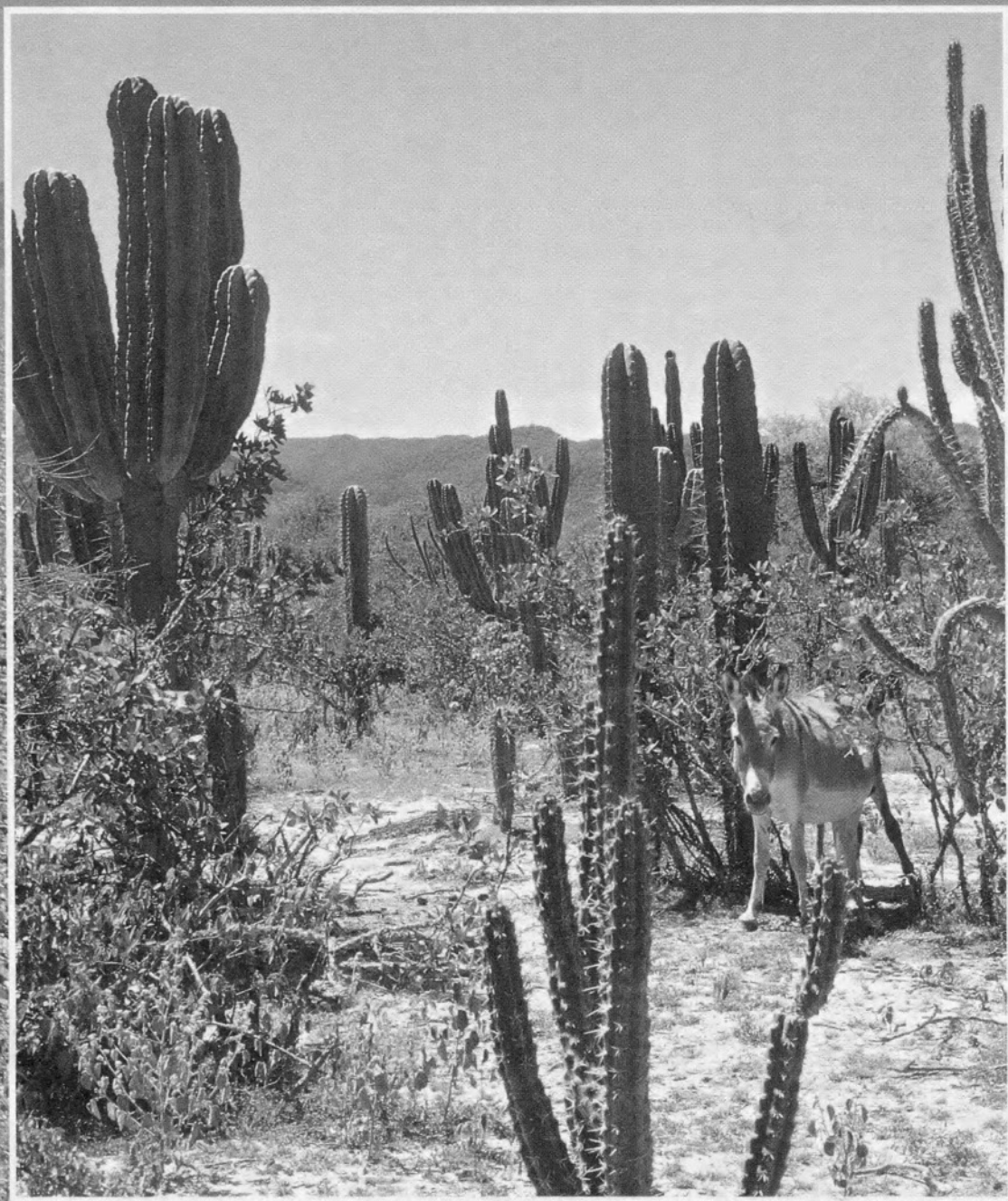


# SUCCULENTES

COMPLÉMENT DU NUMÉRO "SUCCULENTES SPÉCIAL 1999".



# The cacti of Bolivia.

## Geography

Bolivia is situated a little north of the tropic of Capricorn, in South America. It has a tropical climate in the lowlands and a temperate to cold climate in altitude. It is a country of varied geography. The flat lowlands flood in summer. There is Amazonian forest in the NE and extremely dry spiny woodland on the SE. The high mountains have variable vegetation according to orientation and altitude with plateaus at 3000-4000 m above sea level (a.s.l.), surrounded by ranges of bare or snow topped peaks.

Political divisions: the country is divided in 9 departments (dep.), each of them formed by several provinces (prov.).

The population is distributed over all the country, but La Paz, Santa Cruz and Cochabamba concentrate the greatest number of people. The largest part is ethnically Indian; Quichua and Aimara tribes in the mountains and several different ethnic groups related to the Guaranies or Wichies (Matacos) in the low parts. Other ethnical groups are less numerous. Although Spanish is the official and most common language, there are several native languages with many old people in the country not capable of speaking Spanish.

The Andes Mountains, formed by the forces produced by the movement of South America to the west, and the Pacific plate to east, form a wide portion in Bolivia; the "Andean knock". Two sub-cordilleras circumscribe the Puna (Altiplano, or high plateau): the Occidental and the Real; the slopes to the east and north of the latter receive rain in summer- the humid winds from the Atlantic, which produce the dense tropical forest named Yungas. In the middle some valleys are dry, because of the mountains. To the east and north, there are lowlands of different vegetation, according to the different climates. In the south, on a basically clay-soil, there is a dry woodland with spiny plants named "Chaco"; a continuation of a vegetation type from Paraguay and Argentina. To the north, the Amazonian forest occupies several departments. To the east the Cerrado vegetation is also present, with large plants having coriaceous consistency leaves.

The hydrographic system has three river basins. In the NE big rivers (the biggest being the Mamoré, Beni and Madre de Dios) contribute to the Amazonian system. The south-east has some rivers, which disappear in the sands of the Chaco, such as the Parapetí which ends in the Izozog marshes ("Bañados"), but many others contribute to the Pilcomayo, which after crossing the Chaco, joins the Paraguay and Paraná rivers. In the south-west the water forms fresh water lakes, such as the Popo, or saline lakes, such as the immense Salar de Uyuni, considered a sea of salt. As evaporation is higher than precipitation, the salt concentrates on the soil surface. A mountain here is named "The Isle".

## CLIMATE

Bolivia is on the "tropical belt" with low-pressure system in summer (December to March) which produces rising air currents and consequently leads to a convergence of various winds. The dry winds from the Pacific (W, NW, or SW) join the humid winds from the Atlantic (E, SE, NE or also N) and discharge part of their humidity on to Brazilian territory.

In winter the opposite occurs. High-pressure system centre on Bolivia and the air currents descend, bringing dry air. There is nearly no rain through winter. The air is clear and temperature increases during the day due to the intensity of the sun. At night the absence of clouds allows loss of soil heat and temperature drop quickly; with enormous differences in temperature between day and night. With altitude, the temperatures vary from very warm to cool. Permanent snow is present on the high peaks.

## PLANT ECOLOGY

(Summarised from Beck, S. G., Vegetación de Bolivia, in Killeen, T. M., García E. E., and Beck, S. G., Guía de Árboles de Bolivia: 6-23, Herb. Nac. de Bolivia-Missouri Bot. Garden, 1993. Refer also to Cabrera A.L. and Willing, A. (Biogeografía de América Latina, OEA, 1973).

Because of its central position in South America, there is a convergence of 4 phyto-geographical (or biological) regions in Bolivia: Andes, Amazonia, Cerrado and Chaco.

### The Andes Region: composed of the following four Provinces:

• **Tucumano-boliviano forest; Wet-mountain forest and Yungas** (Bosque Tucumano-Boliviano, Bosques montañosos húmedos and Ceja de monte yungueña). In the Cabrera and Willing classification this province is considered part of the Amazonic Region.

On the slopes of the Andes facing E and NE, from 400 to 3200 m a.s.l.; exists an evergreen tropical forest, thanks to a rainfall of 2000 (to 5000! at some places) mm per year; the temperature, variable according to altitude, an annual average of 10° to 24 °C. As in all Bolivia, the rain is concentrated in summer, but throughout the year clouds generate a humid environment.

There is a few cacti there, but *Cereus*, *Monvillea*, *Rhipsalis*, *Epyphyllum* and *Selenicereus* have been reported. Amongst exposed rocks, *Trichocereus*, *Rebutia* and *Parodia* can be found.

• **Dry Interandinean Valleys** (Valles Secos Interandinos)

From N of La Paz to the S of Tarija this formation is a series of dry woodlands, chaparrals, shrub-lands and eroded lands, between 500 and 3300 m a.s.l. The rain is concentrated from December to February, with 500-600 mm per year.

The average maximum temperature is 28° C and a minimum of 2° C. Two large environments can be distinguished in this province, according to the altitude. Valles Mesotermicos, Valles semiáridos or Montes espinosos are the lowest, and Cabeceras de valle, Subpuna or Prepuna, are the highest.

The vegetation is deciduous, closely related to the Chaco. Cacti are frequent here. Pure formations (ie. real forest) of *Neoraimondia herzogiana*, *Browningia caineana* and *Harrisia tephrocantha* are common. *Pereskia weberiana* and *P. diaz-romeroana*, the cacti with perhaps more primitive characters, grow here. In the Cabrera and Willing system this is considered part of the Chaco Region.

#### • Puna

It is the high plateau (or altiplano, from near 2500–4800 m a.s.l.) surrounded by mountains. Part of it is a closed basin, with salt-lakes in the lowest part. Soils here are sedimentary and very thin, but Puna vegetation also develops under the rocky slopes, where more or less rocky soils allow better drainage. Grasses and other herbaceous vegetation cover part of the Puna; shrubs of different families form the typical landscape of a great part of this province. Trees are not common. Temperatures are low: the annual average is less than 10° C; minima of zero can occur all year round.

Cacti are scarce on the flat, sedimentary soils, but *Lobivia*, *Maihueniopsis*, *Oreocereus*, *Newdermannia* and *Puna* appear. On the rocky slopes cacti are more abundant, with the same genera, plus *Parodia*, *Sulcorebutia*, *Lobivia*, *Mediobolivia*, etc.

#### • High-Andean Vegetation

Over 4800 m the vegetation is sparse and low. Temperatures are even lower than in the Puna. Humidity is higher because of much higher precipitation from snow or hail. Cacti are not present in this province, except in the lower part; some *Maihueniopsis* and *Lobivia* species.

#### Amazonian Region

Three formations (or plant communities) compose the region: 1- Amazonian forest (Bosque amazónico), 2- humid forest of the sabana (Bosque húmedo de llanura) and 3- humid forest of the Precambrian shield (Bosque húmedo del escudo precámbrico).

All these are evergreen tropical forests, with trees 30 m high and some isolated 45 m trees. Except for a few months, the climate is humid, with 1200–2200 mm annual rainfall and an annual average temperature of 25–27° C. Vines, palms, and rubber trees are abundant. The first two vegetation types develop at low altitudes: 100–250 m a.s.l., on sedimentary soils. Two different floristic communities can be found, depending on whether the soils are flooded or not for part of the year.

The last province is an undulated plane on granite (the Precambrian shield) and soils are acidic, with low fertility.

The cacti here are *Rhipsalis*, *Epiphyllum*, *Cereus*, *Monvillea*, and perhaps *Pereskia*.

Big areas in the middle of these three provinces are named “Sabanas húmedas” (wet savannas). These are near horizontal lands of low altitude, with sedimentary soils of bad drainage; some parts are frequently flooded. The floristic composition is a mixture of elements of the different regions of Bolivia. Cacti have not been recorded in the savanna.

#### Cerrado

Cerrado (or “Campos cerrados”) means “close” or, more clearly “grassland closed by trees”. It is a Brazilian name and it is in this country where it covers an extensive surface.

In Bolivia the Cerrado has the proper *Campos Cerrados*, and a mostly woody area, the *Bosque Semideciduo Chiquitano* (Semideciduos Chiquitanum woodland).

Families here are almost the same as in the Amazonian forest, but with many of their own genera and species. The peculiarity of this vegetation is the large hard leaves, ever present in most plant families. Thick cork on the trunks and branches is also common as an adaptation to frequent fires. The climate is sub-humid, with a dry season of 3–5 months and an annual rainfall of 100–1500 mm.

There are not many cacti there, but some *Cereus* and *Discocactus* have been reported.

#### Chaco

It is formed in Bolivia by the Chaco dry woodland (Bosque seco chaqueño) and Mountain Chaco (Bosque chaqueño serrano). It extends to the SW of Bolivia and the NW extreme of the same formations in Argentina and Paraguay. There are many cacti in the Chaco, and in consequence more will be said about this vegetation.

This region has vegetation with many spiny species, which form a low dry woodland (ca. 8 m high, with the bigger trees up to 15 m). Also associations of spiny bushes and grassland exist. The annual rainfall is from 500 to 1000 mm, concentrated in the warm season (December to March); average temperature is ca. 22–26 °C, but the between-season differences rise to 48° C in summer and drop to freezing in winter.

The *Bosque seco chaqueño* extends on low sedimentary lands from 300 to 600 m altitudes. The genus *Prosopis*, *Geophraea*, *Aspidosperma*, *Ziziphus*, *Ruprechtia*, *Cereus*, *Opuntia*, *Bouganvillea*, *Vallesia*, *Cleistocactus*, *Gymnocalycium*, etc. are very frequent. Palms are also present. This formation is very uniform over large areas. *Pereskia* and *Quiabentia* appear sporadically.

The *Bosque chaqueño serrano* develops on the lower elevations of the Andean complex, up to 1500 m a.s.l. The mentioned genera are also represent, but frequently of different species. Many endemic species occur, many cacti among them.

## THE COUNTRY

Exploration of Bolivia started with the Spaniards who came from Peru. In fact Bolivia was named "the high Peru" at that time. The presence of silver, tin and gold determined the development of some areas. The city of Sucre (formerly "La Plata"= The Silver) is a good example; the luxury there during the Spanish time was more than in any European city at that time. This can be appreciated. After the mineral richness was finished (including tin at the middle of this century) the country went into a long and deep economic depression. The inefficiency and corruption of national and local governments help to keep this situation. Though there is a good educated elite, the educational level is low and perhaps not a priority for many governments at former times.

The roads are poor. Only a few are paved. In the mountains the natural soil is covered by gravel and can be used also in the rainy season, but the rivulets in that season grow and interrupt transit due to the frequent absence of bridges. The routes on the lower areas, even the main ones, become impossible to use, big trucks destroy them, making big corrugations. It is common that trucks or buses block the traffic. Since last year the situation has improved but it will take many years to come to a more or less acceptable situation.

Depending on the place, hotels and food are simple but acceptable. The people in Bolivia are friendly and help foreigners. The crime rate is very low.

## THE CACTI

### HISTORY

Botanical exploration of Bolivia has been described by Funk, V. and Mori, S. A. in 1989: A bibliography of plant collectors in Bolivia; *Smitsonian Contr. Bot.* 70: 1-20.

Perhaps the first botanist who mentions cacti of the country was Tadeo Henke, a Czech botanist who spent several years in Bolivia (1784-1817) and died in Cochabamba. *Cereus haenckeanus* was named after him.

Others collectors of the Bolivian flora in former times were Alcides D'Obrigny, Henry Rusby, Miguel Banck, R.S. Williams, Erick Asplund, José Steinbach, and Josef Pentland.

Martín Cárdenas H. (1899-1973) was the only prominent Bolivian botanist before recent times. Throughout his life he kept an interest in plant study, even when conditions were not stimulant. He shared his time between botanical research and teaching courses of secondary level chemistry or physics. He worked alone, with only the collaboration of a Peruvian botanist (as C. Vargas) or an Argentinian (e.g. A. Castellanos, A.L. Cabrera). He also corresponded with many botanists all over the world and participated at one IOS Congress, in Wien.

Cacti, were one of his favourite families, we know about correspondence with Castellanos in Argentina and Backeberg from Germany. He published about cacti in Bolivian journals, but also in USA and France. He described more than 160 cacti species in *Flora Ornamental Nativa de Bolivia*.

Ritter, F. In his many years collecting cacti commercially in South America, Ritter visited Bolivia. He has published several species from his explorations. Half of the second volume of his book *Kakteen in Süd Amerika* (1980) is devoted to Bolivia.

Rausch, Walter: As a specialist of the *Lobivia* genus, Rausch visited Bolivia many times. His observations and novelties have been published in the German magazine *Kakteen und andere Sukkulente* or in the Dutch journal, *Succulenta*. He published a book in three volumes combined into one (*Lobivia* 85).

Roberto Vázquez Chavez, an enthusiast of plants, devoted many years and trips to cacti of his country. He became an enthusiast of the native flora in general, especially orchids. He is now completely absorbed in collecting, drawing and describing them; and has collaborated with other authors in publishing several books.

### Recent collectors:

A long list can be made with all the foreign botanists who have visited Bolivia in recent years. The beauty of the sulcorebutias, the lobivias and others. The mystery of a country which keeps the Indian traditions and is in fact the Tibet of America, attracts many friends of cacti. The general flora has also attracted botanists. Tim Killeen, from USA, has lived in Bolivia (Santa Cruz) for 10 years. Stephan Beck has lived in La Paz for more than 20 years now. Gonzálo Navarro, a young Spanish professor of botany, has obtained a licence for several months each year to collect plants and make vegetation studies in Bolivia. Now he is living in Cochabamba. Gonzálo is basically interested in the ecology of cacti and recently produced the first comprehensive publication about the Bolivian cacti: *Catálogo ecológico preliminar de las Cactáceas de Bolivia; Lazaroa* 17: 33-84. 1996. Much of the following information has been taken from there.

### SYSTEMATIC

From the past century the family has been considered composed of two main groups: the ones with the seeds covered by an aril (hard or not), the *Sclerosperms* and the others without aril: the *Malacosperms*. The present tendency is similar: the subfamily *Opuntioidea* (with arilate seeds, glochids, pantoporate pollen...) as separated from the other two subfamilies (or tribes): the *Pereskioideae* (plants with leaves) and *Cereoideae* (plants without leaves, very diverse).

Currently, the depth of treatment of each genus is very variable. It depends on my own knowledge, but also of the reliability of the bibliographic sources used. For small genera, names of all the species are given, but it is not possible in large genera. In some cases, such as *Parodia*, *Rebutia*, *Sulcorebutia* or *Weingartia*, there is a plethora of names based in small differences, and further studies to clear this chaos are necessary.

# Key for the subfamilies of *Cactaceae*

A. Plants with leaves.

B. Plants with flat, nerved leaves. Trunks not succulent. Flowers in racemes or panicles. Glochids absent.

Subfamily 1. *Pereskioideae*

B'. Plants with small conical leaves (except *Quiabentia*), mainly deciduous, not nerved. Trunks, if present, succulent.

Flowers solitary. Areols normally with glochids.

Subfamily 2. *Opuntioideae*

A'. Plants without leaves. Flowers solitary

Subfamily 3. *Cereoideae*

## Subfamily 1: *Pereskioideae*

1. *Pereskia* Miller, *Gard. Dict.* ed. 4: 1754.- = *Rhodocactus* Knuth.

Trees or bushes, sometimes vines. Trunk and branches woody, not succulent. Leaves broad more or less thin nerved. Flowers many, in racemes or cymose inflorescences, rarely solitary. Pericarpel with areoles well developed and leaves. Tube absent. Fruits frequently proliferous. Embryo with big foliaceous cotyledons.

Near 16 species from Mexico and the Carribean to N of Argentina. In Bolivia four species: 1) *P. sacha-rosa* Griseb., from the border with Paraguay and Argentina to Cochabamba, Chuquisaca and Santa Cruz, in Chaco vegetation. 2) *P. diaz-romeoana* Cárdenas, endemic of the area of the Río Grande (dep. of Santa Cruz and Chuquisaca), Samaipata, etc., where it is frequent. It has a close affinity with the following. 3) *P. weberiana* K. Schumann, growing at the N of La Paz, in the dry valleys of the Yungas, where it is common. 4) *P. aculeata*, apparently very rare because have been found only very recently.

Reference: Leuenberger, B. 1986. *Pereskia*. *Mem. New York Bot. Gard.* 41: 1-141. According to this author *P. saipinensis* Cárdenas and *P. sparciflora* Ritter are synonyms of *P. sacha-rosa*; *P. antoniana* (Backbg.) Rauh is a synonym of *P. weberiana*. *P. higueraana* Cárdenas is a dubious species according Leuenberger, but having found *P. diaz-romeoana* near La Higuera in that area, it is plausible that it is another name for the same species.

NOTE: valid names are written the first time mentioned, in *bold-italic*; synonyms and dubious names are in *italic*.

## Subfamily 2. *Opuntioideae*

A. Stems compressed (cladodes). Pollen semitected, reticulated.

2. *Opuntia*

A'. Stem of transversal section circular (stems globose, ovoid or cylindrical). Pollen tectate, tectum perforated and spiny.

B. Spines covered by a papyraceous sheet. Stems cylindrical, with tubercles notably elongated.

3. *Cylindropuntia*

B'. Spines without sheet. Stem globose, elliptic, and cylindrical or obconic, with tubercles wider than high or at least not noticeably elongated.

C. Bushes or small trees with big flat leaves, succulents. Spines many. Chaco area.

4. *Quiabentia*

C'. Bushes of less than 1 m high, leaves subulate to conical, mostly small, succulents. Andes area.

D. Stems ovoid. Leaves deciduous, small. Fruits, mostly, included in between the segments.

5. *Maihue niopsis*

D'. Stem cylindrical. Fruit not included between the segments.

E. Leaves subulate to subcylindric, conspicuous, persistent for some time. Fruits fleshy. Pericarpel areoles well developed, spiny and hairy.

6. *Austrocylindropuntia*

E'. Leaves subulate, very small, deciduous. Fruits dry. Pericarpel areoles reduced to the axilla of a scale, with a few hairs, not spiny.

7. *Puna*

2. *Opuntia* Miller, *Gard. Dict.* ed. 4, 1754. = *Platyopuntia* Ritter, illegitimate name.

Plants of different sizes, from a few cm to 4 m high. Stems generally compressed and articulated. Flowers from the upper border of the young segments. Pollen with tectum open reticulated.

Near 200-400 species, from Canada to N of Patagonia. Several species are naturalised in other continents. Some are of a great economic interest, such as *O. ficus-indica*, with edible fruits, segments are a good forage for dry seasons and for the cochineal insect which can feed on it and produce the grana, a natural red pigment.

Here *Opuntia* is considered in the narrow sense, only for species with compressed segments. Other authors consider in *Opuntia* several genera with segments of circular section (*Maihue niopsis*, *Austrocylindropuntia*, *Puna*, *Tephrocactus*), which have several different morphologic characters and ecological requirements.

The more easily recognisable species growing in Bolivia are:

- O. brasiliensis* (Willd.) Haw.
- O. discolor* Br. & Rose
- O. paraguayensis* K. Schumann
- O. quimilo* K. Schumann
- O. anacantha* Speg. (= *O. retrorsa* Speg.)
- O. salmiana* Parm. (*O. ipatiana* Cárdenas)
- O. schickendantzii* F.A.C. Weber (= *O. cochabambensis* Cárd.)
- O. soehrensii* Br. & Rose (perhaps a complex of several species).
- O. sulphurea* Salm-Dick
- O. ficus-indica* (L.) Mill. (Cultivated both the spiny and non-spiny forms).

3. *Cylindropuntia* (Engelmann) Knuth emend. Backeb., *Descr. Cact. Nov.* 5: 1956.

Stems cylindrical; tubercles longitudinally elongated, areoles at the depressions. Spines covered by a papery sheet (formed by separation of the cuticle). Flowers big, with bright colours.

Several species of USA and Mexico. One of them: *C. tunicata*, was propagated at former times in South-America, where it is known to grow in more or less isolated colonies from Ecuador, Peru, Bolivia, Chile to Argentina, on badlands: eroded soils of clay. Occurs in Bolivia at least, west of Tarija City, Chuquisaca, and Cochabamba.

4. *Quiabentia* Britton & Rose, *The Cactaceae* 4: 252, 1923.

Succulent trees or bushes up to 8 m high, lateral branching, mostly verticillate, fragile. Leaves succulent, near flat, nervation not visible. Flowers big, apical. Receptacle thick, big. Ovary chamber relatively small, with a few, very big seeds (near 7 mm, including the aril).

A few species, perhaps only two, one, *Q. verticillata* (Vaupel) Borg. (= *Q. pflanzii* and *Q. chacoensis*) in the W part of the Chaco, in SW Bolivia, W of Paraguay and NW Argentina; another NE of Brazil. *Pereskioipsis*, from the Caribbean area and Central America is considered very close to or perhaps the same genus.

5. *Maihueniopsis* Spegazzini, *An. Soc. Cient. Argent.* 99: 86, 1925. *Cumulopuntia* Ritter, 1980. Reference: Kiesling, *Estudios en Cactaceae: Maihueniopsis, Tephrocactus y géneros afines. Darwiniana* 24: 171-215. 1984.

Plants normally forming compact cushions. Flowers surrounded by segments; often the petals in between the spines. Fruits in between the spines or outside them, fleshy, indehiscent. Arilar cover of the seeds compact, from very hard to soft, lens-form (*Maihueniopsis*) or pear-form (*Cumulopuntia*).

From the high mountains from Peru to Bolivia, Chile and Argentina and in dry Patagonia.

Backeberg and others have included this genus in *Tephrocactus*, because, when cultivated, vegetative aspect is similar. The main characters to differentiate this genus are seeds, fruits and areols in *Tephrocactus* the aril of the seeds is arenquimatic: each cell when dry has an air bubble, and also there are big air cavities; each aril has a central body and 2 lateral auricles (2 ear);. The fruits are dry and brake irregularly having the seeds exposed to the wind, which can blow them; the areoles are like big bags full of big red gloquids and with a small entrance; the areole of the fruit, when it dries, sticks to the outside aril of the seeds, looking like "seeds with gloquids". *Tephrocactus*. Plants have a fragile constriction between the segments, and brake more or less easily; each broken segment will root and produce a new plant. Ecology is also different: *Tephrocactus* grows in low sandy deserts of W of Argentina; only a few *Maihueniopsis* from Chile and Peru are in similar environments and have a similar habit.

In Bolivia the following species can be recognised:

- M. boliviana* (S.-D.) Kiesling
  - Tephrocactus chichensis* Cárdenas
  - Opuntia floccosa* Salm-Dick
  - Maihueniopsis glomerata* (Haw.) Kiesling
  - O. ignescens* Vaupel
  - M. nigrispina* (Schumann) Kiesling
  - M. pentlandii* (Salm-Dick) Kiesling
  - Cumulopuntia rossiana* (Heinr. & Backbg.) Ritt.
- (names under *Opuntia*, *Cumulopuntia* or *Tephrocactus* have not been formally changed to *Maihueniopsis*).

6. *Austrocylindropuntia* Backebg., *Blatter f. Kakteenfng.* 6. 1938.

Plants with cylindrical stems, from 10 cm to 3 m high, with tubercles mostly wider than high. Spines without sheet cover. Flowers lateral. Fruits not dehiscent, with the seed aril piriform or globose, very hard.

About 8-10 Andean species from S-Ecuador, Peru, Chile, Bolivia and NW Argentina. It is very close to *Maihueniopsis*, differing only by the form of the stems, and leaf size and persistence.

In Bolivia:

*A. exaltata* (Britton & Rose) Backbrg. is common around La Paz and also in a wide area in Peru, both in the field and cultivated, used as fences and as an ornamental.

*A. subulata* (Muldpf.) Backbrg., very similar, is not known in the field, only cultivated; they have been considered as one species, but differ in the cause and spines (absolute and relative) size, the form of the tubercles, and the globose fruit in *A. exaltata* vs. very elongated in *A. subulata*, suggests they are related but separate species. Going up to 3 m high.

*A. vestita* (Salm-Dick) Backbrg., is easy recognisable for the coat of white hairs densely covering the stems.

*A. shaferii* (Britton & Rose) Backbrg (= *O. teres*), some times confused with the former species, have irregular, longer spines but the hairs are inconspicuous; it was known under the name *A. weingartiana*.

*A. verschafeltii* (Cels.) Backbrg. Has a wide distribution, from Catamarca in Argentina to central Bolivia, has a very variable appearance: from cylindrical to globose stems, either with long spines or without them. Under winter conditions the globose small reddish branches drop and produce new plants, this can be a more common form of dissemination for the species than by seed.

7. *Puna* R. Kiesling, *Hickenia* 1 (55): 289-294. 1982.

Plants very small, with thick roots. Stems cylindrical, globose or obconic, just appearing on the soil. Areoles with pectinated spines and a strong tendency to lack of gloquids. Flowers lateral, with the pericarpel areoles very simple only a scale protecting some hairs. Fruits dry, not dehiscent. Seeds covered by a soft aril, some times with a hairy appearance.

Three species of Argentina, one of them also in the S of Bolivia: *P. subterranea* (Fries) Kiesling (= *Teprocactus variiflorus* Backbrg.), which has been found near Villazón.

### Subfamily 3. *Cereoideae* (or *Cactoideae*)

It is the most numerous and complex. It includes all the epiphytic and many terrestrial species. Most of the stems are ribbed, or the ribs are divided in tubercles; the general form is cylindrical, globular or its modifications (depressed, obconic, pseudorosettes...) and also flat stems, when the number of ribs is reduced to only 2 (this means a basic difference with *Opuntia*, where the flat stems are derived from a globular or ovoid form, compressed laterally).

The systematics of this subfamily are based in the receptacular characters: presence of developed areoles, with spines, bristles and hairs (more or less similar to the stems areoles), or areoles reduced in different degree: only bristles or hairs, or protected by a scale, or areoles reduced to the axil of a scale, or receptacle nude (without any sort of areoles or scales). Also form and size of the flowers, stem form, presence or not of a staminoidal ring of hairs, nectar chamber, form and sculpture of the seeds, etc. Some genera have the floriferous areoles different form the others: with many areolar long hairs forming dense tufts, or tufts coming from the vascular tissue. These are named pseudocephalia and cephalia respectively.

#### Key of the groups of Subfamily 3. *Cereoideae*

Note: This key does not pretend to show natural affinities, but in great part the "groups", which are not taxonomic categories, are coincident with the tribes recognised by Buxbaum (1958) or by Barthlott and Hunt (1993).

Buxbaum, F. The phylogenetic division of the subfamily *Cereoideae*, *Cactaceae*. *Madroño* 14: 177-206.

Barthlott, W. & Hunt, D. R. 1993. *Cactaceae* in Kubitzki et al. (Ed.) The Families and Genera of vascular Plants 2: 161-197. Springer Vlg.

A. Epiphytic, rare saxicole or terrestrial plants.

B. Flowers longer than 10 cm, with long tube, nocturnal. Stems cylindrical, 2-3 winged.

Group 1

B'. Flowers shorter than 5 cm, without tube or short, diurnal. Stems cylindrical, clavate or 2-4 winged.

Group 2

A'. Terrestrial plants. Flowers with more or less noticeable tube.

C. Flowers salverform or funnellform. Stems cylindrical, or globular, or depressed.

D. Flowers with areoles developed, or simplified to scales with hairs, bristles or spines at the axil.

E. Stem globular, depressed or shortly cylindric, ribbed or tuberculate.

Group 3

E'. Stems clearly cylindric, ribbed.

Group 4

D'. Flowers with scales only, or without them (nor hairs, bristles or spines).

F. Stems cylindrical, ribbed.

Group 5

F'. Stems globular, depressed, obconic, ribbed or tuberculate.

G. Stems with dense hairs covering part of them; in this case the flowers born at this area (cephalium or pseudocephalium).

**Group 6**

G'. Areoles with short, inconspicuous, hairs.

**Group 7**

C'. Flowers tubulose, with the perianth cylindrical, near closed. Stems cylindrical of different sizes.

**Group 8**

**Group 1.** (correspond to Tribe *Hylocereae* (Britton & Rose) F. Buxbaum).

Epiphytic plants. Cauline roots frequently present. Stems cylindrical, some times very long, 3-4-angled or 2-winged. Flowers mostly white, nocturnal, with long and slender tube. Receptacle with areoles developed or reduced to the hairy or nude axil of a scale.

A. Stems flat, looking long leaves, with crenate border.

**8. *Epiphyllum***

A'. Stems 3-angled (or cylindrical, but not in Bolivia).

**9. *Selenicereus***

**8. *Epiphyllum*** Haworth, *Syn. Pl. Succ.* 197, 1812.- *Phyllocactus* Link.

Epiphytic or saxicolous shrubs. Stems cylindrical when young, later 2-winged, looking like long leaves of crenate or serrate border, with the areoles in the depressions, without spines. Flowers funnel-shaped to salviiform, mostly nocturnal, 10-30 cm long, tube very long; scales small, spaced, of nude axil, rarely with hairs or bristles. External tepals white, pale yellow or rose; internal white or yellow. Fruits ovoid or oblong, 4-9 cm long, nude.

About 15 species, many of Central America, one of them widely distributed in South American forest, also in Bolivia, Paraguay and Argentina: *Epiphyllum phyllanthus* (Ref.: Kimmach, M. *Cactus Succ. Jour.* 36: 105-115. 1964).

**9. *Selenicereus*** Britton & Rose, *Contr. U.S. Natl. Herb.* 12: 429. 1909.- *Mediocactus* Br.& R.

Scandent, epiphytic or saxicolous. Stems frequently very long, 5 to 8 m, adventive roots some times present; ribs 2-12; spines mostly short, like bristles. Flowers nocturnal, funnel-shaped, rare salviiform, medium to big: 10-40 cm long x 10-20 cm diam., nocturnal; receptacle areolate, spines strong to bristle like; external tepals white to pink or brown; internals white. Staminal hairs in between the stamens and tepals. Fruits globular to ovoid, 6-8 cm long., fleshy, mostly red, with the spines persistent.

About 20 species in tropical America and Caribbean. One in the forest of Paraguay, NE Argentina, and Bolivia: *Selenicereus setaceus* (Salm-Dick) Moran (frequently miss-named *Mediocactus coccineus*) from the departments of Beni, Santa Cruz, Chuquisaca and Tarija at 200-800 m a.s.l.

**Group 2.** (corresponds to Tribe *Rhipsalidae* De Candolle).

Epiphytic plants, frequently pendulous, stems cylindrical or flattened, rarely spined. Flowers relatively short, opened for 2-3 days, lateral or apical, mostly white or cream coloured, rarely orange, of radial symmetry, tube short or none (or bi-lateral symmetry, tube noticeable and other colours in non-Bolivian species).

A. Fruits without areoles and spines. Stems cylindrical or winged, rarely spiny.

**10. *Rhipsalis***

A'. Fruits with spiny areoles. Stems of more or less square section, rare 3 or 5 angular, spined.

**11. *Pfeiffera***

**10. *Rhipsalis*** Gartner, *Fruct. Sem.* 1: 137, 1788.- *Lepismium* Pfeiffer. *Acanthorhipsalis* Britton & Rose. Ref.: Barthlott W. & Taylor, N.P., Notes towards a Monograph of *Rhipsalidae*, *Bradleya* 13: 43-79. 1995. Kimmach, M., A revision of *Acanthorhipsalis*; *Cact. Succ. Journ.* (USA): 177-182, 1983.

Epiphytic plants, rarely saxicolous, mostly pendulous. Stems cylindrical, ribbed, angular or 2-4 winged, some times articulated, with adventitious roots, ramification lateral or apical-verticillate. Areoles reduced, rarely spiny. Flowers small, to 2 cm long; rotaceous, mostly white to cream coloured, rarely pink or orange; pericarpel cylindrical, conic or globular, mostly naked, rarely with some scale of nude or hairy or bristle axil. Some times with a nectariferous disk. Fruits small, juicy, nude, some times a little ribbed or with a few vestigial scales.

Obs. Barthlott & Taylor (l.c., 1995) separate *Rhipsalis* and *Lepismium* with a different concept of the traditional: they consider *Rhipsalis* the species with acrotonic (= terminal-verticillate) ramification and fruits smooth; versus lateral ramification and angled fruits in *Lepismium*. As there are several exceptions, I consider this separation artificial. In the traditional sense, *Lepismium* has the species of *Rhipsalis* with the receptacle protected in the areole.



More than 60 species of all tropical America. In Bolivia:  
Species with cylindrical stems:

*Rhipsalis aculeata* Weber (ramification lateral, spines persistent; fruits vinous coloured; xerophytic woodlands)

*R. lumbricoides* (Lem.) Lem., similar to *R. aculeata* but areoles reduced to a scale, not spiny or spines deciduous; humid forest). La Paz, Beni, Sta. Cruz, accord Barthlott & Taylor, l.c.

*R. baccifera* (Mill.) Stern, ramification apical-verticillate; fruits whitish, with the remains of the perianth smaller than the fruit.

*R. floccosa* Salm-Dick subsp. *tucumanensis* (Web.) Barthlott & Taylor (= *R. tucumanensis*). Ramification apical-verticillate; receptacle protected into the areole; fruits big, whitish. Areoles very hairy.

*R. cereuscula* Haw., common in S-Brazil, Paraguay and Misiones in Argentina; at Bolivia, accord Barthlott & Taylor in La Paz department.

With spiny flat stems:

*R. monacantha* Griseb. = *R. incana* Cárdenas?? *R. incahuasina* Cárdenas. Stems flat, spiny; flowers and fruits pink, the latter angled. From NW Argentina and Bolivian forest of Sta. Cruz, Cordillera, Cuesta de Incahuasi, camino Lagunillas-Muyupampa, 1200 m, Samaipata, Baños del Inca.

*R. crenata* (Britton) Vaupel. Stems flat, spiny; flowers red, receptacle with areoles and bracts. See *Limanbensonia* Kimmach (Cact. Succ. J (USA) 56: 101. 1984). From La Paz: Yungas, 1800 m.

With non-spiny flat stems:

*R. boliviana* (Britton) Lauterbach (cfr. Kimmach CSJ 61 (3): 99-103. 1989). Terrestrial plant! Stems flat, linear, near 12-15 mm wide. Flower 1,2-1,4 cm long, inner segments yellowish, the others pink. From La Paz: Yungas, near Coroico, at 2100 m.

*R. cuneata* Britton & Rose, *T. Cactaceae* 4: 246. 1923. Stems with crenate borders and cuneate base; flowers white-pink. From La Paz: San Juan, 800-1700 m a.s.l.

*R. goebeliana* Backbg. *Descr. Cact. Nov.* 1: 10. 1956 (1957). (This species is invalid because the lack of type, but accepted by Barthlott & Taylor).

*R. incachacana* Cárdenas (Cactus 34: 125. 1952; cfr. Kimmach, Cact. Succ. J (USA) 258-262, 1985). Stems flat, wide, with areoles very hairy. From Cochabamba, Chapare, Incachaca, 2200 m.

*R. lorentziana* Griseb. Stems flat, not spiny, flowers whitish. From Argentina (Jujuy, Salta and Tucumán), and Bolivia: Tarija.

*R. paranganiensis* (Cárdenas) Kimmach (1984). Cárdenas, Cactus (Paris) 6 (34): 126. 1952 (similar, if not identical to *R. bolivianum*). Cochabamba: Ayopaya, Hacienda Parangani, 2600-3000 m a.s.l.

Nice photos of the *Rhipsalis* are in the mentioned paper of Barthlott & Taylor, and also in R. Bauer, *KuaS* 49 (1): 1-8, 1998, including some rare species.

#### 11. *Pfeiffera* Salm-Dick, *Cact. Hort. Dick.*: 40, 1844.

Epiphytic spiny plants. Stems 4-6-angular, without adventitious roots. Flowers rotaceous, small: 2-4 cm long and diam., with the receptacle areolate and spiny. Fruits juicy, pink, translucent, with spiny areoles.

A few very related species, *P. ianthothele* with 4-angled stems and cream to white flowers, from NW Argentina to Bolivia, *P. miyagawae* Barthlott & Rauh (*Cact. Suc. Jour.* 59: 63. 1987), with only 3 ribs and orange flowers; *P. erecta* Ritter (*Taxon* 13: 116, 1987) with erect stems, very spiny. *P. matalensis* and *P. gracilis*, both of Ritter, are perhaps synonyms.

#### Group 3. (groups 3 and 4 correspond to the Tribe *Trichocereae* F. Buxbaum, p.p.)

A. Flowers from the base, lateral or superior.

B. Flowers coloured, nearly as long as wide, with strong tube, covered by hairs. Ribs sometimes fragmented in elongated tubercles, of spiral disposition. Flowers some times with "hymen".

12. *Lobivia*

B'. Flowers mostly white, noticeable longer than wider, with thin tube, and sparse hairs on it. Stems with continuous ribs.

13. *Echinopsis*

A'. Flowers central or superior.

C. Very small globular plants, to 4 cm diam., depressed, rare cylindrical. Flowers frequently cleistogamus.

14. *Frailea*

C'. Plants normally bigger. Flowers casmogamus.

15. *Parodia*

#### 12. *Lobivia* Britton & Rose, *The Cactaceae* 3: 49, 1922.-

*Soehrensia* Backbg. *Hymenorebutia* Fric & Buining. *Mediolobivia* Backbg.

Plants globular, from depressed to cylindroid. Stems simple, rarely branched. Ribs continuous or fragmented in tubercles of espiralate disposition. Areoles on the ribs or in the depressions of the tubercles. Flowers saliviform, of similar length and diameter when open. Receptacle covered by dense and long hairs, which are born from relatively small scales. Inner tepals coloured, rare white. Base of the upper stamens sometimes forming a fleshy ring (hymen).

Plants from the Andes from Peru to NW Argentina. The name is the anagram of Bolivia.

The typical lobivias are globular plants to 10 (to 20, rare more) cm diameter, ribs interrupted in elongated tubercles and flowers with hymen. In this group we have, according Rausch (Lobivia' 85) the following species:

*L. acanthoplegma* (Backbg.) Backbg. with varieties, from the area of Cochabamba. (globular to depressed plants, 15 cm diam., without central spine; flowers orange to red or violet, sometimes with the centre white).

*L. arachnacantha* Buining & Ritter also with varieties, from Samaipata, Valle Grande, Comarapa. (globular-depressed, small: to 4 cm diam.; flowers big: 5-6 cm long).

*L. backebergii* (Werd.) Backbg. From La Paz, Rio Caine, Cochabamba, etc.

*L. caineana* Cárdenas, from Rio Caine, Calahuta, Capinota, la Viña, etc.

*L. calorubra* (Cárdenas) W. Rausch, from Comarapa-Totora y Aiquile, and var at Pojo, Mina Asientos to Molinero.

*L. cardenasiana* W. Rausch, from the E of Tarija.

*L. chrisochaete* Werdermann, from North Argentina (Salta), to Culpina, San Antonio and Iscayachi. Big globular or depressed plants, to 30 cm diam.

*L. cinnabarina* (Hook.) Britton & Rose, from Sucre, Potosí, Zudañez, Tarabuco, Aiquile, Padilla.

*L. lateritia* (Guerke) Britton & Rose, from Impora-Tojo, Las Carreras, Tupiza.

*L. maximiliana* (Heyder) Backbg. from Peru to Titicaca area and La Paz. The flowers near tubulose, with the inner tepals shorter than the externals.

*L. pentlandii* (Hook.) Britton & Rose, from the Titicaca Lake to Oruro and La Paz, at the Bolivian puna.

*L. pugionacantha* Rose & Boedeck., from La Quiaca and Villazón in the Argentinian-Bolivian border to Potosí and Chuquisaca, at Culpina, Curque, Salitre, Yunchara...

*L. rauschii* Zecher, from the S of Bolivia: Chuquisaca, from Culpina to Yuquina.

*L. shieliana* Backbg., from Peru to the E of Titicaca, at La Paz Department; provincias Consata, Muñecas, etc.

*L. tiegeliana* Wessner, from N Argentina (Salta) to Tarija, Orozas and Concepción.

Another group of this genus is *Mediolobivia* (or *Digitorebutia*) which have plants with small cylindrical stems and thick roots near 1 cm diam., and 5 cm high. Basically for their small size have been placed in *Rebutia*. They are:

*L. atrovirens* Backbg., from N Argentina (Salta) to Tarija: Iscayachi.

*L. pygmaea* (Fries) Backbg., from Jujuy in Argentina to Oruro, Iscayachi, Culpina.

*L. steinmannii* (Solm-Laub.) Backbg., of the *L. pygmaea* group, growing in S. Bolivia, from the Argentinian border to Camarago, Rio Honda, Cuchu Ingenio...

The boundaries in between *Lobivia*, *Echinopsis* y *Trichocereus* are difficult to define, and this is the reason some authors merge all under *Echinopsis*.

### 13. *Echinopsis* Zuccarini, *Abh. Bayern Akad. Wiss.*, München 2: 675. 1837. *Pseudolobivia* Backbg.

Plants generally globular or claviform, more rarely cylindrical, proliferating from the base; ribs continuous or interrupted. Flowers big: 10-20 cm long, nocturnal or diurnal, salviform, from lateral or superior areoles, mostly white. Receptacle elongated, with separate scales of hairy axils. Stamens in two series, one spirals along the tube and another in a ring at the base of the tepals. Fruits oval, juicy, hairy.

From Uruguay, Argentina, S. Brazil and Bolivia. At Bolivia, from the many names corresponding to *Echinopsis* in the narrow sense, can be mentioned:

*E. arachnacantha* (Buining & Ritter) Fiedrich, from Tarija dep.; *E. bridgesii* S.-D. *E. rhodotricha* K. Schumann; *E. huotii* (Cels) Lab.; *E. mammosa* Guerke, with wide distribution; *E. ferox* Britton & Rose; *E. hammerschmidii* Cárdenas and *E. obrepanda* S.-D.

### 14. *Frailea* Britton & Rose, *The Cactaceae* 3: 208. 1922.

Plants normally with simple, near globular or depressed small stems. Flowers of two sorts: cleistogamous, with aspect of a bud, covered by bristles; and chasmogamous, salviform to near rotaceous, pale yellow. Fruits dry, with thin wall, dehiscent. Seeds of different forms and surfaces, with big hilum and air chamber.

From Uruguay, S Brazil, NE of Argentina, Paraguay and E. Bolivia.

G. Navarro mentioned *F. cataphracta* (Dams) Br. & Rose, *F. chiquitana* Cárdenas and *F. laevis* Vázquez, all from the E of Santa Cruz department. *F. pullispina* Backbg. y *F. uhligiana* Backbg, seems to be synonyms of *F. chiquitana*.

### 15. *Parodia* Spegazzini, *An. Soc. Cient. Argentina* 96: 70. 1923.

Plants globular, simple, ribbed or tuberculate. Spines straight, curved or hooked. Flowers from centrals or superior areoles; salviform, yellow to red coloured, rare green; receptacle scaly, very hairy and bristly. Fruits semi-dry, dehiscent by basal pore, longitudinal furrow, etc., with the perianth persistent. Seeds from very small (0,5 mm diam.), to medium size (1,5 mm diam.), with surface smooth to rugose.

*Parodia* in the traditional sense has species from NW Argentina to Bolivia. At the present also the genus *Notocactus* (from Uruguay, S. Brazil, Paraguay and part of Argentina) is included in *Parodia*, due the lack of consistent differences.

Navarro (1996) mentions 36 species for Bolivia. An incomplete list of names gave more than 70 specific names. J. Brickwood (at *Cact Cons. Initiatives: 22-23*, 1997) recognised 18 species. We can mention *P. ayopayana* Cárdenas; *P. conmutans* F. Ritter; *P. formosa* F. Ritter; *P. schwebesiana* (Werd.) Backbg., *P. maassii* (Heese) Berger, *P. columnaris* Cárdenas; *P. comarapana* Cárdenas; *P. ocampoii* Cárdenas; *P. procera* F. Ritter; *P. taratensis* Cárdenas.

**Group 4.** (To Tribe *Trichocereae* F. Buxbaum correspond: *Trichocereus*, *Haageocereus*, *Samaipaticereus* and *Espostoa*; another is part of *Notocactaceae* F. Buxbaum: *Corryocactus*; other part of *Notocactaceae* is under group 7; *Browningia* is part of Tribe *Browningieae* F. Buxbaum).

A. Plants without long hairs. Floriferous areoles similar to the vegetative.

B. Areoles protruding, with more than one flower simultaneously.

16. *Neoraimondia*

B'. Areoles not protruding, flowers normally 1 at each areole.

C. Flowers without staminoidal hairs

D. Floral receptacle hairy. Flowers longer than 10 cm.

17. *Trichocereus*

D'. Floral receptacle with hairs and spines.

E. Flowers 4-8 cm long.

18. *Corryocactus*

E'. Flowers longer than 10 cm, nocturnal.

22. *Harrisia* p.p. (see group 5)

C'. Flowers with estamidodial hairs.

19. *Samaipaticereus*

A'. Floriferous areoles very hairy and bristly; frequently all the plant very hairy.

F. Flowers and fruits with noticeable scales.

20. *Browningia*

F'. Flowers and fruits with small, inconspicuous scales.

21. *Espostoa*

16. *Neoraimondia* Britton & Rose, *The Cactaceae* 2: 181, 1920. *Neocardenasia* Backbg., 1949.

Plants trees or shrubs. Stems erect, strong, 4-8 ribbed; non floriferous areoles big, brown felted, one or more very long spines; floriferous areoles felted, nearly non spiny, prominent thanks to the continuous growth, flowering each year. Flowers 1-2 simultaneously per areole, small, pink or whitish. Receptacle with small scales with or without bristles at the axils. Perianth short, stamens inserted in the upper part of the tube. Fruits globular to oblong, felted and more or less spined. Seeds widely oval, rugose, with a mucilaginous cover.

One species in Bolivia, *N. herzogiana* (Backbg.) Buxbaum & Krainz; other in Peru, with several subspecies. The Bolivian species has been placed by Backeberg under *Neocardenasia*, a monotypic genus, giving over-importance to the Andean separation. Some landscapes are dominated by the impressive appearance of this massive plants.

17. *Trichocereus* Riccobono, *Boll. R. Orto Bot. Palermo* 8: 236, 1909.- *Helianthocereus* Backeberg.

Trees or shrubs, ascendant, erect or creeping; stems cylindrical, ribs low. Flowers funnel or salverform, normally longer than 10 cm; nocturnal or diurnal; receptacle densely covered by hairs which are born from the axils of triangular scales. External tepals greenish, internal white, to yellow or red.

Near 40 species from Ecuador, Peru, Bolivia, N of Chile and NW of Argentina. The genus *Helianthocereus* has been created to separate the species with diurnal flowers (*Helianthocereus*) and the nocturnal ones (*Trichocereus*), but under this concept, species with very close affinity are separated in different genera, such as *T. pasacana* and *T. terscheckii*, or *T. huascha* and *T. strigosus*, etc. The opposite concept was applied by some authors who consider under *Echinopsis* this and other genus.

The columnar species are *T. atacamensis* Phil. Britton & Rose, (= *T. pasacana* = *T. werdermannianus* ?), *T. terscheckii* (Parm.) Britton & Rose, and *T. tarijensis* (Vaupe) Britton & Rose (= *T. bertramianus*).

Two very curious species are epiphytic: *T. vazquezii* Rausch from Santa Cruz and *T. arboricola* Kimmach, the last one at the south extreme of Bolivia and in Argentina.

There is also a great number of medium size species, as *T. narvaesensis* Card., *T. taquibalensis* Card., *T. tunariensis* Card. (= *T. camarguensis*), and others of difficult differentiation.

18. *Corryocactus* Britton & Rose, *The Cactaceae* 2: 66, 1920.- *Erdisia* Britton & Rose.

Bushes, rarely trees, ascendant, with strong spines. Flowers salverform, diurnal, with short thick tube. Receptacular scales many, with axillary hairs and spines. Tepals shorts, yellow, orange to purple or red. Fruit globular, spiny, without floral remains; funiculus juicy. Seeds oval, smooth or tuberculate, in some species with a mucilaginous cover.

Near 29 species form Perú, others from Bolivia and N of Chile. In Bolivia the recognisable species are *C. melanotrichus* Britton & Rose, from the Puna around La Paz, in a great area (synonyms: *C. ayopayanus* and *C. charazensis*); *C. pulquinensis* Cárdenas, with stems of square section and orange flowers, *C. tarijensis* Cardenas and *C. otuyensis* Cárdenas, the last two very similar to the first one.

19. *Samaipaticereus* Cárdenas, *Cact. Suc. J.* 24: 141. 1952. *Yungasocereus* Ritter, 1980.

Small trees, 3-5 m tall; stems 4-10 ribbed, of only 4-7 cm diam. Flowers more or less tubulose, 5-8,5 cm long., nocturnal and diurnal. Receptacle with small scales, and few axillary hairs and bristles; stamens in two series; perianth white. Fruit globular or ovoid, truncate, with lateral dehiscence; pink-red.

Two species: *S. corroanus* Cárdenas from Sta. Cruz, Florida, a thin tree growing in the shade of tropical-like forest, and *S. inquisivensis* Cárdenas, from La Paz: Prov. Inquisivi, at 2000 m. The last was moved to *Yungasocereus* by Ritter arguing its looks more similar to a *Cleistocactus* (or a *Haageocereus*) than to the type species *Samaipaticereus corroanus*.

20. *Browningia* Britton & Rose, *The Cactaceae* 2: 63, 1920.- *Castellanosia* Cárdenas, 1951.

Trees to 10 m high. Stems cylindrical, 7-13 ribbed, ribs low. Floral areoles less spiny and more bristly than the others. Flowers tubular-salverform, nocturnal, tube some times curved, scales big, fleshy, imbricated, with more or less hairy axils. Tepals short, white to red. Fruits small, globular or ovoid, fleshy or dry, with caducous scales. Seeds smooth or rugose.

Seven species, mostly from Peru, also in N of Chile. *B. caineana* (Cárdenas) F. Buxbaum is from the Chaco of W Paraguay and Bolivia, where is very common over a wide area: E of Cochabamba department, Chuquisaca, Tarija, and Santa Cruz. In some places they form true cactus-woodlands.

21. *Espostoa* Br. & Rose, *The Cactaceae* 2: 60, 1920.- *Vatricania* Backbrg., 1950.

Stem cylindrical, columnar, with low ribs; spiny and covered by abundant long hairs. Floriferous area differentiated, lateral, conspicuously more hairy, forming a true cephalium. Flowers tubular-salverform, mostly nocturnal, small in some species, tube short. Receptacle with small acute scales, of hairy axil; tepals short. Nectar chamber delimited by a diaphragm constituted by the bases of the lower stamens. Fruits globular to ovoid, with small tufts of sparse hairs.

Several species of *Espostoa* are from Peru and Ecuador; only one, *Espostoa guentheri* (Kupper) F. Buxbaum is native from Bolivia, of the valley of the rivers Grande and Mizque. It has been placed in the monotypic genera *Vatricania*, based in the different geographical situation (at the E of the Andes), but without any morphological confirmation.

It is one of the most beautiful species of the cactus family, moving permanently the tall, thin, yellow branches, with the lateral cephalium shining under the sun.

The name *Vatricania* is after Mrs. Vatrican who was Director of the Jardin Exotique.

**Group 5.** (*Harrisia* correspond to tribe Echinocereae (Br.& Rose) Buxbaum; the others to tribe Cereae Salm-Dick, except *Stetsonia*: Tribe Browningieae F. Buxbaum).

A. Stem decurrent or resting on other plants, glaucous or green, up to 5 cm diam.

B. Pericarpel and fruits tuberculate, with scales hairy or spiny. Stamens in two series. Stems decurrent, resting on other plants, rare erect.

22. *Harrisia*

B'. Pericarpel and fruits smooth, with glabrous scales. Stamens in only one series. Stems erect when young, later resting on other plants.

23. *Monvillea*

A'. Stems erect, strong, glaucous, Trees or bushes.

C. Pericarpel and floral tube scaly.

24. *Stetsonia*

C'. Pericarpel and floral tube without scales or small. Trees or shrubs of relatively thin and long trunk.

25. *Cereus*

22. *Harrisia* Britton, *Bull. Torrey Bot. Club* 35: 561, 1908.-

*Eriocereus* Ricc., 1909.- *Roseocereus* Backbrg., 1938.- Ref. Kiesling, R., El género *Harrisia* en la Argentina, *Darwiniana* 34: 389-398, 1996.

Bushes, creeping or ascendant, rare erect. Stems with 3-12 low ribs. Areoles big, spiny. Flowers big, 12-22 cm long., nocturnal, salverform. Receptacular scales triangular, acute, with axillary areoles spiny or not. Tube long, stamens in two series. Fruit globular, juicy, pulp white. Seeds big, very rugose.

Near 20 species: The ones of the Caribbean area with yellow, indehiscent fruits (subgen. *Harrisia*); red and dehiscent in the South-American species (subgenus *Eriocereus*). Four species in Bolivia, one of them of a tree form, *H. tephraacantha*; for this character have been created the monotypic genus *Roseocereus*; the other are *H. bonplandii* (Parm.) Britton & Rose; *H. pomannensis* (F.A.C. Weber) Britton & Rose (non-spiny fruits) and *H. tortuosa* (Lab.) Britton & Rose (with spiny fruits).

23. *Monvillea* Britton & Rose, *The Cactaceae* 2: 21, 1920.

*Mirabella* Ritt., 1978.-

Bushes laxly branched, creeping, semi erect or erect, exceptionally like small trees. Stems cylindrical, ribs continuous. Flowers salverform, shorter than 15 cm, nocturnal, white. Receptacle with few scales, axils glabrous or a little hairy, rare with some small spine. Fruits glabrous, depressed to ovoid, red or mauve, with the black perianth persistent; pulp white. Seeds small, smooth, near 1 mm long, of a colon form.

Near 18 species of South-America. In Bolivia ca. 5 species:

*M. apoloensis* Cárdenas, from depto. La Paz: Apolo. 2000-2500 m a.s.l.

*M. ballivianii* Cárdenas, from Beni, 200 m a.s.l.

*M. cavendishii* (Monv.) Britton & Rose, del Chaco de Argentina Paraguay y Bolivia

*M. spegazzinii* Br. & Rose (= *M. ebenacantha*), del chaco de Paraguay, Argentina y Bolivia.

*M. phatnosperma* (Schumann) Br. & Rose, from Paraguay and Bolivia, in the transition area between the Cerrado and Chaco. It differs from *M. kroenleinii* Kiesling, from Paraguay, by the larger erect stems with more sparse areoles, subulate spines, mostly occupying humid areas.

*M. leucantha* Ritter

*M. chacoana* Ritter and *M. papapetensis* Ritter are considered as synonyms of *M. cavendishii* by Navarro.

The validity of this genus have been discussed by D. Hunt, who interprets the original description of *Cereus cavendishii*, the type species, as describing a juvenile form of an *Acanthocereus* (Bradleya 6: 100, 1988). Later Heat (*Taxon* 41: 85-87, 1992) refused that opinion and used the typification of *Cereus cavendishii* keeping the traditional sense of the use of this name and consequently the validity of *Monvillea*. After that, N.P. Taylor transferred several names from *Monvillea* to *Praecereus*, a genus created by Buxbaum and considered a synonym of *Monvillea* up until now.

24. *Stetsonia* Britton & Rose, *The Cactaceae* 2: 64, 1920.- Ref. Kiesling, R. *Stetsonia*, *Quepo* 10: 22-25, 1996.

Trees with short thick trunk and massive tree top of many stems. Stems long, cylindrical, with rounded, obtuse ribs, glaucous; cortex and medulla dry, corky, except in the growing areas. Areoles big, spines dark, several, long. Flowers salverform, white, from lateral young areoles, ca. 15 cm long. Scales mucronate, dense, imbricated at the pericarpel, sparse on the tube, of nude axils. Fruits globular, yellow when mature, scaly, deliquescent. Seeds small, very rugose, brown.

Only one species (*Stetsonia coryne* (S.-D.) Br. & Rose) from the dry areas of the chaco formations, at SE of Bolivia, W Paraguay, NE of Argentina; and in Brazil just on the border with Paraguay and Bolivia.

25. *Cereus* Miller, *Gard. Dict.* ed. 8, 1768.

Trees or shrubs, some times with a definite trunk. Stems cylindrical, with relatively few and prominent ribs. Flowers big: 15-30 cm long, nocturnal, normally white, rare rose. Floral receptacle without scales or scarce, near residual. Fruits glabrous, red, orange or yellow, without the perianth persistent rests, but with the stile persistent, dehiscent by one or more longitudinal furrows. Seeds big, urneiform, near 2 mm long and diameter, very rugose.

A very homogeneous genera with near 20 species, all from Southamerica. For Bolivia are mentioned:

*C. braunii* Cárdenas

*C. cochabambensis* Card.

*C. coloseus* Ritter

*C. haenkeanus* Web.

*C. huihunchu* Cárdenas

*C. stenogonus* K. Schumann

*Cereus* is one of the oldest genera in the family and, at former times, all cacti with cylindrical stems have been placed under this. These are now included in many other genera of some affinity, but also some species of *Rhipsalis*, *Cylindropuntia*, etc.

## Group 6

Plants with cephalium or pseudocephalium.

26. *Discocactus* Pfeiffer, *Alg. Gtztg.* 5: 241. 1837.

Ref. Taylor, *Cact. Succ. Gr. Brit.* 43: 37-40, 1981; and Buining, The genus *Discocactus* Pfeiffer, 1980.

Plants globular or depressed, simple, ribs definite or formatted by tubercles. Terminal cephalium very hairy, also with bristles and in some species strong spines. Flowers nocturnal, tubulose, mostly white (or pink), fast developing, near 7 cm long and 2 cm diam. Fruits mostly clavate, also developing very fast. Seeds big, black, rugose.

Several species, perhaps 10-20, from Brazil, one or two in Paraguay and also one in the E of Bolivia: *Discocactus boli- viensis* Backberg. from Sta. Cruz, at the border with Paraguay: Chiquitos, Planicies de la Cruz, 10 km from San Cyrilo, E of Roboré, on rocks.

**Group 7.** (Correspond to Tribe *Notocactaeae* F. Buxbaum, p.p. and *Trichocereae* F. Buxbaum, p.p., see also groups 3 and 4).  
Flowers without hairs or only vestigial.

A. Apex of the stems not woolly. Flowers funnellform, of several colours.

B. Plants minute: 1-3 cm diameter, without ribs or tubercles. Areoles simplified to depressions covered by hairs.

27. *Blossfeldia*

B'. Plants more than 4 cm diameter, ribbed or tuberculate. Areoles with hairs and spines.

C. Areoles on the border of ribs. Plants globular, depressed or obconical.

D. Roots fibroses, or carrot like.

28. *Gymnocalycium*

D'. Roots tuberose, separated from the stems by a neck in some species; in others...?

29. *Weingartia*

C'. Areoles in the axils of the tubercles. Plants obconical.

30. *Neowerdermannia*

C''. Areoles on the top or over the tubercles, rarely ribbed. Plants depressed to globular.

31. *Rebutia*

A'. Apex woolly. Flowers rotate, pale yellow.

32. *Cintia*

27. *Blossfeldia* Werdermann, *Kakteenkunde* 11: 162, 1937. Ref.: Bartlott W. & Porensky, St., *Bot. Acta* 109: 161-166. 1996.

Plants very small: 1-3 cm diameter; the upper surface depressed -when dehydrated- to near globular; roots relatively big: to 5 cm long, producing new branches (gemiferous roots). Areoles reduced to a depression covered by hairs (all the stomata are at the areoles). Flowers whitish, near 0,5 cm long, receptacular scales with very short hairs. Fruits globular, dark brown; seeds globular, carunculate, with little projections on the testa.

*Blossfeldia* has a single species: *Blossfeldia liliputana* Werdermann, although several other names have been published. It has a very special ecology, living at the crevices of near vertical rocks, mostly near rivers, from middle Bolivia (Chuquisaca) to west central Argentina (Mendoza).

28. *Gymnocalycium* Pfeif. ex Mittler, *Taschenbuch der Cactusliebhaber* 2: 124. 1844.

Plants globose, rare branched, ribbed. Ribs mostly with prominent tubercles ("chins") under the areoles. Flowers lateral or superior, more or less salverform; scales noticeable, with nude areoles. Fruits globular to fusiform, dehiscence longitudinal or the upper part deliquescent. Seeds many, of different size, form and ornamentation, which is considered as very important to separate the different evolutionary lines (subgenus).

Near 60 species, mostly from Argentina, but some in Bolivia, Brazil, Paraguay and Uruguay. At Santa Cruz department it is growing *G. chiquitanum* Card. (= *G. hammerschmidii*) near Chiquitos, in the mountain, and *G. damsii* more at the south, in the same region but under Chaco vegetation, in sedimentary soils. *G. pflanzii*, widely distributed have different forms at the Chaco low flat areas and in the slopes of the low mountains; several names as *G. marquesii*, *G. zegarrae*, *G. lagunillasense*, etc. correspond to this species. At the Tarija Chaco, on sandy soils, is found *G. eytianum* Card. Also in the Tarija department, but at more than 2500 m, *G. spegazzinii* ssp. *cardenianum* (= *G. cardenianum*) is growing.

Although *Gymnocalycium* is a well defined natural group, some *Rebutia*, and *Weingartia* have been proposed to integrate the genus.

29. *Weingartia* Werdermann, *Kakteenkunde*: 20, 1937.

Plants small, globular, ribs mostly strongly tuberculate. Stems and tuberous roots separated by a "neck" in some species; fibrous roots in others; some species with gemiferous roots. Flowers salverform, receptacle scaly, without hairs or bristles; tube short. Fruits dry, dehiscent at the base. Seeds few.

From the 20 names for *Weingartia* in the narrow sense, we can mention:

*W. trollii* R. Oeser, with orange to red flowers.

All the others have yellow flowers:

Plants with small podaria: *W. neocumingii* Backbrg. and *W. saipinensis* F.H. Brandt.

With big podaria: *W. riograndense* F. Ritter (= *W. lanata*) and *W. pilcomayensis* Cárdenas.

Similar to the species growing in Argentina is *W. kargliana* Rausch, from S-Bolivia, with the stems separated from a tuberos root by a "neck".

30. *Neowerdermannia* Fríc, *Kaktusar* 1 (11): 85, 1930.-

Stems simple, obconic, superior disk more or less at soil level, tuberculate, with the areoles in the axils; obconical part of the stem and root obconical, underground. Flowers small, ca.1.5 cm long., salverform. Receptacle glabrous, scaly. Stamens and stigma lobes few. Fruits globular, semi-dry. Seeds few, colon form, very rugose, dark.

Two species, one common in Bolivia, in the puna; also in Argentina (Jujuy) and SW Peru: *N. vorwerkii* Fríc; the other at the NW of Chile, which is little known. This plants are eaten, after being boiled, in the season when the potatoes are scarce. The common name is Achacana, name also given to some *Lobivia* species.

31. *Rebutia* Schumann, *Monat. f. Kakteenkde.* 5: 102, 1895.- *Aylosteria* Speg., 1923.- *Sulcorebutia* Backbrg., 1951.

Plants small (smaller than 7 cm diam.), globular or depressed, or shortly cylindrical. Stems mostly simple, branched in cultivation. Ribs continuous or formed by tubercles; spines mostly weak, sometimes pectinate or radiant. Flowers salverform, forming basal areoles, to 5 cm long, coloured (red, orange, yellow, rarely white); receptacle of the same colour than the tepals; style free or fused in different degree to the tube; stigma lobes few (ca. 4-10). Fruits globular, irregularly dehiscent by desiccation of the walls.

Near 35 species from Central and S of Bolivia and NW Argentina. Easy to cultivate and freely blooming.

Typical *rebutia*'s have the scales of the flowers with nude axils, and the style free from the receptacle. Then, from outside, the receptacle is conical. The area in the narrow sense of the genus is NW of Argentina, perhaps some species at the southern extreme of Bolivia.

*Aylosteria* was created by Spegazzini to include plants with the style partially fused with the receptacle; then, this part is cylindrical; the receptacular scales have short hairs at the axils. The typical species is *R. fiebrigii* (Guerke) Britton & Rose, and there are a few other species. The area is NW Argentina and S Bolivia (dep. Tarija), where grows for instance *R. margarethae* W. Rausch.

*Rebutia wessneriana*, from Jujuy in Argentina, has intermediate characters and it is the reason we consider about as only one genus.

*Sulcorebutia* share all the characters of *Rebutia*, but the areoles are very elongated; its flowers have not hairs at all at the receptacle and the style is free. The area is basically the departments of Cochabamba and N of Chuquisaca, but exist in other parts of Bolivia. Some authors consider *Sulcorebutia* as part of *Weingartia*. The beauty of several forms of this species produced an intensive collection and over-description of species last years.

Pilbeam (1985), list near 50 species (some of them bear names or invalid), and more have been described up to now; but perhaps the real number of species is not more than 10. We can mention *R. arenacea* Cárđ., *R. steinbachii* Werdermann, *R. glomeriseta* Cárđ., *R. totorensis* Cárđ., *R. menesesii* Cárđ., *R. totorensis* Cárđ.; *S. rauschii*, *S. muschii* Vázquez, *R. heliosa* Rausch, *R. mentosa* (F. Ritter) Donald, etc.

Ref.: Pilbeam, J. *Sulcorebutia* and *Weingartia*, a collectors guide: 1-144. B.T. Bratsford Ltd. London.

32. *Cintia* Knize & Riha, *Kaktusy* 31 (2): 35. 1995. (see *KuaS* 47: 209. 1996).

Plants globular, simple, with thick roots. Stems tuberculate; apex woolly. Flowers salverform, yellow, small, with a few scales. Fruits small, dehiscent at the apex.

A single species, *C. knizei* Riha. Accord the description, it looks similar to some *Copiapoa*. It is from Chuquisaca, Sucre, from Lecori to Otavi, at 4200 m a.s.l.

**Group 9.** (correspond to the genus of Tribe *Trichocereae* F. Buxbaum with the flowers tubulose, stamens exert and cylindrical stems).

A. Fruits juicy, near 1,5 cm diam., dehiscent by a longitudinal furrow. Seeds small (ca. 1 mm long), smooth. Areoles with spines.

33. *Cleistocactus*

A'. Fruits dry, bigger than 3 cm diam., dehiscent by a basal pore. Seeds bigger (ca. 2 mm diam.), rugose. Areoles with spines and long hairs.

34. *Oreocereus*

33. *Cleistocactus* Lemaire, *Illustr. Hort.* 8, Misc. 35, 1861.- *Seticereus* Backbg.; *Bolivocereus* Cardenas; *Winteria* Ritter ?

Stems cylindrical, relatively thin (3-8 cm diam.), branched at the base, rarely with a short trunk. Ribs mostly many, low. Areoles very close. Spines mostly thin, dense, needle-form. Flowers tubular, actinomorphic or a little zigomorph. Receptacle coloured, scaly, hairy. Nectar chamber conspicuous in the base of the tube. Tepals similar to the scales, but bigger, reddish, orange or green, rare yellow or other colour; hardly open at anthesis. Staminodial hairs absent; stamens and style much exerted, coloured. Fruits globular, small (1-2 cm diam.), fleshy, with the perianth persistent. Seeds brown to black, small, smooth.

Near 30 species from Peru, Bolivia, Paraguay, Argentina and Uruguay. The great variation and bigger number of species is in Bolivia, where there are about 20 species.

*Boliviocereus* (*B. samaipatanus* Cárdenas) have been described for plants which are not erect, but climbing from the rocky walls where they lives. *Winteria* for a single species, also climbing from rocky walls, but nice flowers, too open compared with other *Cleistocactus*.

The study of the Bolivian *Cleistocactus* appear as very interesting if it is combined with floral biology: the different size, curvature and angle of the flowers can be related with the pollinators, which are, at less partially, hummingbirds. The more conspicuous species are: *C. baumannii* (Lem.) Lem.; *C. brookei* Cárđ.; *C. candelilla* Cárđ.; *C. ritteri* Backbrg., with yellow flowers, *C. samaipatanus* (Cárdenas) Hunt, mentioned under *Boliviocereus*; *C. smaragdiflorus* (Web.) Britton & Rose, *C. strausii* (Heese) Backbrg., endemic from Tarija and widely cultivated for the nice aspect of the stems and strong dark red flowers, and *C. variispinus* Ritter.

34. *Oreocereus* Ricc., *R. Orto Bot, Palermo*: 258, 1909.

Stems columnar, erect, 1 to 3 m high, relatively thick: to 20 (-30) cm diameter, branched mostly at the base, woody. Ribs vertical, continuous, obtuse. Areoles big, with rigid spines and long white hairs, of silky to bristly consistency. Flowers tubulose, actinomorphic o a little curved. Receptacle with many triangular scales with axillary white hairs. Ovary globular, nectar chamber noticeable, perianth a little open, of more or less small pieces, normally red. Stamens and stile strongly exerted. Fruits of thick wall, rigid, partially hollow in two species; dehiscent by a basal pore, smooth, with a few hairy scales; rest of the perianth persistent. Seeds big, surface very corrugate.

Near 6 species of S Perú, Boliva and NW Argentina, At Bolivia grows *Oreocereus celsianus* (Lem. ex S.-D.) Riccob., *O. trollii* (Kupper) Backbrg. and *O. fossulatus* Backbrg. The first have big trunks: to 3 m or more high and ca. 30 cm diameter: *O. trollii* is near 1 m tall, branched form the base; bout have holly fruits when mature, and are growing at from Potosí, in Bolivia, to Argentina, at the Puna. *O. fossulatus* is near 2 m tall and only to 15 cm diameter, having solid fruits; it is growing at N W Bolivia (La Paz Dep.). As the *Cleistocactus*, this species is also pollinated by hummingbirds.

#### ACKNOWLEDGMENT

I want to thank the people who gave me the opportunity to have two trips to Bolivia. The first one with the collaboration of the Instituto de Ecología of the La Paz University (Calacoto), with the participation of the Dr. Stephan Beck. The second trip from Santa Cruz with participation Dr. Gonzalo Navarro and students, in a car from the Museum Noel Kempf Mercado. Also to the other people who shared the trips, Dr. Werner Hoffmann and Dipl. Biol. Detlev Metzger, from Germany, Walter Rausch from Austria, Omar Ferrari from Argentina and Dr. Jim Mauseth from USA. We all keep a warm remembrance of the students, now diplomated, Carola Antezana from Cochabamba, Aimet Rodríguez O. and Bonifacio Mastacedo from Santa Cruz.

Also to Jean-Marie Solichon for the invitation to prepare this note, and the patience and time devoted to make the translation. To Omar Ferrari, for the free use of his plants.

#### CONSERVATION

As most of the countries now, Bolivia subscribe the CITES, a convention which regulate the traffic of biological species in between countries. The permit for collection and exportation must be obtained in La Paz. If you want to collect cacti, remember to comply with this requirement; if not customs may with hold your plants. With the modern methods to look for forbidden drugs, smugglers of plants are frequently discovered. The CITES regulation have several years and wide diffusion; no one can argue ignorance.

#### CACTUS GARDEN AT LA PAZ

At the department of Biology of La Paz University exist a Botanical Garden devoted mainly to cacti, with plants from several places of Bolivia. The Garden have been made with great effort, several people from the University collaborating, from the city, people of the gardens clubs and also for us at the first of the trips mentioned, under the organisation of Dr. Hoffmann. The garden needs all sort of help and your collaboration will be welcomed. Also the library needs many books and magazines.

**Pr Roberto KIESLING**

Instituto de Botanica Darwinion

Labarden 200

Casilla Correo 22

1640 SAN ISIDRO

(Argentine)

---

**COMPLÉMENT DU NUMÉRO "SUCCULENTES SPÉCIAL 1999".  
ÉDITÉ PAR L'AIAPS JARDIN EXOTIQUE B.P. 105 MC 98002 MONACO Cedex**

Dépot légal : MAI 1999. Commission paritaire de presse n° 74487 AS. ISSN 0258-5359

Imp. ISSENJOU. F- 30000 NÎMES