorporated into the collection. The plant AR-0-LI-2217 unfortunately died and was not preserved. The two other plants still exist in the collection, judging from the index. None of the plants was, resp. is, explicitly called a "holotype" (Fig. 3-4).

Fig. 3-4: *G. carminanthum* BO 130, specimens deposited at the first description in the Botanical Garden Linz.

The plants collected near Los Ángeles, Province Catamarca, by the Viennese Hans Borth in 1973 were taken in a body to the garden centre Hans Bruckner in Wiener Neustadt, labelled "BO 130 Cat.", with the exception of those Borth kept for himself. Among others, Bruckner was a sponsor of Borth's second collection journey. The Succulent Collection Zurich acquired from Bruckner a plant labelled BO 130. A flower of this plant was preserved on June 23rd in 1975, and first catalogued under the number AA 16.551 with the remark "coll. H. Borth, Córdoba Arg.". The wrong specification of the locality Córdoba may be due to a misinterpretation of "Cat.". The current catalogue number of this registered specimen in alcohol is ZSS 28639. Regrettably, the plant itself was not preserved. As the plant was original material from Borth's collection, the registered material could be regarded as an isotype for lack of better material. The problem is that the

Fig. 5: *G. carminanthum* BO 130, plant from the original import.

protologue of *G. carminantum* explicitly mentions the existence of a “holotype” in Linz. This can only have been a living plant, which is not in accordance with the rules of ICN (sect. 8.2). Thus, the registered material in ZSS is irrelevant in terms of nomenclature.

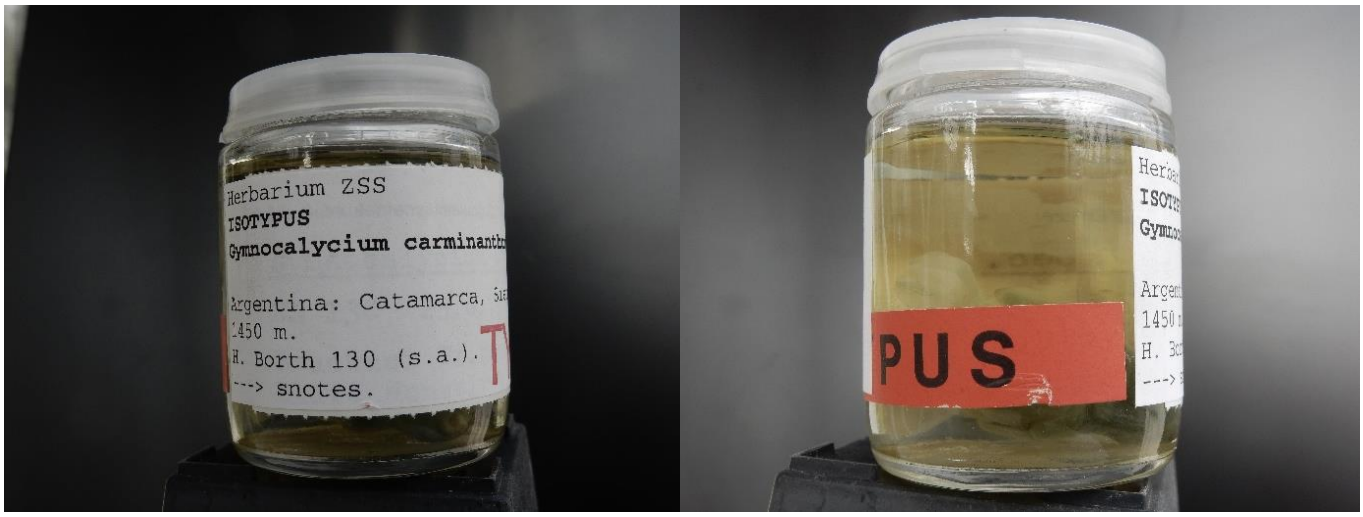

Fig. 6: *G. carminanthum* BO 130, herbarium voucher ZSS 28639 (photo: U. Eggli, ZSS).

CONCLUSION

From the situation mentioned above it emerges without any doubt that *G. carminanthum* was not described in accordance with the rules and thus the name is invalid. Precisely because of its red flower, *G. carminanthum* is very popular and common among collectors. To be able to continue using this name it might be necessary to establish a new formal description of the taxon *carminanthum,* ignoring at present its position within the plant system. A description of the taxon was already published in 1976, and reference to this description is made at this point. In this paper only a nomenclatoral type shall be defined.

Gymnocalycium carminanthum Borth & Koop ex Papsch spec. nov.

Borth, H. & Koop, H.: *Gymnocalycium carminanthum* Borth et Koop spec. nov. - Kakteen und andere Sukkulenten 27(4): 73 (1976); nom. invalidly publ.

Holotype: Hans Borth BO 130 ex coll. W. Papsch, Argentina, Prov. Catamarca, Los Ángeles, 1700 msm; leg. Hans Borth 1973 (Universalmuseum Joanneum Graz, GJO, holo) (Fig. 7).

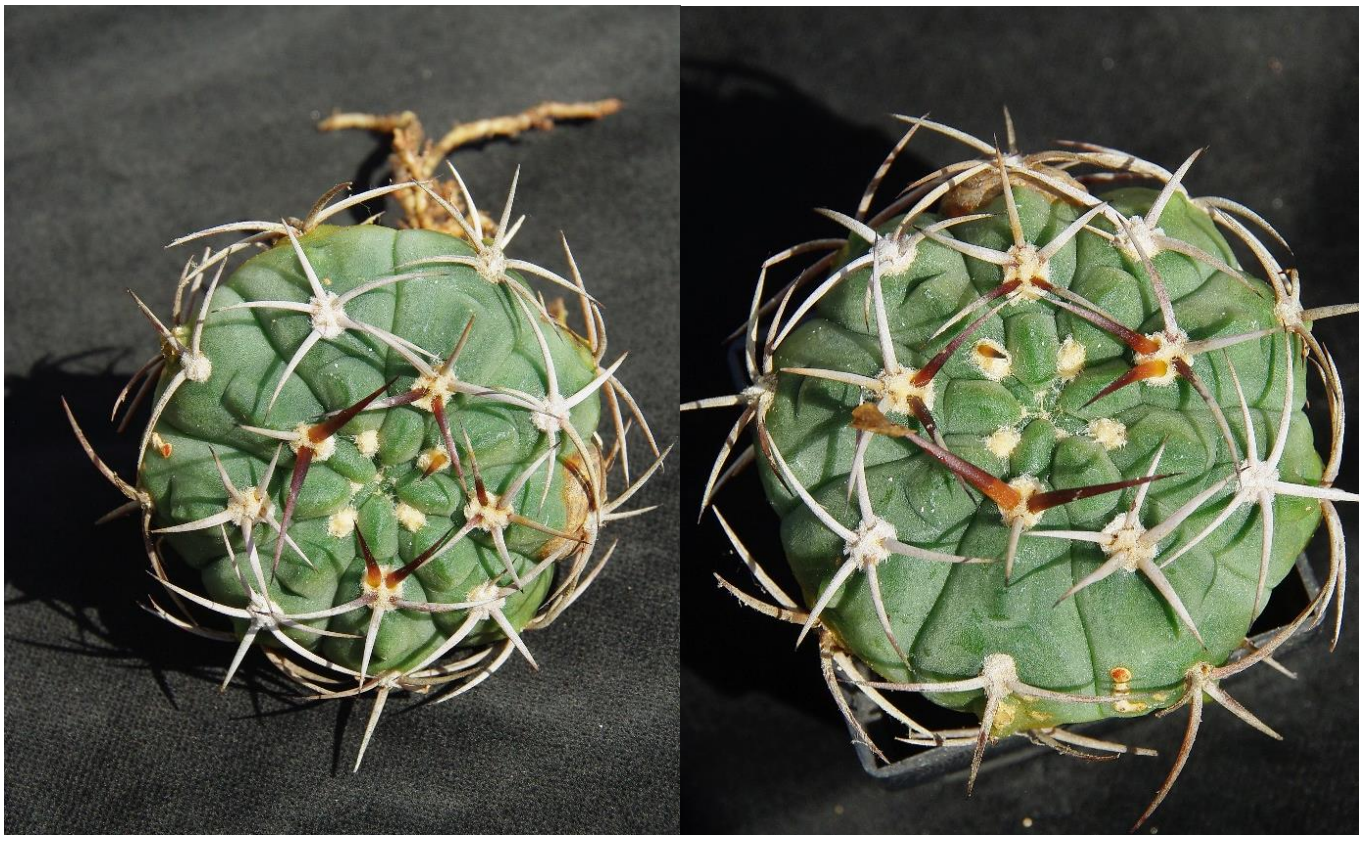

Fig. 7: *G. carminanthum* BO 130, holotype.

The holotype is an offset of an imported plant which was acquired from Borth's collection by the garden centre Bruckner, Wiener Neustadt, in 1974.

G. carminanthum var. *montanum*, which was also invalidly published, is to be dealt with only after detailed discussion of its position in the system of plants.

Fig. 8: *G. carminanthum* BO 130, flower section.

Fig. 9: *G. carminanthum* BO 130, plant from the original import.

ACKNOWLEDGEMENT

We want to express our thanks to Dr Urs Eggli of the Succulent Collection Zurich for his information about the registered material at ZSS as well as the picture of it. We are also grateful to Mr Clemens Füssel of the Linz Botanical Garden for investigation into and helpful discussion about the topic. In general, we greatly appreciate the inspiring discussions of all the participants of the Gymno conference in Radebeul.

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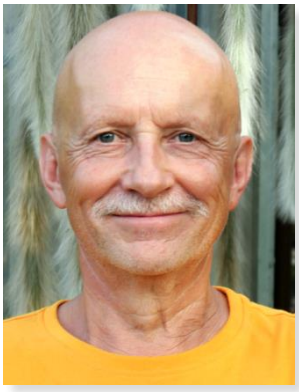
Fig. 10: *G. carminanthum* WP 97-303/659 from Los Ángeles.



The Seeds of the Genus *Gymnocalycium* Pfeiffer ex Mittler Part 3: Subgenus *Scabrosemineum*

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ABSTRACT

The authors present a paper about the seeds of the genus *Gymnocalycium*. The species are introduced with one photograph in their habitats, one of their environments and one of their seed respectively. A map of each plant's locality completes the presentation. Part 3 deals with the subgenus *Scabrosemineum*.

KEYWORDS: Cactaceae, Gymnocalycium, subgenus Scabrosemineum, achirasense, acorrugatum, albiareolatum, ambatoense, armatum, bayrianum, cardenasianum, carminanthum, castellanosii, catamarcense, coloradense, esperanzae, ferrarii, glaucum, horridispinum, hossei, monvillei, mostii, nigriareolatum, prochazkianum, pugionacanthum, rhodantherum, ritterianum, schmidianum, spegazzinii.

INTRODUCTION

In the third part of our work on the seeds of the genus *Gymnocalycium* we present the species of the subgenus *Scabrosemineum*.

For compiling the maps, we used the free GIS software QGIS (http://www.qgis.org/de/site/forusers/download.html). The background of the maps is formed by Google Inc. data, which can be combined in QGIS with the QGIS extension Quick Map Services (http://nextgis.com/blog/quickmapservices/) by Nextgis company (http://nextgis.com/).

Type species of the subgenus *Scabrosemineum* is *Gymnocalycium monvillei* (Lemaire) Britton & Rose (1922) emend. H. Till.

Genus *Gymnocalycium* Pfeiffer ex Mittler (1844)

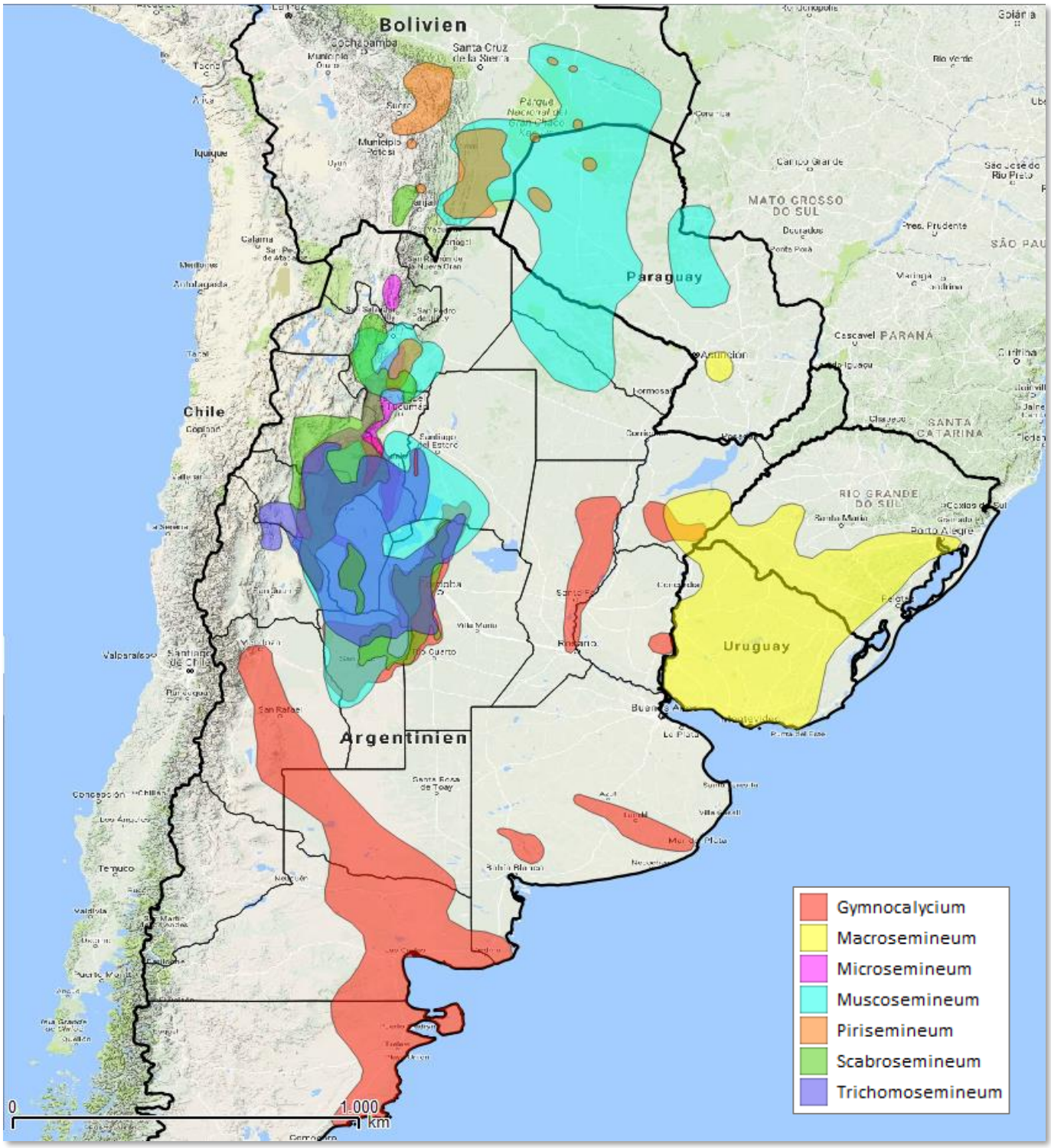

Fig. 1: Overview map of the distribution areas of the subgenera of the genus *Gymnocalycium.*

Subgenus *Scabrosemineum*

Body flat globular to globular, also short columnar in age, some sprouting, fibre or tap root. Spines ± straight or curved, usually strong, ribs often tubercled, flowers funnel-shaped or bell-shaped, appearing at apex. Fruits oval or spindle-shaped, greenish or bluish when ripe, vertically splitting. Seeds 0.6 - 1.3 mm large, ± helmet-shaped, testa dark brown to blackish, hilum-micropylar-area often covered with spongy tissue. Occurrence: southern Bolivia, northern to central Argentina.

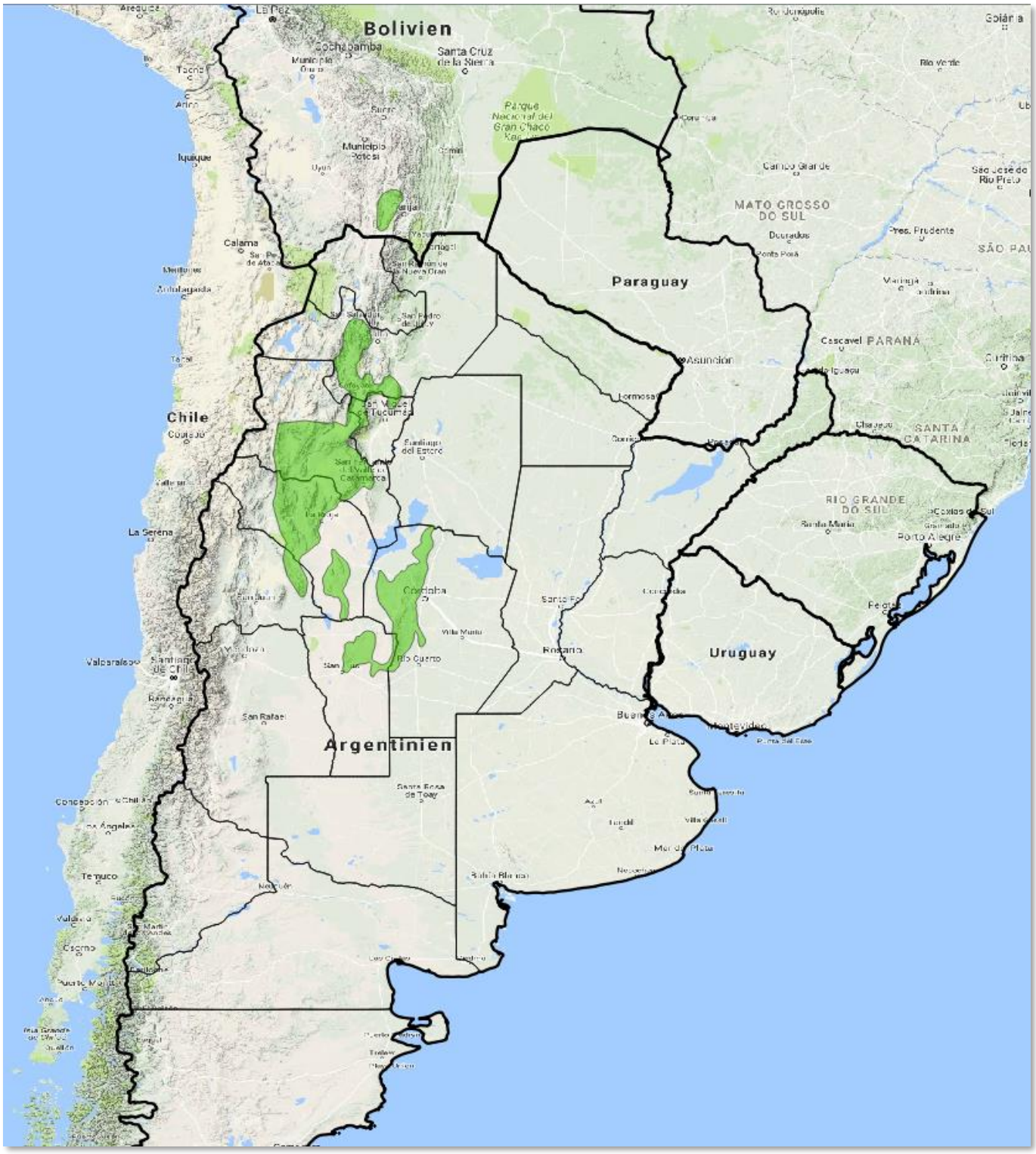

Fig. 2: Overview map of the distribution area of subgenus *Scabrosemineum*.

Gymnocalycium achirasense H. Till & Schatzl ex H. Till (1987)

Fig. 3: *Gymnocalycium achirasense* VoS 179, 4 km west of Achiras, Ruta 10, Province Córdoba, Argentina, 963 m.

Fig. 4: Habitat of *Gymnocalycium achirasense* VoS 179.

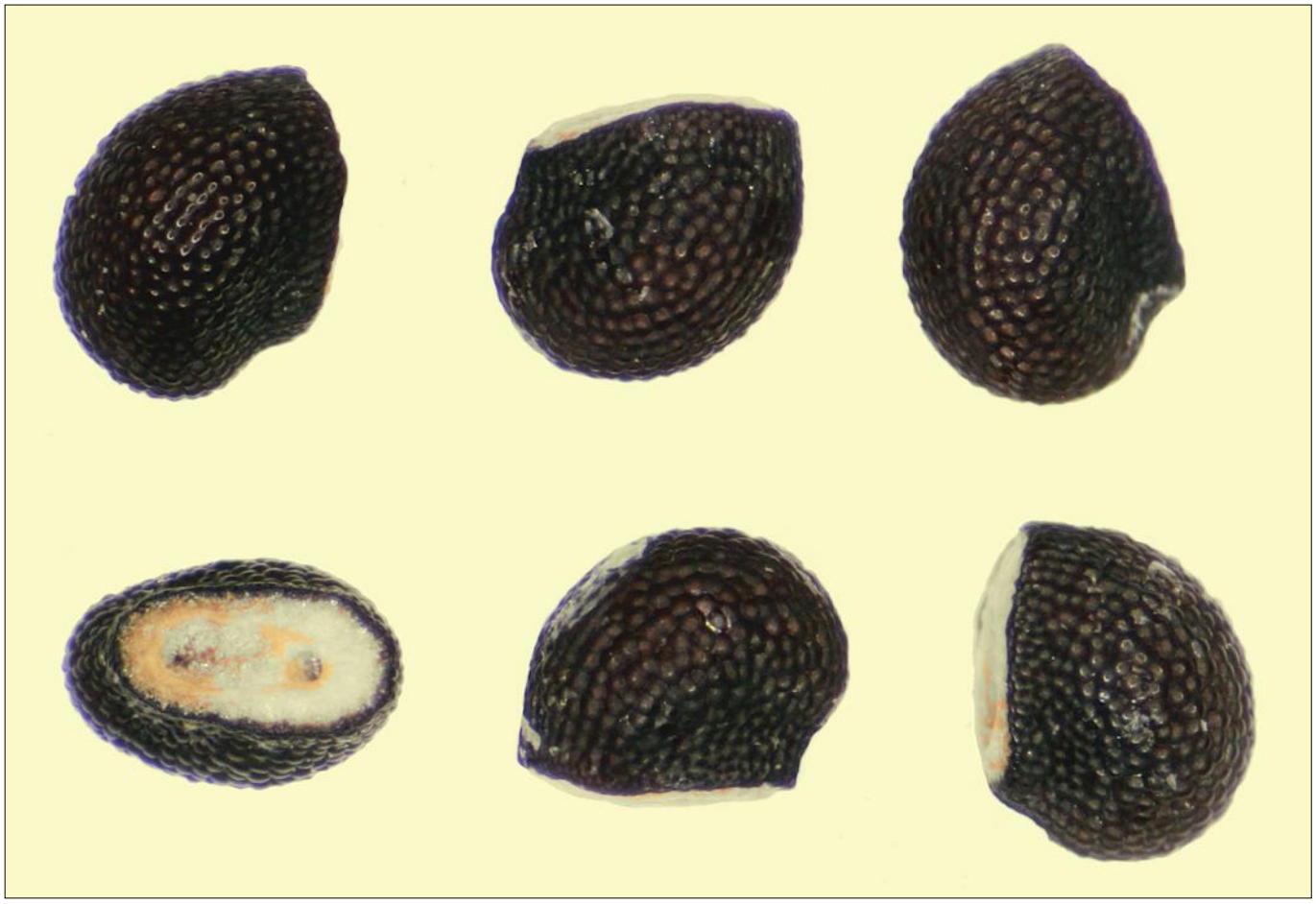

Fig. 5: Seeds of *Gymnocalycium achirasense* VoS 2604, between Yacanto de Calamuchita and Cerro los Linderos, Province Córdoba, Argentina, 1221 m (photographed at 20x magnification).

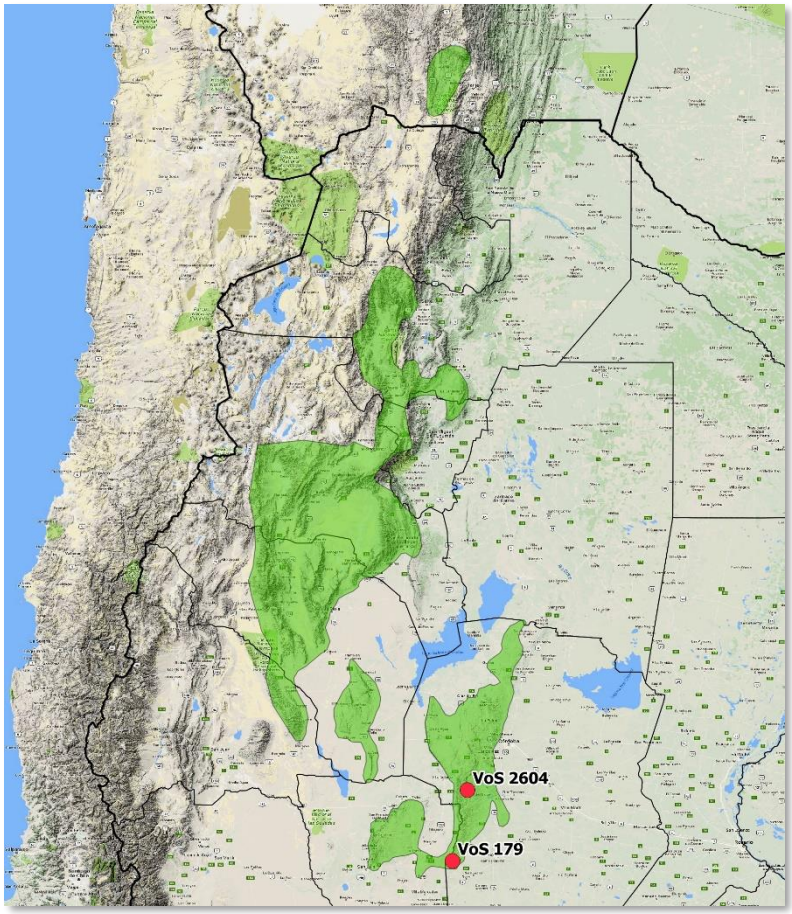

Fig. 6: Localities of *Gymnocalycium achirasense* VoS 179 and VoS 2604.

Gymnocalycium achirasense including *Gymnocalycium orientale*.

Gymnocalycium acorrugatum Lambert (1988)

Fig. 7: *Gymnocalycium acorrugatum* VoS 2506, San Agustín de Valle Fértil, Province San Juan, Argentina, 870 m.

Fig. 8: Habitat of *Gymnocalycium acorrugatum* VoS 2506.

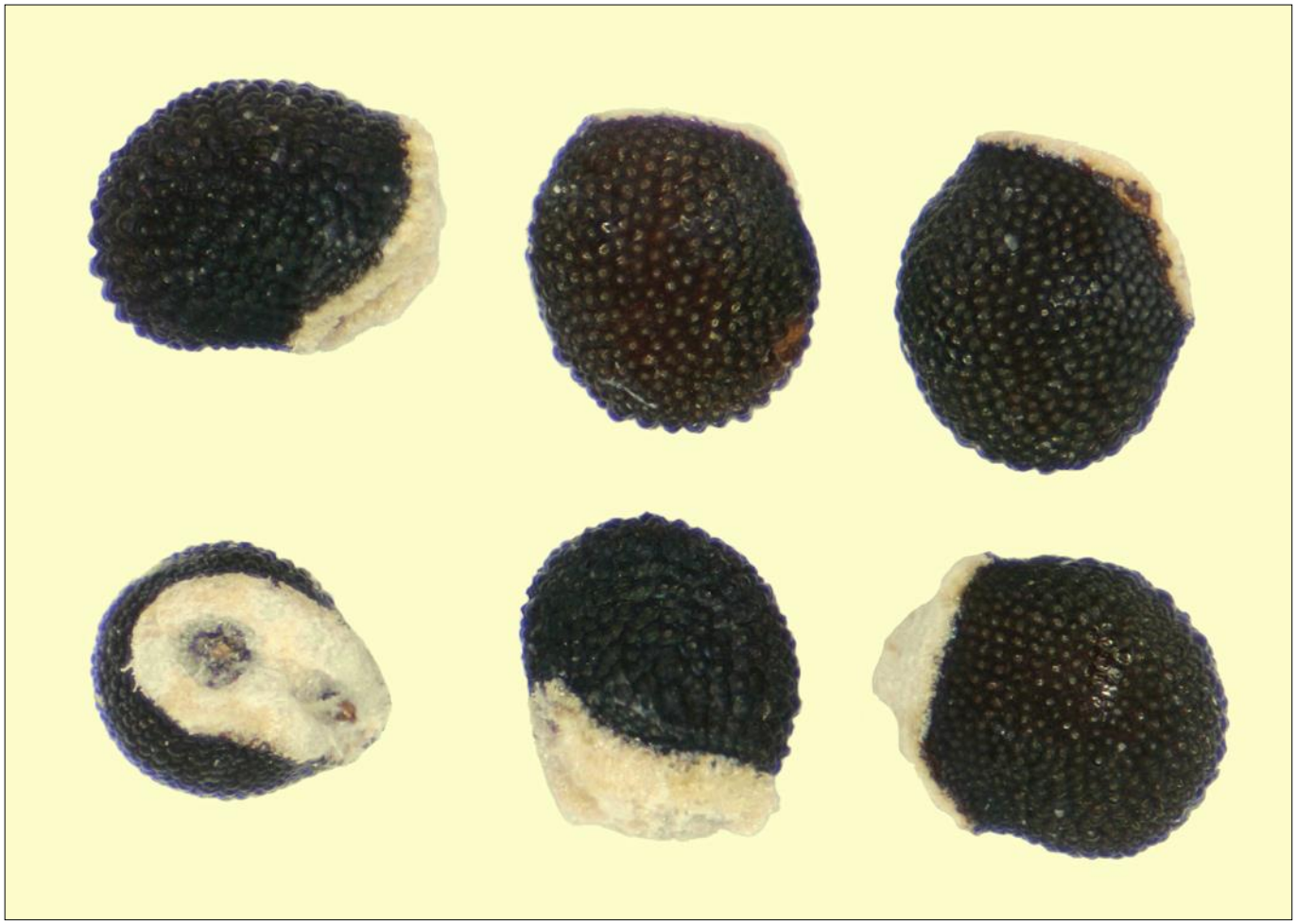

Fig. 9: Seeds of *Gymnocalycium acorrugatum* VoS 2506 (photographed at 20x magnification).

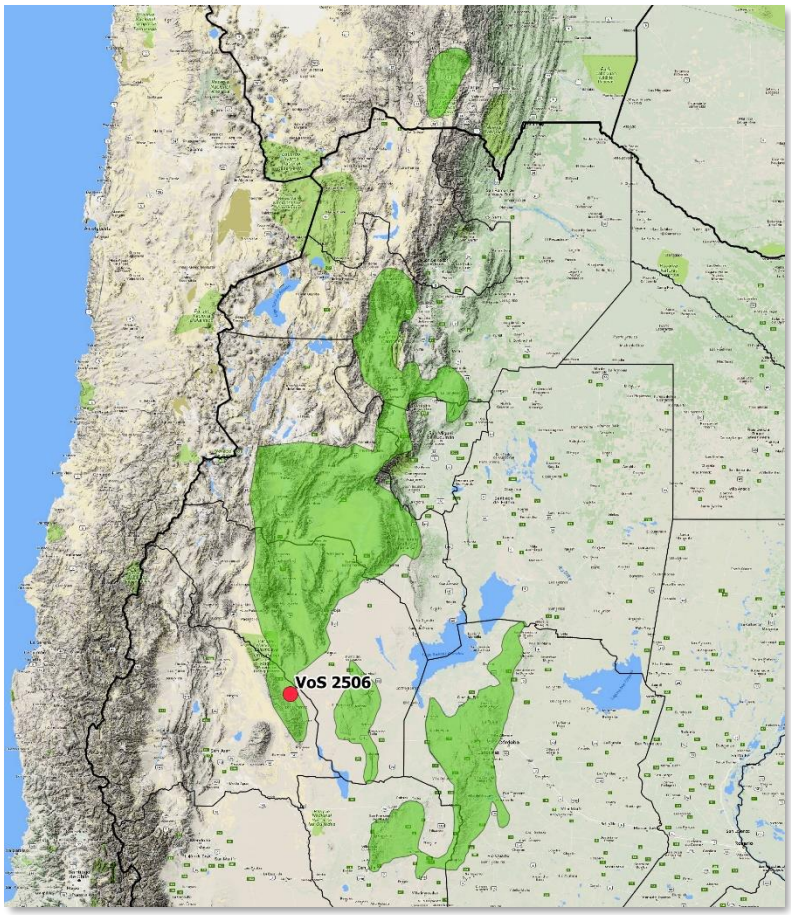

Fig. 10: Locality of *Gymnocalycium acorrugatum* VoS 2506.

Gymnocalycium albiareolatum Rausch (1985)

Fig. 11: *Gymnocalycium albiareolatum* Tom 134, Villa Sanagasta, Province La Rioja, Argentina, 996 m.

Fig. 12: Habitat of *Gymnocalycium albiareolatum* Tom 134.

Fig. 13: Seeds of *Gymnocalycium albiareolatum* TS 1579, Villa Sanagasta, Provinz La Rioja, Argentinien, 998 m (photographed at 20x magnification).

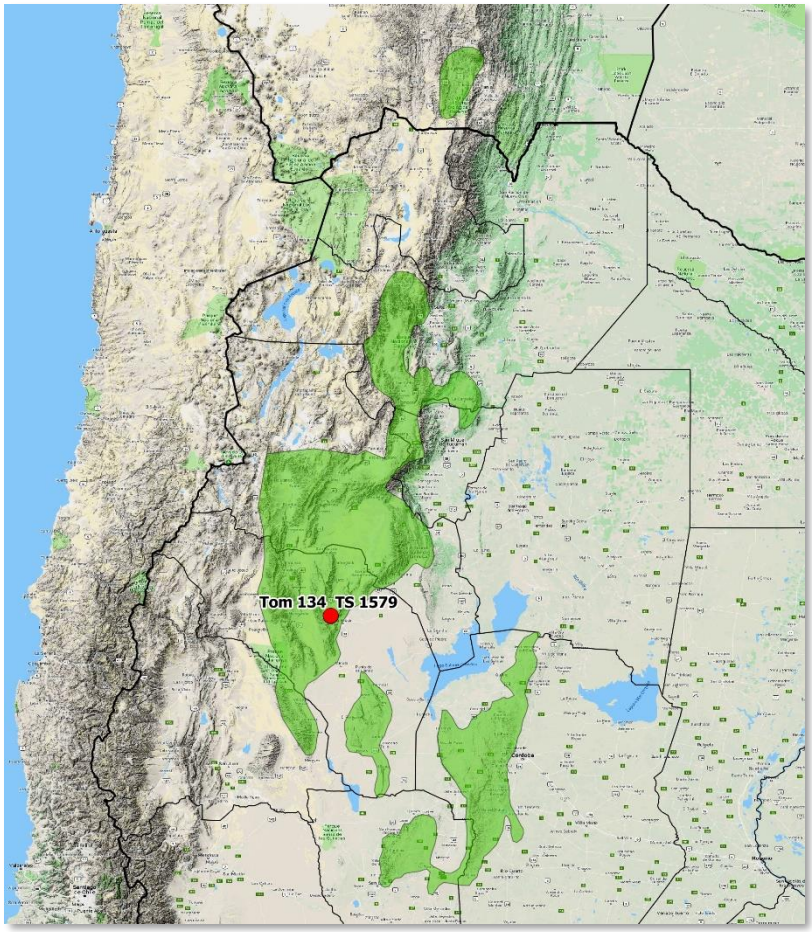

Fig. 14: Localities of *Gymnocalycium albiareolatum* Tom 134 and TS 1579.

Gymnocalycium ambatoense Piltz (1980)

Fig. 15: *Gymnocalycium ambatoense* Tom 129, Concepción, Province Catamarca, Argentina, 900 m.

Fig. 16: Habitat of *Gymnocalycium ambatoense* Tom 129.

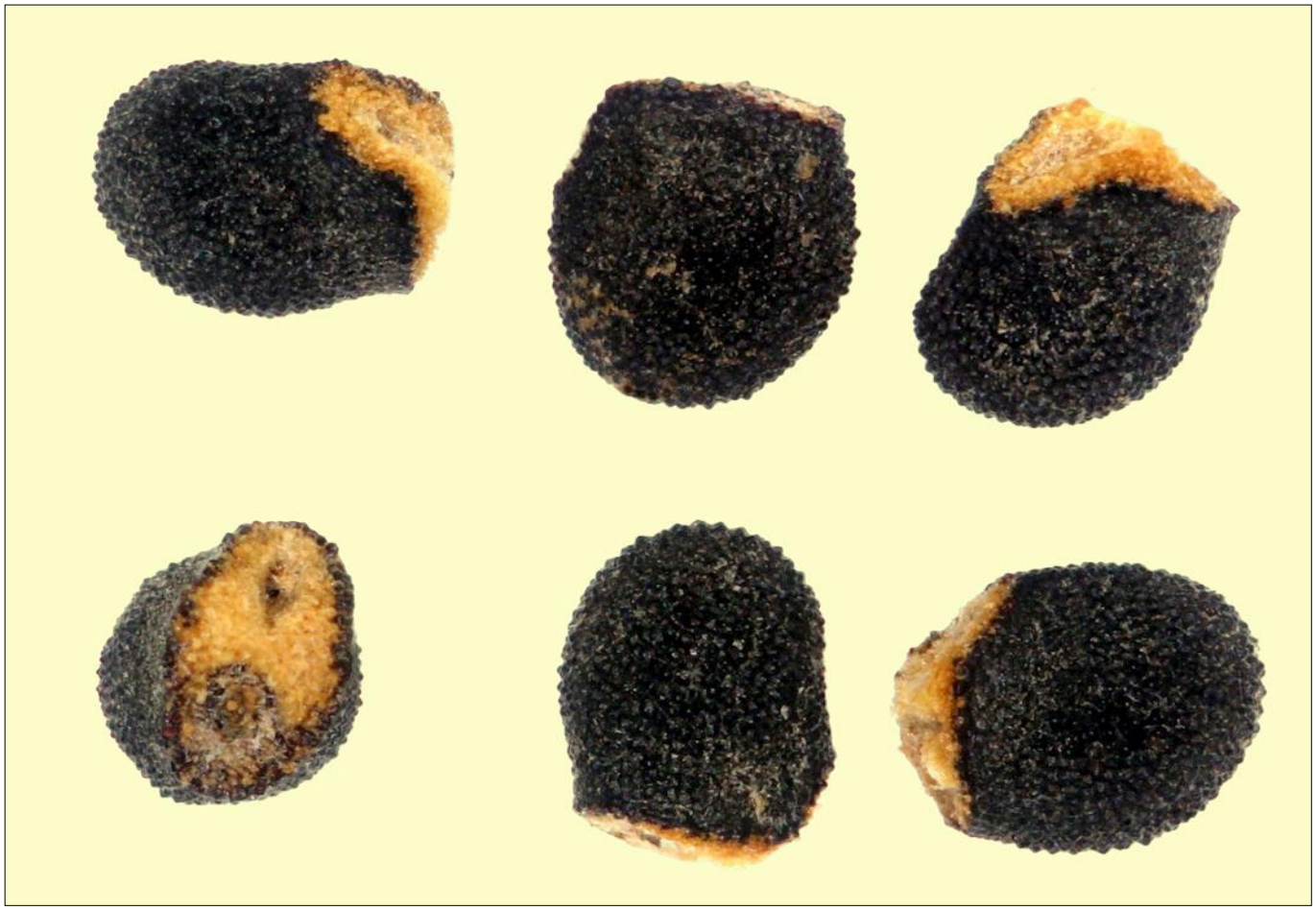

Fig. 17: Seeds of *Gymnocalycium ambatoense* VoS 121, Miraflores, Province Catamarca, Argentinien, 689 m (photographed at 20x magnification).

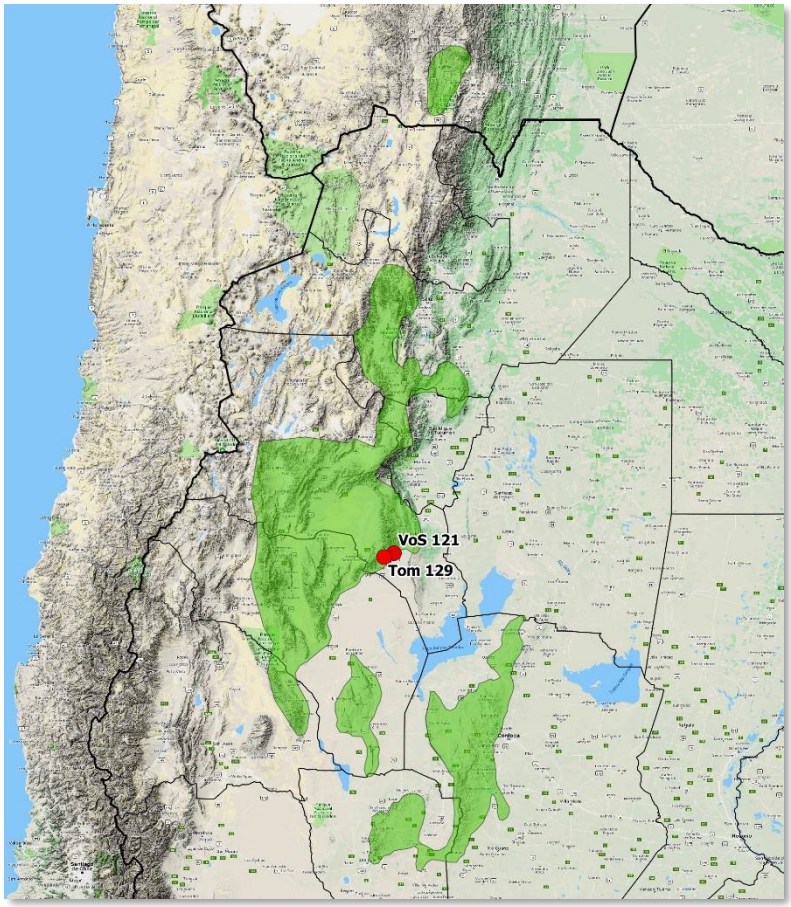

Fig. 18: Localities of *Gymnocalycium ambatoense* Tom 129 and VoS 121.

Gymnocalycium armatum Ritter (1980)

Fig. 19: *Gymnocalycium armatum* VoS 74, El Paichu, Province Tarija, Bolivia, 2700 m.

Fig. 20: Habitat of *Gymnocalycium armatum* VoS 74.

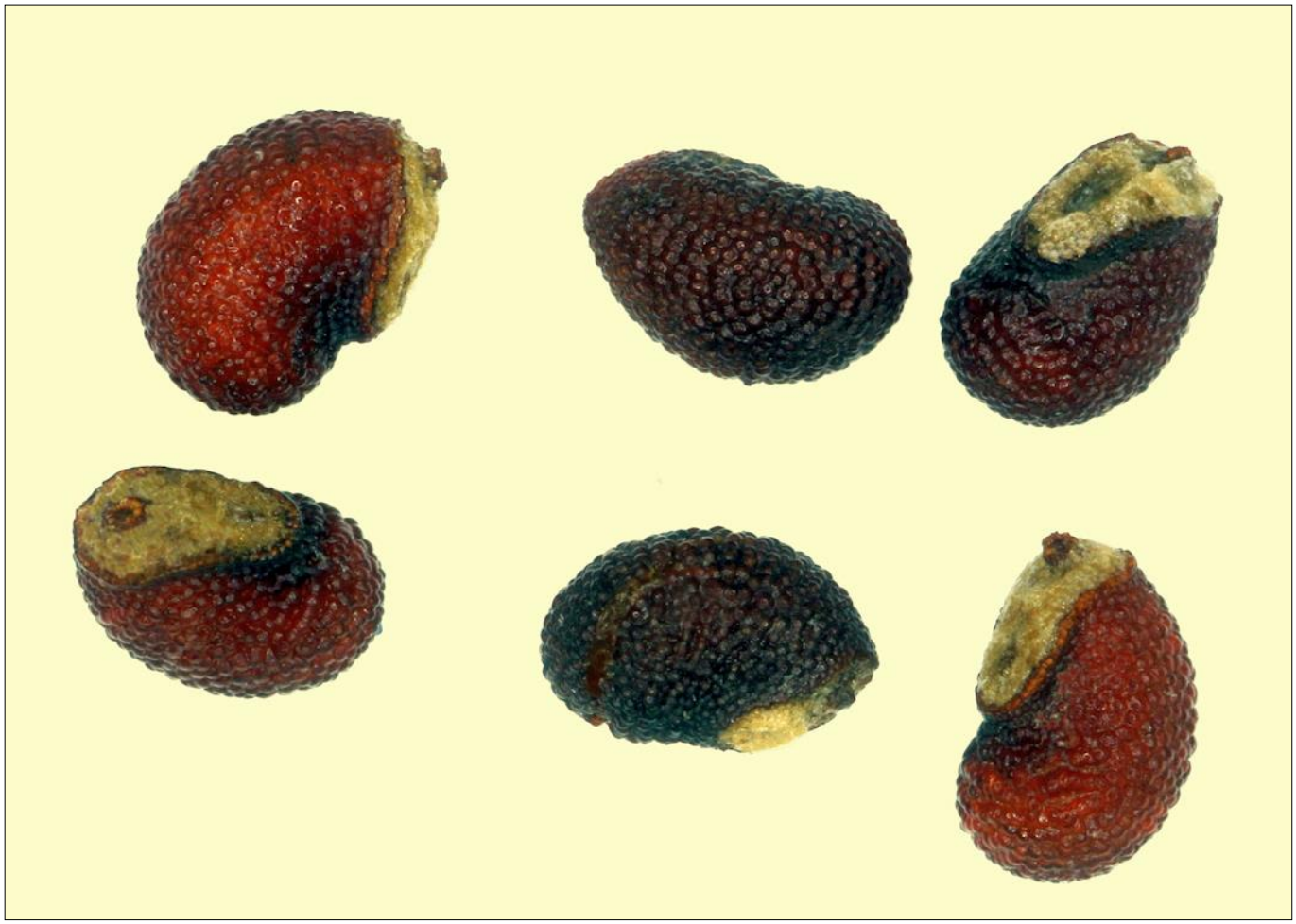

Fig. 21: Seeds of *Gymnocalycium armatum* VoS 74 (photographed at 20x magnification).

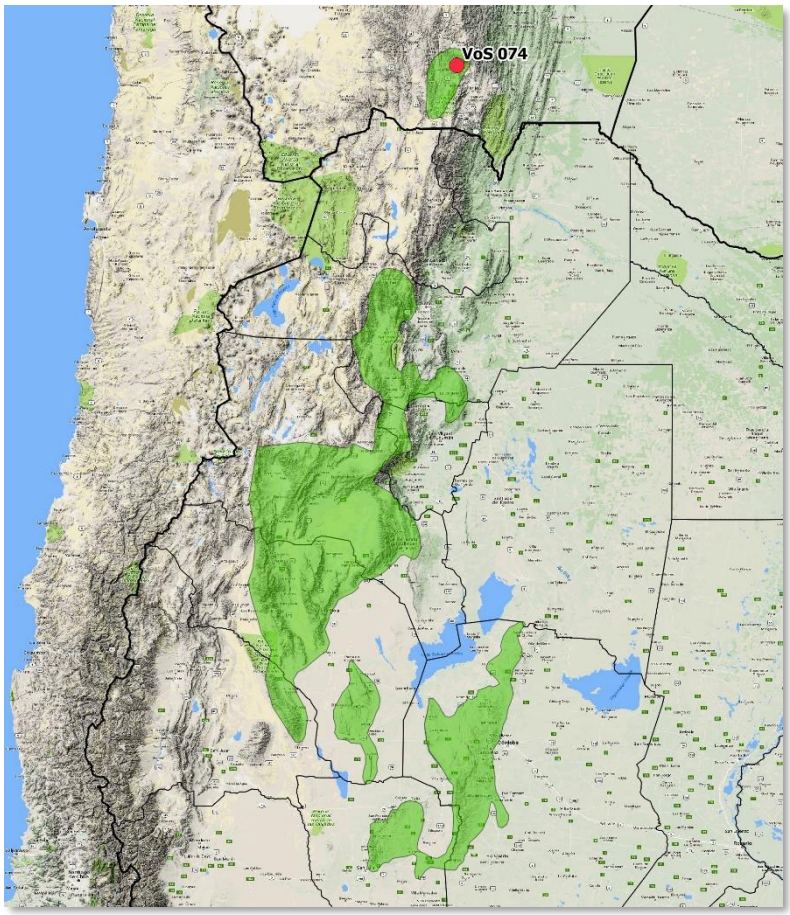

Fig. 22: Locality of *Gymnocalycium armatum* VoS 74.

Gymnocalycium bayrianum H. Till ex H. Till (1987)

Fig. 23: *Gymnocalycium bayrianum* VoS 2407, La Candelaria, Province Salta, Argentina, 1820 m.

Fig. 24: Habitat of *Gymnocalycium bayrianum* VoS 2407.

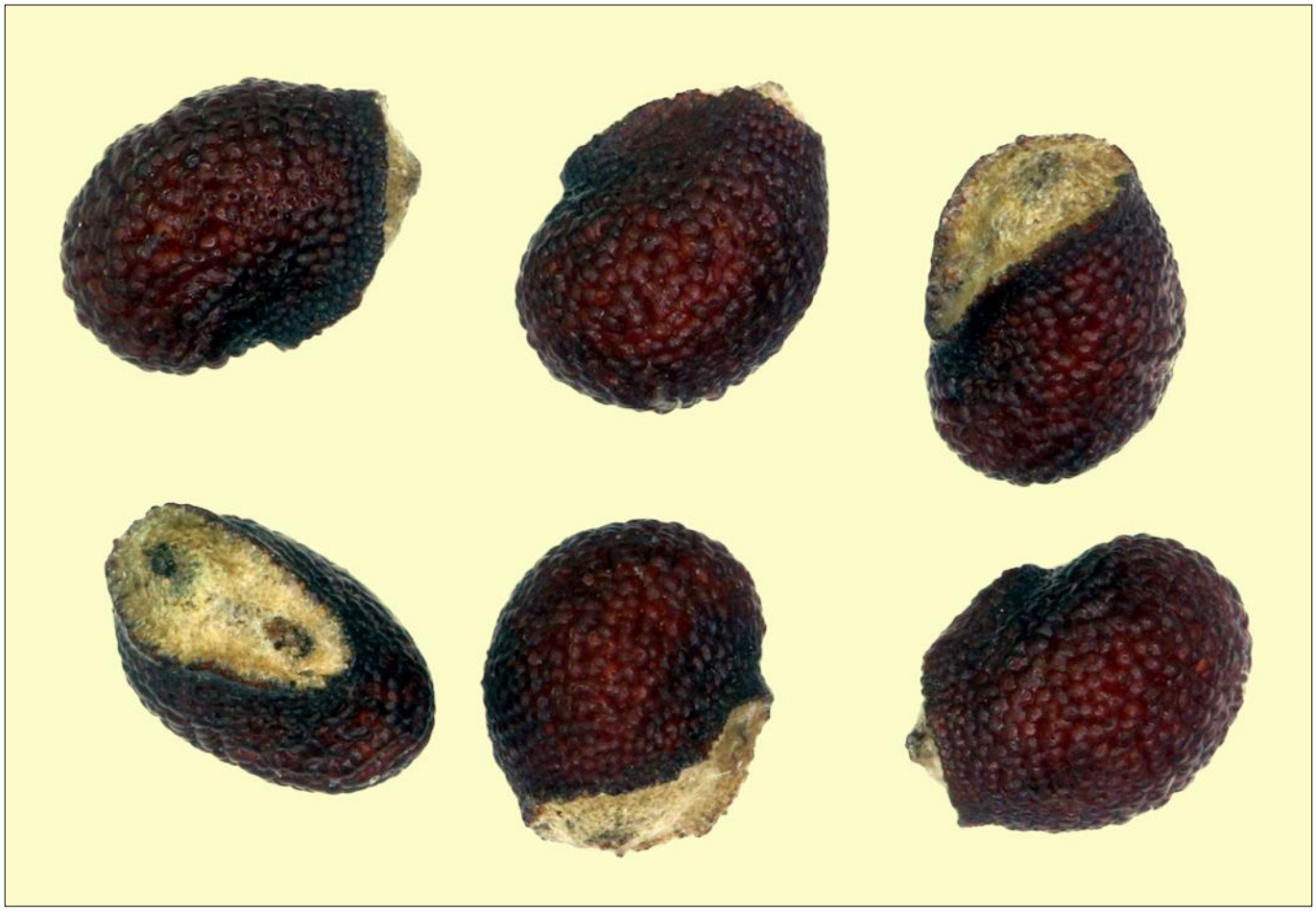

Fig. 25: Seeds of *Gymnocalycium bayrianum* VoS 2407 (photographed at 20x magnification).

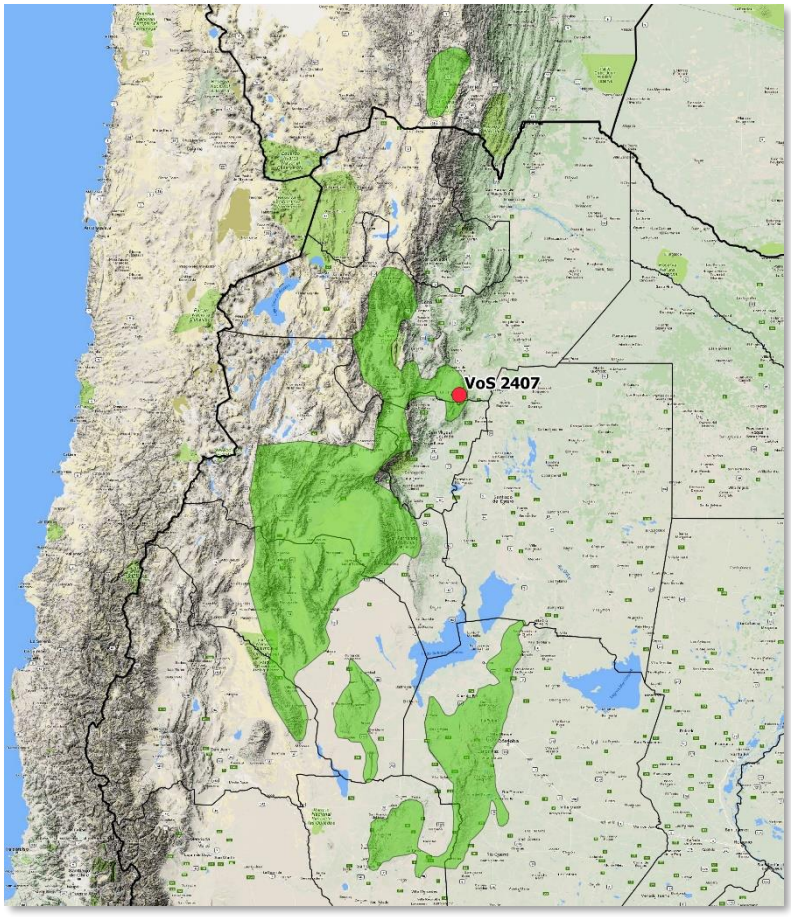

Fig. 26: Locality of *Gymnocalycium bayrianum* VoS 2407.

Gymnocalycium cardenasianum Ritter (1964)

Fig. 27: *Gymnocalycium cardenasianum* VoS 1984, Carrizal, Province Tarija, Bolivia, 2470 m.

Fig. 28: Habitat of *Gymnocalycium cardenasianum* VoS 1984.

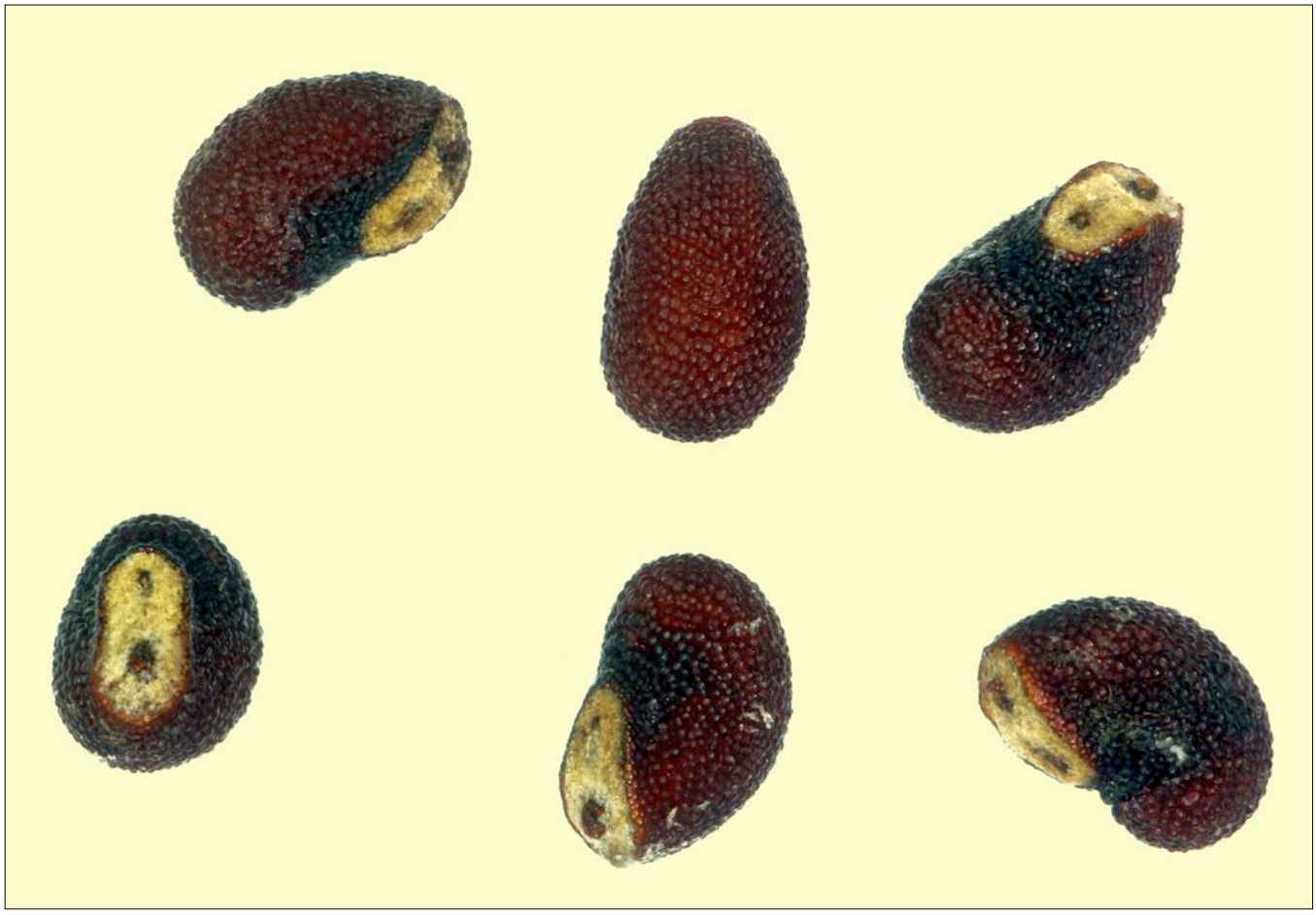

Fig. 29: Seeds of *Gymnocalycium cardenasianum* VoS 999, south of Parroquia, Province Tarija, Bolivia, 2760 m (photographed at 20x magnification).

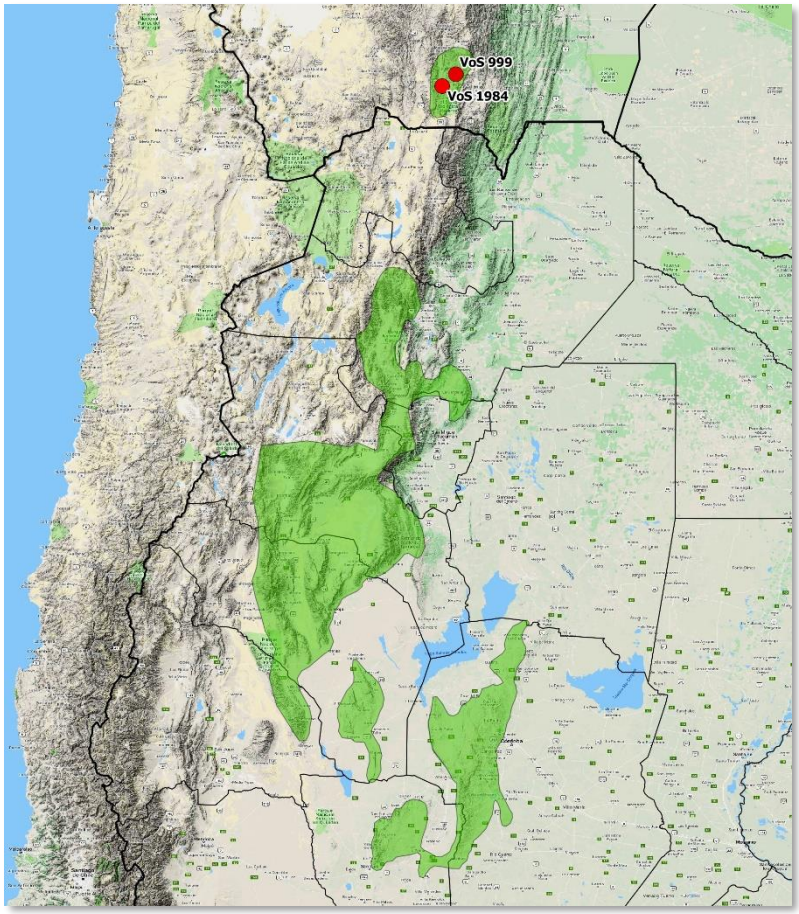

Fig. 30: Localities of *Gymnocalycium cardenasianum* VoS 999 and VoS 1984.

Gymnocalycium carminanthum Borth & Koop ex Papsch (2018)

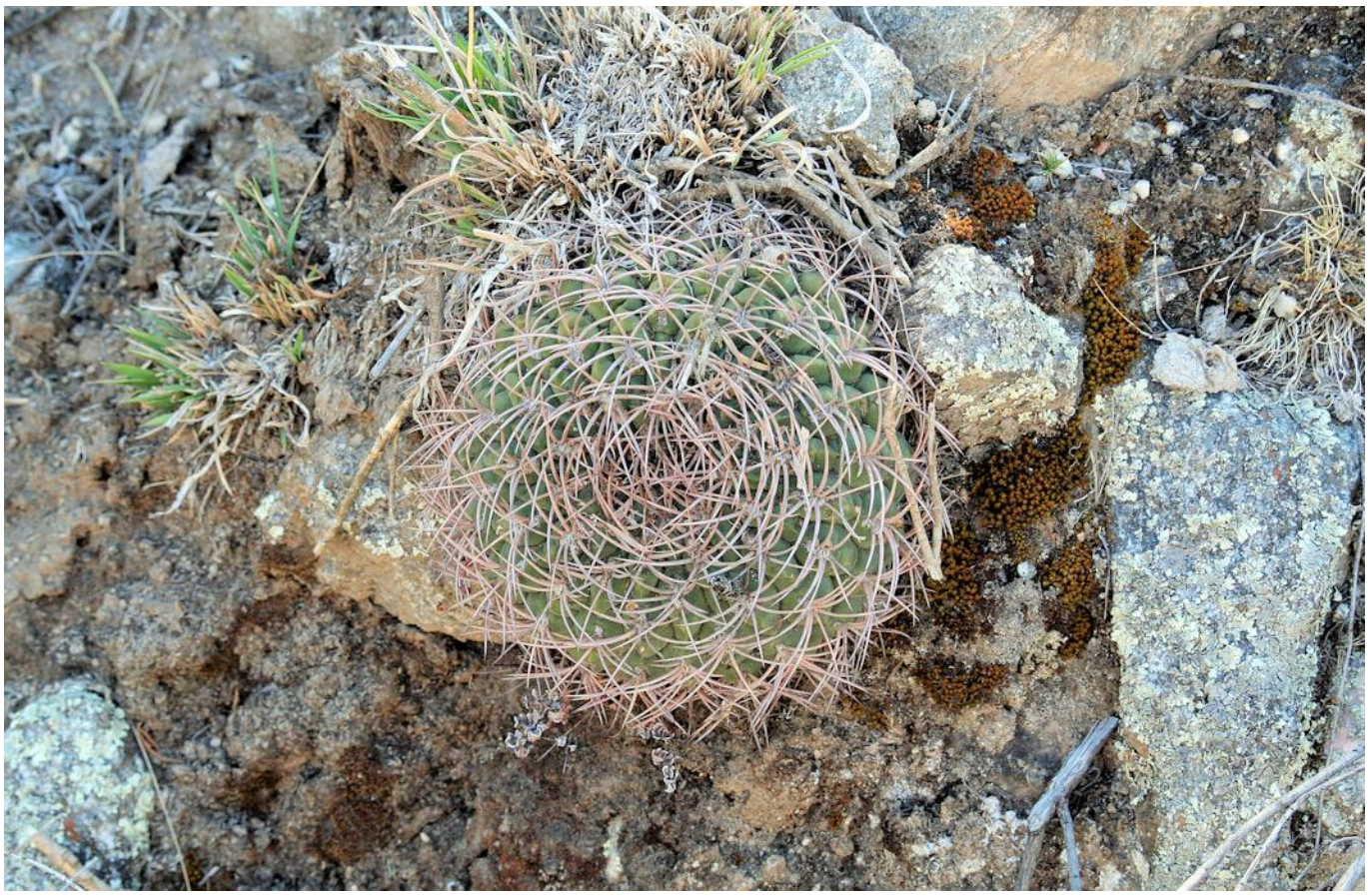

Fig. 31: *Gymnocalycium carminanthum* VoS 118, 17 km north of Miraflores, Province Catamarca, Argentina, 1800 m.

Fig. 32: Habitat of *Gymnocalycium carminanthum* VoS 118.

Fig. 33: Seeds of *Gymnocalycium carminanthum* VoS 118 (photographed at 20x magnification).

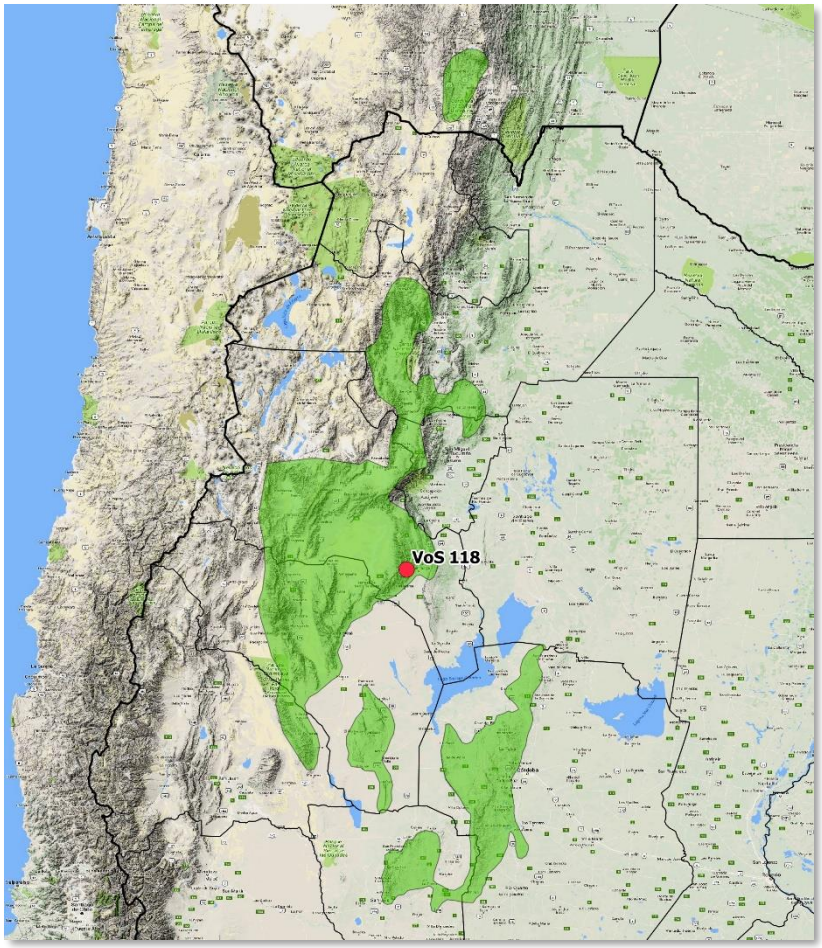

Fig. 34: Locality of *Gymnocalycium carminanthum* VoS 118.

Gymnocalycium carminanthum including *Gymnocalycium oenanthemum* and *Gymnocalycium tillianum*.

Gymnocalycium castellanosii Backeberg (1936)

Fig. 35: *Gymnocalycium castellanosii* VoS 145, Dique de Olta, Province La Rioja, Argentina, 642 m.

Fig. 36: Habitat of *Gymnocalycium castellanosii* VoS 145.

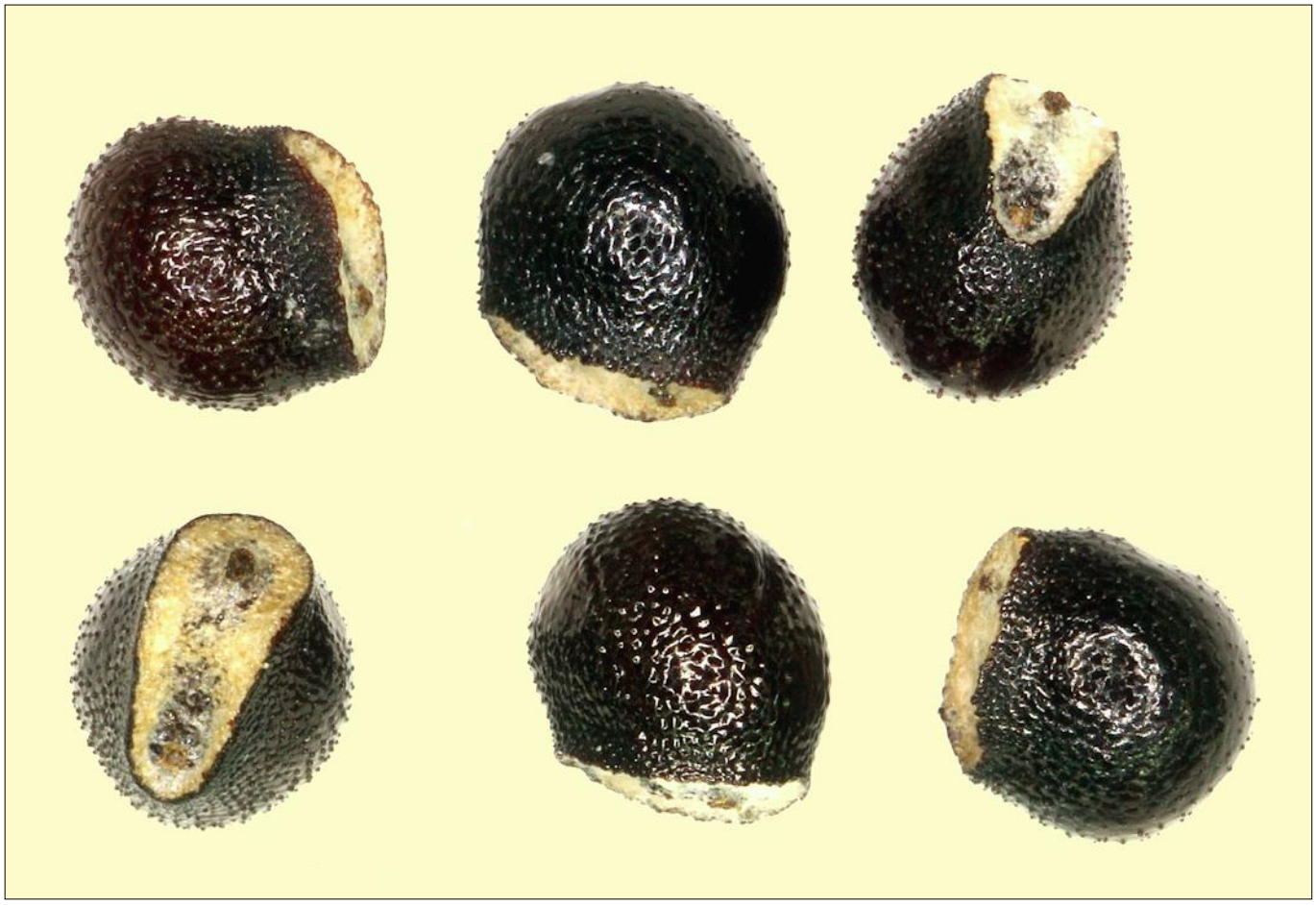

Fig. 37: Seeds of *Gymnocalycium castellanosii* VoS 1773, west of Solca, Province La Rioja, Argentina, 852 m.

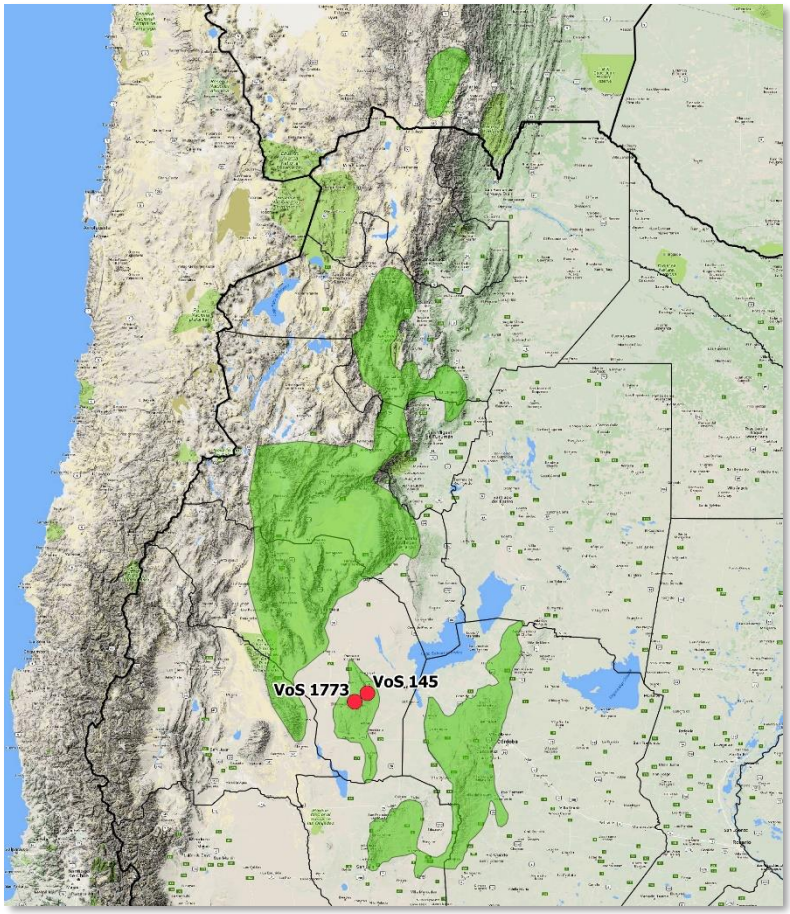

Fig. 38: Localites of *Gymnocalycium castellanosii* VoS 145 and VoS 1773.

Gymnocalycium castellanosii including *Gymnocalycium bozsingianum*.

Gymnocalycium catamarcense H. Till & W. Till (1995)

Fig. 39: *Gymnocalycium catamarcense* fa. *montanum* VoS 2450, northeastern of Hualfin, Province Salta, Argentina, 1966 m.

Fig. 40: Habitat of *Gymnocalycium catamarcense* fa. *montanum* VoS 2450.

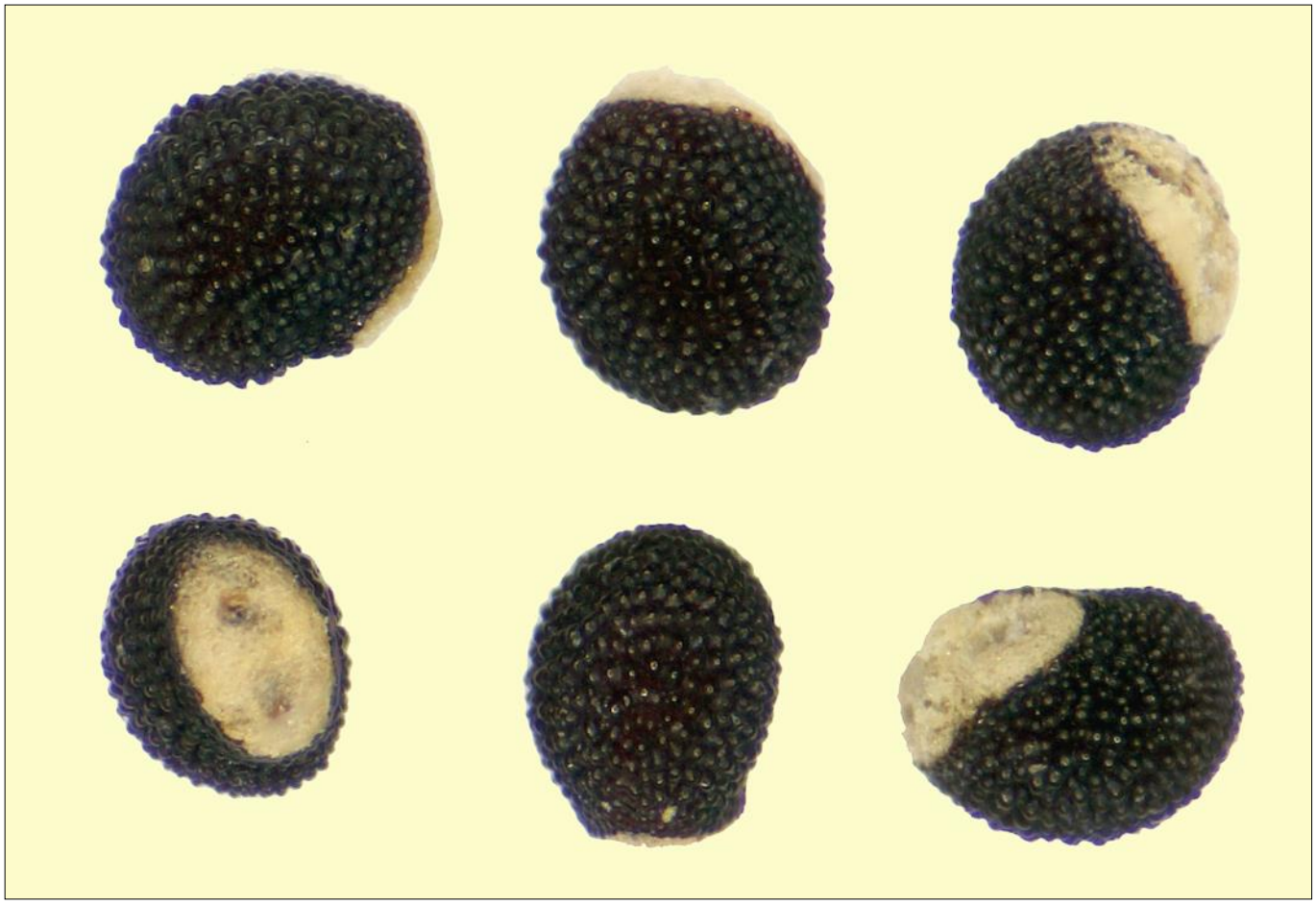

Fig. 41: Seeds of *Gymnocalycium catamarcense* VoS 2457, La Puerta de San José, Province Salta, Argentina, 1389 m (photographed at 20x magnification).

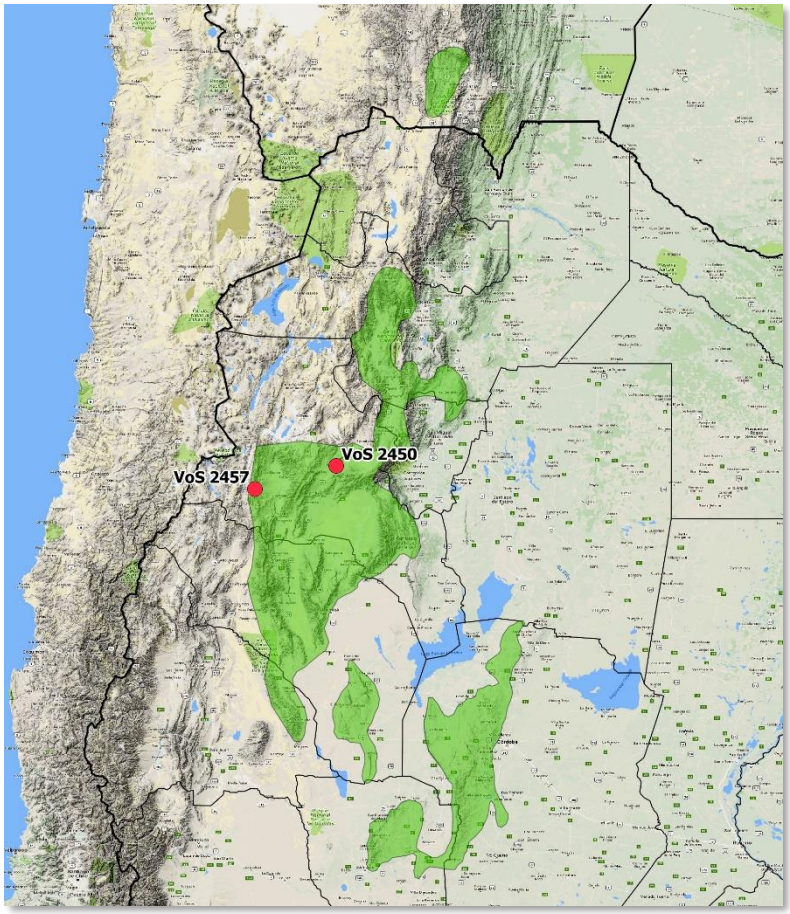

Fig. 42: Localities of *Gymnocalycium catamarcense* VoS 2450 and VoS 2457.

Gymnocalycium coloradense F. Berger (2006)

Fig. 43: *Gymnocalycium coloradense* Tom 538, Sierra Punta Negra, Province La Rioja, Argentina, 570 m.

Fig. 44: Habitat of *Gymnocalycium coloradense* Tom 538.

Fig. 45: Seeds of *Gymnocalycium coloradense* VoS 123, turnout Ruta 9 and Ruta 10, Province La Rioja, Argentina, 552 m (photographed at 20x magnification).

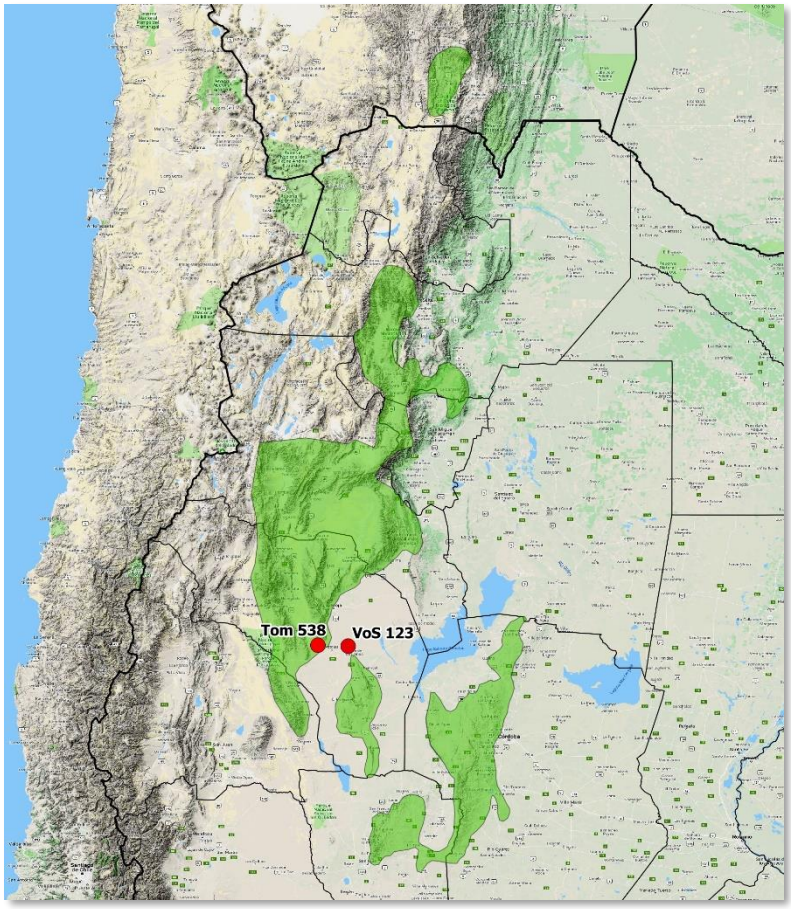

Fig. 46: Localities of *Gymnocalycium coloradense* Tom 538 and VoS 123.

Gymnocalycium esperanzae Řepka & Kulhánek (2011)

Fig. 47: *Gymnocalycium esperanzae* VoS 1791, Corral de Isaac, Province La Rioja, Argentina, 519 m.

Fig. 48: Habitat of *Gymnocalycium esperanzae* VoS 1791.

Fig. 49: Seeds of *Gymnocalycium esperanzae* VoS 1791 (photographed at 20x magnification).

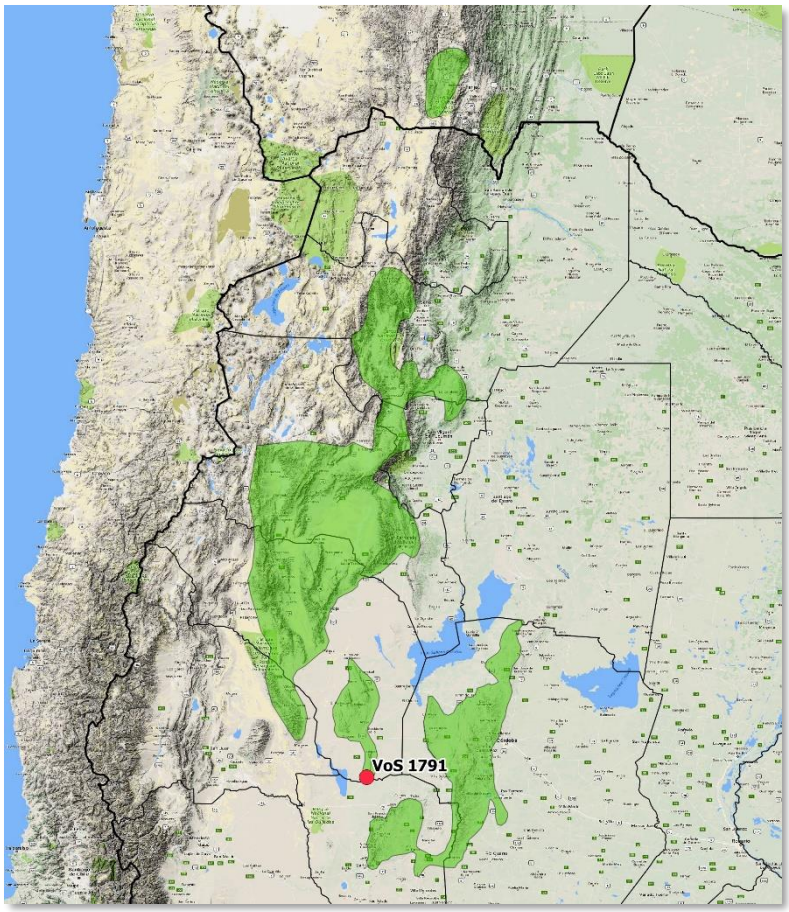

Fig. 50: Locality of *Gymnocalycium esperanzae* VoS 1791.

Gymnocalycium ferrarii Rausch (1981)

Fig. 51: *Gymnocalycium ferrarii* Tom 677, Cerro Mazán, Province La Rioja, Argentina, 760 m.

Fig. 52: Habitat of *Gymnocalycium ferrarii* Tom 677.

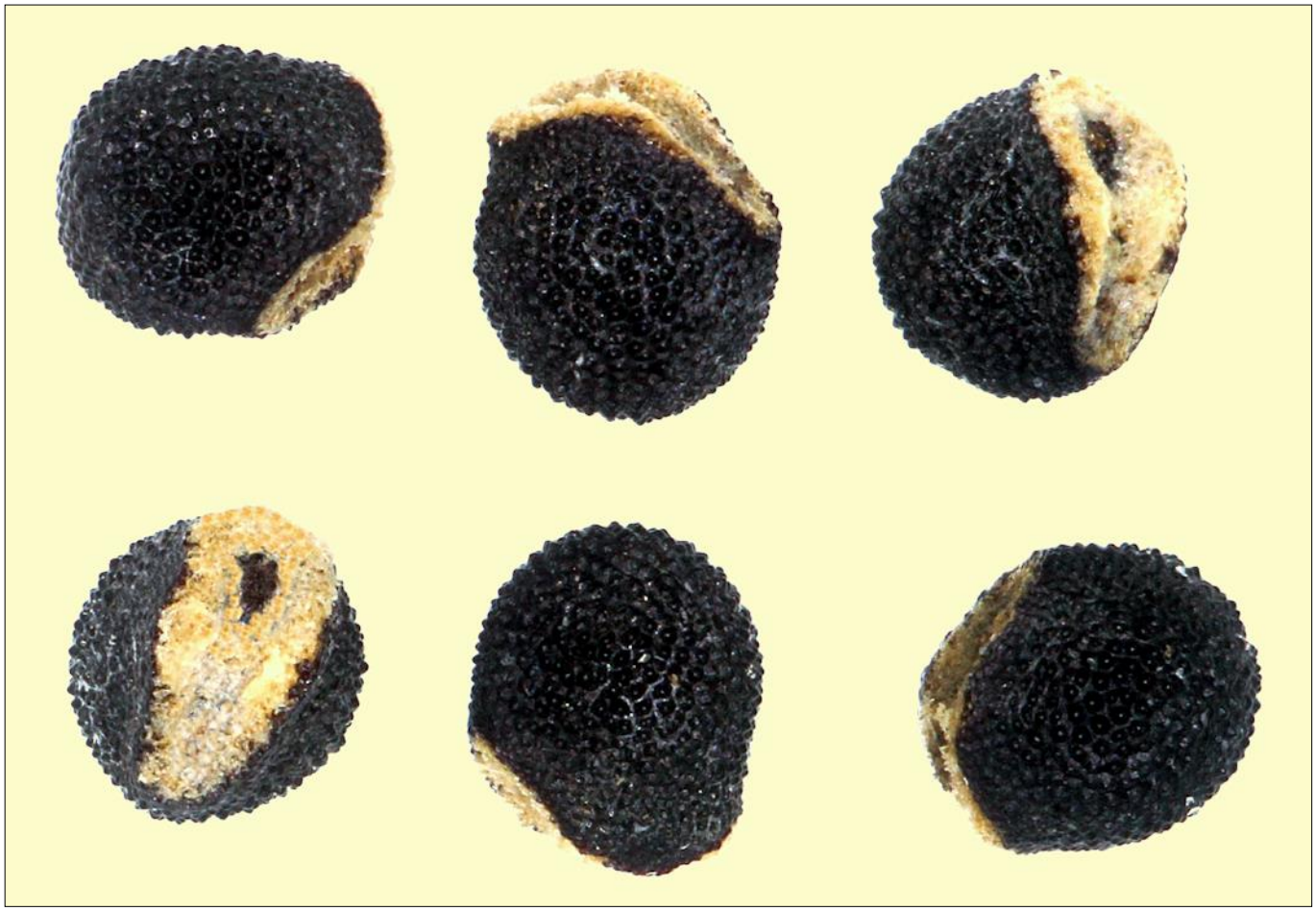

Fig. 53: Seeds of *Gymnocalycium ferrarii* aff. VoS 2356, southwest of Aimogasta, Province Catamarca, Argentina, 626 m (photographed at 20x magnification).

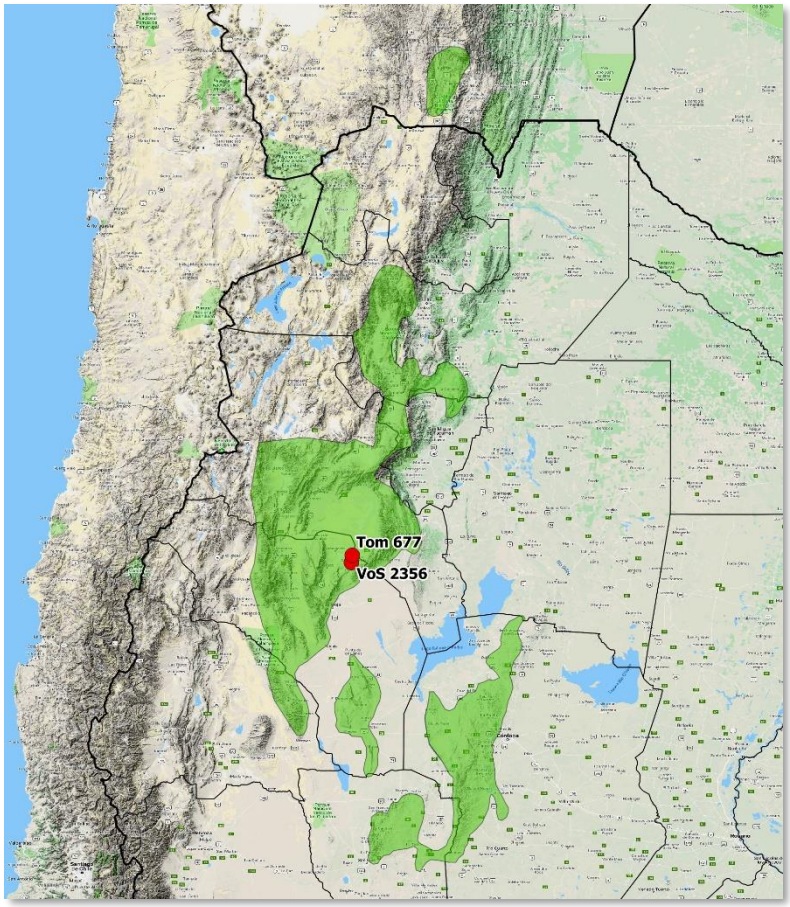

Fig. 54: Localities of *Gymnocalycium ferrarii* Tom 677 and VoS 2356.

Gymnocalycium glaucum Ritter (1963)

Fig. 55: *Gymnocalycium glaucum* VoS 128, 12 km northwest of Copacabana, Province Catamarca, Argentina, 1052 m.

Fig. 56: Habitat of *Gymnocalycium glaucum* VoS 128.

Fig. 57: Seeds of *Gymnocalycium glaucum* VoS 128 (photographed at 20x magnification).

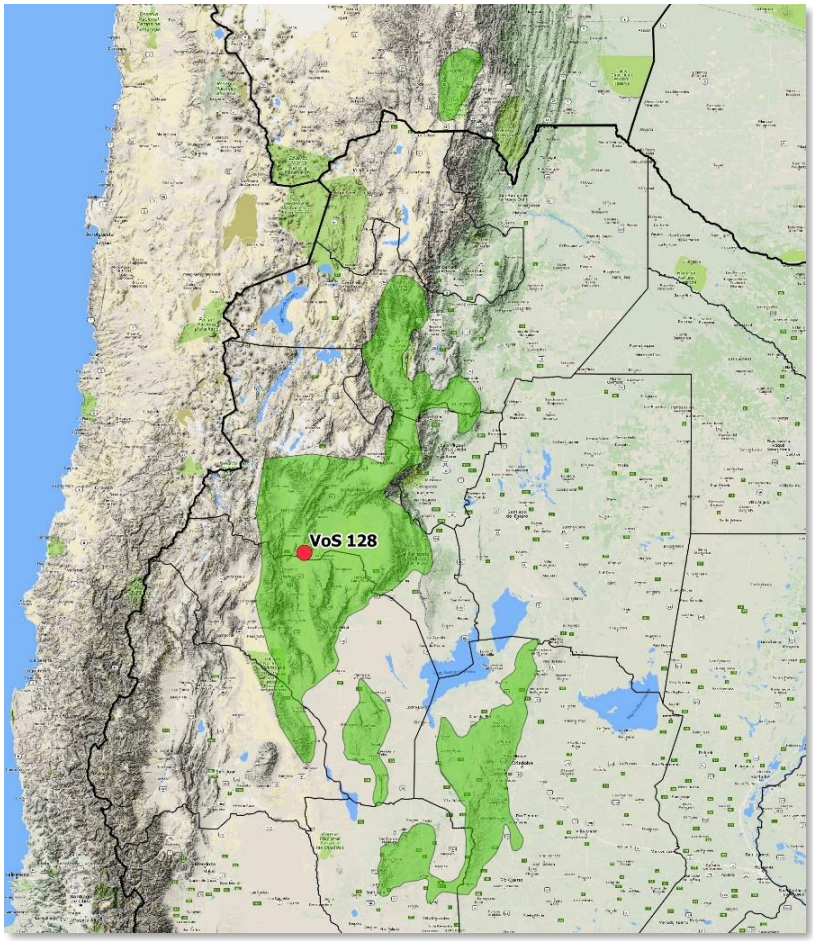

Fig. 58: Locality of *Gymnocalycium glaucum* VoS 128.

Gymnocalycium horridispinum Frank ex H. Till (1987)

Fig. 59: *Gymnocalycium horridispinum* VoS 882, south of La Mudana, Province Córdoba, Argentina, 1196 m.

Fig. 60: Habitat of *Gymnocalycium horridispinum* VoS 882.

Fig. 61: Seeds of *Gymnocalycium horridispinum* VoS 882 (photographed at 20x magnification).

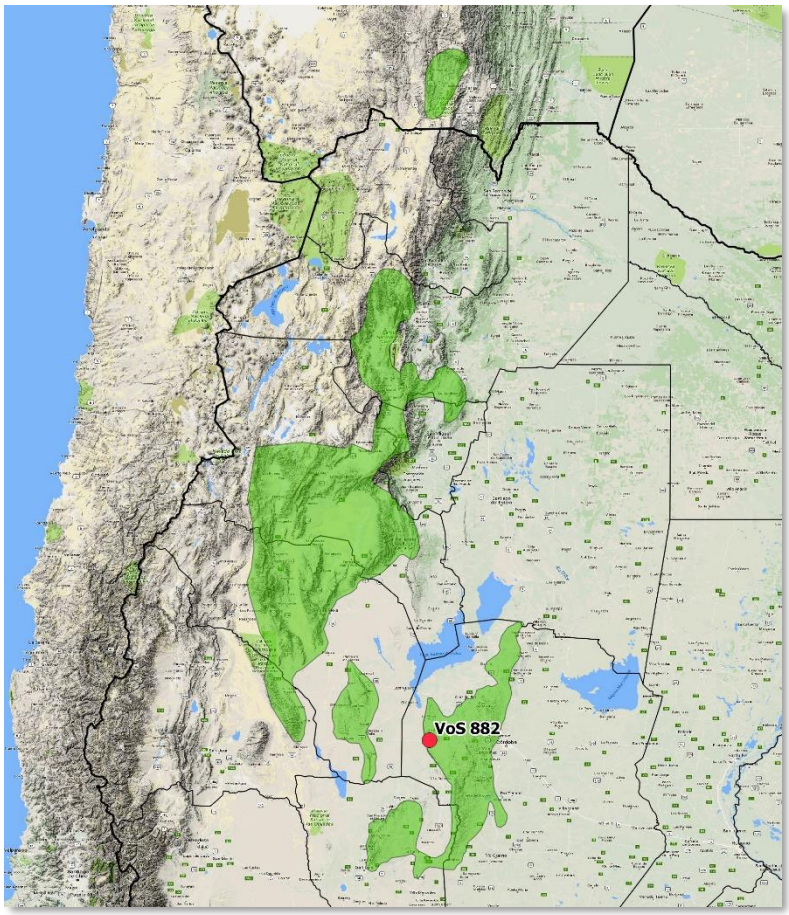

Fig. 62: Locality of *Gymnocalycium horridispinum* VoS 882.

Gymnocalycium hossei F. Haage (1927)

Fig. 63: *Gymnocalycium hossei* Tom 131, crossing from Carrizal to Anillaco, Province Catamarca, Argentina, 866 m.

Fig. 64: Habitat of *Gymnocalycium hossei* Tom 131.

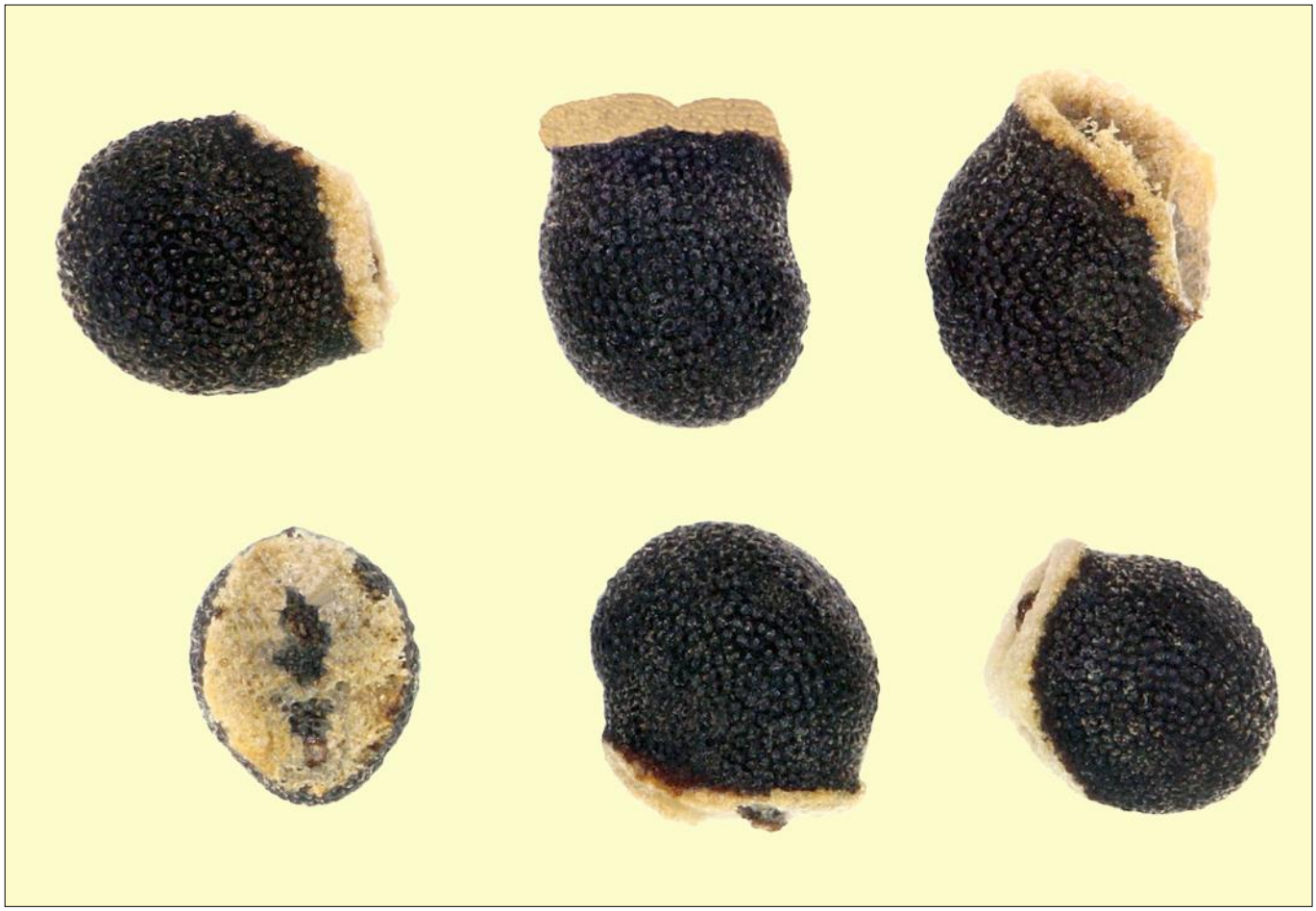

Fig. 65: Seeds of *Gymnocalycium hossei* VoS 124, 24 km south of Villa Mazan, Province La Rioja, Argentina, 588 m (photographed at 20x magnification).

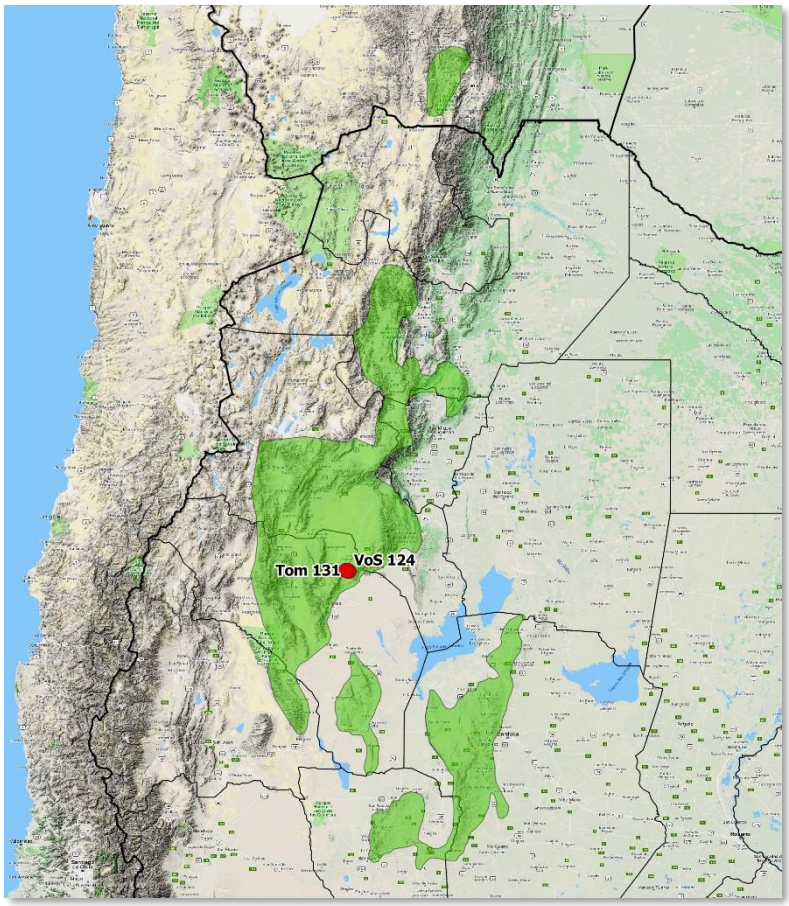

Fig. 66: Localities of *Gymnocalycium hossei* Tom 131 and VoS 124.

Gymnocalycium hossei including *Gymnocalycium mazanense*.

Gymnocalycium monvillei (Lemaire) Britton & Rose (1922) emend. H. Till

Fig. 67: *Gymnocalycium monvillei* VoS 646, 5 km north of La Estancia, Province Córdoba, Argentina, 788 m.

Fig. 68: Habitat of *Gymnocalycium monvillei* VoS 646.

Fig. 69: Seeds of *Gymnocalycium monvillei* var. *safronovii* VoS 888, Ámbul, Province Córdoba, Argentina, 1146 m (photographed at 20x magnification).

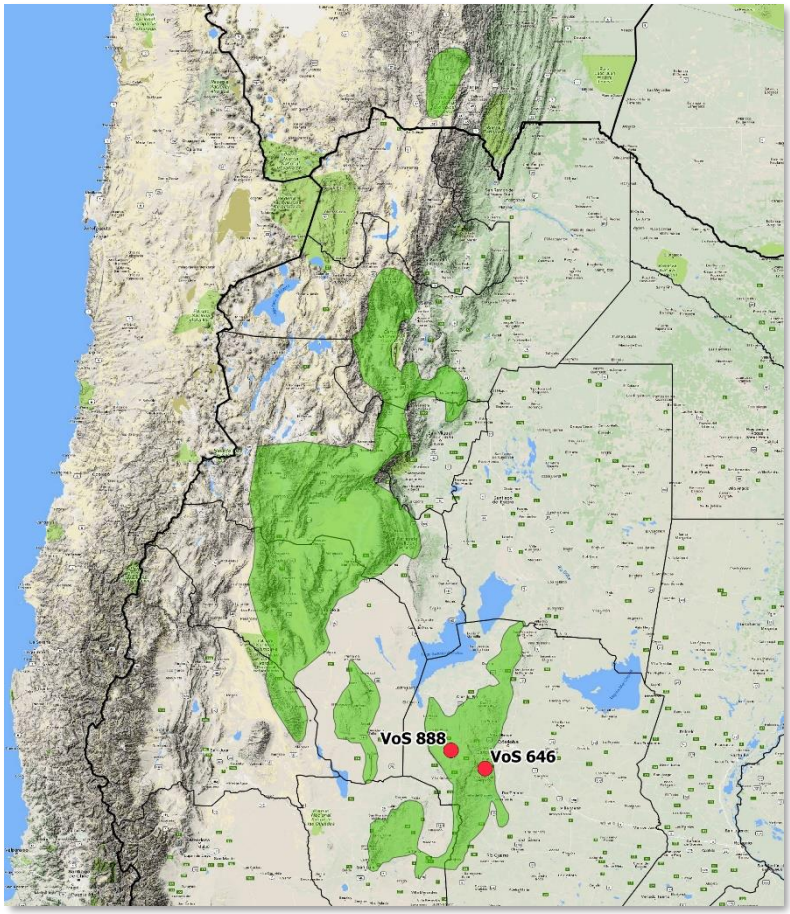

Fig. 70: Localities of *Gymnocalycium monvillei* VoS 646 and VoS 888.

Gymnocalycium monvillei including *Gymnocalycium schuetzianum*.

Gymnocalycium mostii (Gürke) Britton & Rose (1918)

Fig. 71: *Gymnocalycium mostii* VoS 2283, south of La Cumbre, Province Córdoba, Argentina, 1160 m.

Fig. 72: Habitat of *Gymnocalycium mostii* VoS 2283.

Fig. 73: Seeds of *Gymnocalycium mostii* VoS 2283 (photographed at 20x magnification).

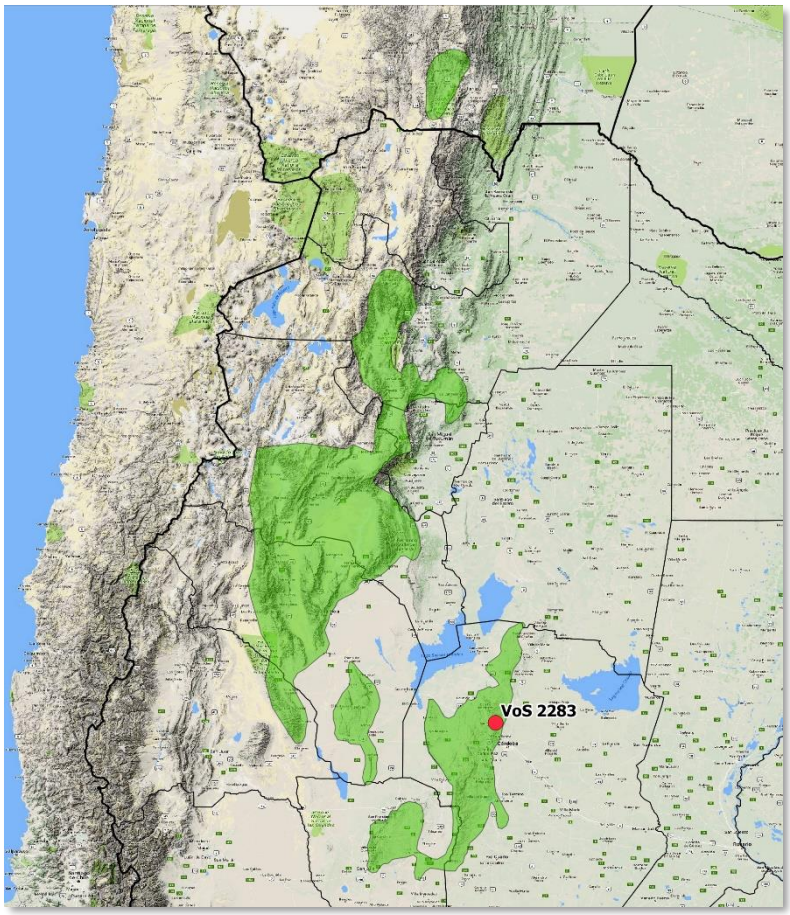

Fig. 74: Locality of *Gymnocalycium mostii* VoS 2283.

Gymnocalycium nigriareolatum Backeberg (1934)

Fig. 75: *Gymnocalycium nigriareolatum* VoS 115, 6 km northeastern of Huaycama, Province Catamarca, Argentina, 958 m.

Fig. 76: Habitat of *Gymnocalycium nigriareolatum* VoS 115.

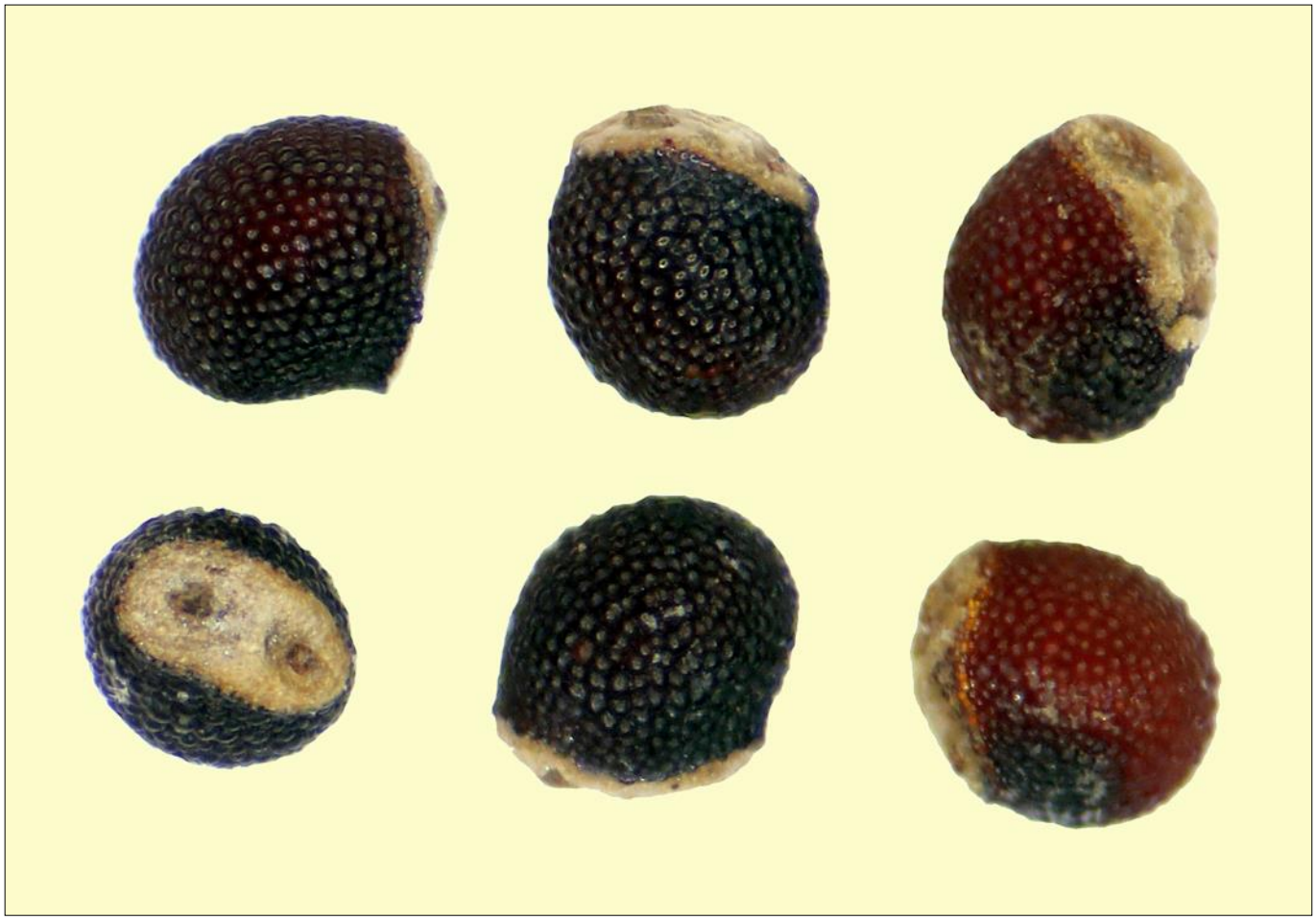

Fig. 77: Seeds of *Gymnocalycium nigriareolatum* VoS 115 (photographed at 20x magnification).

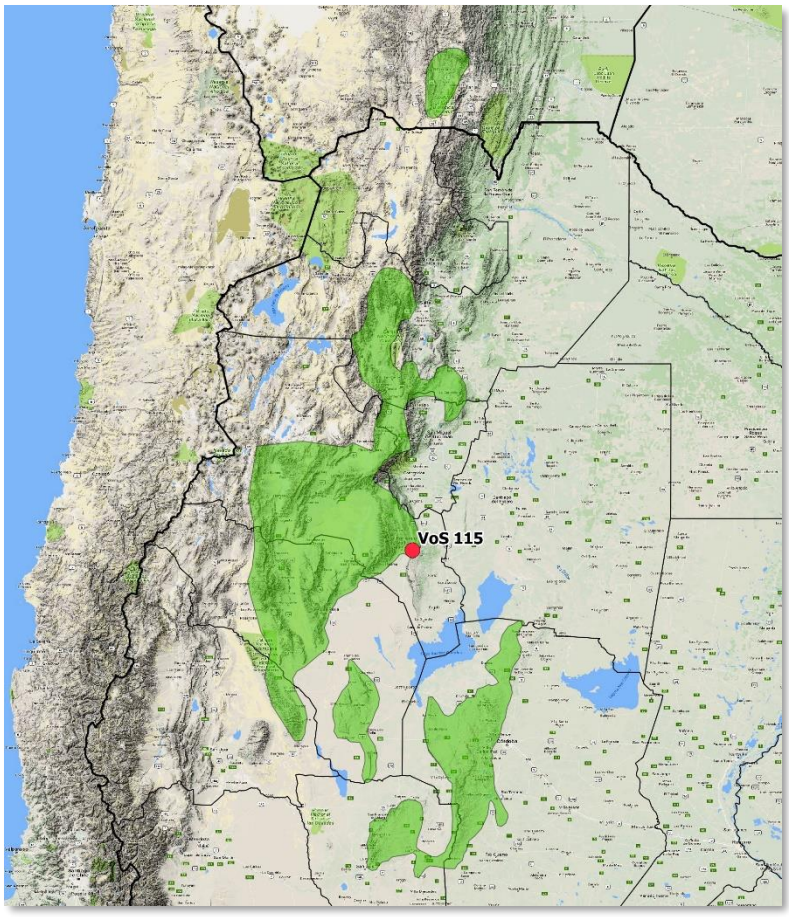

Fig. 78: Locality of *Gymnocalycium nigriareolatum* VoS 115.

Gymnocalycium prochazkianum Šorma (1999)

Fig. 79: *Gymnocalycium prochazkianum* VoS 1417, south of Orcosuni, Province Córdoba, Argentina, 743 m.

Fig. 80: Habitat of *Gymnocalycium prochazkianum* VoS 1417.

Fig. 81: Seeds of *Gymnocalycium prochazkianum* VoS 1417 (photographed at 20x magnification).

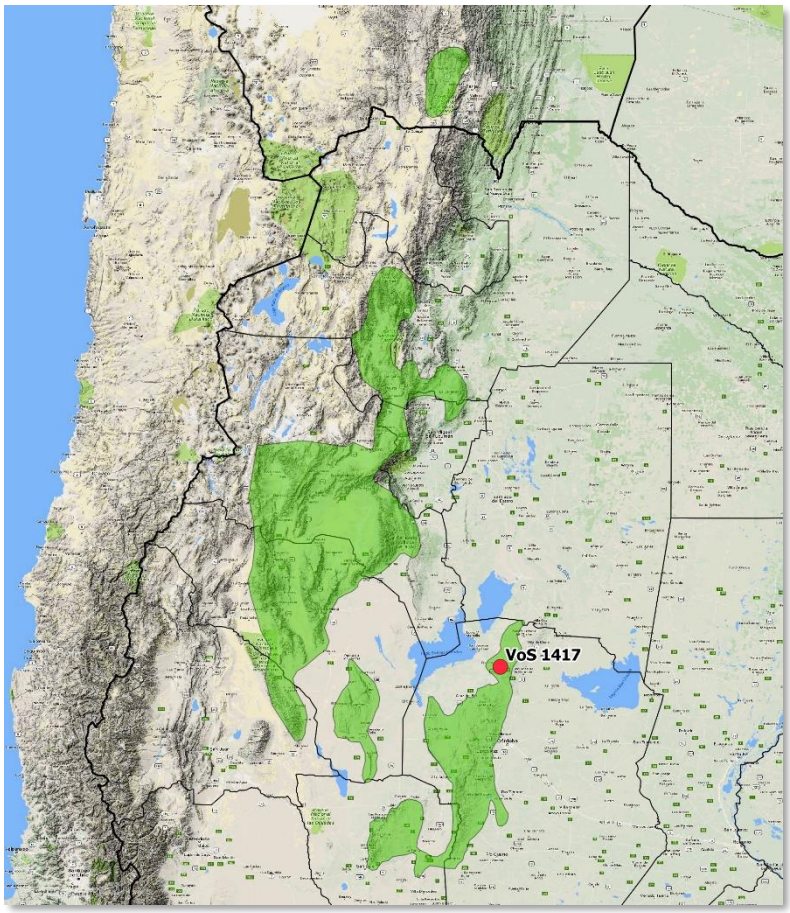

Fig. 82: Locality of *Gymnocalycium prochazkianum* VoS 1417.

Gymnocalycium pugionacanthum Backeberg ex H. Till (1987)

Fig. 83: *Gymnocalycium pugionacanthum* Tom 290, Questa de Belén, Province Catamarca, Argentina, 1100 m.

Fig. 84: Habitat of *Gymnocalycium pugionacanthum* Tom 290.

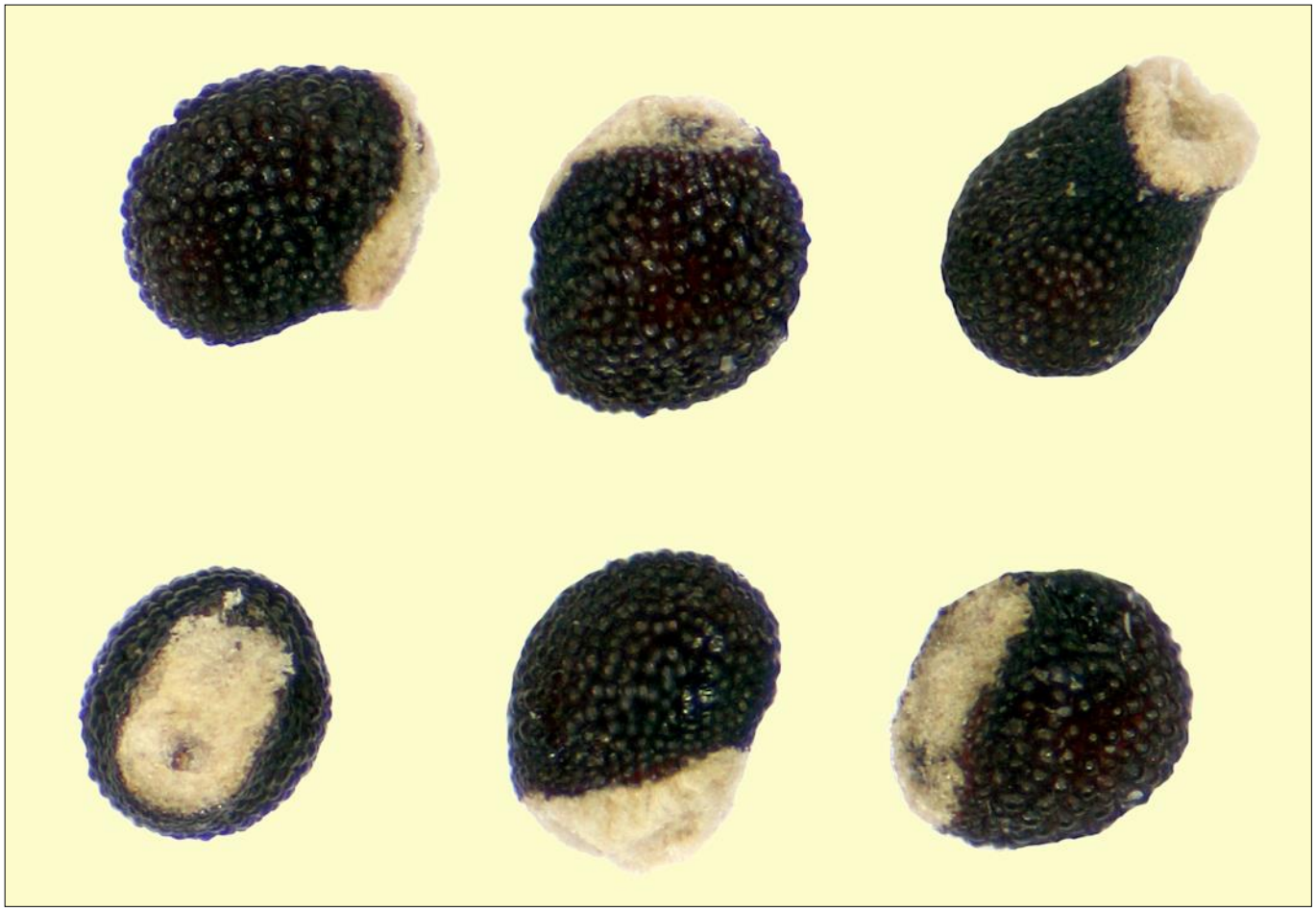

Fig. 85: Seeds of *Gymnocalycium pugionacanthum* VoS 2461, Questa de Belén, Province Catamarca, Argentina, 1309 m. (photographed at 20x magnification).

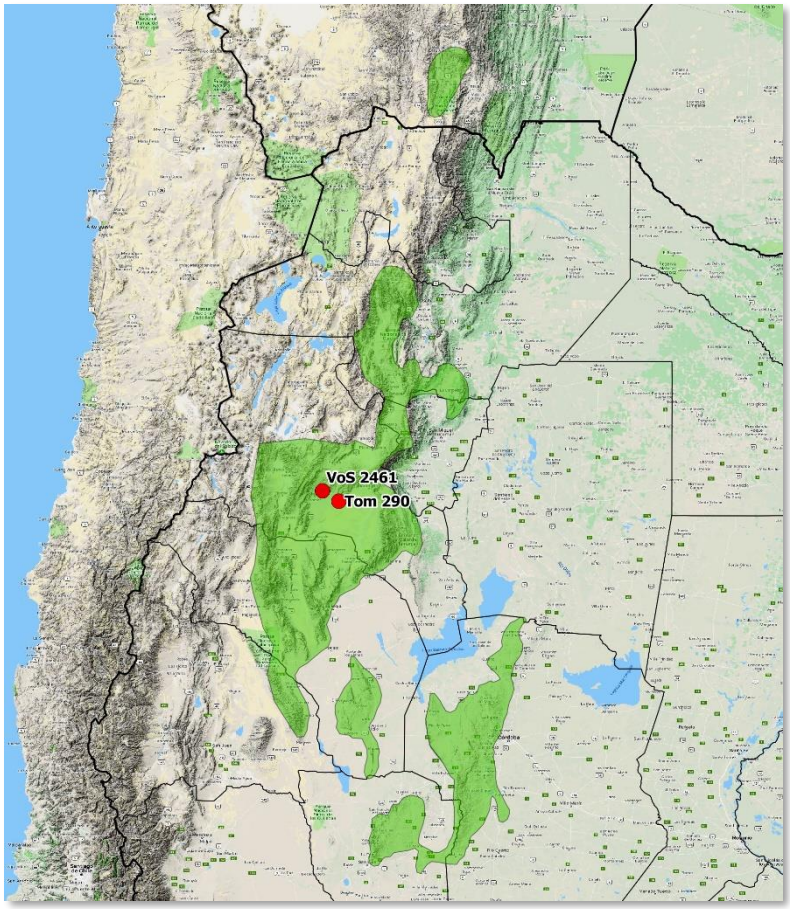

Fig. 86: Localities of *Gymnocalycium pugionacanthum* Tom 290 and VoS 2461.

Gymnocalycium rhodantherum (Boedeker) H. Till (2004)

Fig. 87: *Gymnocalycium rhodantherum* VoS 133, 21 km south of Pituil, Ruta 40, Province La Rioja, Argentina, 1188 m.

Fig. 88: Habitat of *Gymnocalycium rhodantherum* VoS 133.

Fig. 89: Seeds of *Gymnocalycium rhodantherum* VoS 133 (photographed at 20x magnification).

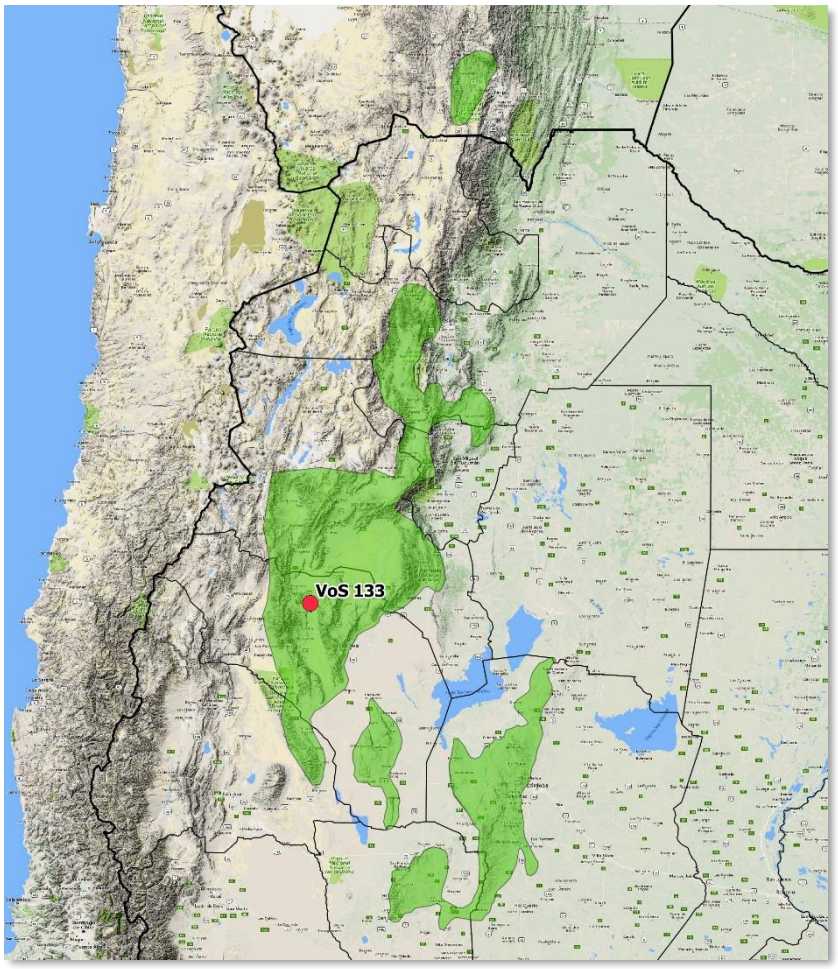

Fig. 90: Locality of *Gymnocalycium rhodantherum* VoS 133.

Gymnocalycium rhodantherum including *Gymnocalycium guanchinense*.

Gymnocalycium ritterianum Rausch (1972)

Fig. 91: *Gymnocalycium ritterianum* VoS 2482, north of Guanchín, Province La Rioja, Argentina, 2305 m.

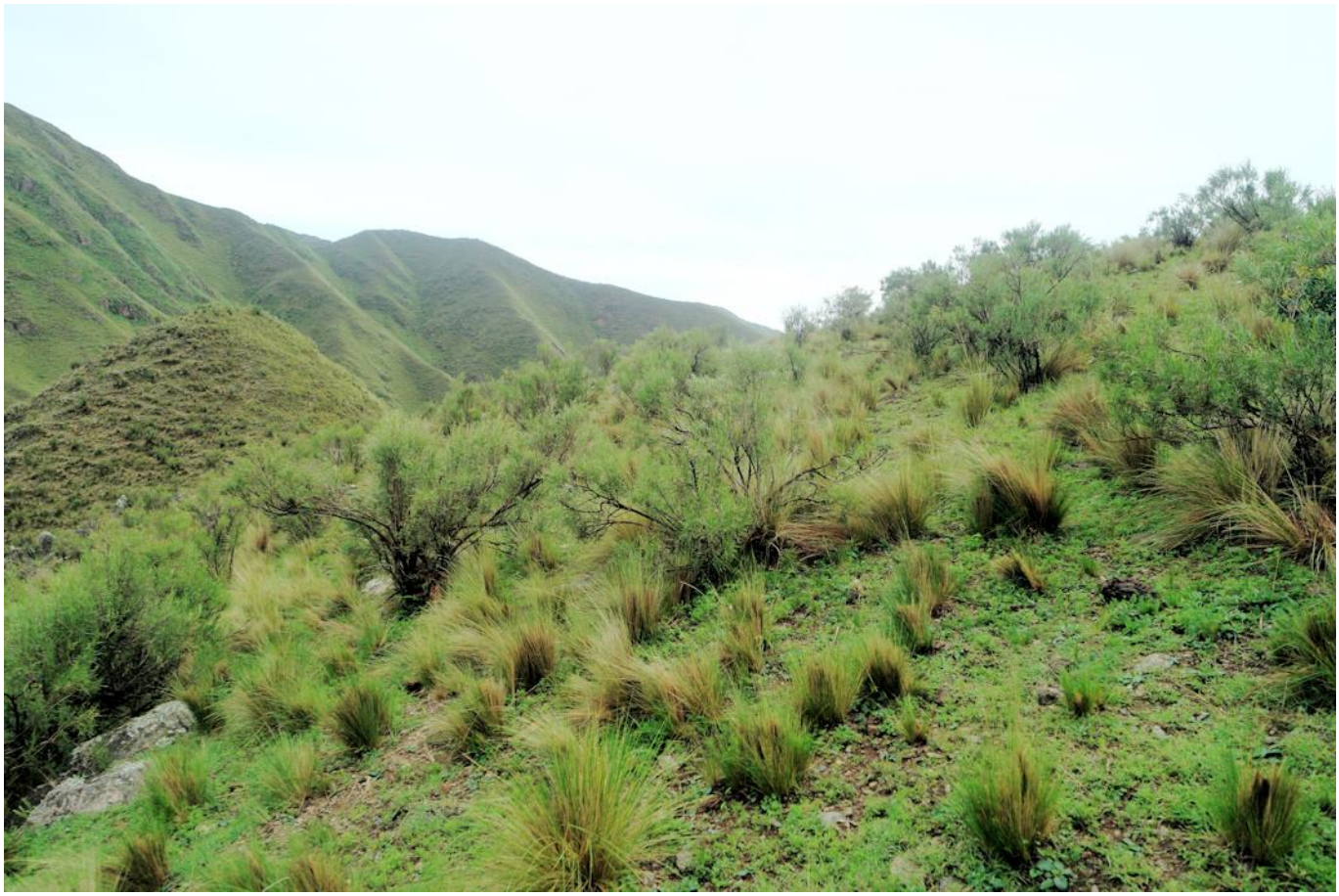

Fig. 92: Habitat of *Gymnocalycium ritterianum* VoS 2482.

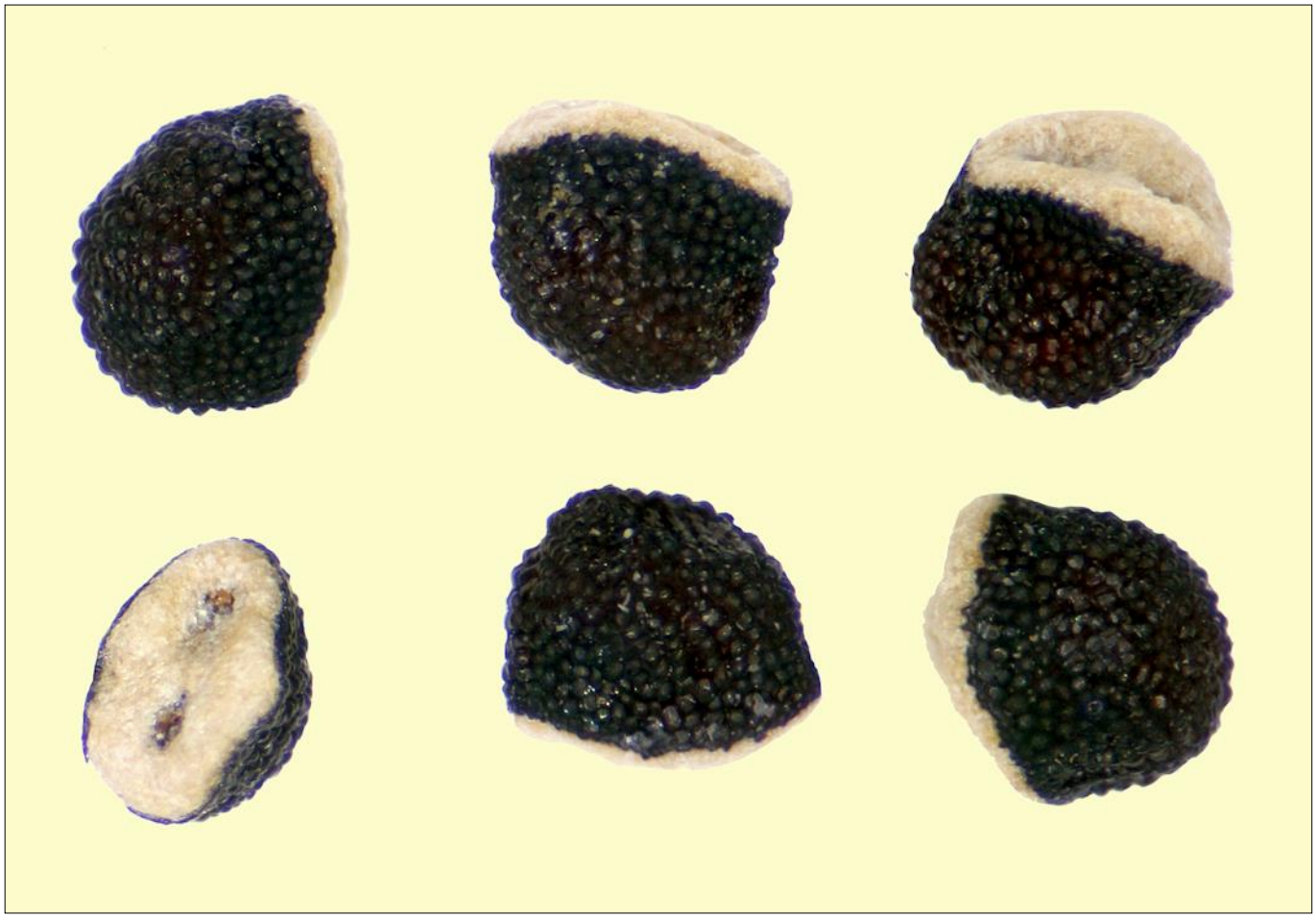

Fig. 93: Seeds of *Gymnocalycium ritterianum* VoS 2482 (photographed at 20x magnification).

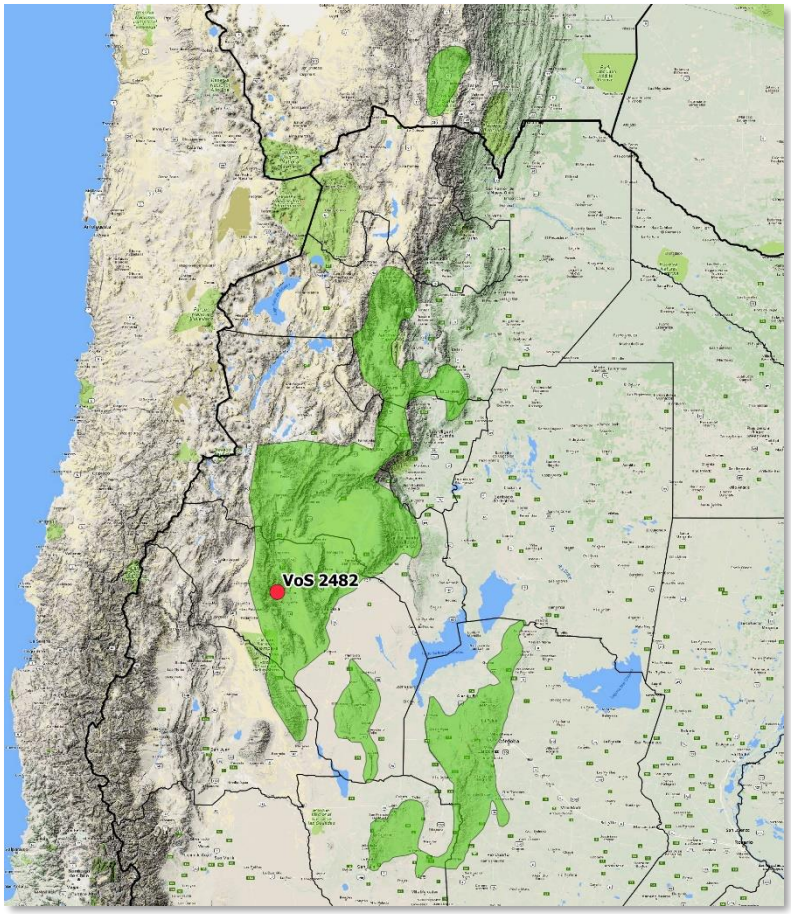

Fig. 94: Locality of *Gymnocalycium ritterianum* VoS 2482.

Gymnocalycium ritterianum including *Gymnocalycium jochumii*.

Gymnocalycium schmidianum (H. Till & W. Till) Meregalli & Kulhánek (2015)

Fig. 95: *Gymnocalycium schmidianum* Tom 820, 19 km south of Tinogasta, Province Catamarca, Argentina, 2045 m.

Fig. 96: Habitat von *Gymnocalycium schmidianum* Tom 820.

Fig. 97: Seeds of *Gymnocalycium schmidianum* subsp. *asperum* VoS 2467, north of Palo Blanco, Province Catamarca, Argentina, 2045 m (photographed at 20x magnification).

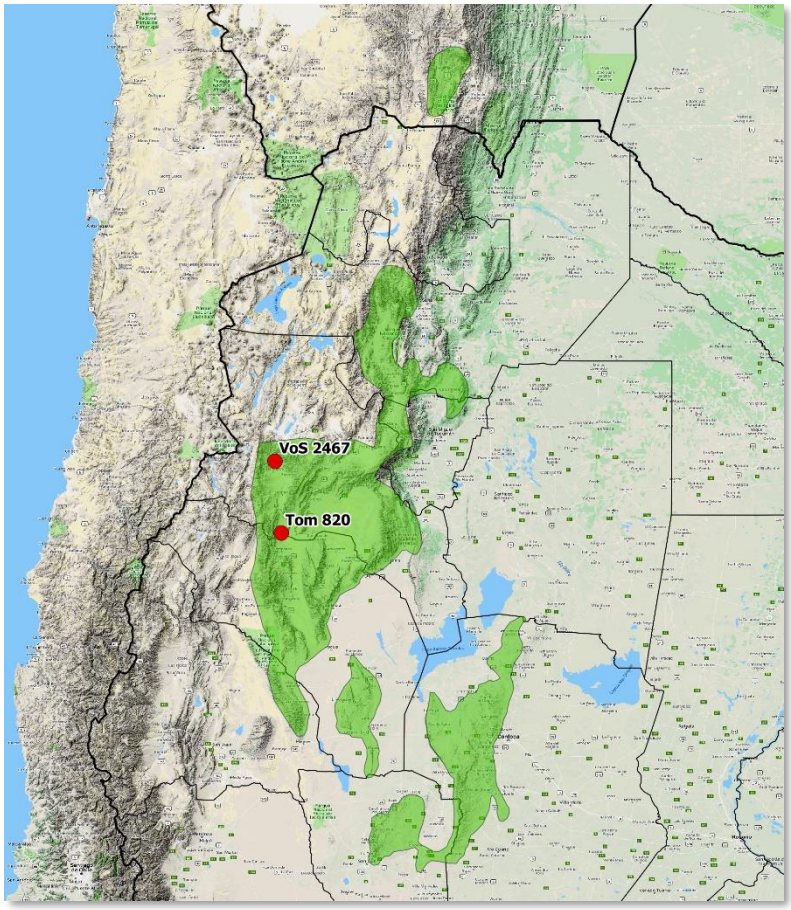

Fig. 98: Localities of *Gymnocalycium schmidianum* Tom 820 and VoS 2467.

Gymnocalycium spegazzinii Britton & Rose (1922)

Fig. 99: *Gymnocalycium spegazzinii* var. *majus* VoS 104, 5 km southwest of Molinos, Province Salta, Argentina, 1940 m.

Fig. 100: Habitat of *Gymnocalycium spegazzinii* var. *majus* VoS 104.

Fig. 101: Seeds of *Gymnocalycium spegazzinii* var. *punillense* VoS 1697, Quebrada de Las Conchas, Province Salta, Argentina, 1570 m (photographed at 20x magnification).

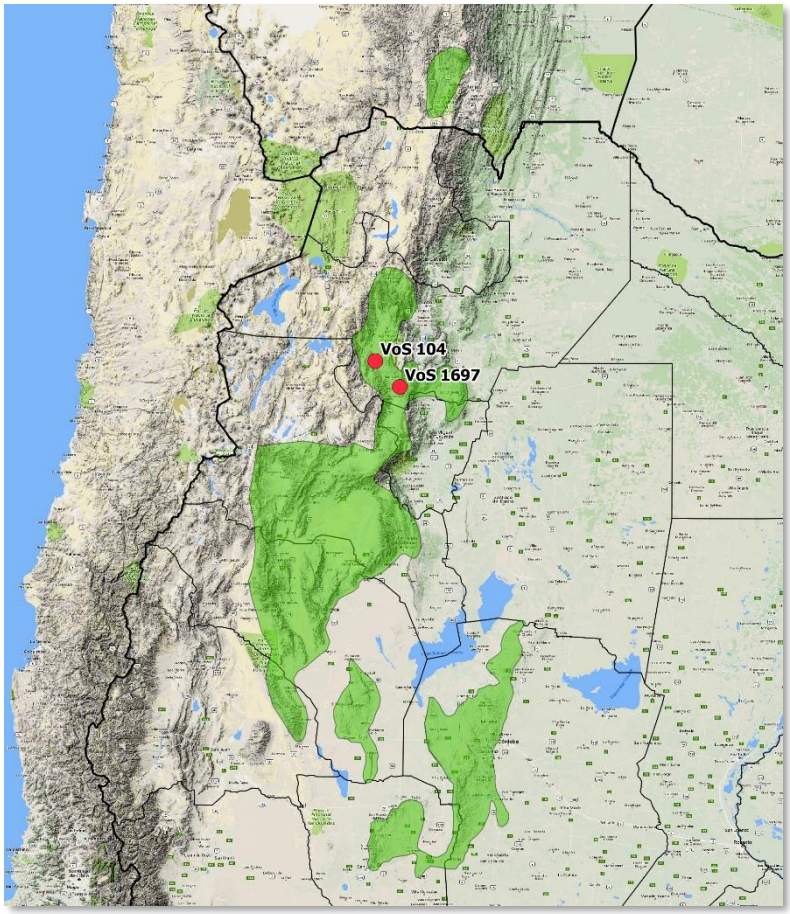

Fig. 102: Localities of *Gymnocalycium spegazzinii* VoS 104 and VoS 1697.

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Unless otherwise stated all photos by the authors.

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