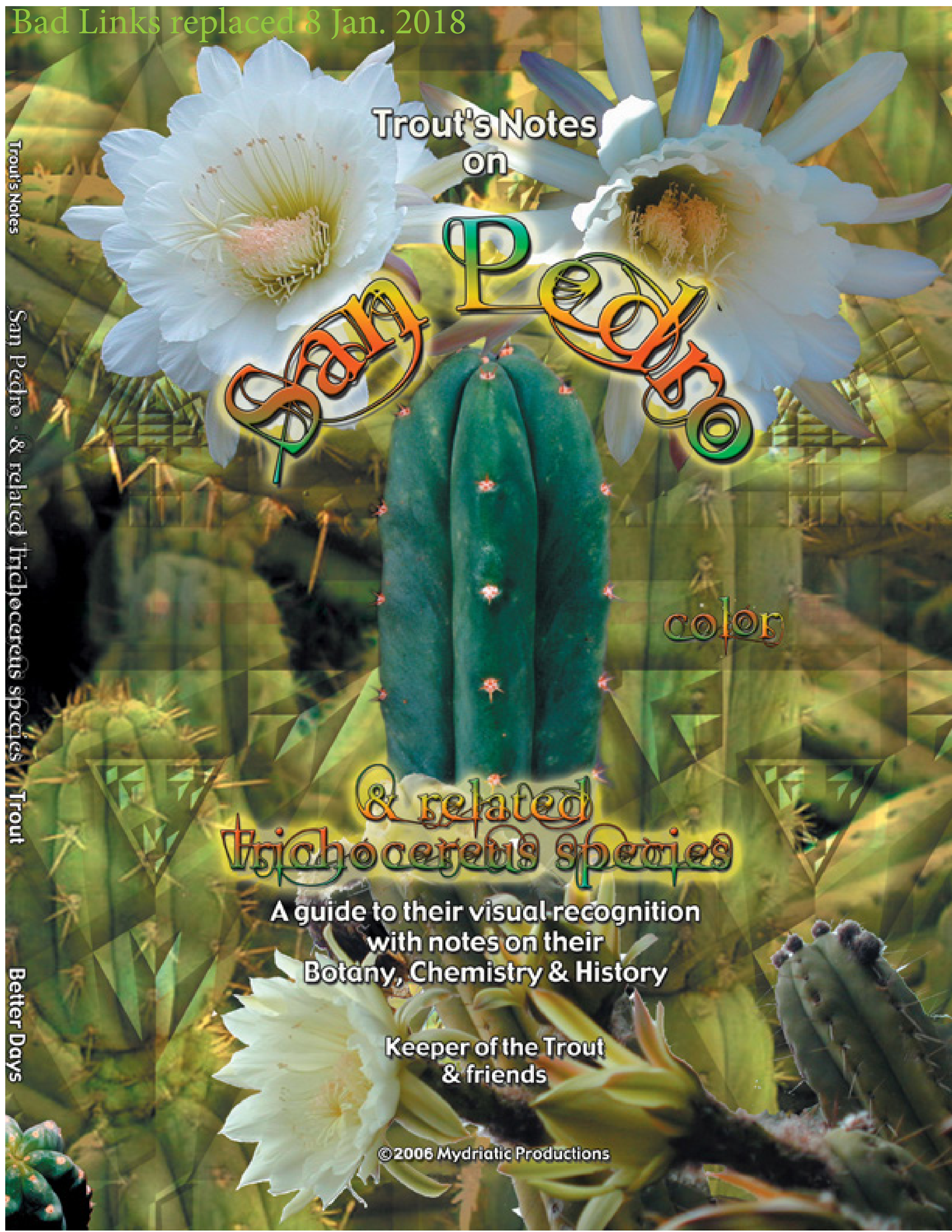
Bad Links replaced 8 Jan. 2018



"More than you need to know."

San Pedro includes the cacti known as San Pedro and related Trichocereus spp. Its wealth of photos can assist readers in gaining familiarity and some understanding of this often misunderstood and bewildering grouping of species and hybrids.

These large, fast growing, columnar species have been reported to contain mescaline. Several have long sacramental histories; recorded in the assorted chronicles left by the invaders of the "New World" and in ancient Peruvian art spanning millenia of their vibrant and beneficial relationship with humans. This relationship persists even into modern times.

Originally released as the Trichocereus chapter of Sacred Cacti, the text of this edition has been expanded to include corrections and updates along with hundreds of additional photos!

San Pedro provides an informative examination of the botanical characteristics, horticultural offerings & points of confusion, sacramental histories if known, published chemical analysis, if any, and reported pharmaconautical applications.

It is intended to help both researchers and the reader who is already employing these sacred beings as sacraments & spiritual teachers to better recognize, and understand these ancient allies.

Note concerning this book and PDF.

This entire work has seen major revision and updating due to a wealth of new information and images. That new book will be produced as soon as resources permit that.

Until that date, this book as it presently stands will continue to be of value as a survey of the horticultural morass surrounding the San Pedro cactus. It was with that in mind we (Trout & Moksha) decided that it was time for us to release this book as a PDF. A number of newer works addressing the spiritual and religious and anthropological aspects of these cacti have been published and we hope new ones will continue to appear.

Some things however need commenting on due to this book, San Pedro, causing a perpetuation of several comments that I believe are errors.

1) Despite Curt Backeberg's claim to the contrary, there is no evidence that he was the person who introduced T. pachanoi to horticulture. Its clear that Harry Blossfeld and others were far more prolific contributors providing material entering cultivation in the 1930s. If Backeberg did introduce it in 1931 his offering was absorbed into those that came from everyone else.

2) Following on that awareness, there does not appear to be any evidence that what is referred to in this book as Backeberg's clone came from Backeberg. The meager evidence suggests that if a clone came from his hands it would likely resemble what he showed in his images, as seed grown pachanoi is often more spiny.

My present suspicion is that it MAY be a hybrid between a pachanoi and a bridgesii. Or it could simply be a collection made by Blossfeld in 1935 and distributed to multiple large cactus growers and distributors in Victoria and elsewhere.

More details concerning this subject can be found online at http://troutsnotes.com and in the addendum at the end of this PDF. MUCH more will be said in the next edition of this book.

3) There is no real soundness for differentiating peruvianus from pachanoi unless also dividing pachanoi into further subdivisions. It would be better to instead take the simpler approach of recognizing the Matucana and Rimac River type peruvianus material as a variety of macrogonus subsp. macrogonus sensu Lodé (according to Albesiano & Kiesling's scheme which places pachanoi as a subspecies of macrogonus.)

4) Some readers appear to have a misunderstanding of what this book is. Its just an overview of what was available and what was understood a few years ago. Parenthetical names used in photograph titles are NOT being given as a horticultural name.

At the beginning of the book the labeling format is explained. The species name is followed by a cv name if one exists and then by the grower *or location* given in parenthesis. More than one grower could easily have the same plants. And a single grower can have more than one plant. This book simply recorded what was available in horticulture in the time period of its assembly.

5) If a clone or trade name is used, those are only the clone or trade names and mean nothing outside of that limited application. They can't meaningfully be applied backward to any wild populations that they resemble without a lot of actual work.

All of this and more have been discussed in the new editions. Until those become available it is hoped that this compendium will continue to be found useful and enjoyable.

This book does have one highly vocal critic who uses disingenuous wording to trash it while hiding his agenda being a personal attack that only involves this book as the means to attempt and bring harm to me. Its pretty nutty. Its also just not worth wasting my time defending a good book from what would form a long list of false accusations, mistaken representations, misunderstandings and straw dogs generated by what would be termed a cyberbully if we were still a couple of high school kids. I feel sad for the guy. It must really suck carrying around so much resentment and anger for no good reason. I wish him well in body, mind and heart.

With much love and my best wishes to my many fans and occasional critic,

Keeper Trout 20 June 2013

Jan. 2018: Any prior pdfs with links to Largely Accurate Information Media should be destroyed and replaced with new copies. That website is being used by a malware distributor.

Trout's Notes on

San Pedro

color

& related Trichocereus species

A guide to their visual recognition with notes on their Botany, Chemistry & History

Keeper of the Trout
& friends

Sacred Cacti **3rd Ed.**

Part B

Trout's Notes on

San Pedro

& related *Trichocereus* species

A Guide to assist in their visual recognition;
with notes on Botany, Chemistry & History

Written, compiled &/or edited by Keeper Trout & friends

A Better Days Publication

"More than you *need to know*?"

Sacred Cacti 3rd Edition; Part B (2006)

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Compiled & edited by Keeper Trout & friends

Executive production & worldwide distribution by **Moksha Press**

First published in 1997 as one volume, entitled ***Sacred Cacti & Some Selected Succulents. Botany, Chemistry, Cultivation & Utilization*** by Narayan Publications, Sedona, Arizona and released at the Mind States Conference 21-22 November in Berkeley, California to coincide with the 100th anniversary of the world's first pure mescaline experience, by a German pharmacist's assistant named Arthur Heffter on 21 November, using the purified alkaloid that he had previously isolated from the peyote cactus.

This third edition was heavily updated & illustrated and published as two volumes (Part A & Part B).

This full color version has been expanded to incorporate corrections, updates & additional images.

Cover graphics & design by Neil Pike based on a photo collage by Keeper Trout
Photographs are by Trout except for where it is indicated otherwise.

Photo on page 1: *Trichocereus pachanoi* (CCC via Shamanismo) Photo by Logan Boskey

MydriaticProductions

This work is dedicated to you, the reader.

monstrose *Trichocereus bridgesii*

Trichocereus peruvianus **(GF)**
(This tip is over 6 inches in diameter)

Cruz Sanchez 1951 noted that the San Pedro-using healers tended to drink in remote areas to avoid persecution.

Of them, he wrote:

"*Hay diferentes clases de curanderos o nigromantes: adivinadores, curanderos propiamente dicho, rastreadores, hechiceros o maleros. La mayoría de ellos son depravados sexuales. Los adivinadores son charlatanes y embaucadores que afirman predecir el porvenir con el auxilio de la 'cimora'*."

and commented further about them and their assistants:

"*Todos estos individuos experimentan continuamente los efectos tóxicos de la* [San Pedro] *y de otras plantas de propiedades tóxicas, neurostimulantes*."

Table of Contents

Trichocereus rosei
***AKA T. peruvianus* (Australia)**
Photograph by Joylene Sutherland

Comments on the color version

We have attempted to preserve as realistic of color portrayal as possible but some caution is needed.

Color images can be highly variable for many reasons including whether the image was shot with 35mm or other film format or using a digital camera, whether it was viewed under cloudiness, haze, fogginess, hot sun or other weather conditions, whether the specimen was wet or dry, whether it was taken outdoors or in a greenhouse, whether it was shot in full sun or in shade or under artifical shade in a hot sun situation, or under artificial lighting indoors, whether it used a flash or no flash, whether it used or lacked appropriate filters if 35mm, whether the image was taken at night or during the day, whether it used a low resolution digital camera, whether the master was obtained as a digital file, an online download or a photograph requiring scanning, and many other factors including the time of day and the viewing angle relative to direct sun (a significant factor that is not always within the photographer's control if shooting in a formal botanical garden),.

When they were available, we have replaced a number of lower quality images with better ones featuring the same subject.

We had no control over the quality of some of the contained images (other than their potential rejection) and believed that readers would appreciate their inclusion even if a better image would have been desirable. Sometimes it is simply not possible to obtain a replacement photo.

Color can also vary with browser or monitor if viewing the CD version. We used a Trinitron monitor for editing to ensure the highest possible quality color representation but have no control over how they will view on an individual monitor.

Important notes on our labeling and designations of specific names:

Labeling on the images were usually left as encountered, with commentary added only if we had problems with the name.

Our generic format for labeling:

Genus species Horticultural designation {if any} [Collection number] {if any} (Grower) {or location}

Inclusion of **cv** followed by a common name usually indicates a plant that is now being propagated as cultivars. Some of these are of wild origin and others were hybrids resulting from plants already in cultivation.

Often these plants are unclear in their placement or origin, and are intermediates in terms of their appearance.

Use of a cv. designation or reference to a plant by use of its grower's name or initials in its designation is only for clarity in OUR discussion and does not mean these are accepted (or being proposed) as names. This is just our way of dealing with a bunch of sometimes obviously identical or at least related but unlabeled, inadequately labeled, unclear and/or unidentified plants.

Two different growers' plants could in fact be from identical clone lines or seedstock. Or one grower may have more than one clone they do not differentiate. Our designation by growers name means nothing beyond permitting us to be able to compare the plants within these pages. Through this convention we hope that over time it will enable assignment of synonymities wherever possible. These are NOT being presented as form or varietal names.

Inclusion of "Hort" or "cv." in any species title indicates that it is NOT a proper binomial but rather is a descriptionless designation created and assigned by the grower indicated; generally to be specifically applied to material they cultivate and/or sell. NONE of these are valid names.

Important comments concerning the images we included

The subgenus *Trichocereus* (and for that matter *Echinopsis* itself) is presently hopelessly muddled. This situation is the result of a complex combination of, at least, several factors.

The first being the disturbing fact that shoddy to inadequate descriptions exist for many, if not most, of the species considered to comprise the subgenus. This is further complicated by there being no meaningful systematic overview or monograph. The creation of such is almost precluded by the existence of a bewildering wealth of hybrids or intermediates not just in horticulture but also as what appears to be hybrid swarming and/or grex in the wild.

There are layers of additional introductions of confusion including correctly labeled, mislabeled and unlabeled plants, entering horticulture through an indeterminate number of university-funded cactus collection expeditions and other sources for material destined to populate botanical gardens, as well as from commercial outlets and a myriad of private *Trichocereus* collectors whose activities span more than half a century. Many of these have failed to retain proper identification and/or labeling.

There are the perhaps less numerous but still no less confusing progeny resulting from isolated thefts of seeds from botanical gardens introducing what are most often hybrids under the name of the mother plant (sometimes even now accompanied by HER collection number!)

There is also impact resulting from the lengthy and prolific WORLDWIDE wholesale distribution of an amazing morphological spectrum of these cacti by Karel Knize, who we will mention again later. Hopefully the reader will rapidly discern the extent of this for themselves while viewing the various Knize-sourced cacti shown within these pages. Despite the immense & multilayered morass of confusion arriving along with them, any *pachanoid-peruvianophiles* might reflect on the need of some gratitude for the existence of Sr. Knize due to his steady wholesale output of mass quantities of such beautiful and often excellent, although frequently poorly labeled, *Trichocereus* cuttings and seeds over a period of time approaching 40 years. No matter what complants may have been justifiably voiced, Knize has in fact provided an amazing volume of living biomass to cactus suppliers and other horticulturalists all over the world.

There is also the impact of literally millennia of deliberate cultivation in regions where San Pedro was not native but where it proved to be readily hybridizable with many other Trichocerei and probably a few other related genera of cacti as well.

The following work should not be viewed as any sort of authoritative declaration concerning the taxonomy of the *pachanoid-peruvianoid Trichocereus* species. Instead it should be seen as a overview of what readers may encounter in horticulture accompanied by some verbal and visual guideposts that MIGHT be of value to the reader who, like myself, is foolhardy enough to attempt navigating through this section of what often seems to resemble a taxonomic analog of the Sargasso Sea.

Our inclusion of a plant within a particular species should not be seen as indicating our agreement that it actually belongs in that species; only that it has been sold or represented as such.

Our goal is only to help familiarize our readers with this section of the *Trichocereus* species as it now exists within horticulture.

We would also suggest that should our readers encounter anyone who considers themselves an expert on this genus, or anyone who insists that they know what differentiates, say, a short-spined *peruvianus* from a long-spined *pachanoi*, the best course of action is probably to nod one's head, indicating a lack of desire to argue, & leave them to their beliefs.

However, that being said:

If the experts can't be bothered to write a monograph, or to include meaningful references for new combinations or to address the nomenclatural confusion that they clearly recognize as resulting from the "reunification", their pronouncements can, and probably should, be ignored until they actually do the work.

We recognize the work in your hands has no authoritative merit. Be that as it may, we think it is more likely help the reader with interest to better recognize them than any taxonomic key or authoritative work in existence. Or at least, we will attempt to paint a nice picture of the confusion in hopes of dispelling at least some of the mythology that accompanies it.

***Trichocereus cephalomacrostibas* KK1421**
Matarani, 300m
Our cutting of an *identical* cactus arrived labeled:

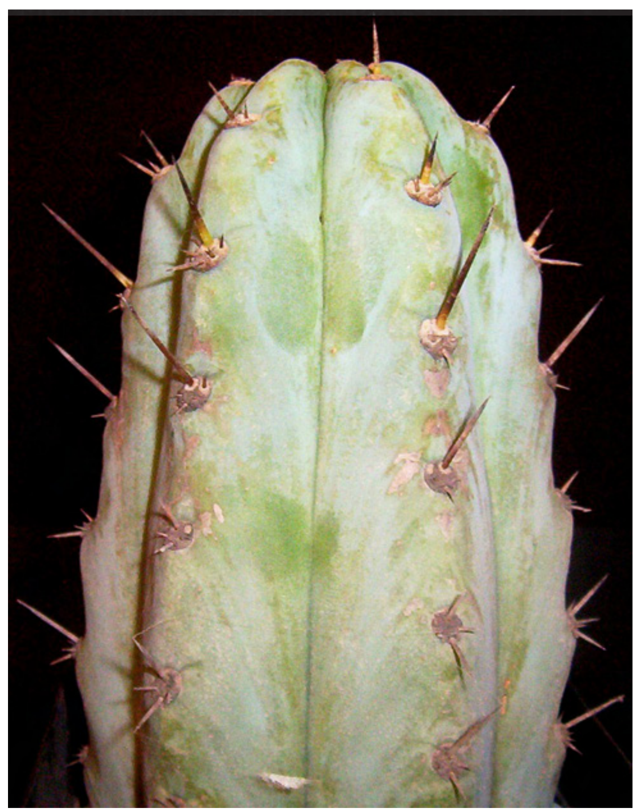
The faxed invoice read:

```
Key to see the origin,qty,price of items.
Trich.peruvianus numbered as 1-11  11 pieces tot
dif forms,some L.KK 242 (Central Peru 2200m      US$ 40.-
                       12-13   2 1x red            100.-
                 KK 337 rubriflora  (1x white)       10.-
    puquiensis   KK1689    14-16 rare  5 ribs        30.-
```

***Trichocereus peruvianus* KK2151**
Ayacucho, 2600m (See pp. 179-180)

***Trichocereus uyupampensis* KK341**
Cuzco, Uyupampa, 2500m (See pp. 23-24)

***Trichocereus longispina* KK1670**
Cuzco, Pisac, 2800m (See page 194)



***Trichocereus peruvianus* KK1688**
Ancash, San Marcos, 2200m

All photos on this page were provided by Karel Knize

Comments on *San Pedro*

In the work that follows, most taxonomic synonyms were omitted as these are readily available in the sources cited and are primarily only of historical importance. (More detailed and 'properly' worded taxonomic descriptions of the plants can be found in the listed references.)

To aid the reader in search of more information, it was thought helpful to include synonyms that are in horticultural use or used in the references included.

Many times plants get renamed or transferred by one authority without being accepted by some or most others. In some cases, such as *Stenocereus*, it is not uncommon to find several different names for the same plant depending on which reference work one consults. While it is unlikely that they would be encountered and still referred to as a *Cereus*, as many cereoids were originally called, it is just as likely they will not be listed by **MOST** sources as a *Stenocereus*.

It is hoped that the reader will find the following helpful. Feedback towards making this more useful is welcomed.

***Proviso*:**

It must be kept in mind that substantial differences in the alkaloid content and in the relative ratios of alkaloids present have been noted by numerous researchers. (True in many families) These differences have been noted to sometimes appear seasonally, such as the higher presence of N-methylated (as compared to N-demethylated) alkaloids detected by Lundstrom during summer in greenhouse maintained peyote. In contrast; <u>in the same population</u> of plants, winter analysis found levels of N-demethylated compounds to be higher than N-methylated ones. [While he used cultivated plants, the mescaline content was comparable to most of what is collected from the wild.]

They can vary as well according to the age of plant (young plant versus adult plant) or even by age of part. In cacti, the actual variables are largely unstudied.

Alkaloid content has been noticed to vary substantially in amount and/or even actual composition between varieties considered closely related by morphology, and concentrations sometimes vary widely even from one individual or locality to the next. In other families even daily fluctuations have been noted; in *Phalaris* and *Papaver*, for example, alkaloid concentrations were often found to be higher in the morning but this area still needs more study. (Quantitative comparative isolations of *Papaver* were published in Fairbairn & Wassel 1964 & *Phalaris* was reported by Appleseed)

Very few workers seem concerned with any of this, and work on this subject has rarely been performed or published.

Species suggested by published analysis to be variously weak or potent have on occasion proven to be the opposite!

Often the only data included is whether the plant was cultivated or collected from the wild. In many early papers we literally have to rely on the word of the workers as to the identity of what they analyzed, as vouchers were never prepared and there is no physical means for confirmation.

In recent decades, more attention is being given to the importance of herbarium vouchers being prepared to accompany the analysis. Even then, not all workers note enough variables for their observations to have meaning.

Size and approximate age, part of plant used and stage of growth, i.e. actively growing versus fully developed (if sampling only branches of large specimens), and time of harvest (time of year and time of day) should all be considered to be critical data to include along with place of origin. Ideally for a voucher, local ecology and a description of habitat would also be quite valuable (Plants associated with it, conditions of occurrence, and a description of the terrain)

Even better would be also including a local soil test, and analyzing different parts and ages of the material, repeating the tests *with the same specimen***s** at different times of year

If performing repeated samplings of the same individuals, stress can become a factor capable of influencing the results. I suggest initially using **pooled** smaller samples of adjacent individuals within a given population with additional small samples being from several individuals within the population that is pooled to check uniformity. Most plants can recover rapidly and well from light prunings. A minimum of two years time is suggested for a series of samplings. Differences in regrowth versus original growth should also be evaluated.

The factors controlling alkaloid production would be a fascinating and productive area for future academic research. If chemotaxonomy is to ever be considered a truly useful inclusion in the repertoire of taxonomic tools, the parameters of alkaloid production must be better defined.

Determining and taking steps to maximize alkaloid content would also be of benefit for those who view these plants as sacraments. Selection for known high alkaloid strains or focusing on clones of specific exceptional individuals for intensive large scale breeding and propagation efforts would be a worthwhile avenue for everyone involved with sacramental use of these plants.

Wira-kocha with San Pedro from Chavín de Huántar Rendering by Mango Frangipani. See photograph on page 109

Note what looks like 2 cacti under the figure on the left

the *Trichocereus* species

Trichocerei containing mescaline are said to all be candelabra like, stem forming and generally branching from the base.

Trichocerei that are columnar & branch higher up, or are creeping / low forms contain only N-methylated tyramines & 3,4-disubstituted-β-phenethylamines [**Pardanani *et al.* 1977**; citing Agurell 1969b and Mata *et al.* 1972]

While this is largely true, exceptions such as the monstrose *T. bridgesii, T. vollianus* and *T. strigosus* do exist.

Trichocereus is said to be derived from the Greek meaning "*Thread-Cereus*" in reference to the hairy flower areoles. **Britton & Rose 1920 2:** 130. [It is a "bastard" word combining *Trichos,* from Greek τριξ *(Trix),* with the Latin *Cereus*, meaning *wax* or *candle*]

Echinopsis comes from the Greek meaning "*having the aspect of a hedgehog*" [εχηινοσ (*Echinos*) + οπσισ (*opsis*): Hedgehog + Aspect]

An assay of *T. santaensis* has been reported to be successful. An assay of many *Trichocereus* and *Echinopsis* species is in order. While most of the *Trichocerei* assayed to date do not show the presence of mescaline, it has proved to be a genus with a high frequency of alkaloid occurrence. The few *Echinopsis* species that have been assayed show a similar tendency.

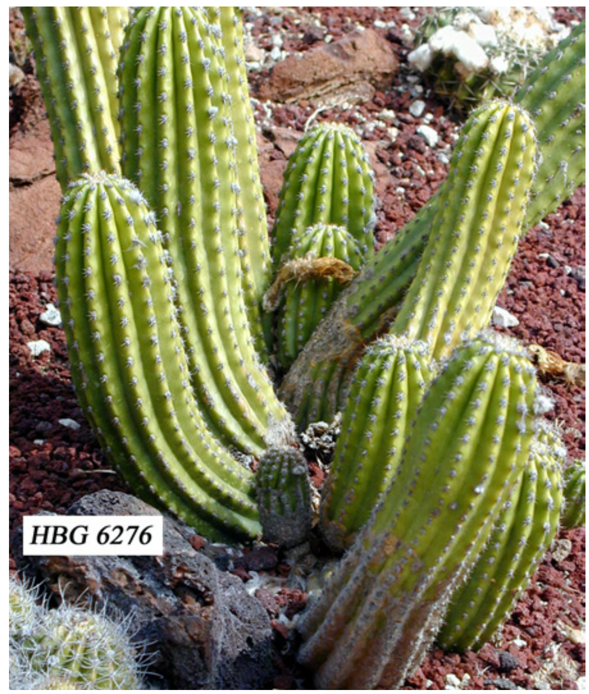
Trichocereus santaensis
OST 92701 (seedling)

Ritter 1981: fig. 1188; p 1551 shows an older specimen of *santaensis* that is similar but 'spineless' & v-notched.

Trichocereus and *Echinopsis* intergrade so there appears to be no possible line of division between them that can be agreed upon by all experts.

There are also commercially available hybrids of *Trichocereus* X *Echinopsis*. Often referred to as X*Trichonopsis* (One, produced from a hybrid raised by the "*American plant breeder Hummel*", is thought by Backeberg to most probably be from *E. eyriesii*).

We will return to the subject of hybrids later.



Trichonopsis imperialis

A number of cactus experts insist that San Pedro is now properly referred to as *Echinopsis pachanoi*.

The unity of *Trichocereus* and *Echinopsis* was suggested by Berger in 1905, when proposing *Trichocereus* as a subgenus of *Echinopsis*, but this was rejected by Riccobono, Britton & Rose, Backeberg and others.

In a major revision incorporating a number of genera including *Lobivia*, *Echinopsis* and *Trichocerei*, all were merged into *Echinopsis* a few years ago by Friedrich and associates. Undoubtedly we have not heard the last on this. Considering that the results of taxonomic study are used for identification, the constant battle between those who want to further delineate new genera (the "*splitters*") versus those who tend towards the reductionist view of having as few as possible (the "*lumpers*"), introduces more confusion than it alleviates.

Uppermost image modified from
Sawyer 1975

While agreeing that the actual dividing line drawn between *Trichocereus* and *Echinopsis* is purely arbitrary, I would hope that revisions would clarify both the relationships and descriptions, as well as better enabling ease of recognition.

I am unconvinced that their proposal clarifies ANYTHING beyond confirming a similarity between seed surfaces within a very limited number of cactus species. It does, however, introduce a lot of potential and real confusion into an already confused area.

Granted, taxonomists exist in a constrained world of ultraspecialization and don't have to care how their decisions affect horticulturists but it IS important to know a specific name for a plant if attempting to communicate about it.

What is interesting about their proposal is that if *Trichocereus* is to be preserved for any use, they argue it should be reserved for the "*northern*" species; which include *T. pachanoi*, *T. validus*, *T. taquimbalensis*, *T. werdermannianus*, *T. peruvianus*, *Echinopsis lageniformis* (Foerst.) Friedr. & Rowley, ie *T. bridgesii*), *T. tacaquirensis* (Vpl.) Card., and the descriptionless and holotypeless *Echinopsis gigantea* Knize [Oddly they included *Trichocereus giganteus* Knize **[**despite it being not **nomen nudum** but rather a **nomen confusum] [Note 1]** without altering the author designation or describing it.]

Since they apparently consider these species closely related and all of the first 5 or 6 are known mescaline containing species, perhaps an analysis of the last couple are also in order. **[Note 2]**

A note to those who plan to consult this piece, concerns *Trichocereus bridgesii* Salm-Dyck and *Echinopsis bridgesii* Salm-Dyck. Both occur in Bolivia but these are very different plants. The first grows to 2-5 meters in height and the second forms short clusters.

As it is a given that the revision is accepted, due to the rules of priority *Trichocereus bridgesii* finds itself renamed as *Echinopsis lageniformis*, rather than *Echinopsis bridgesii* reverting to *Echinopsis salmiana* and *Trichocereus bridgesii* becoming *Echinopsis bridgesii*.

Currently *lageniformis* is used only as a varietal name that evidently will become *Echinopsis lageniformis* var. *lageniformis*.

Echinopsis bridgesii
2 forms at the UCBG
Bolivia 55.0061 (Top) & Bolivia 90.2224 (Bottom)

Lower left image
L *Trichocereus bridgesioid* (sold as San Pedro in Amsterdam) now *Echinopsis lagenformis*
R *Trichocereus macrogonoid* Knize; no label

Similarly, readers should be aware that *Trichocereus werdermannianus* is considered by the CITES Cactaceae Checklist to no longer exist.

Echinopsis werdermannia was apparently absorbed into *Echinopsis terscheckii* by D. Hunt but I have not yet been able to determine any published justification or rationale. Dr. Hunt sadly did not include any reference that was meaningful as he cited only Friedrich & Glaetzle.

Friedrich & Glaetzle kept them as separate species & placed them in separate groups (Ib & IIb respectively) based on their seed coat morphology. [They also kept *E. deserticola* and *E. fulvilana* separate.]

Echinopsis werdermannii still exists but is quite different.

Consider the following, fairly widely cultivated, plants in light of the proposal to merge *Trichocereus, Helianthocereus* and *Echinopsis.*

Echinopsis werdermanii

Echinopsis grandiflora Link 1857 (white flowers)
Echinopsis grandiflora Hort? (Flowers various shades of red)
Echinopsis grandiflora R. Mey (deep pink flowers)
Helianthocereus grandiflorus (Br. & R.) Backbg. (flowers brilliant red; variable)
Trichocereus grandiflorus Backbg. n. sp. (white flowers)
Trichocereus grandiflorus (plants in cultivation are variously said to have red or white flowers)
Trichocereus grandis Hort.? (orange flowers)

Some plants have been transferred or renamed so many times it can sometimes make even locating information about them difficult.

Of course, now that the IOS has accepted this merger it conveniently eliminates many problems by simply transferring them into nomenclatural limbo. This, at best, is a lazy (even lame) way of addressing a real problem.

It literally reminds me of former Ronald Reagan's 'elimination' of many thousands of impoverished people by redefining the definition of the poverty level to a lower value.

It's not as though verifiable material is not presently in wide cultivation on at least 4 continents.

[Even the experts get confused sometimes; an otherwise authoritative recent text was encountered that described *Anhalonium williamsii* as a former name for *Lophophora williamsii* and *Anhalonium lewinii* as the previous name for *Lophophora diffusa*, and based their rationale on the fact that *A. lewinii* was described as yellow green in color. Exactly the opposite of what actually occurred. Perhaps they assumed Heffter had mislabeled his original colored plates? See a discussion under *L. diffusa* .]

It often seems that it is a matter of, as the English say, "*picking the fly-shit out of the pepper*" in an attempt at achieving dubious fame and immortality by linking one's name to a plant's formal designation. It might be stressed that there was evidently no attempt to publish descriptions of the included species and that many of the previously published descriptions are impoverished at best.

Rejecting some differences used to divide them as being purely morphological, G. Rowley, H. Friedrich & W. Glaetzle relied on purely morphological characteristics to introduce further complication into the recognition and classification of these plants. I will stick to referring to them as *Trichocerei* until someone can be bothered to create a proper treatment of the genus or genera involved.

This after all IS one of the functions of taxonomy. Namely describing and classifying plants in such a way that we can identify them and know for certain what specific plant we are talking about when referring to one by a specific name. Certainly their proposal will not help clarify the matter any more than the (fortunately mostly ignored) attempts to transfer all existing *Coryphantha* species back into *Mammillaria*. I hope that this is accepted similarly.

This scheme merges the following into *Echinopsis*:
Chamaecereus
Echinopsis
Helianthocereus
Hymenorebutia
Pseudolobivia
Soehrensia
Trichocereus [They commented that if the genus or name is preserved at all that it should be used for the northern columnar forms]
Portions of *Lobivia* (They believe the northernmost species had a "*separate and very primitive origin*" and thus should be excluded from *Echinopsis*)
Possibly some portions of *Rebutia*
Possibly *Acanthocalycium* but they felt this questionable and left it for future workers to sort out.

(And this is only a partial list of what are now considered to be the *Echinopsis* species!)

[A discussion of synonymy can be found in the 1986 *Bradleya* 4:72 and the 1974 *IOS Bulletin* 3(3): 93-99.]

Their distinguishing features for the genus include [Although exceptions can be found for each!]

1. Hairs but no spines in the axils of the floral scales
2. Stamens arranged so that the upper series forms a dense ring in the flower throat
3. Absence of a well defined nectar-chamber
4. Seed testa is hard black to dark brown but sometimes obscured by projecting cuticular fold giving them the appearance of being rough and light colored

Trichocereus pachanoi **(GF)**

Trichocereus **sp. Peru 57.0884**

They reject the following as inconstant and hence inapplicable:
1. Habit (globose versus short-columnar)
2. Possession of flowers suitable for hawkmoths (night versus day bloomers)

[It might be added that the majority of *Trichocereus* and *Echinopsis* can be divided within these two discriminants]

Trichocereus peruvianus **(GF)**

In this attempted revision, they used "Seed morphology as an aid to classifying the genus *Echinopsis* Zucc.", [the title of their article describing their rationale; published in the (1983) *Bradleya* 1: 91-104] **[Note 3]**. While their arguments have little more substance than those presented elsewhere, pro or con, their article does feature some very nice pictures, using scanning electron microscopy, of the seeds and seed surfaces of several *Trichocerei* of interest.

Oddly they do not include seed pictures of *T. pachanoi* (but considered it renamed *Echinopsis pachanoi* (Br. & R.) Friedrich & Rowley, *T. bridgesii* (renaming it *Echinopsis lageniformis* despite *lageniformis* NEVER having had anything remotely resembling an acceptable description published) or *T. werdermannianus* (renaming it *Echinopsis werdermanniana* (Backeberg) Friedrich & Rowley)

Trichocereus **sp. Juul's Giant interior.**
Dissection & photo thanks to Jon R. Hanna.
Specimen thanks to Kamm.

They do include very nice microphotographs of seeds of :
Trichocereus macrogonus as *E. macrogona* (Salm-Dyck) Friedrich & Rowley, Pl. 1, #2.
Trichocereus peruvianus as *E. peruviana* (Britton & Rose) Friedrich & Rowley **[Note 4]**, Plate 1, #1.
Trichocereus validus as *E. valida* Monville, Plate 1, #3.
Trichocereus terscheckii as *E. terscheckii* (Parmentier) Friedrich & Rowley, Plate 2, #7.

[For those who were wondering; yes, this is the same Gordon Douglas Rowley who attempted to saddle peyote with the very odd purportedly 'common name' of the "*L.S.D. cactus*".]

Interestingly they make the note that their system of classifying *Echinopsis* species into clearly defined groups based on their seed morphology works within those species they believe are *Echinopsis* but fails for the rest of the Cactaceae.

In other words, their proposed system cannot even be relied upon to reliably distinguish *Echinopsis* seeds from those from some other genera!

A quote from Friedrich & Glaetzle may be helpful here,
"*In their general characters the seeds of all* Echinopsis *species are referable to a type which is common in the subfamily Cereoideae. It is thus scarcely possible to recognize with certainty that some unfamiliar seed definitely belongs to* Echinopsis. *Similar seed forms also occur in quite unrelated genera. To this extent, therefore, seed forms are unsuited for determination beyond the genus.*"

They also stress the importance of subdividing the genus into sections since so many differing plants are being combined.

Does this clear up the confusion or simply add to it? Who volunteers to flip a coin?

Despite his utter failure to prepare vouchers, a comment made in Backeberg 1977 springs to mind:
"*The choice is clearly between the narrowly conceived genus, or a continuation without demarcations of the "lumping" process, whereby the concept of a "type-species of a genus" loses all meaning. These attempted combinations start an unwarranted series of chain-reactions.*"

In few cases is this so painfully true as with the devil-may-care expansion of *Echinopsis*.

It is a shame that taxonomists seem to exist at one extreme or another with seemingly no middle ground.

I do not suggest their attempts don't have merit, what I object to is the selective rejection and acceptance of some morphological characteristics over others. Plants vary substantially from individual to individual, which is one reason that morphological classifications have such problems.

Seeds *may* be more consistent but they still can vary. To demonstrate this, one has only to pour a couple dozen *Trichocereus* seeds out of a single seed pack for any given species and carefully compare them using a 10X hand lens.

They also do not always agree with taxonomists (for instance *T. fulvilanus* synonymity with *T. deserticolus*)

Chemotaxonomy suffers the same problems.

However, it is suggested that taxonomists consider utilizing the two and delineating ranges of characteristics for both, to better enable accurate classification and relationship studies. If an attempt was made to better define the parameters of alkaloid expression based on such obvious things as approximate age, available nutrients, plant part and season of sampling, I suspect that most conflicting data would resolve itself nicely.

If additionally combined with actual DNA typing such is now routinely performed on a rudimentary and crude scale for forensics work, surely far more solid sets of standards could be reached and agreed upon.

Nothing new is being proposed, the technology exists for all of this. Some taxonomists fear that the conflicting data they encounter because of local variability will cause only more confusion and upset their previously accepted order.

While quantitative percentages of alkaloids may vary, it is rare that actual qualitative expression is radically changed by environmental differences when seasonal fluctuations and plant part or age variances are taken into account (There are known exceptions.) Alkaloid expression is a product of the enzymes that are present and hence mirrors elements of genetic makeup far better than simple morphology as the synthetic machinery (enzymes) is coded for by the DNA. (Terpenoids, flavonoids and unusual amino acids are also valuable markers for chemotaxonomy)

Chemotaxonomic work in the genus *Acacia* has not only supported the previously proposed major divisions but has provided new and valuable information about the evolutionary divergence and origin of some of the Pacific species. The previously proposed major divisions were supported not only by chemotaxonomic profiles based on unusual seed amino acids but also in a similar approach evaluating wood flavans.

I do not suggest that *Trichocereus* and *Echinopsis* are not allied, they clearly are, and quite closely, based on their flowers and seeds. I also agree that there is no clear dividing point between them. I would urge more thorough taxonomic work before establishing yet another point of confusion.

On balance, the absorption of *Trichocereus* into *Echinopsis* creates far more problems than it solves.

It can easily be argued that despite those species which do not cleanly fit into one or the other genus when viewed separately, the merger of the genera does not actually contribute anything of true value beyond neatly solving the otherwise problematic placement of these few species.

In my humble opinion, ANY effort to rename or name plants MUST be accompanied by some type of meaningful description or at least a reference to an existing and meaningful description. Lack of this simple but obvious requirement makes a number of HUNT 2000's odd combinations seemingly meaningless.

Regardless of one's views on the actual purpose and function of taxonomy, it should be clear that it is not intended to make classification and identification of plants more abstruse. In no other branch of science would such casual to shoddy referencing be tolerated.

Inserted addendum to the 2006 printing:

Bob Schick discussed the wisdom of viewing ***Echinopsis*** *sensu latu* as evolutionarily related but noted that the details are better understood when that unwieldy supergenus is treated as three genera.

Echinopsis *sensu latu* (*sensu* Schick)

1. ***Echinopsis*** [comprised of 7 subgenera.]
- subg. ***Echinopsis*** (e.g.. ***eyriesii***, ***oxygona***, **Mamillosa** group)
- subg. ***Pseudolobivia*** (e.g.. **Obrepanda** group, ***ancistrophora***)
- new subgenus for ***subdenudata***
- subg. ***Lobivia*** (e.g.. ***aracnacantha***, ***aurea***, ***cinnabarina***, ***haematantha***)
- new subgenus for ***PseudolobivaXLobivia*** hybrids (e.g.. ***calorubra***, ***rojasii***)
- new subgenus for **Maximiliana** group
- subg. ***Chamaecereus*** (e.g.. ***Chamaecereus***, ***saltensis***)

2. ***Trichocereus*** [comprised of 3 subgenera.]
- subg. ***Helianthocereus*** (e.g.. ***bruchii***, ***formosa***, ***huascha***)
- subg. ***Trichocereus*** (e.g.. ***candicans***, ***spachianus***, ***thelegonus***)
- new subgenus for ***TrichocereusXHelianthocereus*** hybrids (possibly ***pseudocandicans***, possibly ***pasacana***)

3. New genus for *leucantha* and *rhodotricha*

Observations from Bob Schick:

The subg. ***Echinopsis*** and subg. ***Trichocereus*** have superficially similar flowers that are bilaterally symmetrical whereas most of the other members of ***Echinopsis*** *sensu latu* have flowers that are radially symmetrical.

Features of ***Trichocereus*** helpful in recognizing the genus:

The flower tube is stouter and has less elongate scales than ***Echinopsis***. Has a floral tube diameter near base 15-23 mm (wider than ***Echinopsis***; less reliable due to overlapping; 11-18 mm and 13 mm in **Mamillosa** group.) Scales are (1)-3-10 times longer than broad (not as elongated as ***Echinopsis***; less reliable due to overlapping: 8-29 times in Echinopsis proper and only 5 in **Mamillosa** group.]

Throat stamens form a diffuse cluster in the throat. (In ***Echinopsis*** it is more compact due to their being more tightly adhered to each other.) [Note 1]

Rim stamens are green along their inner surface. (Those of ***Echinopsis*** are white.) [Note 2]

Has fruit that are wet-type rather than dry to semi-dry type as in ***Echinopsis.*** (Note 3)

Has a nectar chamber (0)-3-13 mm long. (Less reliable due to overlapping; 12-40 mm long in ***Echinopsis***.)

Dave Ferguson made another helpful observation (at Cactus_etc):

In *Trichocereus* there are "*primary central spines in the areole that continue to elongate from the meristem at the base of the spine for several years, sometimes for the entire life of the plant. In Echinopsis + Lobivia the spines are as a rule mature at the end of the first growing season, and that is the end of that*."

Note 1:

"...*filaments in subg.* ***Echinopsis*** *have adhesive surfaces that serve to hold the stamens together as a compact cluster. Some throat stamens in subg.* ***Trichocereus*** *are also held together by the stickiness of their filaments to form a similar cluster, but many other stamens run courses through the throat independent of the cluster so that, unlike subg. Echinopsis, the filaments form a loose assemblage within the upper part of the throat. It is quite apparent just looking down into the flowers. Another way to distinguish the two is to cut the flowers off at the base and hold them upside down. The throat stamens of subg.* ***Echinopsis*** *will flop over as a single compact unit, but those of subg.* ***Trichocereus*** *will separate out in small cluster*s." Bob Schick 2004

cristate *Trichocereus peruvianus* (CCC)

Note 2

Due to the green of the throat the white filaments of the rim stamens can appear to be green so color determination requires that they first be excised for examination.

Note 3

In the fruit of the genus ***Echinopsis*** the membranous covering of the funiculi "*are resistant to breaking down, but are quite permeable to the contained fluids (except in a few subg.* ***Lobivia*** *in which a unique type is present). In genus* ***Trichocereus*** *the covering of the funiculi is more fragile and completely breaks down a day or two after fruit dehiscence so that the fruit is essentially a bag of a featureless viscous goo*".

Helianthocereus can be differentiated from ***Trichocereus*** by its having:

Radial stamen symmetry rather than bilateral symmetry.

Flower pigmentation (with possible exceptions).

Flower opening being diurnal and remaining open more than a single day rather than as with ***Trichocereus*** opening before 9M and remaining open a single day or less.

Comments on the subject of variable morphology;

I have seen, either in person or as published photographs in reference works, what appeared to be both long and short spined forms of *T. bridgesii, T. macrogonus, T. pachanoi,* and *T. peruvianus*. These are very often misidentified or hybrids.

John Borg 1976 mentions that a cristate form of *T. macrogonus* is commonly cultivated. I have not yet knowingly encountered any offered for sale.

Cristate specimens of *T. pachanoi* are becoming increasingly available.

They are said by commercial growers to occur within any large planting of seeds.

For example the plant pictured above arose in a planting of TJGX*peruvianus* hybrids.

Crests of *T. peruvianus* & *T. cuzcoensis* also exist (both were offered in commercial cutting listings by Karel Knize) but I have not yet knowingly encountered any of the latter in person. Cristate *T. bridgesii* also are in horticulture.

Much of what is available resemble intermediate *pachanoi-peruvianus* material (ex.: CCC)

Monstrose forms of *T. bridgesii*, *T. cuzcoensis*, *T. pachanoi* and *T. peruvianus* are occasionally available commercially.

The first of these seems to exist in *at least* two separate offerings, one has a tendency to elongate, grow sparse fairly weak spines near the base but often produces normal *longispinus*-like new offshoots, while the other forms shorter rounded joints with sometimes fiercely spined lower portions and reproduces true via cuttings.

What was believed to be a *T. peruvianus* monstrose (obtained from Altman) was very slow growing in our experience. We lost this clone some years ago but during the time that we had it we saw absolutely no spines nor visible ribs on what resembled a fat frosted grey-green cucumber.

All seem sensitive to overwatering.

MS Smith proposes that the monstrose *pachanoi* are in fact short spined monstrose *peruvianus* but so far as I can tell this is based entirely on his acceptance of what is being sold as short spined *peruvianus* as actually being true *T. peruvianus* (This point, while it may turn out to be true, currently lacks taxonomic evaluations and stands in need of further work) It is possible that there is another answer.

A monstrose purported to be *T. strigosus* is commercially available [these are misidentified *T. shaferi* monstrosus originating from a single clone arising in a lot of seedlings produced by Oasis.]

The most important point that should be stressed is that the exact parentage (and specific identity) of some of the cristate & monstrose Trichs is unclear to anyone.

An unlabeled *bridgesii* cutting shipped by Knize.

seedgrown 17-branched *Trichocereus pachanoi*

Too many questions and too few answers concerning some 'pachanoid' *Trichocerei*:

Nathaniel L. Britton & Joseph N. Rose 1920 published the first taxonomic descriptions for a number of *Trichocerei* species. Their key shows *T. bridgesii*, *T. pachanoi*, *T. macrogonus* and *T. peruvianus* to be roughly similar plants physically. As mentioned, variants exist for all of these, keeping identification interesting.

All are said to be branched with stout joints and ribs between 4 and 9 in number, with slender spines between 1 and 7 cm long. Differences were defined in terms of such simple physical features and color descriptive terms.

Interestingly, if examining a large enough number of specimens, or often even branches on a large adult, one can find points in spination, rib numbers or the published floristic descriptions, which can be applied so that the odd example from any of these 4 will fit into each other's description.

It is apparent from observations over the years that hybridization has most probably occurred at multiple points in cultivation and in the wild, that there is substantially more variety than indicated and that these species are all highly variable & probably intergrade; intermediate forms do exist for many and an almost grex-like wealth of intermediates exist for *pachanoi* and *peruvianus*. We are perhaps seeing speciation in process but it is arbitrary to say *pachanoi* and *peruvianus* are one species based on their flowers but not include *bridgesii*, *pallarensis*, *tarmaensis*, *puquiensis* and several others. If the floristic differences ARE adequate for dividing *bridgesii* from the rest then *peruvianus* itself would LARGELY need to be split from *pachanoi* and what is presently known as *peruvianus* would have to be split up further into at least several species.

Whether a meaningful taxonomic key can ever be generated for the *pachanoid-peruvianoid-bridgesioids* remains to be seen. Without some type of adequate means for recognizing what are hybrids, success seems doubtful.

As growers, we can agree on much of what we have growing but the best we can presently do with a good amount of it is to recognize that they might perhaps be intermediate, an assumption most often never to be known with certainty when it refers to horticultural plants that can so readily hybridize.

Even such simple features as spine color can't be taken for granted.

One friend, a commercial grower in TX, grew several flats of *T. pachanoi* seedlings in which ALL spines were intensely reddish. Despite initially appearing uniform, they grew up into mainly regular looking spiny seed grown pedros but a few showed regular v-marks above the areoles and several other grew very long spines. One formed 17 branches before reaching several inches.

While *T. pachanoi* is described as dark green or bluish-green, many horticultural specimens are bright green, light green, or sometimes even yellowish-green, some very much so on all three accounts. One recent domestic seed listing (1996 and 1997) offered varieties of San Pedros and *T. peruvianus* that were either more blue or more green. It remains to be seen whether these would stay as distinct if grown out side side-by-side in full sun.

seedgrown *Trichocereus pachanoi*
(grown from WOH's Knize-sourced seeds)

T. peruvianus usually has pronounced spination but at least occasionally this is apparently not the case. For example, if looking at plate 75 in Backeberg 1959, it is mainly due to the broad low rounded ribs that one would not mistake this example of *T. peruvianus* for *T. pachanoi*, although there are other differences, such as the spines, the v-shaped groove over the areole and the areoles themselves.

However, that said, please see the examples depicted below under *pachanoi* and *peruvianus*. We largely kept them as

spiny *Trichocereus pachanoi* (BBG; now absent)
Photo by Jon R. Hanna

labeled despite this generating some seemingly capricious 'species assignments.' We would suggest that any attempt at strict segregation or line drawing would not be meaningful.

While San Pedro normally has very short spines, Cordy-Collins 1982, page 147, includes a picture showing a long spined form of San Pedro. We have also seen such plants originating in plantings of shorter spined forms raised from seed by a friend and commercial grower on the west coast.

At first glance some of these plants could almost be mistaken for what is often sold as seed-grown *T. macrogonus* or *T. cuzcoensis*. The long spined form was present only as a few plants in a larger planting; the plants were all more or less identical in every other aspect of appearance. The end of a branch of San Pedro pictured on page 1120 of Backeberg 1959 has no apparent spines. It is often mentioned as being spineless but we have not yet seen a totally spineless specimen, just individual areoles without any visible spines.

It has also been proposed that San Pedro only has seasonal spines, but we have NEVER seen any indication of this in cultivated plants. Some plants do appear to suggest this but observation during growth reveals intermittent expression rather than spine loss.

To further complicate matters, spines up to 2.5 inches have been reliably reported.

See a number of examples of long spined *T. pachanoids*, correctly and incorrectly identified, elsewhere in this work.

Depending on the authority, San Pedro is said variously to have 6 to 8 ribs (Backeberg, Britton & Rose, and Schultes & Hofmann 1980) or 4 to 8 ribs (Schultes & Hofmann 1992)

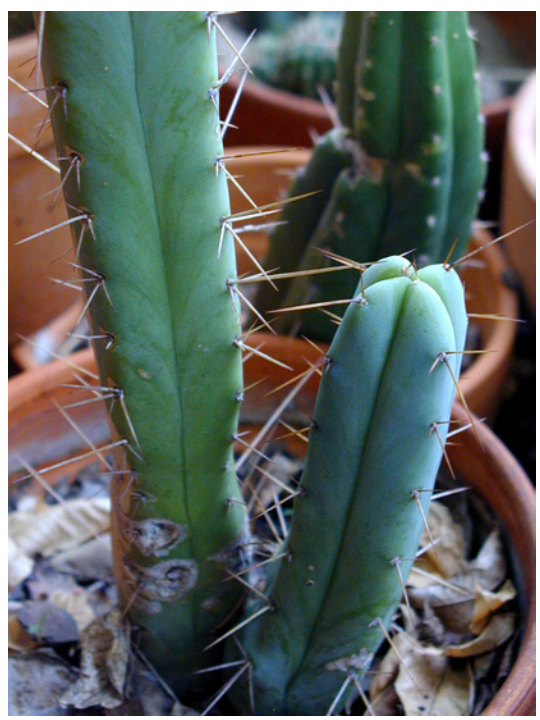
In Britton & Rose's key (this being the authority who originally collected, defined and described *T. pachanoi*), the number of ribs is used as the differentiating step between *T. pachanoi* and *T. bridgesii*.

We have seen not just numerous plants but single branches of plants that obviously were *T. pachanoi* and which showed 5 ribs. Similarly, plants with more than 8 ribs (up to 14!) have been reliably reported by growers.

Clearly, using 6 to 8 as the number of ribs for San Pedro and less than this for *T. bridgesii* cannot be a deciding criteria between these species. *T. peruvianus* is also known to be able to send off branches with as few as four ribs, but, as is the case with *T. pachanoi*, these are apparently rare.

Cordy-Collins proposes that 4 ribbed San Pedro plants may be mythical. Schultes & Hofmann considers them to be very rare. I have never witnessed firsthand an entire plant or branch of a plant which had only 4 ribs. One plant grew almost half an inch before adding a fifth rib, and another grower had a longer section exhibiting four ribs before adding another. It is not uncommon for plants to add or lose one rib as they grow.

***Trichocereus pachanoi* (Albert)**



Trichocereus bridgesioid
sold as "San Pedro" in Amsterdam

Reports from growers confirm the existence of 4 ribbed San Pedros; again usually adding a rib or two as they grow.

Photos of a 4 ribbed *peruvianus* were kindly sent by a friend in southern California and photos of a 4 ribbed *pachanoi* that seems more likely to be a *bridgesii* or *scopulicola* were sent by a friend in Italy. What appears to be a 4-ribbed branch tip is pictured by Polia but the angle precludes any firm conclusion other than it being out of focus.

***Trichocereus scopulicola* growing in Oz**

See more comments on ribbing under *T. pachanoi*

T. bridgesii commonly occurs with four ribs (Sometimes 3; See p. 11) On monstrose forms some could be described as having no ribs, or two ribs.

T. scopulicola also commonly forms only 4 or 5 ribs. Like *T. bridgesii*, it has been proven to be a useful species.

Interestingly, *Trichocereus scopulicola* had been in use for some years in Oz before anyone realized they were not using *Trichocereus pachanoi*.

One point several authors include which is puzzling concerns the depiction of cacti. Many times when there are 4 ribs clearly indicated on flat drawings or engravings these are referred to as 4 ribbed plants. Unless the plant was cut on one side and then rolled out flat, we would think these to be 7 or 8 ribbed plants, as one side is not visible. We do agree that the depiction of four ribs is symbolically important. It is also encountered as 3-dimensional representations.

Britton & Rose described the species based on Ecuadorian plants; Backeberg extended the range of known occurrence into Peru and Bolivia. Torres & Torres reported the presence of a pachanoid growing in the wilds of northern Chile. Whether it is an actual native or an escaped cultivar is unknown at present.

Britton & Rose 1920 mentions that it was probably impossible to know its natural distribution as it had been widely and intensively cultivated for so many years.

The impact of uncontrolled hybridization that occurred during this movement of San Pedro bears some thought.

The *Trichocereus* species readily hybridize with each other forming F1 hybrids that often exhibit a literal spectrum of forms between them. Back crossing should be expected to create a condition of hybrid swarming and formation of grex populations.

They are furthermore largely self-sterile AND pollinated by creatures with a good flying range (ie large night flying moths and bats) suggesting that uncontrolled hybridization has probably occurred in ANY region where they have been cultivated in the presence of other *Trichocereus* species.

It is worth reflecting on the fact that San Pedro has been in known use and deliberate cultivation throughout the Andes for a substantially longer time period than is believed to have produced the wealth of highly specialized biodiversity in Hawaii.

Another point in curious question is that of diameter. E. Wade-Davis 1983 describes a magnificent stand of San Pedro cacti at Caseria Laumache, around three miles from Huancabamba, that are reputed to be the strongest in the valley but protected by a giant serpent causing malevolent harm in the form of a skin disease (reputedly sometimes resulting in death) to any who harvest them.

For this reason he claims they are left alone, even by highly trained medicine people who employ San Pedro. Davis also mentioned coincidentally experiencing problems in the form of undiagnosed blemishes covering his head and neck after making a simple herbarium voucher from the periphery of the stand.

What is puzzling is that he describes them as 45 feet in height and with some specimens up to 14-1/2 inches in diameter, both far in excess of what is described for either *T. pachanoi* or *T. peruvianus*. He also mentions that sections of *T. pachanoi* are available in the local markets that measure 8 inches in diameter, which is twice that of the largest size described for *T. pachanoi* and around the size given both by Britton & Rose and also by Backeberg for *T. peruvianus*. As vouchers were collected of these plants, they should be re-examined to be certain that they were not enormous short-spined *T. peruvianus* or an undescribed species or variety. It is generally not that difficult to tell the two apart although intermediates apparently exist; as do 3-5 chemically unexamined species that look close or identical to overly large specimens of *T. pachanoi*. (At least one has been reported to be far superior to the San Pedro commonly cultivated)

Davis' are not the only reports of such huge 'pedros'. I have heard of several instances where San Pedro populations commonly have 8-12 or more inch in diameter specimens. These are supposedly often associated with long abandoned structures. The importance of definition and study of these plants is not only for taxonomy but for anthropology, and horticultural potential. My present suspicion is that these may not be *T. pachanoi* but rather some other larger pachanoid.

Borg made an odd mention when referring to *T. peruvianus* usually being more slender than *T. macrogonus*. This may be in reference to cultivated plants. It certainly is not the case with plants reported to have been observed in habitat or botanical gardens. Some growers apparently believe that most of the available *T. peruvianus* is actually *T. macrogonus* but we do not know their rationale for this conclusion.

Some modern experts consider *T. peruvianus* to be a variety of *T. pachanoi* apparently based on the similarity of flowers and the ready observation that all levels of intergrading exist between them. Whether this first point is true needs clarification. The various degrees of intergrading has now been shown to be

wild "San Pedro" (despined)
Photo by IcarosDNA

true for the alkaloid content of the hybrids as well. A hell of a range appears to exist just within *T. pachanoi* itself!

Currently girth, spination, color of areole and felt, and the shape of the notch or groove above the areole are considered to be the main deciding criteria on nonflowering specimens. All of these features, while of usefulness in many cases, fail miserably when studied rigorously.

A v-shaped groove above the areoles can also be observed not just on *T. peruvianus*, but also on *T. macrogonus*, *T. huanacoensis*, *T. pallarensis*, *T. fulvilanus*, *T. knuthianus*, *T. cuzcoensis*, *T. tarmaensis*, many *T. bridgesii* specimens, some *T. pachanoi* specimens, some sp. Juul's Giant and a GOOD

***Trichocereus pachanoi* seedling showing v-marks (grown from WOH's Knize-sourced seeds)**

number of other *Trichocereus* species. The careful reader can find many examples herein; in addition to the *Trichocereus pachanoi* seedling on page 19.

Brown to tan new felt is rather common and has been seen on most examples of *T. peruvianus*, all *T. macrogonus* observed to date, many specimens of *T. bridgesii*, some examples of *T. pachanoi* and (as light tan to brownish) on TJG. In most cases the felt fades to white or grey, occasionally blackish with age.

A San Pedros clone, with a girth described to be more in the range given for *T. peruvianus* (6-8 inches), is said to be cultivated for sacramental purposes in a remote area of one of the islands of Hawaii (we will not list its name on the off-chance that it may threaten the plant or its people) and to similarly be far more potent than what is generally thought of for San Pedros. The person who told us this claimed to have participated in a ritual gathering of several dozen people who experienced strong effects from an overall total of 18 inches of cactus made into tea. They were absolutely convinced that the smaller, short spined and weaker San Pedros were not "true" San Pedros.

A decent number of poorly understood fat *pachanoid* or *peruvianoids*, collected in Peru, Paraguay or Bolivia are known. All but two that we know of as having been evaluated were reported to be active. MOST appear to lack reported bioassay. (Terscheckioids also have some active forms but in that case some clones are more stimulant than psychedelic or they are inactive)

Another interesting specimen, probably misidentified, but in need of clarification is the photograph labeled *Trichocereus pachanoi* in Emboden's *Narcotic Plants*. We always assumed it was just an erroneous inclusion but, in light of what we have just mentioned and its superficial resemblance to *T. pasacana*, *T. terscheckii* **[Note 5]**, and other purportedly active species, it would be interesting to ascertain where and when the photograph was taken and if material was available for identification and analytical assay. Emboden lists several botanical collections as sites for his photographs but does not attribute individual pictures to any. We suspect this was at the Huntington.

More taxonomic study is needed in this interesting group of plants.

Floristic characteristics and chemotaxonomic studies would be invaluable for more accurately defining these species beyond simple morphology.

Carlos Ostolaza (in conversation 2001) made an extremely important point on this topic. Due to the highly variable nature of the *Trichocereus* species, examination & dissection of at least 50, if not 100, individual flowers need to be made for each, simply to know if any purported 'characteristics' are really characteristic.

Unfortunately, these plants do not always flower reliably in cultivation. Even if it meant determining they intergrade, chemotaxonomic studies are called for.

DNA typing could also be of use for more clearly delineating species and varieties but we know of no one who is looking into this approach for aiding taxonomic studies of the genus. It certainly is an area that would be worthwhile for study and development.

T. macrogonus has been reported to be rather low in alkaloid and *T. cuzcoensis* even lower, yet *T. macrogonus* has also produced extremely solid bioassays **[Note 6]** now reported by multiple people AND what appears to be *cuzcoensis* is sold despined in the Cuzco marketplace.

T. pachanoi and *T. peruvianus* both appear to show high variability of alkaloid content, both ranging from extremely low, even useless, to extremely potent, but the parameters are not known.

This extreme variability suggests that despite the reports of inactivity for material believed to be *T. cuzcoensis* growing near Cuzco and the apparently low values determined in both *T. cuzcoensis* & *T. fulvilanus*, neither one can be dismissed on the basis of one lonely analytical report. The odd reports of activity for both species in human bioassays suggests that much broader analysis is needed and underscores what should be obvious – Plants neither read nor do they follow the dictates of scientific reports. A phytochemical report can only be taken to apply to what it actually analyzed and cannot necessarily be extrapolated as indicating a predictable concentration. Similarly the one lonely report of stimulant action from *T. huanucoensis* can be taken to mean nothing on its own beyond being an indication more rigorous work is needed.

Curiously, analysis of *T. bridgesii* is similarly minimal (2 lab analysis published) but it has been successfully bioassayed by many people on at least 4 continents. The first one in print being that of E. Wade-Davis who included no details about the amount or form he sampled. It appears to have both traditional use among healers and by young hallucinogen users in Bolivia despite this being contested by Kavlin 2000. This is an area which begs for attention.

A partial list of uninvestigated *Trichocerei* which seem to be worth analyzing based on their morphology:

Trichocereus peruvianus* var. *knuthianus
(NMCR)
Photo by MS Smith

Cereus (?) *arequipensis* [northern Chile],
Trichocereus argentinensis. This material that was originally mislabeled *Cereus argentinensis* (by Merrit Dunlop?) [See Bob Ressler's columnar cactus website for a photo of this 8-10 inch in diameter bluish *macrogonoid* that Ressler renamed. Remain aware that *Cereus argentinensis* is actually the name of a quite different plant described by RITTER. That one IS a *Cereus* species),
Cereus (?) *bolivianus* [Ex. NY Bot. Garden's No. 6231],
Tricho(non)*Cereus* (?) *colossus* Bolivia 66.0159 (and any other nonCereus material cultivated under this RITTER s n.) [See page 199],

Trichocereus* aff. *huanucoensis
(California Cactus Center)

Cereus (?) *hempelianus* BAUER,
Cereus sp. [ANY plant labeled *Cereus* where the material that has broadly rounded ribs and hairs on the flower or fruit]
Cereus tephracanthus bolivianus WEBER,
Cereus tetracanthus LABOURET,
Trichocereus aff. *huanucoensis,*
Trichocereus cephalomacrostibas (as seen by Knize)

Trichocereus* aff. *huanucoensis
(Huntington) Bottom left

T. chalaensis,

Trichocereus chalaensis **Peru 60.0624**

T. forbesii [See pp. 243-244],
anything called *Trichocereus glaucus*, (See page 291)

Trichocereus glaucus **(SS)**

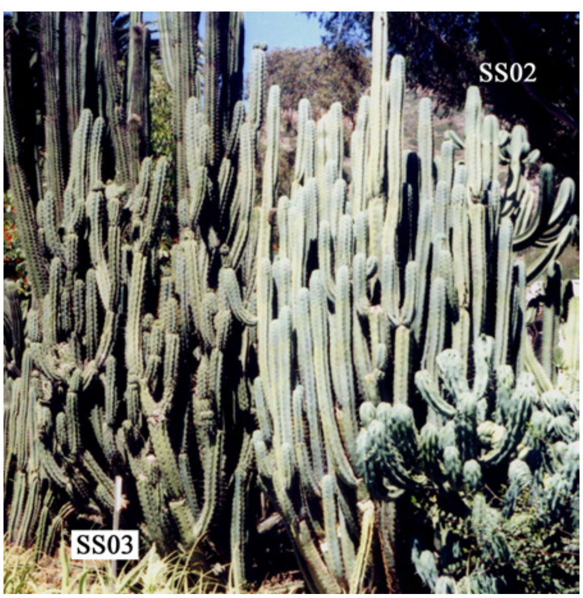


Photo by Kamm

T. huanucoensis JOHNSON (Harry Johnson, Sr., Paramount CA [ex.:Peru 56.1153] [See entry pp. 200-203],

Trichocereus chalaensis **Peru 60.0624**

Trichocereus ***sp.*** **SS04**

T. knuthianus as species or as variety of *peruvianus*,
T. pallarensis F.RITTER 676 [ex.: "South America 61.0850"] [See entry pp. 137-141],
T. puquiensis [See entry pp. 204-206],
T. robinsoniana [See p. 244],
T. sp. Peru 64.0762 [See pp. 229-230],
T. sp. Peru 65.0715 [See pp. 185-186],
T. sp. Peru 65.0729 [See pp. 230-231],
T. sp. RAUH K 68-1954,
T. sp. SS01 [See pp. 76-78],
T. sp. SS02 [See pp. 46-48],
T. sp. SS03 [See p. 194],
T. sp. SS04,
T. sp. W.BAKER 5452 [See p. 51],

Trichocereus ***sp.*** **SS04 (new growth)**

T. tacaquirensis,

Trichocereus tacaquirensis **Bolivia 65.0839**

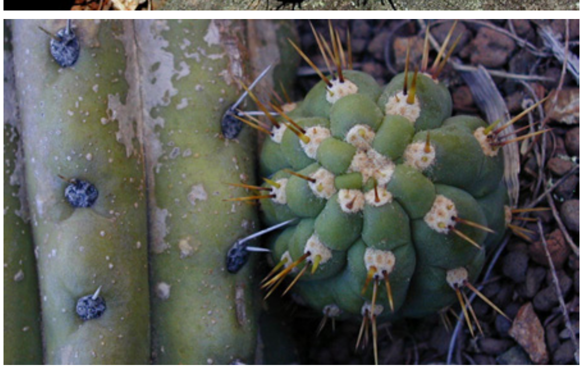
Trichocereus tacaquirensis **Bolivia 65.0839**

Trichocereus tacaquirensis **(RS)**

T. tacnaensis, (now considered to be a form of *peruvianus*)
T. tarmaensis [See pages 187-188 & 291)
T. [aka *Eriocereus*] *tephracanthus,*
T. torataensis, (now considered to be a form of *peruvianus*)
T. tulhuayacensis

Trichocereus tephracanthus **(Lower left)**

and *T. uyupampensis* [See pages 8, 23-24].



Trichocereus uyupampensis **Peru 60.0450**
Entire page

Species was reported to contain mescaline in a 2006 bioassay.

***Trichocereus uyupampensis* Peru 60.0450**
source: "Jardin Exotique, Monaco 3487'
[who obtained their material from Curt Backeberg]

(See also KK341 on pages 8 & 291)

Unfortunately, mislabeled plants are common in the horticultural market, as are plants sold as *Trichocereus* spp. with no specific designation. For some of these, even the grower may have no clue as to the species. Occasionally these have originated, as seed grown plants, from mixtures of numerous species including ones which the original seed collectors and retail sources were unable to identify and sell as known and recognizable species. Such mixtures often contain unrecognizable species and may even rarely contain one that is undescribed. They are more likely to be hybrids.

A similar situation arises when growers harvest fruit from a *Trichocereus* collection containing more than one species with similar flowering times. This is a common if not the USUAL case for seed material stolen from botanical gardens.

There are no doubt many more.

***Trichocereus bridgesioid* (no visible label)**
(Huntington)

See a number of examples under *Trichocereus peruvianus* and elsewhere here.

Then there is the prolific collection and sales efforts of Karel Knize in Peru who has provided a wealth of beautiful plants accompanied by such careless and inconsistent labelling as to have been suggested by this author as being the probable source for MOST of the confusion existing in horticulture today.
See numerous examples herein.

Torres & Torres encountered and successfully bioassayed an unidentified mescaline containing northern Chilean *Trichocereus* pachanoid (page 259). Its identity is still unclear but at least one clone is now solidly in horticulture.

This is proving true for a handful of others from Argentina, Bolivia, and northern Chile. As for the cacti in Paraguay?

The field is ripe and waiting only for more exploration.

It is an area where the lack of available information is curious.

Despite being studied intensively and few new potent species released, it appears that the MAJORITY of *pachanoid-peruvianoid-bridgesioid* cacti are active and there is a trivial likelihood of getting anything worse than a misguessed dosage if careless. Unless getting arrested of course.

While the current legal status of mescaline, once extracted from plants, causes a major complication for legitimate workers, it is important that more work be done to not only identify how broadly mescaline is truly represented within the genus but to more adequately define the mescaline content in known mescaline producers and, more pointedly, in their horticultural varieties. [Also, any unevaluated plants closely allied to the group containing the known mescaline producers should be targeted.]

Cultivation of plants for sacramental use would be greatly facilitated if propagation efforts focused upon high alkaloid strains. Focused work and concerted effort in this area could greatly help offset the current pressures placed on the domestic peyote populations.

Curiously, cultivation of peyote or even *Trichocerei*, if done specifically for entheogenic usage, is against the law for any person. While the sacramental USE of peyote is protected for the NAC, there is no provision specifically allowing its cultivation.

The Texas DPS, the agency which oversees peyote harvests and licenses peyoteros, has expressed their opinion indicating that they consider cultivation to be completely unprotected; even if done by the peyoteros that they license for harvesting peyote from the wild. Even more interestingly, they have claimed they have no plans to issue any licenses in the future as there will be "*no need*". With a strategy like this and the unrealistic limitations that such moronic policies place upon the NAC, we agree that there will soon be no need for licensing of ANY peyoteros.

Peyote is not specifically against federal law to grow for horticultural purposes but possession of any part of the plant, or even its seeds, is.

Additionally, possession is against the law of many states and will result in arrest or, at the least, destruction of discovered plants. As it is listed by TOE as an endangered plant in Texas, it is ironic that all confiscated plants are destroyed.

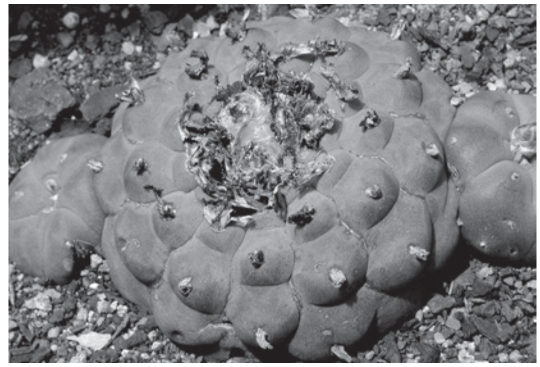
Trichocerei are not illegal to grow <u>for horticultural purposes</u> in any state, as far as I can ascertain. That does not mean that people have not been arrested and wasted plenty of their time and money in the courts over them.

Unfortunately illegality is apparently now interpreted to be based upon INTENT for use, or end application involving distribution for use or processing for use (this could easily be construed by legal authorities to include both extraction performed for assay or isolation for quantification regardless of actual end use), and intent is left <u>solely at the discretion</u> of the observing officer. This is a tenuous and grey area permitting the continuation of widespread deliberate religious and spiritual oppression, as well as restriction of both pure and applied research.

While rare, at least some users HAVE been arrested for San Pedro. While conviction seems unlikely, it still proved to be such a costly adventure that some have plead no contest and entered into DRUG DIVERSION programs to avoid further legal expense. Said programs consider hallucinogens to be addictive, dangerous drug equatables with alcohol, heroin and cocaine. It is also noteworthy that these programs are most commonly modeled on Alcoholics Anonymous, a largely ineffectual re-education program featuring a sanitized rendition of Judeo-Christian religious tenets, as its CORE for successful drug addiction treatment.

A curious feature of the real-world expression of this approach is that it transfers the power to functionally decide the sincerity and legitimacy of an individual's religious and spiritual intent from out of the hands of the courts and into the hands of police and law enforcement personnel.

These are people who are specifically trained not to differentiate but rather to lump all such practices together as invalid **[Note 7]** and in violation of the law, supposedly to allow the courts to make all decisions on whether and how formal charges will be pursued.



Be careful where you point that thing, it's a dangerous plant!

What is conveniently overlooked is that even if formal charges are not pursued in the courts, or even if they are actually vindicated by the court, a person will still lose all of their plants, thus **depriving them of sacrament** (and possibly also any real property they might own) **based solely on the opinions and decisions of law enforcement personnel** and **NOT the courts**.

Some day sanity will prevail over bigotry but that dawn does not seem imminent.

The only claims that peyote is "*dangerous*" have been made by people who decided it was before ever examining the matter. A good example is the observation by Bergman, in his exhaustive study of reported problems from peyote use among the Navajo, noting that if an Indian had any mental problems and had ever used peyote, the peyote was automatically assumed by professional mental health workers to be the cause of the problems. Similarly, repeated claims of deaths due to peyote were invariably shown (unless entirely fabricated) to have involved seriously ill people who were expected to die at any moment and to whom peyote was then given. When they died from their pre-existing conditions; peyote was always given as the direct cause of death. [See Stewart 1987 for examples.]

There has **never** been as much as one single verifiable death from use of peyote or San Pedro, nor for that matter any verifiable reported death in the scientific literature resulting from mescaline, despite it being reported that people have willingly ingested up to 8 grams of mescaline [**Note 8**], and **never any verifiable instance** of harm to normal people directly resulting from their use, except for as a direct result of the law itself, which *HAS* caused many people, Indian and non-Indian alike, great misery, grief and harm.

I would expect that psychotic individuals have probably experienced problems from their use. These types of people are ill advised to use any type of hallucinogen. Even so, all examples we've located of problems (relatively minor and short term) experienced by psychotics came not only from high doses of pure mescaline but were at the hands of trained medical professionals; viewing and using them as laboratory specimens, despite all available indications that mentally ill people were at risk of having their condition worsen because of exposure to any hallucinogen or other mind-altering experience.

This should be recognized as purely and simply unethical human experimentation as, by legal definition, a mentally incompetent person cannot give informed consent.

The use of mescaline or mescaline containing cacti poses NO risk (other than legal), either in terms of health or psychiatric well being to any normal, or even halfway sane, individual who uses them ***knowingly and voluntarily***.

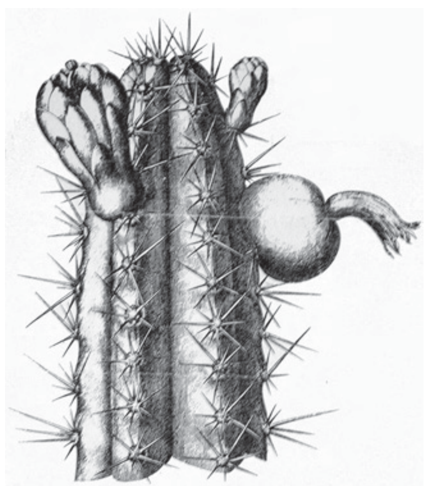
Even if somehow given surreptitiously, a difficult thing to do, the experience is a beautiful and fairly controllable one and lacking the overwhelming distortions and ego-death potentially encountered with a strong dose of LSD. I personally do not know anyone who has had a bad time with true mescaline unless it was mixed with large amounts of alcohol. Unfortunately this is not an area where accurate figures can be obtained as many people firmly believe that they have ingested mescaline who have not. (Nor is alcohol ingestion always considered to be a noteworthy point in such accounts.)

It must however also be mentioned that LaBarre mentions a number of unpleasant experiences recorded among native Peyote users. There are also other reports of people having unpleasant times for one reason or another. This is usually the result of either an inappropriate dosage or use in an inappropriate setting of environment (pysical or psychological) As with ANY psychedelic, set and setting can be critical factors.

Some people should probably avoid them altogether. People who are alcoholics or heavy beer drinkers can have particular problems with purging responses.

It can be intense & physically unpleasant at very high dosages but very few people can ingest that much cacti even with effort (many common strains of San Pedro take 1-3 kilos for perceivable but not strong effects) or would take several large capsules of pure mescaline unknowingly. As in most parts of the country this would now cost one or more hundred dollars it hardly seems likely it would be given "*as a prank*" as BROWN & MALONE 1978 have alleged as a potential source of mescaline "*panic reactions*". (This was their lone example of the 'danger' of mescaline.)

If their assertion had any basis it is much more likely that it was acid (LSD-25) that was used, rather than mescaline. Panic reactions are fairly common in people who have been given acid unknowingly. (This is a cruel act that should be viewed as a form of assault.)



Botanical illustration accompanying the description of *Cereus macrogonus* Salm-Dyck
Elements of the flowerbuds and fruit appear to be fanciful or supposed rather than observed

Sorry to get sidetracked. Back to the subject of vague areas of concern....

In passing, *Trichocereus atacamensis* should be briefly mentioned. This plant appears listed with the common name of *San Pedro*. It should be noted that San Pedro (de Atacama), Chile is a place of origin for this gigantic Argentinian/Chilean species and NOT its common name. Its woody skeleton forms the structure of a local church there and is the basis of a local craft industry that carves small churches and other items for sale.

RÄTSCH 1998 reports that this plant has bitter flesh and produces stimulating effects. (The person who performed this bioassay told me in conversation he had ingested a 6-8 inch piece of a single rib carved from a large plant)

A similar claim of stimulant (but nonhallucinogenic) activity has been made for *T. pasacana*. Most experts consider them to be variants within a single species.

Before moving on to the remainder of our book, we would like to comment on random bioassays. We would suggest any reader specifically raising plants for sacramental use might bioassay every strain that they have and get rid of anything that bioassays poorly.

One reason that more is not known is that people do not always know what they are eating so can offer limited information. Another is that they often wisely err on the side of caution and avoid eating unknown cacti due to concerns of toxicity. This is not a bad idea not just for cacti but for any type of plants.

However, in the case of the *Trichocereus* species, it is worth considering:

A) The amount of cactus required should realistically be between one hundred grams and a kilo of fresh material or 10-100 grams of dried plant. If it requires more than this, making a better selection should be an obvious suggestion.

B) With one exception, there has never been any *pachanoid-peruvianoid* species with any indication of toxicity of any sort at this dosage level. See **Note 9** on page 257

C) 'Toxic' materials encounterable in these species aren't that toxic and certainly aren't going to pose any health risk to humans ingesting them. (Assuming they start low and work their way up slowly, and they see Item D.) Pesticides and fungicide residues excepted of course.

D) To err on the side of caution, we will suggest that any species in which the presence of candicine is thought possible should probably be avoided. We would suggest an acidified tea rather than direct consumption for evaluating unknowns. This will lessen the chance of candicine ingestion even if this alkaloid was present in abundance.

Some people use dried cactus powder as this permits them a standardized approach to comparative bioassays between plants, determining replicate dosages and affords a number of other advantages. (See ***Sacred Cacti*. 3rd ed. Part A** or ***Sacred Cacti* 2nd ed.** for a more in depth discussion of the various aspects of cactus utilization)

As is the case for consuming fresh flesh, this practice might best be reserved for use with plants that have first been determined to be both active and lacking toxicity.

If a reader knows their material and ingests a reasonable amount, random bioassays of unknown pachanoid or peruvianoid appearing species does not appear to pose much risk other than the potential of serious, or at least costly and problematic, legal problems if they are noticed to be doing so.

We hope this work can be of some help despite the obviously huge gaps that still exist in our understanding concerning these amazing plants.


Trichocereus bridgesii
monstrose
short form
(SS)

Trichocereus bridgesii (Salm-Dyck) Britton & Rose

Mescaline is present at levels of over 25 mg. per 100 grams of fresh plant.

***Trichocereus bridgesii* Bolivia 53.0162**

From Bolivia (La Paz)
Frequently grown as a hedge plant in Bolivia. It is also placed on top of walls for the protection of gardens.

Actual origin of European material is unknown but it is generally supposed to be from Bolivia as it was named for Bridges who collected there.
The plants that Rose collected in Bolivia (Rose 18842) appeared to match those already present in European collections.

It has variously been known as *Cereus bridgesii* SD (this is its first collection; name published in 1850), *Cereus lagenaeformis* Förster, and *Cereus lasianthus* Schumann.

Known as *Achuma* in Bolivia. Rätsch 1998
Also as *San Pedro* in Bolivia. Kavlin in White 2000
It has been similarly encountered being sold labeled as ***San Pedro*** in both the US and Amsterdam.
Kavlin was unable to find evidence of use in Bolivia; however, Dickson 1978 found it being sold as "San Pedro" in Bolivian herb markets. She believed that she was writing about the use of *T. pachanoi* in Bolivia but ALL of her photographs clearly depict *T. bridgesii* specimens.
Murple commented on the abundant evidence of heavy harvesting in the La Paz area (pers. comm. 2005).

The monstrose form is known by the common name of "*The Penis Plant.*"
Forms a tall branching shrub to 5 meters high with branches from the base up to 15 cm in diameter. [10 to 15 cm in diameter (Britton & Rose 1922); to 6 inches (Brickell & Zuk 1996)] Stems are usually erect but may be prostrate.
The stems are pale green, grayish-green and more or less frosted. [Pale to dark green (Brickell & Zuk 1996); We have observed, firsthand, a broad range of color from bluish-green to grass green to grey-green on material identified as this species.]
The 4 to 8 ribs are rounded at first, but later grow flatter. (Britton & Rose say obtuse, separated by broad but shallow intervals.) [This varies substantially between varieties.]
Areoles are large and about 2 cm apart, each has 2-6 yellowish spines. [Brickell & Zuk 1996 describes with grey areoles and yellow radials; Borg says with yellow wool and yellow spines passing to brown.] Spines are dissimilar, acicular to subulate, and can grow up to 10 cm. long. Spines are often shorter in cultivated plants. Spines are not swollen at the base.
[Ed.: Material propagated from cuttings, and examined, invariably **[Note 10]** had a v-shaped groove or mark above at least some of the areoles (often with the tip merging with the top of the areole and the "v-mark" consisting of short curving lines), and frequently has tan or light brown felt rapidly turning white, whitish or greyish. Spines have been yellow, yellow and brown, reddish-brown or brown; the bases on some are briefly tinged with red when new. Mostly the spines fade to greyish or whitish.]
[Ed.: Seed grown material from several sources showed yellowish to light tan felt aging rapidly to white or greyish. All had new spines that were brown or greyish, tipped with brown; most aged greyish and/or light brown. In no case was either a v-shaped mark or groove observed above any areole but none were over a few inches in height. At 9 x 2 cm in size, one seedling of *T. bridgesii* KK919 already had several long central spines; up to 25 mm (borne medially to basally).]
Its flowers are white and up to 18 cm long; petals are white and the sepals are brown. The scales on the flower tube and ovary are small and scattered. Ovary, floral tube and sepals have dark hairs.
[Flowers June - July. Olmos 1977] Nocturnal flowers (Brickell & Zuk 1996). See also page 294 herein.
Oblong fruit is scaly, long-hairy, 5-6 cm in length.
Backeberg 1977; page 492 and
Borg 1976: page 181 and

Trichocereus bridgesii
monstrose form

Brickell & Zuk 1996; page 389 (As *Echinopsis langeniformis*) and

Britton & Rose 1920; page 134.

Borg 1976 also lists three cultivated varieties:
var. ***brevispinus*** K.Schumann 7 or 8 ribs & very small spines.
var. ***longispinus*** Hort **[Note 11]**. 4 or 5 ribs & very long central spines. [I've seen these form 6 & 7 ribs]
var. ***lageniformis*** (Först.) K.Schumann More or less club-shaped stems having 6 or 7 ribs and short but numerous spines.

***Trichocereus bridgesii* var. *brevispinus* (NMCR)**
Photo by MS Smith

In addition to **KK919** mentioned above,
KK920 is also available; both as ***T. bridgesii*** and as ***T. bridgesii*** v. (**Rio La Paz**). [From the same company!!]
In 1999, Karel Knize offered **KK910** from Bolivia. Cuttings obtained from Knize in 2000 only raised more questions due to their inadequate and conflicting labeling.

It appears that there are still more in cultivation, including multiple clones originating from completely unclear points of origin and from Britton & Rose and by additional collectors (for example: **Bolivia 53.0162**)
The seeming multitude of plants known by this name appears to be in great need of clarification.

Trichocereus bridgesii has been reverted/collapsed into the name ***Echinopsis lageniformis***.
[Do not confuse with *Echinopsis bridgesii* which is an entirely different plant (a low clump former).]

Olmos 1977 recommends a 3° C temperature minimum but notes it is frost resistant.
We found some had no problem down to 22° F.
Especially if kept dry.
Said to be very cold hardy by many.
Brickell & Zuk 1996 recommend a 10° C minimum.
Borg 1937 mentions that these plants require a "*substantial soil and full sunshine*" and recommends avoiding calcareous soils for this species.
Some amazing very dark green specimens are featured in a color photograph on page 139 of Olmos 1977.

The species is highly variable in growth even on a single plant. This can reflect growth conditions but sometimes seems inexplicable.

I have witnessed, and was formerly growing, two distinct forms (that sometimes appear to be present on some large plants).

One has denser and smaller spines, (both forms also have longer spines that become stouter with age.)

The other has fewer and much flatter ribs with broad shallow depressions between them as opposed to narrow grooves. The spines are distributed more sparsely with some being much longer than the rest.

I believe this is simply a form that these plants take when they grow older but do not yet have enough cultivation experience with the species to be certain.

[The occasional branch arising from this latter form (var. *longispina*), shows little or no spination. These are often cut, rooted and sold as monstrose specimens. Most new growth will show normally spination.]

The only bioassay mentioned in the scientific literature is that of E. Wade-Davis 1983 who implies they are not only highly active but bioassayed more than once. No details were concerning the form chosen or amount.

It should be added that this species is highly regarded by anyone who is familiar with it; at least here in the US or in Oz.

See more comments below under monstrose *bridgesii.*

***Trichocereus bridgesii* "Parque de la Coca, LaPaz" (Murple)** see also p. 297

Many forms exist in horticulture.

A mere sampling of existing *bridgesii* forms and some of the multitude of assorted *bridgesioids* follows.

This is a very typical form.

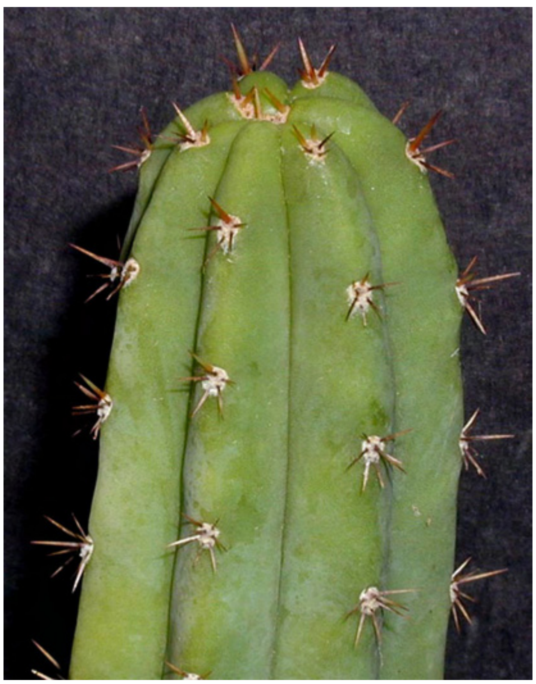
Trichocereus bridgesii
(B & B Nursery)
entire page

Trichocereus bridgesii

Trichocereus bridgesii **Bolivia 53.0162**
(Berkeley)
entire page
Top right photo by Jon R Hanna

Photo by Philip

bridgesii **form sold by Cactus Gems**
Lower on the same plant shown at center left



2 bridgesii **forms sold by Cactus Gems**
top & center left

Trichocereus bridgesii **(Huntington) center right**
Photo by Zifko

Trichocereus **aff.** ***bridgesii*** **(Huntington)**

Happy plants in Oz

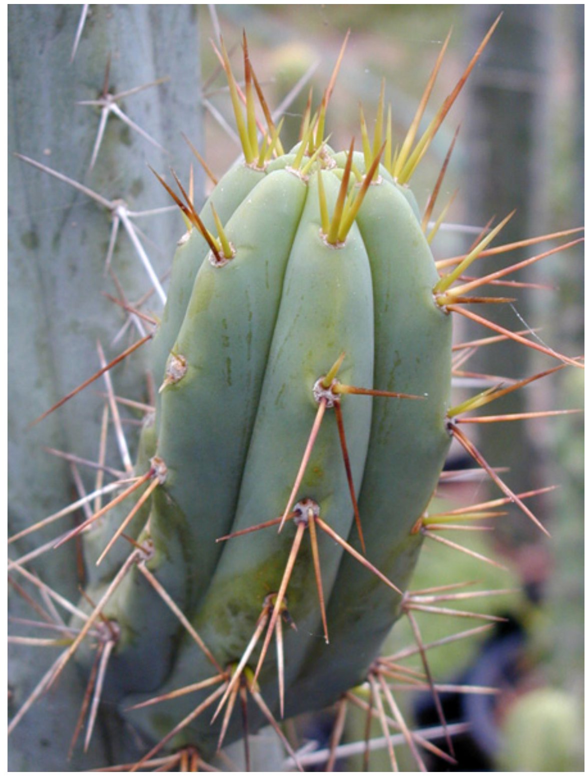
A monstrose *Trichocereus bridgesii* in Oz

Monstrose growth arising from normal *bridgesii* f. *longispina.*
Lower left & center
Photo on lower left by Mary

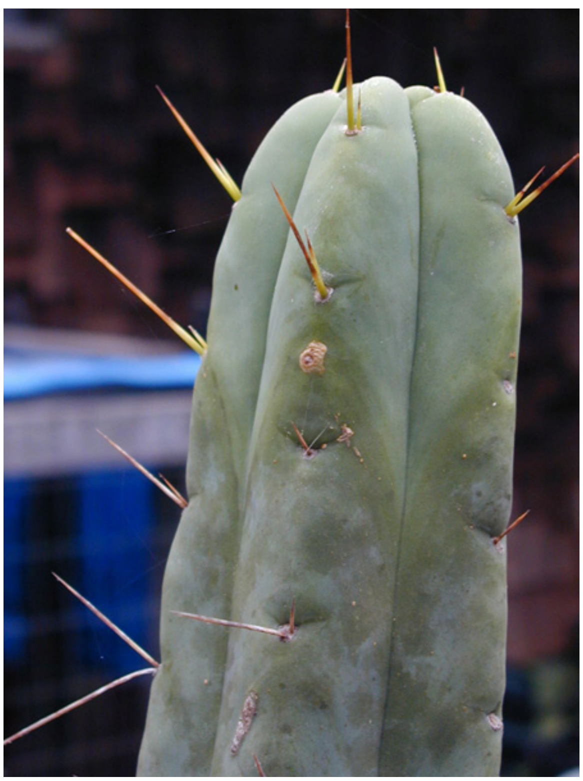
A *Trichocereus bridgesii* KK919 seedling grown from Knize-sourced seed by Mesa Garden.
Photo by Logan Boskey

Trichocereus bridgesii
Cuttings obtained from Karel Knize. One on left was unlabeled; one on right above was labeled KK920
Material designated KK919 & KK920 are given as "La Paz, Rio Abajo, 2900m" by Knize in 2004
(see page 291)

Trichocereus bridgesioids
Two *bridgesii*-diametered plants grown from a single lot of Knize-sourced seed labeled *T. peruvianus* KK242.
Lower two images.



Interestingly these bridgesioids from Knize were grown in the company of much stouter *peruvianus* forms that were also produced from seed.



Trichocereus bridgesioids
Two more *bridgesii*-diametered plants grown from the same lot of Knize-sourced seed labeled *T. peruvianus* KK242 above & upper right.

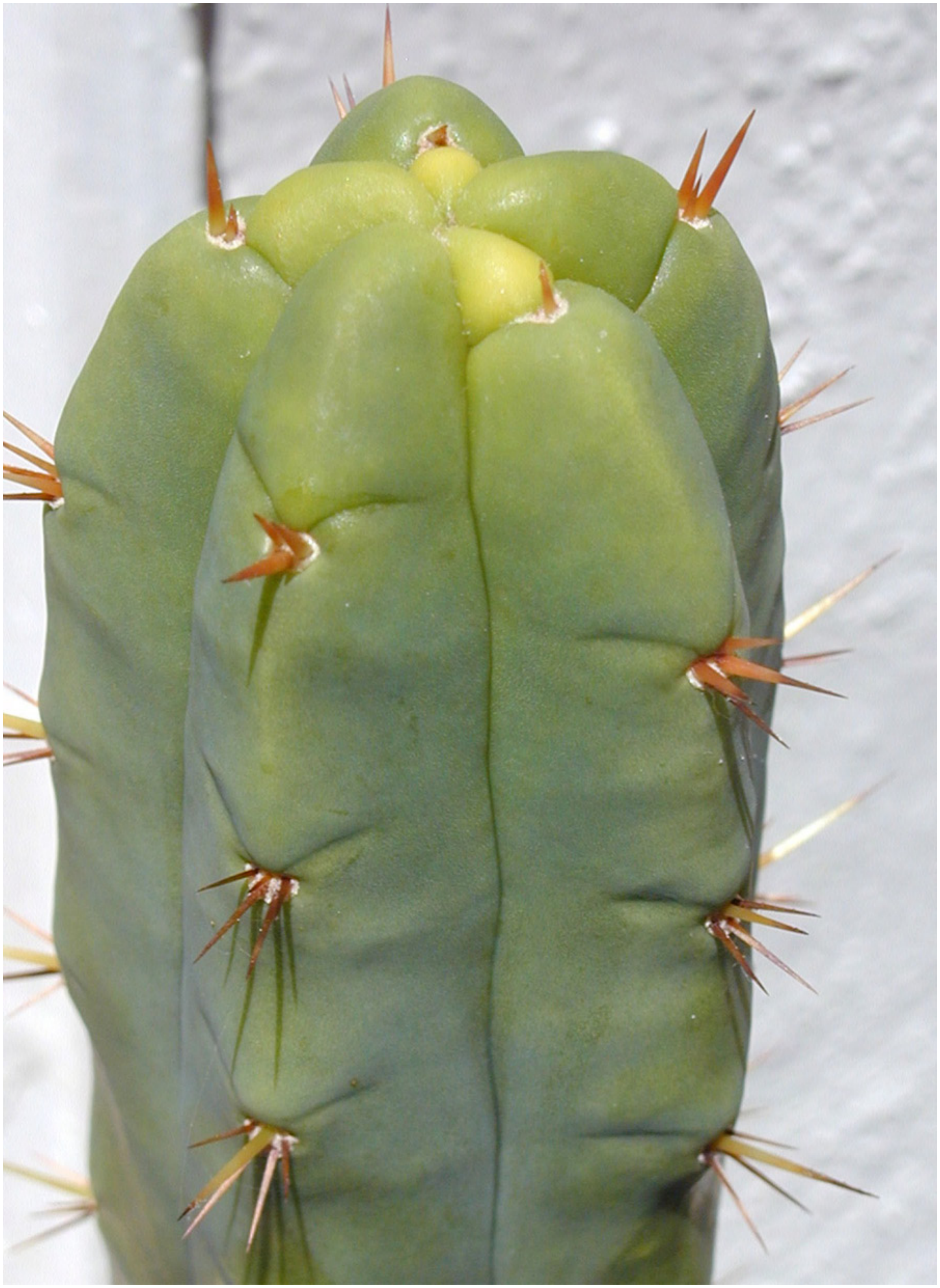
***Trichocereus bridgesii* (Dragonfly)**
lower right

Trichocereus bridgesii (Carlyle) above
Photo by Anonymous

Trichocereus bridgesii (Golden Gate #2)
said to have originated from a clone in the Golden Gate Park; also to be an excellent form
topright and center right

Trichocereus bridgesii (Middleton)
Collected in the 1950s; lower left

Trichocereus bridgesii cv. Magnus
lower right See also page 296
Said to be an excellent form

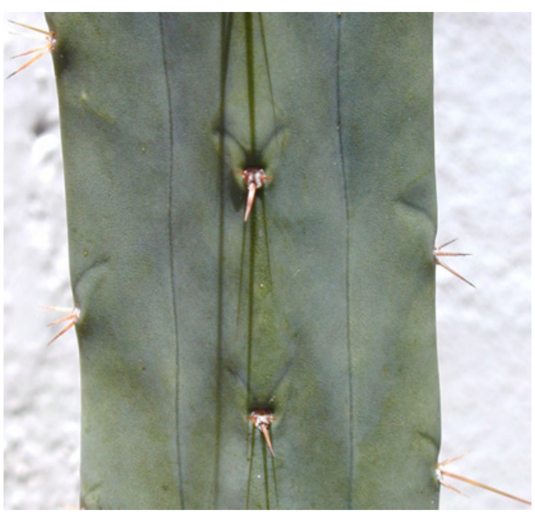


Trichocereus bridgesii **RS0005 Eusaporus**

Trichocereus bridgesii RS0005

A form known as the **Eusaporus** clone is reputed to be extremely potent and nearly palatable but I lack any details beyond it originating from the defunct cactus nursery Sticky Business.

It is said to lack slime but this is apparently seasonal as our lone assessment of this feature was rather slimy.



As is the case for so many of these species, this can be rather variable in appearance and spination depending on its local conditions during growth.

Trichocereus bridgesii **RS0005 Eusaporus**

Bridgesioids

Numerous unlabeled or mislabeled plants exist that would either key into *T. bridgesii*, or else very near this species, but several need more work to adequately define. Some of these may be hybrids; a number appear to be possible *bridgesii*X*peruvianus*.

A number of *bridgesii*X*peruvianus* hybrids are known to have been produced in horticulture but we have not been able to examine any with certainty.

It is unknown if seeds were collected by anyone but SEVERAL interesting *Trichocereus* species have been witnessed by the author blooming together with and near *bridgesii* in Berkeley.

Any unknown with this appearance, spiny or not, is worthy of a closer look.

***Trichocereus bridgesioid* (Bob Wallace)**

Possibly a *bridgesii*X*pachanoid or bridgesii*X*peruvianoid* hybrid?

This has substantially stouter columns than a normal *bridgesii*. It forms club-like tips but possesses narrow almost cylindrical bases common to *bridgesii*.

Basal spination is like a typical *bridgesii.*

We lack any further information about it.

Notice the tiny leaves on new growth.

***bridgesioid* (Bob Wallace) Entire page**

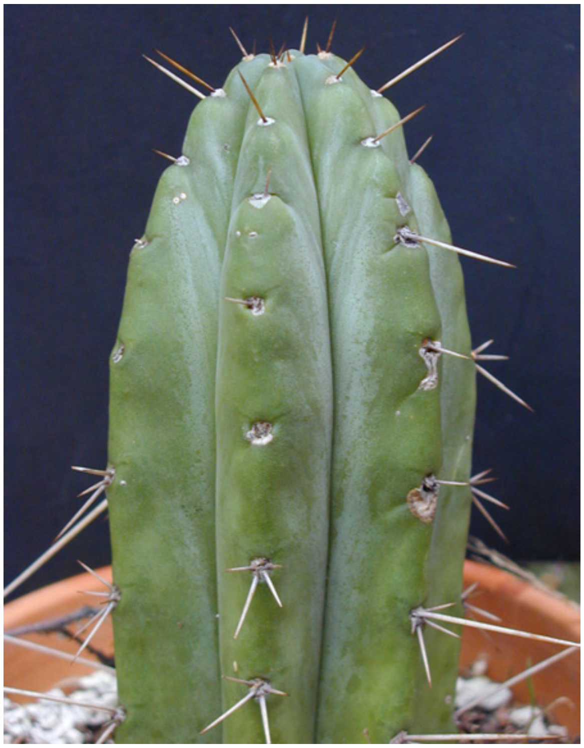
unclear *Trichocereus bridgesioid* (Gay Collection)

Found unlabeled in a very old planting of cacti. Suspected of being a spontaneous hybrid arising from dropped seed. Its placement in the garden and its intermediate characteristics suggest that it may possibly be a *bridgesii*X*huanucoensis* hybrid? We lack any more information about it. (More photos p 310.)

Trichocereus bridgesii huanucoensis **intermediate (Gay collection)**

***Trichocereus* cv. (Lumberjack)**
Unlabeled form obtained in a Sacramento, CA Lumberjack store. Proven to be a potent mescaline container by human bioassay. Now cultivated for sacramental purposes.

Appearance suggest that this may be a hybrid or intermediate of *T. bridgesii* with *T. peruvianus* or something similar.
*T. peruvianus*X*bridgesii* and *T. pachanoi*X*bridgesii* hybrids are known to exist in horticulture but we have never encountered any that were actually labeled as such.



***Trichocereus bridgesioid* (Lumberjack)**
All photos on this page are of a single plant.

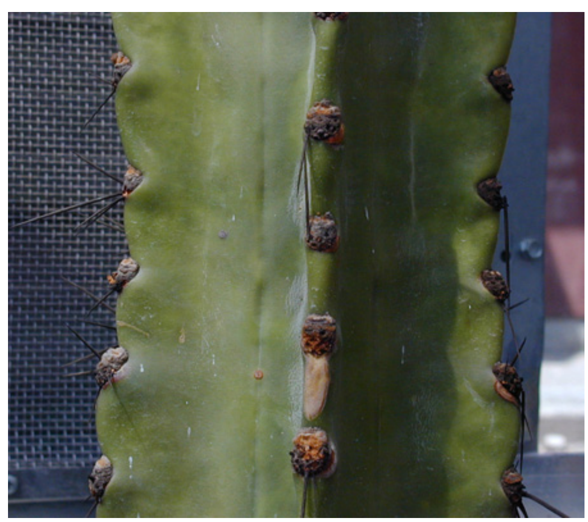
Trichocereus bridgesioid **sold as** ***T. herzogianus*** **(Cactus Gems)**

Obtained mislabeled with printed Cactus Gems label. We have also encountered this mislabeled as *Neocardenasia herzogiana, Neoraimondia herzogiana* & *Neoraimondia giganteus*) Spination often becomes fierce in sun but can be nearly absent.

bridgesioid **(Cactus Gems)**

bridgesioid **(Cactus Gems)**

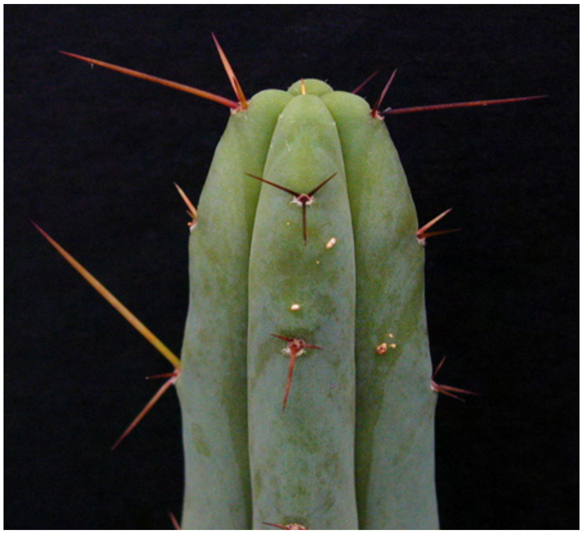
For comparison:

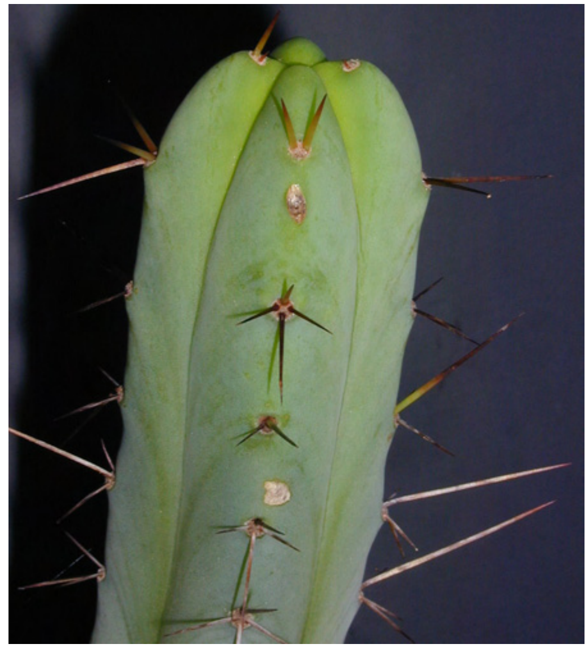


Authentic ***Neoraimondia herzogiana***

Trichocereus bridgesii

***Trichocereus bridgesioid* sold as San Pedro in Amsterdam:**
Very slender but fast growing and freely offsetting.
Reputed to be potent. (See also p. 17)





Notice the tiny leaves on early new growth

***bridgesioid* San Pedro (Amsterdam)**

***bridgesioids* sold as *pachanoi* on three continents:**

***bridgesioid* obtained as a 4-ribbed *pachanoi* (Italy):**
Photos above by Bobby Brown; courtesy of Maurizio Bini
Identity is unclear. It could be a form of *pachanoi* but its appearance suggests this is more likely a form of *T. bridgesii* or *T. scopulicola*.

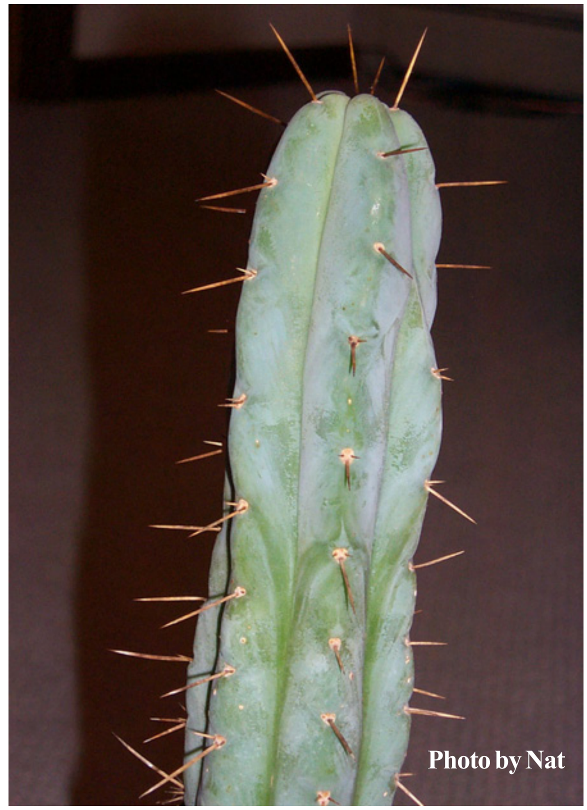


Photo by Nat

***bridgesioid-peruvianoid* sold as *T. pachanoi* (Oz)**

Photo by MS Smith

Photo by MS Smith

Sold as *Trichocereus pachanoi* (Altman)
Lower & center right

***bridgesioid* sold as San Pedro in Southwestern US:**
Reported to be potent in human bioassays.

***bridgesioid* San Pedro (WOH)**

Wild *Trichocereus bridgesii* in habitat

Trichocereus bridgesii
growing wild near La Paz, Bolivia.
Photo by Anonymous

The plant below appears to be *bridgesii* but lacks a label.

***Trichocereus bridgesioid* (No label)**
(Strybig)

***Trichocereus* sp. SS02**

This appears to be a form of *T. bridgesii* but no data is available other than it coming from a large plant in a longtime collector's planting.

It is a fast growing and beautiful plant.

So far growth has been upright and rapid. New branches for us have been around 2 inches in diameter but with some columns exceeding 4 inches.

***bridgesioid* sp. SS02**
righthand column

Spination has been extremely variable even on a single column.
Human bioassays have shown it to be a reliably better selection than *T. pachanoi*.

***bridgesioid* sp. SS02**
entire page

bridgesioid **sp. SS02**

cv. "Standard"

There is also some perplexing material originally propagated as *T. peruvianus* which needs more study and intensive propagation

It has been referred to as "*the standard peruvianus*" by those growing it, and a proposal was made that it be designated as the "*standard superior*" strain.] This appears as a glaucous, very bluish blushed, fairly pale green plant with honey and brown spines that only has 2-5(-6) **[Note 12]** spines of dissimilar length (most observed instances have been 4). While the sometimes 2-3 spines per areole would seem to preclude it from being considered *T. peruvianus*, *T. peruvianus* Peru 48.1540 at the BBG & cv. GF also express only 2 or 3 spines on some areoles.

One is often longer than the rest but it is not placed like a clear central spine would be, except for a few areoles. Areoles start light brown and turn darker brown before becoming grey.

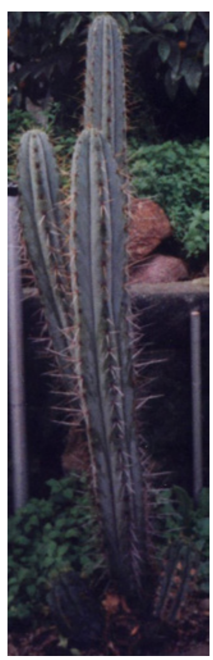
There is a distinct v-shaped mark above the areoles, partially merging with them. It often has 5 or 6 ribs, uncommonly 4.

Overall its appearance and characteristics suggests some sort of hybrid between a long-spined form of *T. bridgesii* and something like *Trichocereus peruvianus*, or *T. macrogonus*. It strongly resembles *T. bridgesii* but retains very rounded ribs rather than flattening out as per *T. bridgesii* var. *longispina*. It is distinct from any of the forms of *T. bridgesii* we have examined.

While observing multiple photographs of entire plants, only two 5-ribbed branch cuttings and their resulting growth has thus far been examined in person by the author.

It has been reported to be superior to the other sacramental cacti bioassayed.

Despite being fairly slender, it is a very fast growing and freely offsetting plant.



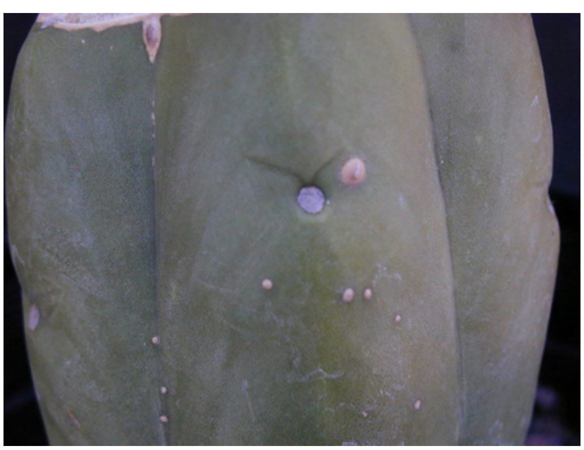
***Trichocereus* "Standard"**

Lower right photo of mother plant by Entheos

Trichocereus sp. "Unknown C"

This is highly variable in appearance and diameter (often looking sort of like TJG but with an even and lighter color, a *scopulicola*-type grainy texture to the skin, brown felt and commonly bearing pairs of white spines around the same length as TJG's long single spines.)

It is proven effective in human bioassays, is moderately fast growing and has excellent water tolerance. (ENTHEOS; personal communication)



Trichocereus sp. "Unknown C"
Upper left photo by Entheos

***Trichocereus* sp. "Unknown C"**

unlabeled *Trichocereus bridgesioids* (MH)

unlabeled *Trichocereus bridgesioids* (MH)

***Trichocereus bridgesii* W.Baker 5452**

Collected by Julio Cruz: Murillo, Jayuri Province, Bolivia. 20 March, 1983.

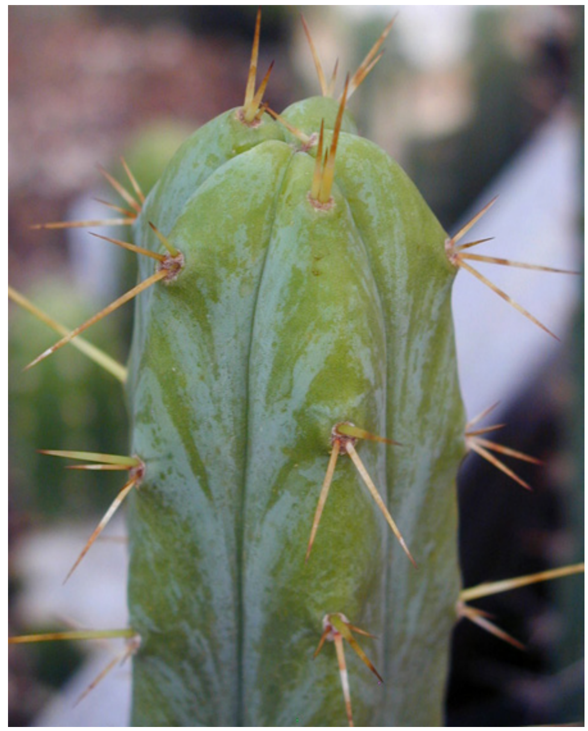
Vouchers originally submitted as a form of *T. pachanoi*.

It appears to be a rather typical *bridgesii*.

It strongly needs a published analysis. It is believed to be a good strain based on two independent bioassays and an unpublished analysis. (All requesting anonymity.)

Indigenous usage is claimed but no details can be located.

Perhaps the common name San Pedro played a role in the initial misidentification, similar to what occurred in Dickson's article on San Pedro use. (i.e. *T. bridgesii* use in Bolivia.)



***Trichocereus* sp. W.Baker 5452**

monstrose *bridgesii*

They are (for me) rather slow-growing and very prone to rotting from care. They grow well only if I ignore them.

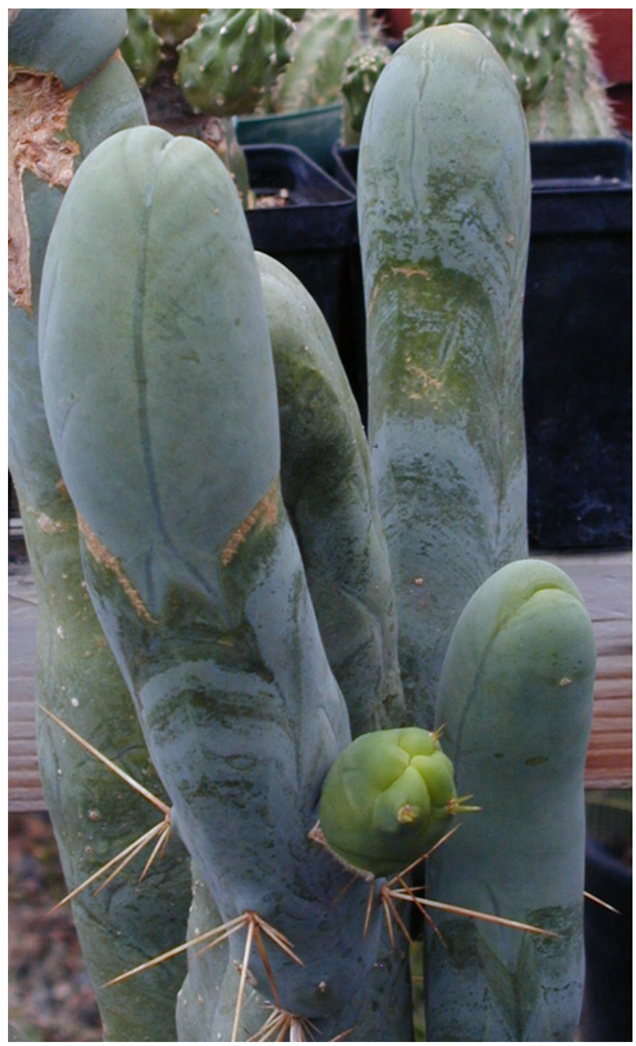
These often nearly nude monstrose forms tend to develop a few spines, especially lower on the branches, appearing unpredictably anywhere else on the stems with age.

There appears to be several distinct monstrose forms of this plant. Another, not adequately pictured here, is far more spiny overall, with fairly long yellowish spines and produces very consistent normal new growth with only the occasional monstrose branch. These are often rooted but tend to revert to mostly normal *longispinus*-looking growth. (See p. 33)

monstrose *Trichocereus bridgesii.* (SS)

Backeberg 1959 has a nice picture on page 1121. He shows both a picture of the monstrose form and a nice plant specimen where both variations we mentioned can be seen. Backeberg calls the spines yellow but those of the denser spined form often looks more reddish brown when young. Some specimens have new spines that are entirely dark brown.

Both adult plant photos by Kamm
Notice the distinctive tall and short forms.

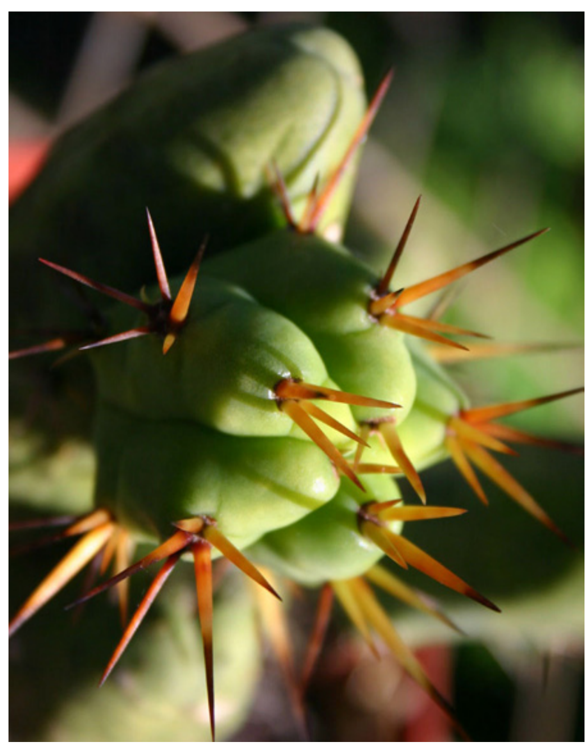


monstrose *Trichocereus bridgesii.* (SS)

Trichocereus bridgesii

We were told by several reliable & reputable sources that the monstrose forms have been successfully bioassayed by a number of people.

Interestingly, monstrose *bridgesii* has been separately reported, by several anonymous sources, to be superior to the normal form and to most *pachanoids*.



cristate growth arising from a monstrose *Trichocereus bridgesii.* top & above left

spiny new growth on a monstrose *Trichocereus bridgesii* cultivated in Oz. lower right Photo by Zariat

monstrose *Trichocereus bridgesii*

(SS)

(B & B)

(B & B)

Reported analysis of *Trichocereus bridgesii*

Tyramine (1-10% of over 50 mg total alkaloids/ 100 gm of fresh)
3-Methoxytyramine (1-10% of over 50 mg total alkaloids/ 100 gm fresh)
3,4-Dimethoxyphenethylamine (1-10% of over 50 mg total alkaloids/ 100 gm fresh)
Mescaline (Over 25 mg. per 100 grams fresh.)
AGURELL **1969b** [Obtained via European commercial sources]
[3,4-diMeO-5-OH-PEA and 3,5-diMeO-4-OH-PEA are also listed **in error** for *T. bridgesii*. The reference cited, AGURELL 1969b, did not report either compound.]
Bridgesigenin A (a triterpene: 0.0378% dry wt.)
Bridgesigenin B (a triterpene: 0.00657% by dry wt)
Both triterpenes by KINOSHITA *et al.* 1992 [Both triterpenes arose via acid hydrolysis of the saponin fraction]
Reported to contain kaempferol & quercetin (flavonols)
RICHARDSON 1978 (based on acid hydrolysis)

All forms & varieties of this species are believed to contain mescaline, showing variability similar to that exhibited by *T. pachanoi* with concentrations ranging from extremely potent to nearly inactive.

Potency & palatability can vary as much as their appearance and are purported to not always be correlated with each other.

The ***Eusaporus*** **clone**, the materials referred to here as **San Pedro Amsterdam** & **San Pedro WOH** & **sp. SS02** & the **monstrose** form are all said to be exceptional.

Comments based on conversations with friends, DAVIS 1983, DAVIS 1997, DAVIS 1999 & also 1998 *Entheogen Review* 7 (3): 70-71.

(B & B)

The degree of sliminess for *T. bridgesii* is noted by growers to range from extreme to almost lacking.

There are still many unresolved questions about the influence of watering history and the season & time of day chosen for harvest in terms of the mucilage content.

monstrose *Trichocereus bridgesii*
tall form

Backeberg claims to be responsible for bringing the monstrose *bridgesii* in cultivation. He commented this was a mutant clone-line that arose in a large lot of seeds he had planted.

We have no doubt that Backeberg is responsible for a clone of the monstrose *bridgesii* being under cultivation but doubt that it was the only one and are unclear which of the known forms was Backeberg's.

Trichocereus cuzcoensis Britton & Rose

Mescaline was reported at 0.5-5 mg. per 100 grams of fresh material

Urubamba Valley at 3500 m. Ritter found it with larger flowers below Cuzco at Chillca and at Chalhuanca (Dept. Apurimac.)

***Trichocereus cuzcoensis* Peru 57.0360 flowering**

The species was originally collected in Peru (Cuzco region) by J.N. Rose on 1 September, 1914 (Rose 19022) Ressler 2000 notes that it occurs south of Cuzco in the Vilcanota Valley at 3000 m and north of Cuzco in the

This is a densely branching species that grows erect to 6 meters high in the wild. To 3 meters in California: Ressler 2000 [“*branching freely from the base*” Borg 1937] Ressler 2000 also describes as freely branching.

Light green at first (Backeberg 1977) [Pale green passing to dull green: Borg], branches 7-10 cm thick Ritter 1981

Branches have 6 to 8 (Britton & Rose 1920 & Ritter 1981) [(7-)8-9(-10) Ressler 2000], low, rounded ribs,

Rib width can range from 2-3 cm higher on the plant to 4-5 cm lower. Ressler 2000

Areoles are 7-12 mm long; spaced 10-12 mm apart at the type locale (Cuzco) but farther apart at other places: Ritter 1981. Set 1.5 cm. apart: Backeberg 1977; Set 1 to 1.5 cm apart: Borg; Areoles are ~8-9mm dia. and set 2.5-4 cm apart: Ressler 2000.

Branches are somewhat notched with areoles obscured by ample felt. Ritter 1981

Areoles, surmounted by a slight v-notch, start whitish and turn grey: Ressler 2000 [Brown areoles: Borg]

Areoles on new growth are more rounded than oval areoles on older growth: Ressler 2000.

Spines are yellow (Backeberg 1977 & Ressler 2000), radial spines yellow but often turning amber and grey with age: (Ressler 2000); brownish and passing to grey (Borg), brown with several stronger and longer spines that are partially brown (Ritter 1981)

The areoles have numerous spines (to 12) which are subulate and thickened below, growing to 7 cm. long (Backeberg 1977)

Spines are strong and straight: Borg.

Usually 8-16 radial spines, mostly at the lower edge of the Areole, these are fine and 10-15 mm long. Ritter 1981

Towards the upper edge of the areole, the spines are not sharply separated and are stronger. The upper spines are awl-like and 15-30 mm long. Ritter 1981

Around 2-4 robust central spines, ~4-8 cm long. Ritter 1981

2-4 longer spines are placed more or less as centrals and there can be up to 15 spines per areole. Ressler 2000

Radial spines are shorter and thinner than the centrals and curve slightly on older growth Ressler 2000

Flowers are white and around 14 cm long (Backeberg 1977).

Ovary and tube are scaly and hairy: Borg 1937

Description from:

Backeberg 1977: page 494.
Borg 1937: 14; 1976: 183
Ressler 2000: pages 309-312
Ritter 1981: page 1327

High branches can have smaller spines with oval areoles. Ritter 1981

Britton & Rose described the flowers as 12-14 cm long. Ritter measured a flower below Cuzco at Chillca that was 20 cm long. Similarly long or a little shorter flowers were found at Chalhuanca (Dept. Apurimac)

The latter are similar to the Type but with less spination.

***Trichocereus cuzcoensis* Peru 57.0360 (Berkeley)**

A peculiar flowering was noted at Chalhuanca that was closer to the apex similar to *T. pachanoi*, erect and oblique towards the top; spreading outwardly far apart.

Nectar chamber of only 13 mm.

Ovary around 8 cm long with brown wool

Filaments 6-7 cm long; those of the seam 3.5 cm long.

Stigma 14.3 cm long with 16 lobes that were 25 mm in length.

White Petals are 7-8.5 cm long and 2.7-3.3 mm wide

Seed like that of the type from Cuzco. Very similar to that of *T. pachanoi* but with an arching hilium

Fig. 1190 shows a *cuzcoensis* at CHALHUANCA in bloom. Ritter 1981

***Trichocereus cuzcoensis* Peru 57.0360**
(whole page)

Trichocereus cuzcoensis **Peru 57.0360**

Flowering began when 4-5 ft tall on plants started from cuttings.

In California flowering occurred "*late July through the first few weeks of August*" [RESSLER 2000].

Flowers were borne between 8" and 24" from the apex on Ressler's plants. [Ressler 2000].

In 2002, in Berkeley, California we witnessed buds in May, flowers opening as early as June 8 (and as late as midAugust) with ripe splitting fruit in July and August.

Karel KNIZE offers cristate specimens of **KK340** for sale.

T. peruvianus f. *cuzcoensis* and *T. peruvianus* var. *cuzcoensis* are probably the same as *T. cuzcoensis*. This tentative conclusion is based on the observation that, when a KK# is included, ALL bear the collection number **KK340**.

However, as logical and rational as this might seem to be, please see our comments about Knize-numbering which are made farther below under KK242.

Trichocereus cuzcoensis **(NMCR)**
from KK340 seed
Photo by MSSmith
Compare to *T. peruvianus* v. *cuzcoensis* KK340
(NMCR) on page 159.

Trichocereus cuzcoensis **(Cactus Gems)**
Photo by Logan Boskey
upper right

Trichocereus cuzcoensis **Peru 57.0360**
lower left

Trichocereus cuzcoensis **(GF)**
a field collection from the Eltzner collection.
center and lower right

Trichocereus cuzcoensis **(GF)**
upper left & right

Spiny pup is new growth at base of plant on the upper left.

The four images on pages 60-61 are of a single clone.

Trichocereus cuzcoensis **KK340**
cutting obtained directly from Karel Knize
lower left & right

Photographs of ***Trichocereus cuzcoensis*** published in;
RESSLER 2000: 309 & 310; flower 310 & 311; fruit 312.
RITTER 1981: page 1552, figure 1190
SCHUSTER 1990: page 216

RESSLER 2000 also reported that a single plant grew ~15 inches in a year but others grew more slowly.

He recommends keeping the soil loose or planting on mounds to minimizes the impact of foot traffic.

RESSLER 2000 also noted that the region where the cold tolerant ***cuzcoensis*** originates receives an average rainfall of 32 inches per year (86% of which occurred in the months from October through March) with annual extreme temperatures ranging from 23-84ºF. (All monthly average nighttime minimums were below 37ºF with monthly average maximum daytime highs ranging from 73-84ºF) Yearly average temperature 54ºF

RITTER 1980 assigned **FR 677a** to his collection from Chalhuanca (Dept. Apurimac)

Karel KNIZE reported collecting **KK340** near Cuzco around 3200 meters.

Published analysis of *Trichocereus cuzcoensis*

Using GC-MS, over 50 mg. of alkaloids per 100 grams of fresh plant was found, of which:
3-Methoxytyramine was present as over 50% of total alkaloid
Tyramine formed 1-10% of the total alkaloid.
Mescaline formed 1-10% of the total alkaloid.
3-Hydroxy-4,5-dimethoxyphenethylamine* was present as traces
AGURELL *et al.* 1971b
There was no indication made as to the form chosen for the analysis. The material was from European nursery stock.

Using glc-ms and mass fragmentography, LINDGREN and coworkers identified:
3-Methoxytyramine
Tyramine
Mescaline
3,4-Dimethoxy-5-hydroxyphenethylamine*
LINDGREN *et al.* 1971
[*3-Hydroxy-4,5-dimethoxyphenethylamine is a synonym of 3,4-Dimethoxy-5-hydroxyphenethylamine.]

There was no indication as to the form used for the analysis. The material was European nursery stock.

DJERASSI *et al.* 1956a found β-Sitosterol and a long-chain aliphatic alcohol but reported finding no alkaloid in material harvested near Cuzco. See comment elsewhere on DJERASSI

Bioassays of wild material growing in the Cuzco area have been reported to have yielded multiple negative bioassays. There is, however, one bioassay said to have used the same material that was claimed strongly effective. No details are available but more work is clearly needed.

This species is also suspected as the identity of a glaucous cactus being sold in the Cuzco marketplace with the spines removed with longitudinal slicing down the ribs. They were said to be used as a hair rinse but further questions revealed it could also be used "*for flying*" as well. (Respondent requesting anonymity; besides witnessing the despined cacti, they saw living plants and piles of removed spines outside Cuzco.)

It is further claimed that horticultural material has been successfully bioassayed, and that some strains rival *T. peruvianus* in potency but so far any such anecdotal claims lacked details. The discovery of some active forms existing within this species would not be surprising

One ethnobotanical company had listed a *Trichocereus Cuzco*, claiming it rivalled peyote in potency, but more recently altered this to "*Trichocereus peruvianus* hybrid". This was later altered to *Stenocereus hystrix*. See photos in Part A.

Another ethnobotanical seller offers *T. cuzcoensis* that is demonstrably active and potent at 25 grams dry weight. This material was collected at Huamanga, Peru but we have some questions concerning the identification. See a photo in Part A.

***Trichocereus cuzcoensis* Peru 57.0360**
(Be aware that the more spiny *Trichocereus chalaensis* is behind it)
Photo taken 8 June 2002

Trichocereus fulvilanus Ritter

Traces of mescaline.

Originally collected in Chile (Taltal, or from Chañaral to El Cobre)

Renamed *Echinopsis fulvilana* (Ritter) Friedrich & Rowley in Rowley 1974

Trichocereus fulvilanus is grass-green to greyish-green [dark greyish:green: Innes & Glass], growing 1.5 meters high or more [3 to 4.75 ft.: Innes & Glass]

They branch from the base, with branches that are 4 to 7 cm. in diameter. It has 8-12 (sometimes 13) obtuse ribs that are notched across half the length, with shortly oval areoles to 1.25 cm. long.

Areoles have orange to reddish or yellowish felt at first, later it is brownish black. [Innes & Glass describe the areoles are large and white felted.] Seedlings have a light brownish felt which becomes whitish from the base upwards.

The spines are dark brown then greying. There are 9-12 radial spines that are dissimilar and thinner to subulate, mostly 1.5 to 3 cm. long. The 2 to 4 (sometimes 6) central spines are spreading and 3 to 10 cm long, occasionally reaching 18 cm.

The apical perfumed flowers are 9-12 cm. long and 7-9 cm. in diameter, with grey and black hairs. [Nocturnal flowers borne in summer: Innes & Glass]

Fruit is green and spherical, around 4 cm. in diameter with matte black seeds, 1.2 mm. long.

Backeberg 1977; page 494.

[Requires sun and 50°F min. Entry with picture (in flower): page 295. Innes & Glass (1991)]

Backeberg [and also Hunt] regarded *T. fulvilanus* to be a form of *T. deserticolus*. Werderman's original type-material of *T. deserticolus* is believed to have been destroyed at Dahlen. Most growers agree with Backeberg. It might be added that Friedrich, Rowley & Glaetzle kept them separate.

Using GC-MS; over 50 mg of alkaloids per 100 grams of fresh plant was found by Agurell, of which:

Tyramine was present as 10-50% of total alkaloid

N-Methyl-tyramine formed 10-50% of total alkaloid.

Mescaline was present as traces.

Agurell *et al.* 1971b

Analysis of this species using wild adult plants is needed; as well as for *Trichocereus deserticolus*.

Unlike *T. fulvilanus*, *Trichocereus deserticolus* appears to be fairly common as cultivated material

Despite Agurell's report of trace amounts, there is an anecdotal account of a successful human bioassay using material cultivated in the US under this label. The material examined had only 7 ribs suggesting that it might have been misidentified but this does suggest that material being cultivated under this name needs a closer look.

As does the material designated *T. peruvianus* var. *fulvilanus*

Trichocereus fulvilanus
Photo by Graham Charles
reproduced with permission

Trichocereus macrogonus (Salm-Dyck) Riccobono

Mescaline was reported at 5-25 mg. per 100 grams of fresh plant.

Trichocereus macrogonus **South America H1306 (Huntington)**
Photo by Kamm

The actual origin of this species is uncertain. Salm-Dyck originally described it in 1849 (as a *Cereus* sp.) from a specimen growing in the Berlin Botanical Gardens that included no point of origin. **[Note 13]**

[Schumann listed it as originating from Brazil but the plant described was later proven to be *Cephalocereus arrabidae*. The illustration [see p. 26] in DeMartius 1890 seems to be a creative composite but the body and fruit do resemble those of a *Cereus*X(*Cereus*X*Trichocereus*) that we have seen.

According to Backeberg, it was apparently never recollected from the wild but now *T. macrogonus* **KK923 Cieneguillas, Bolivia 3000m** & **KK1422 Villa Abecia, Bolivia** 2800m exist. (see page 259)

[Borg 1976 says Bolivia and Argentina.] [Mata & McLaughlin 1982 say simply "*South America* ".]

Horticultural material labeled *Cereus tetracanthus* Labouret (from Chuquisaca, Bolivia), *Cereus tephracanthus bolivianus* Weber **[Note 14]**, *Cereus bolivianus* (No. 6231 in the New York Botanical Garden) are all thought to be *forms* of this species.

Cereus hempelianus Bauer is believed to be a stout, bluish-green variety. Britton & Rose 1920.

Quite oddly, Friedrich & Rowley renamed this *Echinopsis macrogona* without mentioning how they differentiated between it and *T. peruvianus*, AND without adequate descriptions existing for EITHER species which can provide meaningful discriminants.

A *Trichocereus* specimen (***T.* sp. Rauh K 68-1954**) collected by Rauh in 1954 at 1900 meters in the Apurimac Valley of central Peru was believed to be a wild form of *T. macrogonus* by Backeberg.

Britton & Rose equated with *Eriocereus tephracanthus* Riccobono but this needs evaluation.

Eventually it grows to over 2 meters tall. [Britton & Rose describe as "*probably tall*" and stout but often slender in cultivation]

It is branching, with bluish-green branches, frosted at first, around 7 cm. in diameter [5 to 9 cm: Borg]. Blue color is most pronounced on young growth.

Usually possessing 7 low, rounded ribs [6 to 9, usually 8: Borg] 1.5 cm high [At least one seedling MS Smith grew from verified European seed stock showed 10 ribs] Separated by acute intervals.

They are more or less depressed over the large grey areoles which are set 1.5 cm. apart [1.5 to 2 cm. apart: Borg].

[All specimens that I have thusfar examined, including the Huntington and seed grown material from European sources, have had light brown new felt; turning grey with age..]

There are 6-9 subulate radial spines [5-8 mm] up to 2 cm. long with 1-3 central spines that are stouter and longer [about 2 cm]. [Centrals can reach 5 cm but are usually up to 3 cm long: Borg] Horn-colored to brown spines, later becoming blackish or dark grey or greyish-brown. Spines are acicular.

White flowers can reach 18 cm. long. [Ovary and floral tube are scaly and have brown hairs. The petals are white and the sepals greenish. They occur at the top of the plant, usually in groups of 2 to 4 or more. They bloom together. Borg]

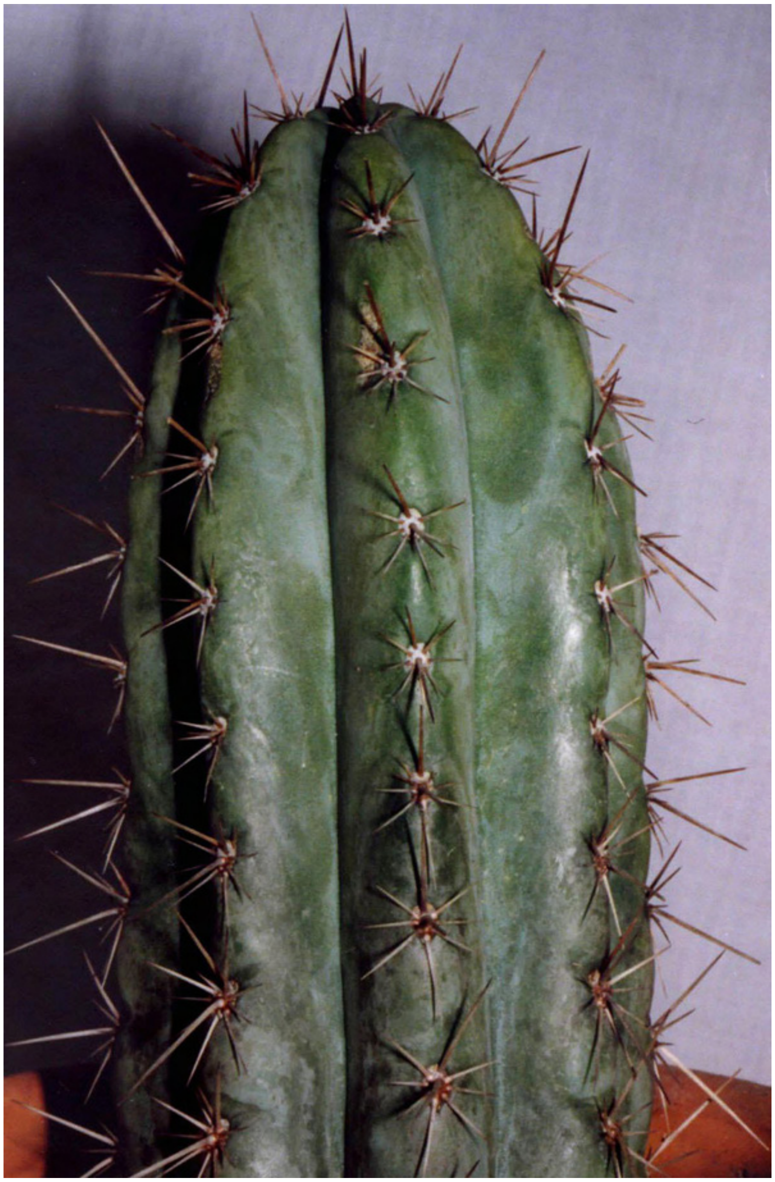
[Flowering in June-July. Olmos 1977 p. 139 features a color photograph. Bob Ressler does too at: http://www.columnar-cacti.org/trichocereus/t_macrogonusfl.jpg]

Fruits are 5 cm. in diameter and "*rather broadly spherical*" with glossy black seeds.

Britton & Rose 1920: page 136 &
Backeberg 1977: page 495.

Trichocereus macrogonus
South America H1306 (Huntington)
column details

Trichocereus macrogonus
(AN; Australia)
Photo by Snu Voogelbreinder
(plant was unlabeled)



***Trichocereus macrogonus* (A)**
Photo by Logan Boskey

OLMOS 1977 recommend a 3° C minimum.

Backeberg and Borg both note that this species makes a robust grafting stock. This is true, as it is for *T. candicans*, a non-mescaline containing *Trichocerei*, but the pronounced spination may have a tendency to dislodge the grafted scions.

Easy from seed. Plant when hot.

Perhaps the sturdiest, toughest & most robust of the *Trich* seedlings.

Reported Analysis:
10-50 mg. of total alkaloid per 100 gm. fresh;
Mescaline (MS, IR) (Over 50% of total alkaloid)
3,4-Dimethoxyphenethylamine (MS) (1-10% of total)
3-Methoxytyramine (MS) (1-10% of total alkaloid.)
Tyramine (MS) (1-10% of total alkaloid.)
AGURELL 1969b

Same reference is cited by MATA & MCLAUGHLIN 1982 who also cite RETI 1950 which surely must be a typo.

The analysis above suggests that this plant may not be usable for consumption unless used for extraction purposes, as the range given above would require 1.6 to 8 kg. of fresh plant per 400 mg of mescaline.

Now back to the real world; unidentified sources reported strong effects from bioassays of this species. They believe it (subjective and experientially) to be much stronger than San Pedro. Personal communication relayed via J.HANNA, June 1997.

Since that time I have heard reports from other people who had separately evaluated the species and found it superior to San Pedro in its lack of slime and its potency. [2 to 2.5X commercial San Pedro]

There is also a claim that much of what is believed to be *T. peruvianus* (in the commercial market) is actually *T. macrogonus*. While some confusion certainly exists, the question as to how much remains.

More work is needed to better define the concentration in this species. AGURELL is the single analysis in the literature and used plants cultivated in northern Europe.

A demonstrably high variability in more than just simple palatability is one reason the analysis above should be regarded with some additional questions.

A wide range of macrogonoids are available.

Please compare to each other and to the *peruvianoids*.

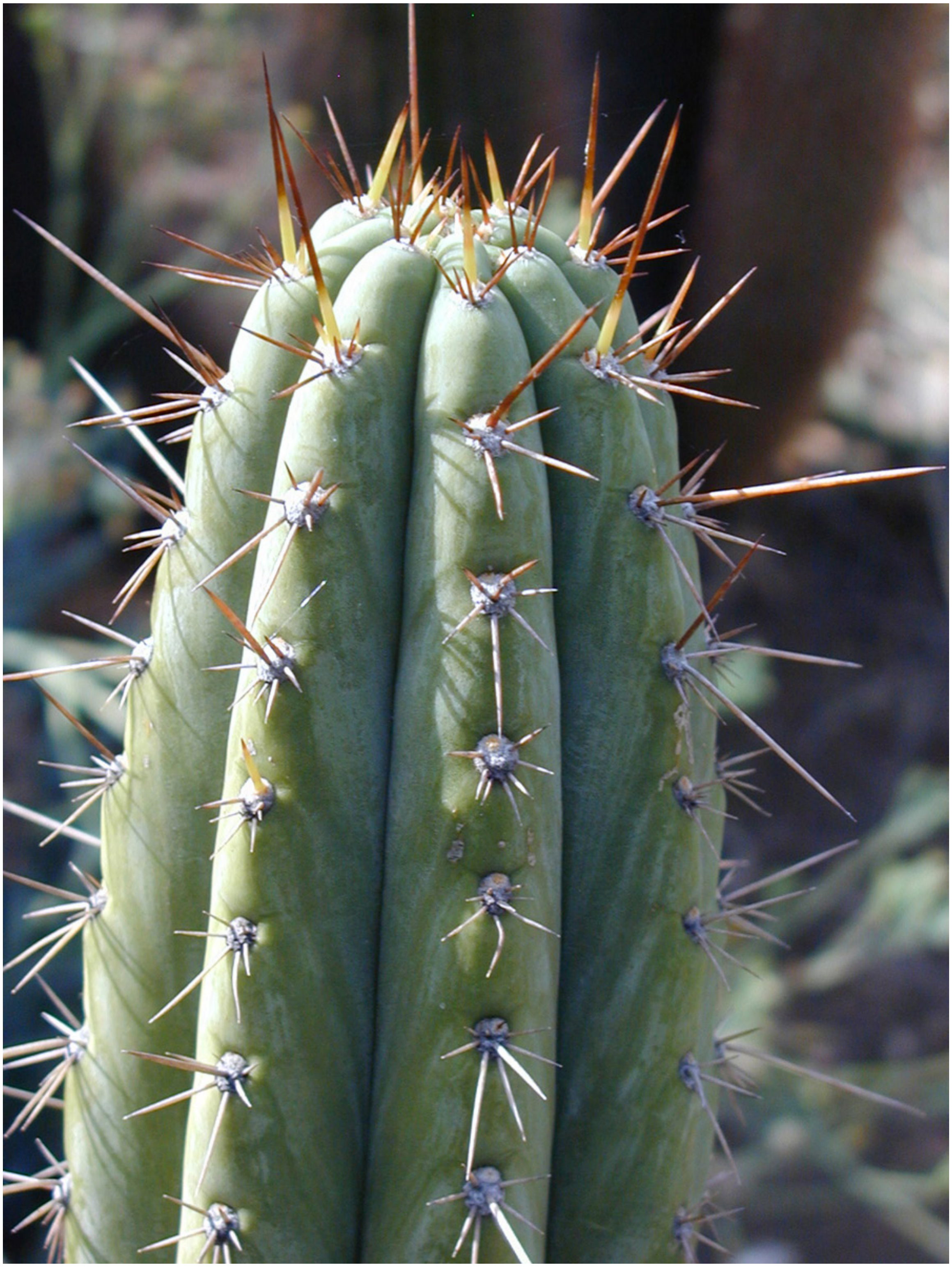
Trichocereus macrogonus
(Hobart Botanical Gardens)
Photo by RKundalini

Trichocereus macrogonus **South America H1306 (Huntington)**

Sadly the Huntington material has no information available as they have either lost or misplaced the file card containing its acquisition data.

The staff commented that its number indicates it to be one of the Huntington's early acquisitions but they can discern nothing further.

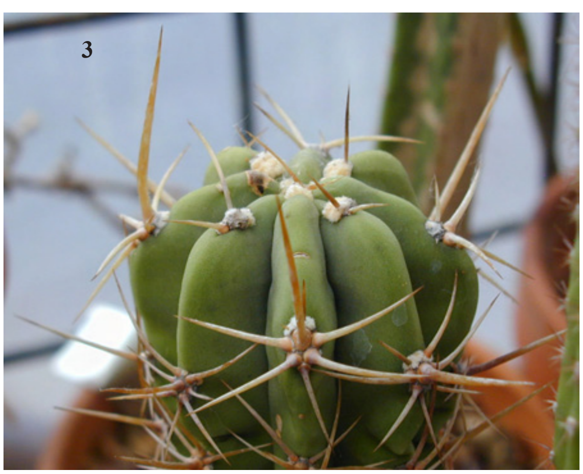
Trichocereus macrogonus **South America H1306**
(Huntington)



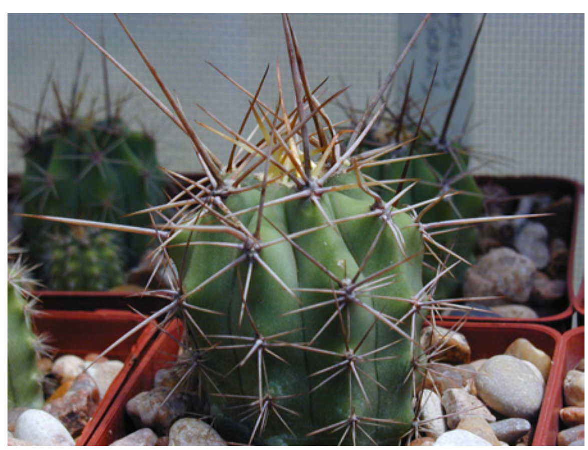
Trichocereus macrogonus **South America H1306**
(Huntington)

***Trichocereus macrogonus* (Koehres) seedlings**


grafted but same age as seedlings upper right




same macrogonus seedlings; nongrafted



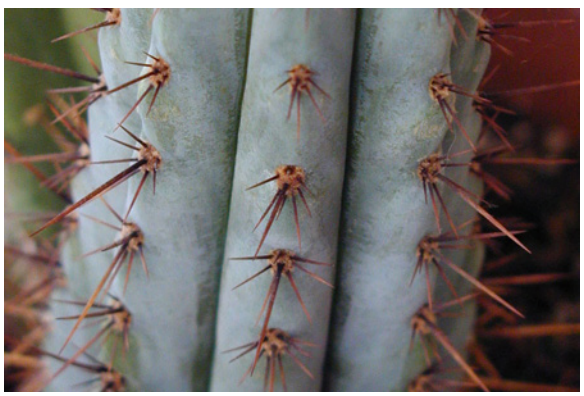
All of there are from the same lot of seedlings.
First three are paired chronologically.

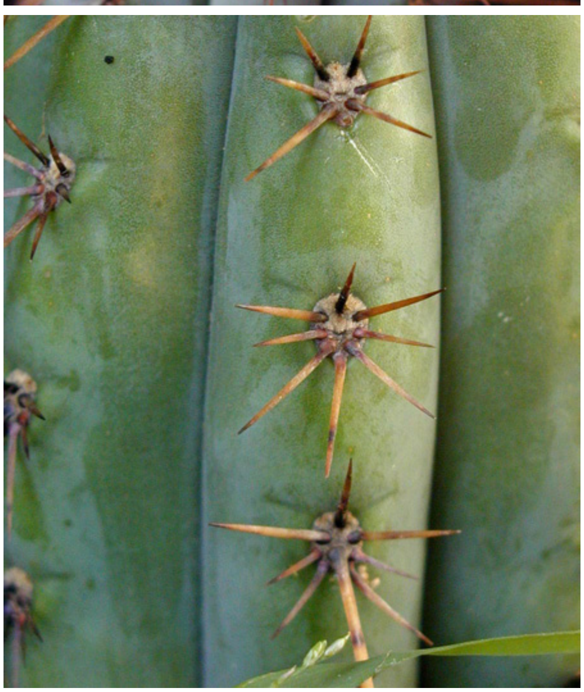
Left hand column is grafted.

Right hand column is nongrafted.

Trichocereus macrogonus **(RS0004)**

This is a proven clone of reliable potency.





Lower left is younger growth and lower right is older section lower on the same branch

Trichocereus macrogonus **(RS0004) entire page**

***Trichocereus macrogonus* (RSfat4)**
Another tried and true *macrogonus* form. Said to have good potency and not excessive slime.

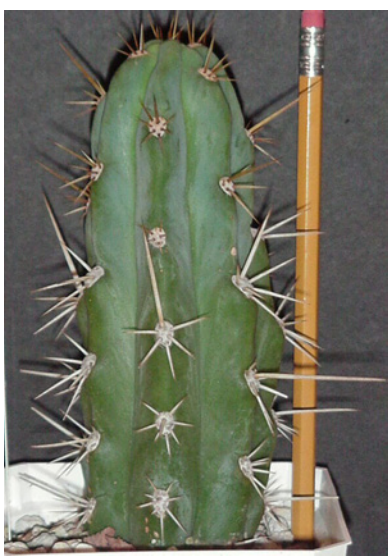
***Trichocereus macrogonus* (RSfat4)**
Note transient leaves on new growth

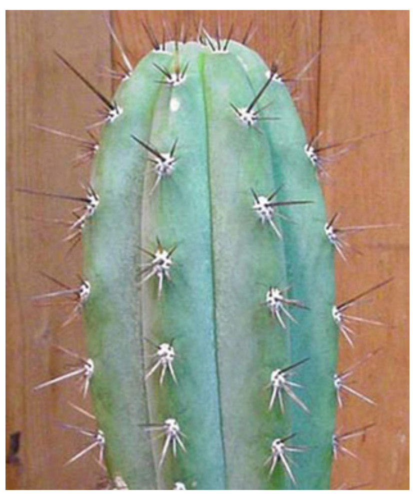
***Trichocereus macrogonus* (RSfat4)**
entire page except for lower right

***Trichocereus macrogonus* (Strybig)**

***Trichocereus macrogonus* (Strybig) lower right**

A specimen of *Trichocereus macrogonus* owned by Sasha Shulgin. (Both above.)





Six specimens obtained under the name *Trichocereus macrogonus*
2 photos above & 1 on right by MS Smith

Obtained unlabeled but appearing to be a *Trichocereus macrogonus* (AN; Australia)
Photo above by Snu Voogelbreinder

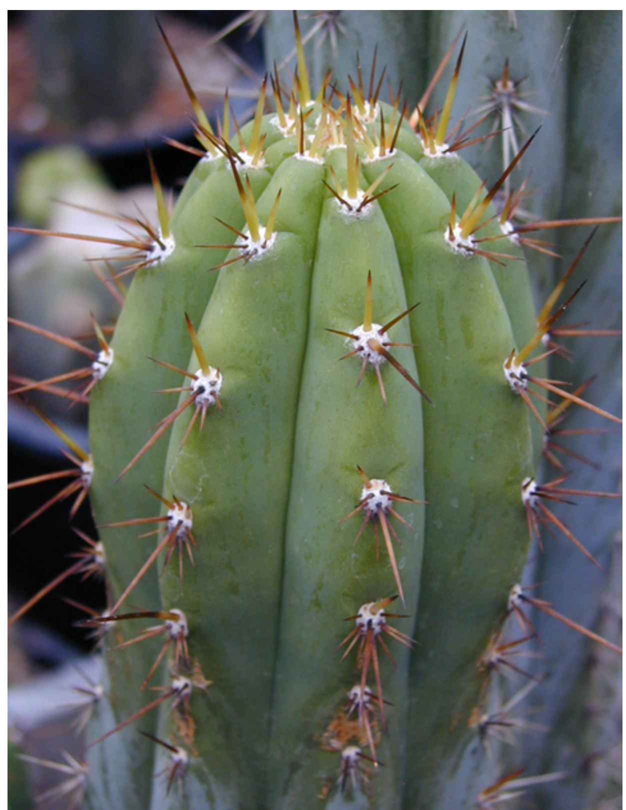
Some unclear *macrogonoids*

We are not clear if these would be better off placed in *macrogonus* or *peruvianus*. Names merely reflect sources of origin.

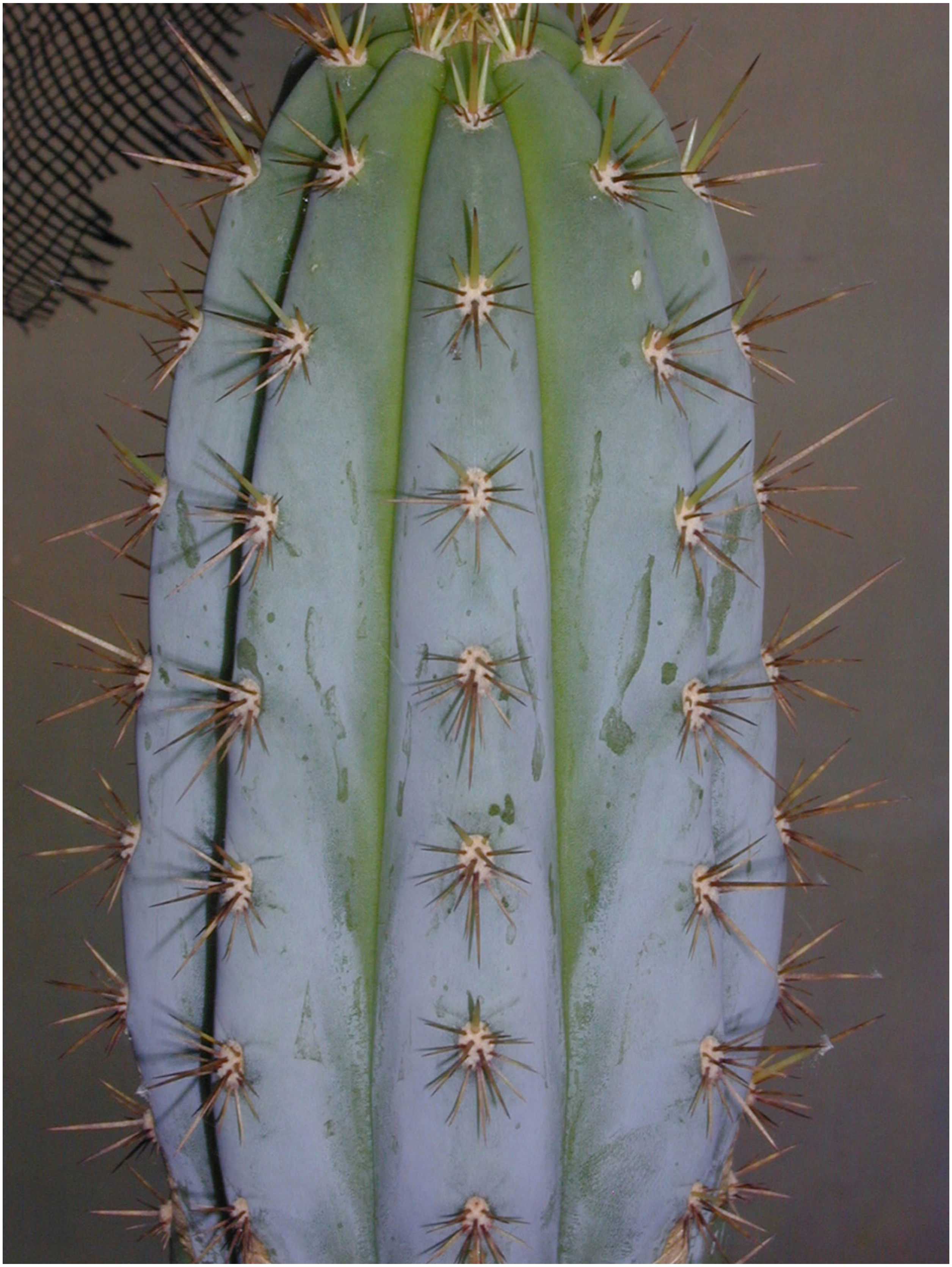
Trichocereus **sp. (Burbank Gardens/ Luther Burbank)**

Believed to be a *T. peruvianoid* selected from the wild near Cuzco. It is now available but so far as we can tell, nothing is known of its chemistry. As is the case with so many of these 'unknowns', they are more likely to be active than not.

(Compare to Neon Palm)



Burbank Gardens/ Luther Burbank



Trichocereus macrogonoid/peruvianoid **Burbank Gardens/ Luther Burbank**

***Trichocereus* cv. Neon Palm (RS)**
Named by RS for the nursery selling it. Bioassay and analysis are apparently lacking.

cv. Neon Palm (RS) above

***Trichocereus* cv. "Oklahoma"**
Encountered unlabeled in an Oklahoma nursery Assigned this designation by ML.

Oklahoma (ML)

[For ***Trichocereus* sp. SS02** See under the *Trichocereus bridgesioids* entry.]

[For ***Trichocereus* sp. SS03** See under the *Trichocereus peruvianoid* entry.]

***Trichocereus* sp. SS01**

Appears to lie somewhere in between *T. peruvianus* and *T. macrogonus*. Points at variance with *T. macrogonus*: persistent yellow on some spines and brown felt on areoles. Points at variance with *T. peruvianus*: forms up to 9 ribs. This is a very bluish-green & highly ornamental strain which needs wider propagation. Fast growing and very robust. Material examined (two 5" diameter cuttings with pups) had central spines up to 2 inches; mostly directed downwards (one upwards when 2 were present)

It is said to show a strongly prostrate habit once large.

Photo above by Kamm

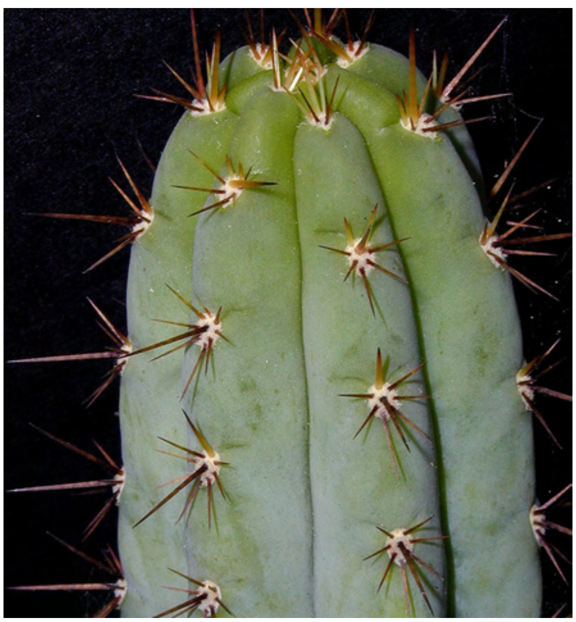


Photo above by Kamm

***Trichocereus* sp. SS01**
entire page

***Trichocereus* sp. SS01**

mislabeled as
***Trichocereus grandiflorus* (NMCR)**

SS01 new growth above

Photos by MS Smith

For comparison:

Authentic *Trichocereus grandiflorus*
Photo by ML

Macrogonus as represented in the US appears to be quite active although variable in potency and degree of slime.

The **RS0004** is purported to yield a nearly nonslimy beverage that is palatable and potent. The solid pulp is claimed to spontaneously separate from the liquid when run in a blender; unlike the nonspontaneously separating thick foamy mucus-like slime that results from most *macrogonus* forms if treated that way. We have been told this rather than witnessing it.

In contrast, the form from the Huntington Botanical Gardens is reputed to be active but excessively slimy.

European stock often seems to be much less potent than some of the forms under cultivation in the US.

A *macrogonus*-sourced
"pot of snot"
Photo by Anonymous

Unidentified *Trichocereus* specimen (California)
top two images

***Trichocereus* sp. 72674 (HBG)**
lower left

***Trichocereus chalaensis* (BBG)**
center right

***Opuntia cylindrica* (FK)**
lower right

monstrose *Trichocereus pachanoid* (SS)
This clone shows on-again, off-again monstrose growth.
There are a number of such clones known

Trichocereus pachanoi Britton & Rose

Named for Professor Abelardo Pachano (of the Quinta Normal, Ambato, Ecuador) who traveled with Dr. Rose through the Ecuadorian Andes in 1918.

The type specimen was collected by Joseph Nelson Rose, Aberlado Pachano and Nathaniel Lord Britton at Cuenca, Prov. Azuay, Ecuador, 17-24 September, 1918. [J.N.Rose, Pachano & G.Rose 22806; (NY)]

Britton & Rose 1920: page 135 & Madsen 1989.

Mescaline recoveries reported:
0.025%-0.12% reported isolated from fresh plants.
0.331%-2.0 % reported recovered from dry plants.

***Trichocereus pachanoi* (GF) flowering**

Over 25 mg. per 100 grams of fresh plant (0.025%). 25 mg per 100 grams represents 1600 grams for 400 mg dose of mescaline. Juiced, this is between a pint and a quart. This is a low figure unless using only young cultivated plants, in which case it is a good estimate.

Similarly, Jim DeKorne says 100 grams of dry weight (1 kg fresh wt.) for 300 mg. mescaline. [This apparently comes from Crosby & McLaughlin's figure which is among the lowest reported in the literature. While it may be accurate for young plants, some cultivars, or poor extraction technique, if a person was to use this and be fortunate enough to have material which assayed as well as Poisson's, they would get a 2 gram dose. This may or may not be appreciated. Many will not willingly sample a full gram more than once. It should be stressed that one cannot assume constancy in the matter of alkaloid concentrations in plants

A more in depth look at the various reports follows, later in this section, under "Chemistry." **[Note 15]**

Common names include: '*achuma*' (in Bolivia), '*aguacolla*' [or '*agua-colla*'] and '*gigantón* ' (both names used in Ecuador), '*huachuma*' (in the northern Andean region) [early Spanish accounts in northern Peru mention that it was then called '*achuma*'], and '*San Pedro*' (in northern coastal Peru)

Schultes & Hofmann 1992: p. 155

Gigantes appears as its name, in Northern Peru, within the 1768 account of Marcos Marcello's trial for being a healer who used San Pedro. Glass-Coffin 1998 **[Note 16]**

Reyna Pinedo & Flores Garcés 2001 give *la paja* and *huachuma* as common names used in Peru

Backeberg 1959 gives "*achuma*" as the name used in the Cochabamba province of Bolivia (mentioning that this is how Cardeñas had labeled a photo.)

Additional names listed in Rätsch 1998 or Reyna Pinedo & Flores Garcés 2001

aguacolla-cactus alucinógena	*kachum*
cardo	*rauschgiftkaktus*
cimarrón	*San Pedro Hembra*
cimora blanca	*sampedro*
cuchuma	*San-Pedro-kaktus*
huachum	*San Pedrillo*
huando hermoso	*simora*

"*Candle cactus*" is another name used in California.

"*Torch cactus*" also appears in the literature: this is a fairly generic name used by some for many such Cereoids.

Evans 1979 made a claim that the cactus was named for the northern Peruvian coastal town of San Pedro but as no other source stating this has been encountered, this is included with reservations due to the wealth of mythology and general ill-informedness that Evans so casually presents as facts. (He does however correctly give San Pedro as the name used for this cactus in Bolivia.)

As is encountered with other sacred plants, some curanderos simply use the word '*hierba*', meaning "*herb*", to refer to the San Pedro brew. Glass-Coffin 1998

Rätsch 1998 notes that indigenous users recognize two forms of this cactus; a male with long spines and a female with short or absent spines.

Carlos Ostolaza commented that *T. peruvianus* is known as *San Pedro Macho* and is regarded as a higher potency form of San Pedro by traditional Peruvian healers.

Friedberg 1964 similarly made comments about healers in the Huancabamba region raising specific cultivars that had been selected for their efficacy.

While we will mention it again, we should add at this point that Holguín made reference to '*ahuakolla*' as a type of large spined 'gigantón'.

It has been claimed by some growers that *T. peruvianus* is what was used traditionally in earlier times and not *T. pachanoi* but the rejection of the latter flies in the face of all the available evidence. It has long been my belief that BOTH of these have been employed since early times [as, no doubt, has *T. bridgesii* & other similar species]. Some circumstantial archaeological evidence, suggesting this, is included under the entry for *T. peruvianus.*

It must be remembered however that *T. pachanoi* itself can sometimes have fairly long spines.

This species is considered, along with the rest of *Trichocereus*, to be more properly referable to the genus *Echinopsis* by many, but not all, authorities.

The first to 'describe' it as *Echinopsis pachanoi* (Britton & Rose) Friedrich & Rowley was Heimo Friedrich & Gordon Douglas Rowley (1974) *I.O.S. Bulletin* 3: 96 (This is actually a simple renaming lacking a description)

An earlier, and rejected, attempt to rename it *Cereus pachanoi* (BRITTON & ROSE) WERDERMANN was mentioned in BACKEBERG (1931) *Neue Kakteen* 73.

As synonyms RÄTSCH includes *Cereus peruvianus* nom. nud. and *Cereus giganteus*. Both of these names were very improperly applied to this plant in Peru fairly early in its modern history; both are more frequently and far more properly applied to other species **[Note 17]**.

Almost all authors have commented on the fact that San Pedro (St. Peter) **[Note 18]** is considered to be the keeper of the keys to Heaven.

E. Wade DAVIS 1983 mentions that three varieties of San Pedros or Huachuma were recognized locally in northern Peru, "*la curandera*, *la huachuma misha* and *huachuma rastrera*." [The distinguishing characteristics were not included], [citing FRIEDBERG 1960: page 25]

Trichocereus pachanoi was originally collected in Ecuador's Chanchan Valley **[Note 19]**.

***Trichocereus pachanoi* KK339**
Huigra, Chanchan, Ecuador

SCHULTES & HOFMANN 1980 give its occurrence as Andean Ecuador and Peru and probably also Bolivia; between 6,000 and 9,000 feet.

BRITTON & ROSE also give the same (2000 to 3000 meters)

OSTOLAZA 1982 mentions occurrences in Quebrada Santa Cruz, Ancash Dept. at 3300 meters.

BACKEBERG 1959 similarly gives the same elevations of occurrence; mentioning RAUH finding a specimen at 3300 meters "*in der Quebrada Santa Cruz* (*Cordillera Blanca...in Peru)*"

In a 2005 email, Manuel TORRES commented on encountering it just over 13,000 ft in northern Peru.

Besides the Chanchan Valley in Ecuador, and the Huancabamba region of Peru, BACKEBERG mentions that it is especially cultivated in the Cochabamba Province near Angostura in Bolivia around 2560 meters, but that it apparently exists in the wild there as well. [Stating CARDEÑAS illustrated this occurrence with a photo.]

DICKSON 1978 made the claim that she found it to be most common in Bolivia over 11,000 feet.

[Alana CORDY-COLLINS 1980 says it grows from sea level to near 3000 meters.]

It is widely cultivated and apparently has been for millennia. This has created many taxonomic difficulties.

***Trichocereus pachanoi* HBG 53196**
Cajamarca, Bolivia
(SS)

***Trichocereus pachanoi* OST 90641**
Ancash Dept., Peru; 2300m

SCHULTES & HOFMANN 1992 noted that it is planted on the edges of fields as natural fencing.

BRITTON & ROSE 1920 observed the same widespread cultivation as both "*an ornamental and as a hedge plant*" They felt that while it appeared to be native in some Ecuadorian valleys such as above Alausí, it had been cultivated so long that it was impossible to be sure of its natural habitat.

They picture it growing on the face of a very steep slope **[Note 20]**: p. 135. [Entry is pages 134-135. *Trichocereus* key is on page 130]

Rocky slopes and cliff faces seem to be its favored natural habitat.

"*Some 30 years ago I was responsible for introducing this sp* **[Note 21]**, *which is now regarded as the best grafting stock* **[Note 22]**." BACKEBERG 1977: page 496 (First edition published in German in 1966)

[In BACKEBERG 1959: his introduction of *T. pachanoi* into Western horticulture was said to have been in 1931.]

Trichocereus pachanoi
probably Backeberg's clone

Trichocereus pachanoi is a more or less tree like cactus, growing to 6 meters tall [19.7 feet] ["9-20" feet- SCHULTES & HOFMANN] with numerous branches sprouting from the base or adjacent to injury, rarely from center (of prostrate stems).

A friend of ours produced a seedling of *T. pachanoi* that sprouted 17 branches despite it then only being several inches tall. See page 16.

The bluish green branches are frosted at first. Some varieties tend more towards bluish green and others to bright green or yellowish green. Usually the latter are stouter.

Trichocereus pachanoi
(Southern California)

While they can grow to 4 inches in diameter, they are generally smaller in domestic cultivated specimens.

Larger specimens 5-7(-8) inches in diameter have been reported but they seem rare. The odd reports of even larger specimens need investigation to determine if they are actually the same species. Similar appearing plants with diameters greater than 4" exist that clearly are not *T. pachanoi.*

Adventitious roots, valuable in anchoring the plant on steep rocky surfaces, can form anywhere that the plant is allowed to contact soil and have even been observed within a few inches of the tip of the column in rootbound plants.

BACKEBERG states it to have 6-8 broad rounded ribs, with a transverse depression over the areole. [SCHULTES & HOFMANN refer to them as "*basally broad, obtuse, with deep horizontal depression above areole*."] At least occasionally, this horizontal depression is expressed as a v-shaped groove or mark similar to that seen on *T. peruvianus*. [Observation by TROUT, MS SMITH and several unnamed growers] It also occurs with 5 ribs less frequently [but rather commonly] and more rarely with 4 ribs [SCHULTES & HOFMANN 1992]

The number of ribs per column is often mixed on a given multibranched specimen and may also vary within a single column. The adding or dropping of a rib or two as the stems elongate is not uncommon.

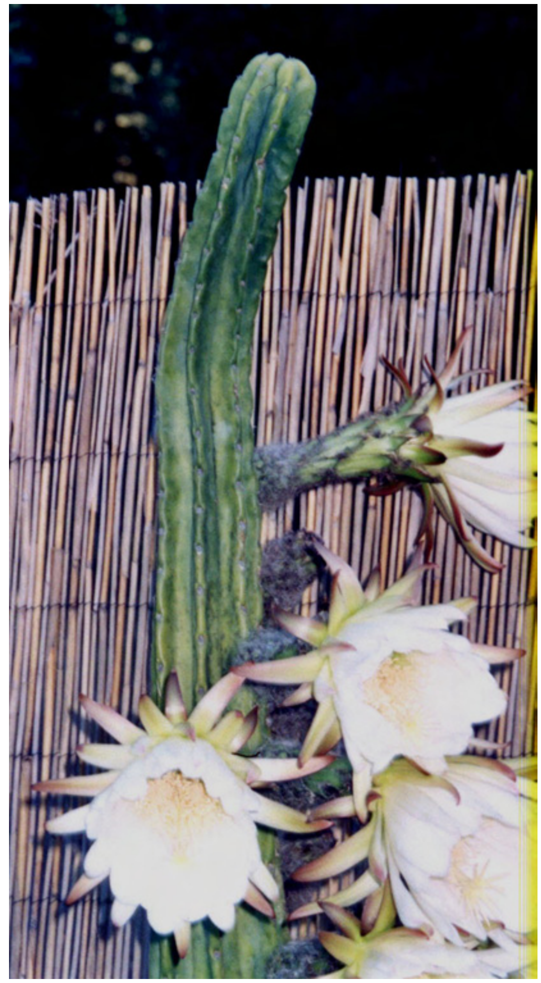
4 ribbed plants, occasionally observed in cultivation, seem have a marked tendency to add another rib or two as they grow in height. We have only seen one 4 ribbed plant in person, this was a short section rather than an entire plant. Similar observations have also been reported to us by experienced growers. **[Note 23]**

OSTOLAZA 1984 lowered the upper limit to 7 based on his personal observations but this is in conflict with the occasional 8 ribbed specimen in our collection.

At least two professional growers with extensive experience propagating this species have reported observing 9 ribbed specimens and noted ethnobotanical explorer Rob MONTGOMERY has reported encountering verifiable *T. pachanoi* populations expressing anywhere from 4 up to 14 ribs [pers. comm.; 1997] (This has similarly been reported by a commercial grower requesting anonymity) [See page 99.]

The dark yellow **[Note 24]** to brown **[Note 25]** spines are variable, usually they are very short but occasionally are longer. They are present as (0-)3 to 7(-10) dissimilar lengths [OSTOLAZA 1984 interestingly was only able to observe 1-4 spines during his studies of Peruvian material (pers. comm.)].

The spines are normally up to 2 cm long **[Note 26]**, but are commonly tiny or even absent, especially on cultivated specimens **[Note 27]**.



***Trichocereus pachanoi* (SS)**
Both photos by Kamm
Dessication is due to flowering demands
note the unusual flowering down the column

Density, color and length of spines can vary substantially from one plant to the next, even if arising from a single lot of seeds. Sometimes this can be true even between different branches on a single plant!

The vast majority of short spined plants in Western horticulture are believed to be clones directly descended from Backeberg's material [and are therefore largely self-sterile]

Both wild and seed grown material are often much more spiny. It needs to be stressed that many wild Peruvian specimens do have very short spines similar to Backeberg's clones but that the direct comparison of the relative activity of the two is reported to be like comparing night and day [Personal communication with travelers who have first-hand experience with both] Reasons for this will become clear.

Flowers are up to 23 cm long [21 cm: RITTER], white, and perfumed, with blackish hairs.

Backeberg 1977: page 496, [other authorities as noted], and Trout & friends' personal observations.

It has very fragrant night-blooming flowers [opening at 7 pm and close around 10-11 am; Ostolaza 1984], 19-23 cm. long, (usually) borne near apex of the branches.

Flowers are borne, spreading outwards, on the side of and generally not very far below the tip of the branches. They form more or less a right angle to the ends of the branches, with a distance of ca 20 cm between the uppermost flowers. [Ritter].

Schultes notes the inner perianth segments (petals) are white and the outer perianth segments (sepals) are brown.

Internal petals are white, rounded 9-10 cm long, 3,5-4 cm wide, widest at about 2/3 of their length, surmounted above with a light yellow tip.

Sepals are 8-11 cm long, 14-18 mm wide, almost the same from base to tip, light green lower portions with tips of reddish-brown. They are bent strongly outward.

Scales are dark green; OSTOLAZA 1984

BORG 1937 described the ovary and tube as covered with scales and long brown hairs.

Above the ovary the floral tubes bend gently towards the top. [RITTER]

Ovaries are 22 mm long and wide, green, covered with podaria, bearing narrow green scales from under 1 mm lower to more than ca 4 mm above; with ample black-brown wooly hairs. [RITTER]

Nectar chamber is 23 mm long, but only about 5 mm wide around the style. It is pale brownish, with little nectar. [RITTER]

Around that the receptacle is 8 cm long and opening 4.5 cm wide; with greyish-green scales 6 mm long lower increasing in size towards the top until around 25 mm long, with black tufts of wool 15-25 mm long. [RITTER]

The ovary is black and hairy with yellowish linear stigma lobes. [BACKEBERG 1959 has a nice picture of flowers on p. 1119]

OSTOLAZA describes the 14-16 lobed stigma as creamy white with a felty surface.

Style is pale green, 19.5 cm long, 15 twisting light yellow lobes, 3 cm long, towering beyond the anthers. [RITTER]

Filaments are greenish and long, the style being greenish underneath and white above.

Filaments are pale green ending in light yellow, those of the floral tube are 8-10 cm long, those of the hymen are 4 cm long; the insertion gap is around 4 cm.

Anthers appear creamy yellow to creamy-brown, 2.5 mm long, 1 mm wide and white with pollen.

Pollen is spheroidal and tricolpate. The spikey projections on its surface are larger then the pores. See an EM photograph in RETAMOZO 2002.

[The TV show "Pee-Wee's Playhouse" featured short but exquisite time-lapse photography of a San Pedro flowering, during one episode (featuring Cowboy Cleetus (sp?) and his 'magic seeds'.)]

The green fruit has scales, long black hairs and white flesh. [Fruit are said by friends and growers to be delicious.]

Description based on **SCHULTES & HOFMANN 1980** and **OSTOLAZA 1984 except as noted**

Ritter based his description on a blossom collected from Samne, Prov. Otusco, Depart. La Libertad, Peru. He noted that at this locale both *pachanoi* and *peruvianus* grow together along with what he termed transitional forms.

As a result, Ritter (and Madsen) created a taxonomic description that merged the characteristics of both species with their intermediates.

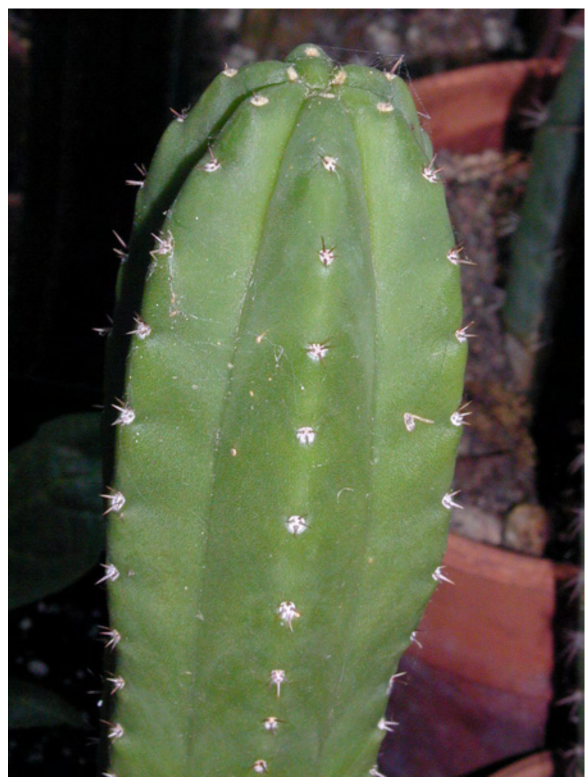
Cristate specimens of San Pedro are apparently not infrequently produced.

Monstrose specimens are also known and are fairly commonly encountered. A nice picture of a monstrose plant can be found on page 506 of RÄTSCH 1998.

Some cristate and/or monstrose clones were started from branch cuttings taken from plants which exhibit an on-again-off-again habit while others were selected from seedlings that arose spontaneously showing an entirely monstrose or cristate form. These are often propagated by grafting but in some cases they are vigorous and available on their own roots.

There are at least a few distinct clones in horticulture.

monstrose *Trichocereus pachanoi* (Miles-To-Go)



monstrose *Trichocereus pachanoi* (Loehmans)

Loehman's monstrose *Trichocereus pachanoi*

This looks almost identical to the CCC short spined *peruvianus* except for it usually lacking v-marks and it being of a smaller diameter. Like the CCC material, it forms blobby growth of rounded tubercles at the end of columns once they pass a given size and may alternate back and forth between monstrose and normal growth.

Trichocereus pachanoi **monstrose (Loehmans)**

Compare Loehman's monstrose ***T. pachanoi*** **(center) to the California Cactus Center's monstrose** ***T. peruvianus***

Cristate ***Trichocereus pachanoi***

A number of growers offer more than one form/clone of cristate *pachanoi*. Some are grafted but many are available on their own roots. These crests can arise from cristate growth that is propagated vegetatively but also arise in large plantings of seedlings. Some show on-again-off-again cristate growth alternating with monstrose and/or normal growth while others express it consistently

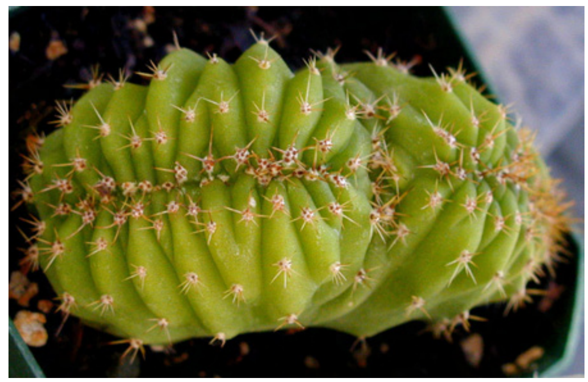
cristate ***Trichocereus pachanoi*** **(B&B and/or SS)**

Trichocereus pachanoi

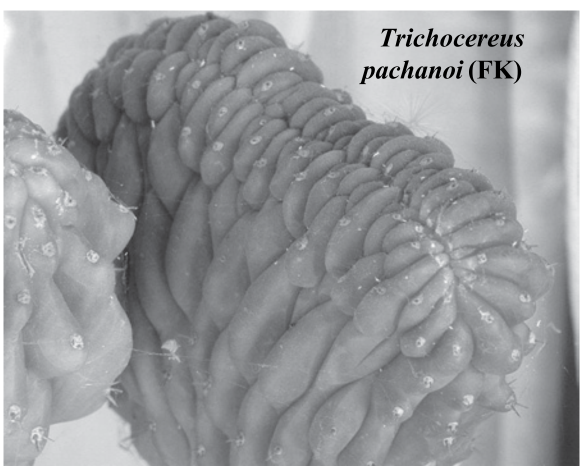
2 forms from one grower

2 forms from anothergrower

Trichocereus pachanoi **Form 1 (SS) above**



Trichocereus pachanoi **Form 2 (SS) above**



Trichocereus pachanoi **(FK)**

Trichocereus pachanoi **(FK)**

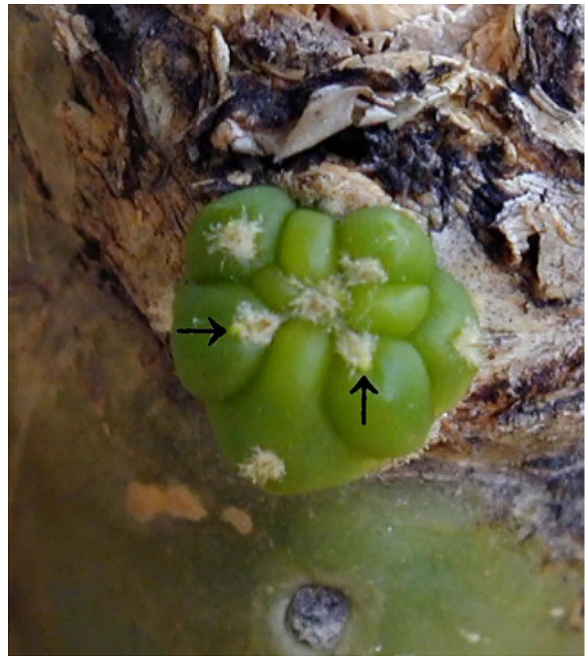
Normal growth (probably Backeberg's clone):

Trichocereus pachanoi
Photo by Logan Boskey

Variegated San Pedros also exist. Since variegated plants are believed to arise as a result of some sort of a viral interaction, this should not be surprising.

Photo above by Kamm

Trichocereus pachanoi does not generally show visible leaves on new growth but they clearly can occur at least occasionally & weakly as the following two photos show. Due to our inclusion of this odd feature for some of the other proven active trichs, this seemed appropriate for inclusion despite not understanding if it has any significance.



Trichocereus pachanoi
showing odd growth

Trichocereus pachanoi
showing minute leaves on new growth

Trichocereus pachanoi **Britton & Rose**

93.5% water by weight according to Poisson 1960; 95% according to Reyna Pinedo & Flores Garcés 2001

Tyramine (trace) Agurell 1969a and Agurell 1969b

3-Methoxytyramine (0.01% by dry weight) Crosby & McLaughlin 1973; (1-10% of over 50 mg total alkaloid/ 100 gm fresh) Agurell 1969b; (Less than 0.01% fresh) Agurell 1969a.

[Also reported in Agurell & Lundström 1968]

Hordenine (trace) Agurell 1969b

3,4-Dimethoxyphenethylamine (1-10% of over 50 mg total alkaloids/ 100 gm fresh) Agurell 1969b [Obtained via European commercial sources; probably seed grown]

3-Hydroxy-4,5-dimethoxyphenethylamine (trace) Agurell 1969b

4-Hydroxy-3,5-dimethoxyphenethylamine (trace) Agurell 1969a and 1969b. Also reported in Agurell & Lundström 1968

Mescaline Highly variable. 0.025%+ (over 25 mg per 100 gm) [Agurell 1969b] to 0.12% [Poisson 1960 (Collected in Peru)] reported by fresh weight. [Also 0.04% fresh/ ~ 0.67% dry: Agurell 1969a & 0.067-0.079% fresh: Bruhn & Lundström 1976a];

Recoveries from 0.331% [Crosby & McLaughlin 1973 (seed grown in CA, USA)] up to 2.0 % [Poisson 1960 (collected in Peru)] have been reported from dry plants. [See also Turner & Heyman 1960 who reported 0.9% by dry weight in misidentified plants (collected in Peru)] Cruz Sanchez 1948 **recovered** 5% mescaline by dry weight when using only the cortex of the plant (cultivated in Peru);

From 0.109% to 2.375% dry wt. (6 specimens) was estimated photometrically in Swiss cultivated plants by Helmlin & Brenneisen 1992;

0.310% by fresh weight (3.10 mg/gm fresh: average of three specimens; estimated using HPLC) They also reported an average of 2.06% by dry weight. [Ed.: Note the obvious discrepancy] (Cultivated in Italy.) Gennaro *et al.* 1996;

A gc estimate of 0.155% free base by dry wt. was made on a nongrafted control vs. 0.15% ten months after being used for grafting (with the mescaline-free *T. spachianus*). (Initially 2" by 12" plants) Pummangura *et al.* 1982a;

Gonzales Huerta 1960 recovered 4.5% using the outer tissues of correctly identified Peruvian plants;

Reyna Pinedo & Flores Garcés 2001 reported 0.78% in material from Chiclayo (January) and 1.4% in material from Barranca (August). Both figures are by dry weight

Anhalonidine (0.01% of total alkaloid) Agurell 1969a; (trace) Agurell 1969b

Alkaloids were detected in Brown *et al.* 1968 but none were identified.

[Anhalinine has been listed **in error**. The reference cited, Agurell 1969b did not report this alkaloid.]

[Pellotine has been listed **in error**. The reference cited, Lundstrom 1970 did not report this alkaloid.]

Unidentified lactone-forming acid (tlc by Kringstad & Nordal 1975)

Aglycones isolated after acid or enzymatic hydrolysis of the isolated corresponding sapogenins:

Pachanols A, B & C

Bridgesigenins A, B & C

Kinoshita *et al.* 1995 & 1998

Concerning the reported mescaline content of *T. pachanoi*:

Notice that the reported range is nearly 22X from max to min WITHIN Helmlin & Brenneisen's Swiss specimens. (i.e A San Pedro sample obtained in Switzerland was determined to be almost 22 times stronger than another San Pedro sample, also obtained in Switzerland, which was simultaneously being evaluated)

Recall also that Gennaro's estimation was higher still indicating the potential for mescaline concentration being at least 30X from low to high. And there are probably both stronger and weaker specimens that still remain unanalyzed.

T. pachanoi from a number of sources & in a number of forms:

Backeberg's clone is probably still the predominate form in horticulture. This material was selected and introduced by Curt Backeberg in 1931 and its vegetative progeny forms the bulk of the material that is so common today. As are *probably* many of the following. Some people may prefer more certainty about knowing what came from where but the reality is, in most cases, no records were kept detailing lineages of the plants that people have in their hands.

Spinier forms commonly arise in seed grown material. This often represents a juvenile form (as is also the case for *T. scopulicola*) but sometimes is extreme and persistent into adulthood.

The picture is however clouded due to the unfortunate merger of *pachanoi* and *peruvianus* by Ritter and those later workers following his lead. This resulted in a distressing number of instances where *T. peruvianus* seed and cuttings were sold to growers as *T. pachanoi.*

Add this to the ease of cross pollination between species, the incredible antiquity of deliberate San Pedro propagation and quite a mess rapidly develops if anyone cares to actually examine the picture.

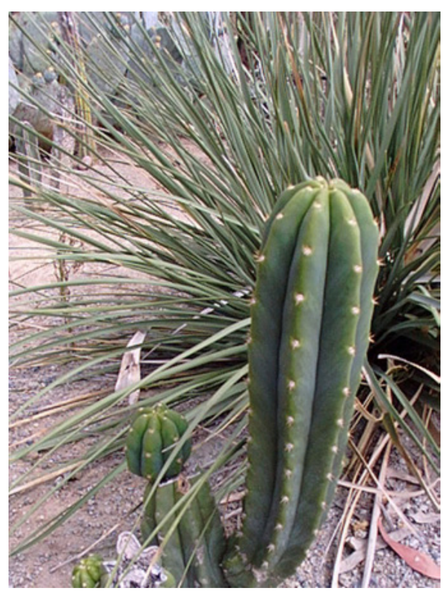
This next image is a *pachanoi* as are ***many*** of what follows.

Probably produced from Backeberg's clone.

Trichocereus pachanoi
from assorted sources

Trichocereus pachanoi
(unlabeled; Big Sur, California)

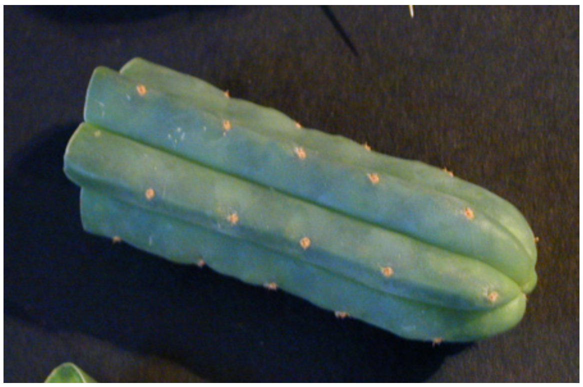
March 2001 both photos above
June 2001 below



Trichocereus pachanoi
(Bob Wallace)

Trichocereus pachanoi
(unlabeled; Balboa Park)

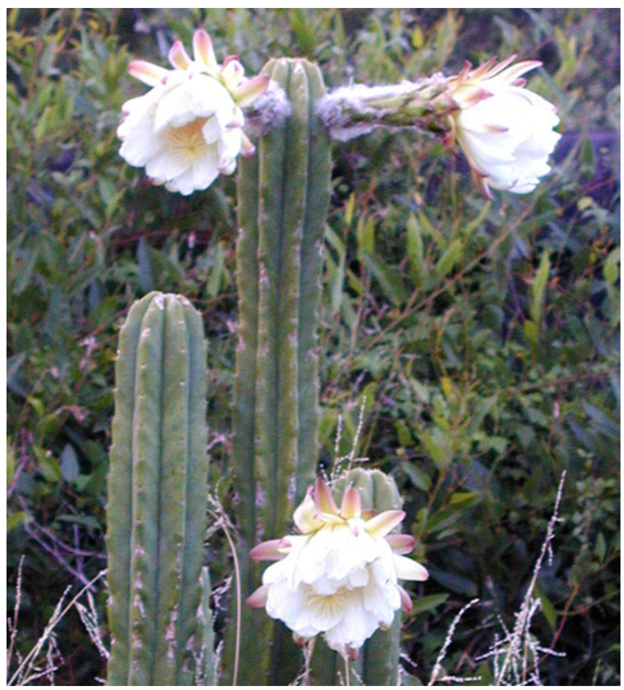
***Trichocereus pachanoi* (Dave)** is said to be a slender-growing form of *T. pachanoi.* It is reported to be potent in human bioassay. It needs analysis.



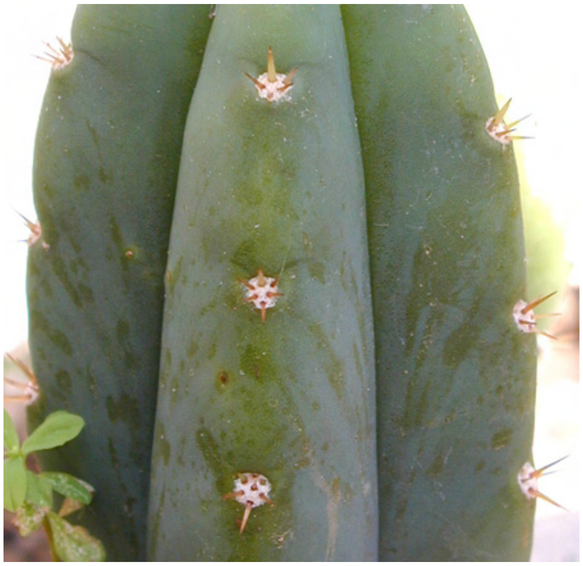
Trichocereus pachanoi
(Dave)

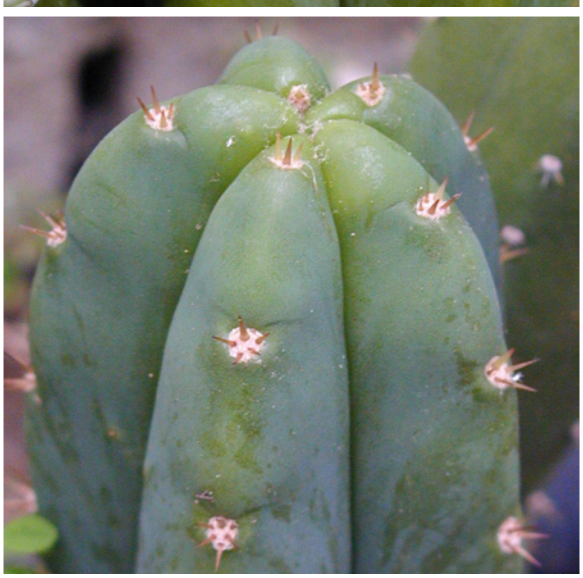
Trichocereus pachanoi
(GF)

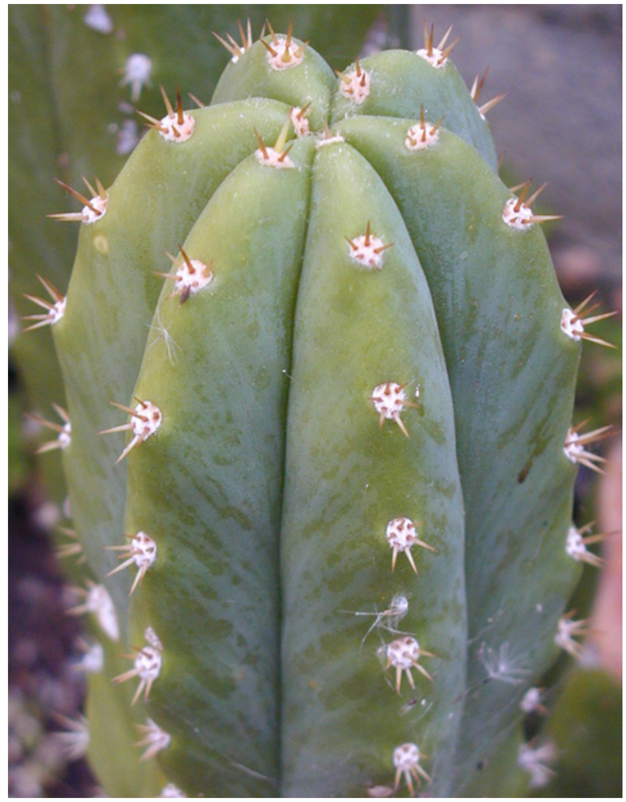
Notice the degree of dessication due to demands of flowering (In contrast, the plants in the right-hand images are growing near a flowing creek)



Trichocereus pachanoi
(Eltzner)





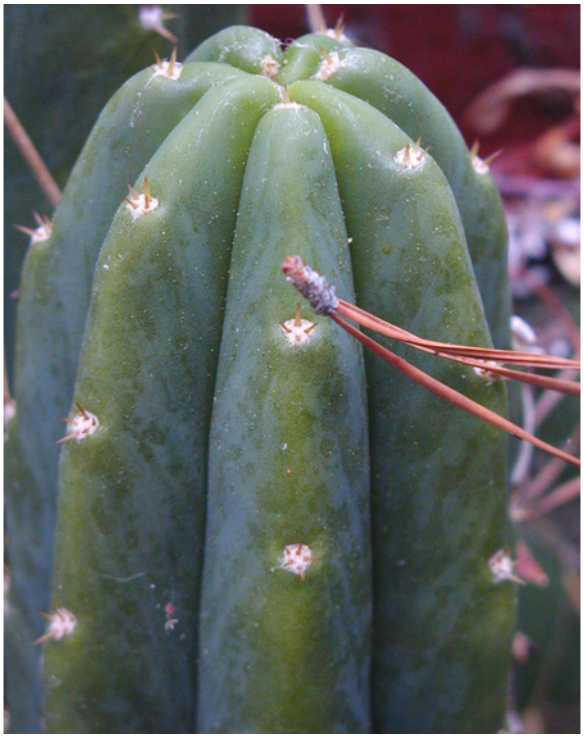


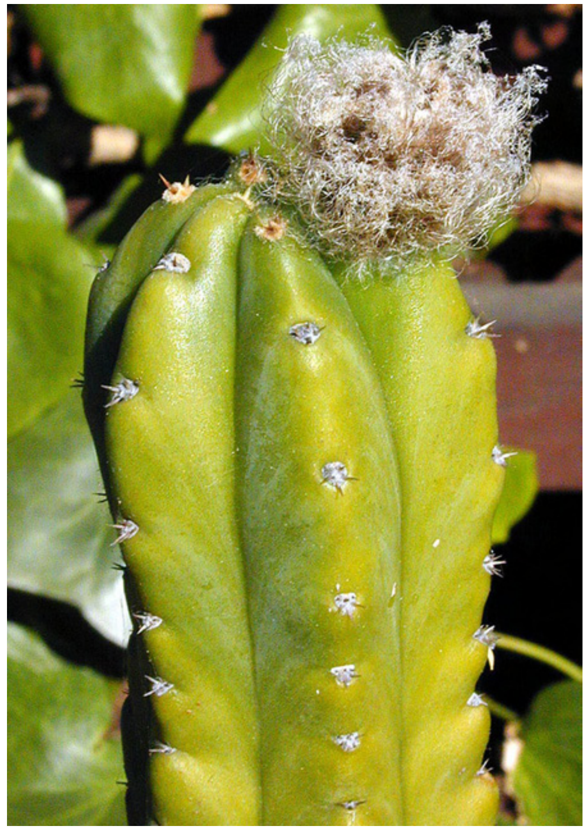
Trichocereus pachanoi
(DP)

More variations on a theme.

As was the case with the similar appearing images on the previous and following pages, these are all simply *T. pachanoi* despite the variability in their markings and appearance.

Trichocereus pachanoi
(GB)





Trichocereus pachanoi
(GF)
Upper 4 images

A *Trichocereus pachanoi*
with v-marks
(Giovanni's via Gardens)
Photos by Mark
Lower left & right

***Trichocereus pachanoi* (Henrietta's)**, said to show v-marks above the areoles, has been reported to have a "*high alkaloid" content*. Anonymous bioassays; information relayed by MS Smith 1999.

We do not dismiss this claim about this strain (we have no further info in either direction) but should add that presence of v-marks is not necessarily correlated with potency. Friends growing a form of *T. pachanoi* showing regular v-marks found theirs rather weak (*painstakingly* determining by human bioassay that it required 4 kg per dose!) See photos of that material, on page 94. (Also please look closely and note just how many of the *Trichocerei* and OTHER genera of cacti pictured herein show v-marks!)

V-marks are frequently only irregularly expressed; as also seems to be the case with the Henrietta's material in our possession (kindly provided by MSSmith).

***Trichocereus pachanoi* (Henrietta's)**

***Trichocereus pachanoi* (Huntington)**

A cristate/monstrose prone form.

Trichocereus pachanoi
(Henrietta's)

***Trichocereus pachanoi* HBG73000 Ecuador (Huntington)**

Trichocereus pachanoi **KK339**
Huigra, Chanchan, Ecuador;
2000m
Left column

(see also
page 291)

Trichocereus pachanoi KK339

One retailer of Knize's seeds has described KK339 as a "*strong form*" but whether this means potency or growth habit is not clear.

Nor is it clear if all KK339 are synonymous with each other as, based on comments made by Karel Knize, Knize's collection numbers mean almost NOTHING, at least not in the usual sense that taxonomists & plant collectors use them. They apparently define elevation ranges of occurrence within geographical localities only.

See comments under *T. peruvianus* KK242

Center left and both lower photos are of KK339.

Both lower pictures are of new growth.

Knize also offers KK2150 "Ayabaca, 2000m" (page 291)

Trichocereus pachanoi **KK591**

Trichocereus pachanoi **KK591**
Loja, Ecuador
Right column

Both of these are cuttings that were obtained from Knize.

Trichocereus pachanoid **Knize: No label (TN Clone #SO6)**

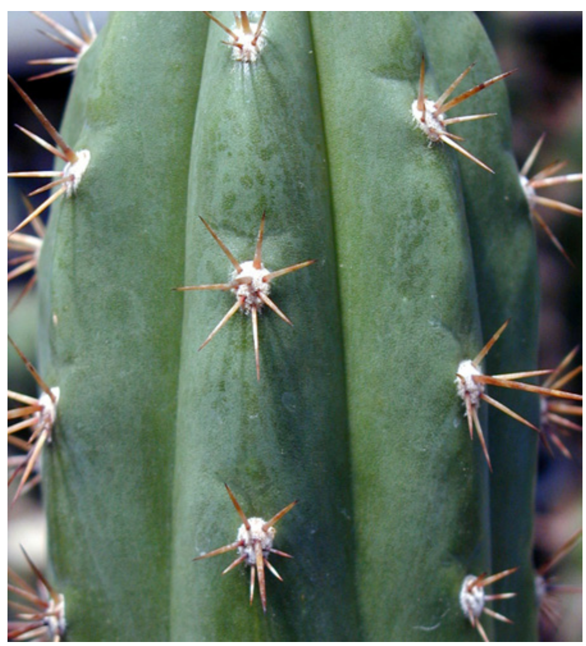
The cactus shown in the two images above was reported by Anonymous 2003 to be "*Full on at 250 gm*" of fresh cactus

Trichocereus pachanoi
flowering in a Peruvian shaman's garden
Photo copyright by Geneva Photography
Reproduced with permission

***Trichocereus pachanoi* (LA)**
Photos by Entheos (above)

Trichocereus pachanoi
Slices showing variable rib numbers.
Evidence that you can't always trust everything you read.

***Trichocereus pachanoi* OST 90641**
Ancash Dept., Peru; 2300m



***Trichocereus pachanoi* OST 90641**
(SS)

Trichocereus pachanoi **OST 90641**
Ancash Dept., Peru; 2300m

Trichocereus pachanoi **OST 90641**
(Seedling from Mesa Garden)
Photo by Logan Boskey

Trichocereus pachanoi **OST 90641**

Trichocereus pachanoi **OST 90641**
Taking on adult features.

Trichocereus pachanoi (Oz)

Pachanoi/pachanoid material encountered in Australia (NSW) was often spinier and more variable than in the US overall. This probably reflects the source of most of this material being seedlings rather than vegetative propagation due to restrictions on live cactus importation. Voogelbreinder commented that material in Victoria is often reproduced via cuttings and more frequently resembles Backeberg's material.

However, SOME of the material in Australia is known to have arrived via Australian cactus collectors directly from South America as both cuttings and as wild-collected seeds.

There, of course, is also the substantial impact of Knize-sourced seed to consider.

These cacti have been cultivated in Australia for many years and huge adults are known to exist there. Sadly, as is so common elsewhere in the world, the general state of affairs for labeling was found to be inadequate to nonexistent so it is likely that none of the cacti below were obtained with labels.

Trichocereus pachanoi
(Oz)

(Strybig)
this column

Trichocereus pachanoi
entire page

A couple of *Trichocereus pachanoi* variants
(FK via Tania)
Lefthand column & above

The two images above and the image on the upper right hand are of plants being grown by thesame grower.

It is common for *pachanoi* to appear darker and more green-blue when grown under lush conditions with some shading (or in a greenhouse) and to be more yellow-green when grown in full sun. However, this is not the case in this instance.

These two *pachanois* are growing next to each other in the same location with the same amount of sun exposure.

Crests are known from both of these variants. See the image of cristate specimens grafted onto normal columns of both of these forms and growing next to each other (page 87).

These two forms were selected for by the same grower (FK) who produced those two grafted crests.

Photo by Johnny B. Goode

Trichocereus pachanoi
(Tucson Botanical Gardens)
Lower Right

A form (hybri?d) said to be excellent in human bioassay.

***Trichocereus pachanoid* (NS)**

Contrary to the assertion found elsewhere, that *Trichocereus peruvianus* has had the highest mescaline content outside of peyote reported from it **[Note 28]**, the 2% recovered from San Pedro by Poisson is over twice the 0.8% reported from *T. peruvianus* by Pardanani and coworkers (this last figure being the ONLY published analysis to find mescaline in *Trichocereus peruvianus*).

This last figure is over twice as high as the amounts reported to have been recovered by Crosby & McLaughlin from San Pedro. (As we will mention below, the 1960 report of Turner & Heyman claimed an isolation of 0.9% of mescaline from San Pedro identified as *Opuntia cylindrica*.)

As noted at the beginning of this chapter, the percentages given by McLaughlin and associates usually reflect percentages of recovery based on their yield of high purity recrystallized salts isolated from dried raw material. It is, for this reason, always going to be lower than the actual percentage found in the plant and the amount potentially obtained via ingestion of plant material. I also suspect some loss due to binding with the ion exchange resin they used.

A commonly encountered error in print is that *T. peruvianus* is 10 times more potent than *T. pachanoi*.

T. pachanoi has indeed had, as its lowest published values, specimens reported that were in the *ballpark* of 10% of Paradanani's value but Helmlin & Brenneisen 1992 found at least one Swiss *T. pachanoi* specimen that they estimated to be some 22 times more potent than another Swiss *T. pachanoi* specimen that they also examined. Helmlin & Brenneisen evaluated a total of 6 specimens obtained via retail outlets and private collections in Switzerland. [Their specimen of Swiss grown *T. pachanoi* showing the highest estimate was almost 3 times stronger than Pardanani's *T. peruvianus* and also stronger than many of the peyote plants for which analysis has been reported.] Similarly, Gennaro *et al*. 1996 reported 3 Italian plants to average 0.31% when fresh [& 2.06% by dry wt]. Interestingly Gennaro also found that their *T. pachanoi* was stronger than the *Lophophora williamsii* they also cultivated in Italy. [The latter averaging 0.255% fresh wt for 2 specimens (1.75% dry wt)]

dried *Trichocereus peruvianus* Matucana above

"*Opuntia cylindrica*" in Jardin Botánico de Lima right column from Cruz Sanchez 1948

Cruz Sanchez 1948 did not give the average concentration of mescaline in material they were studying under the misnomer *Opuntia cylindrica.*

He DID however report recovering 5% mescaline from the dried outer green tissues.

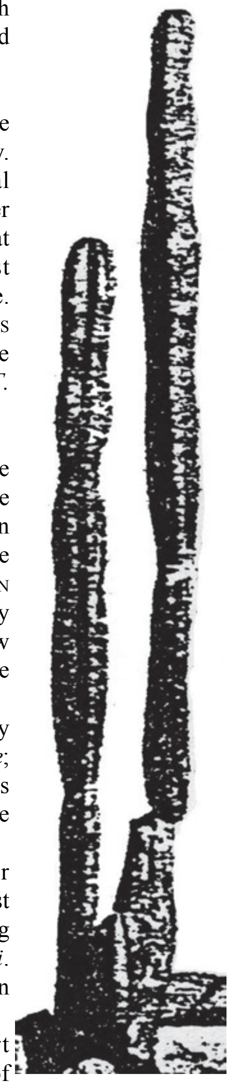
Cruz Sanchez's thesis includes a photograph of "*Opuntia cylindrica*" leaving no doubt that its correct identity was in fact *Trichocereus pachanoi* The photo below on the right was scanned from a photocopy of Cruz Sanchez 1948

Consider the lower left image .

The potent chunks pictured are both cuticle & spine-free, carefully dried chlorophyllaceous parenchyma.

Subjective estimate: > 1 to 1.5%

This is as potent as most of the peyote that reaches the NAC today. Cruz Sanchez's analogous material taken from *pachanoi* outer flesh rather than *peruvianus* was even stronger, at 5%, so as to almost rival the best peyote ever reported in the literature. (~6% in Heffter 1896a) (Gonzales Huerta 1960 recovered 4.5% from the dried outer flesh of Peruvian *T. pachanoi*.)



Poisson's *pachanoi* specimens were described as tentatively identified since they were lacking floral confirmation but apparently they conformed to the size and other specifications of Britton & Rose 1920 as mentioned by Friedberg 1959. Friedberg clearly saw the flowers but apparently was not able to include them with her vouchers.

Interestingly, Poisson additionally cited Backeberg's 1958 *Die Cactaceae*; and in 1960 quoted his 1959 comments on alkaloids being present (see comment farther below)

I therefore do not know whether Backeberg or Friedberg was the first to associate in print that the ritual drug San Pedro was *Trichocereus pachanoi*. Clearly Friedberg had more interest in this area.

Exactly when (and how) Curt Backeberg actually became aware of this plant being a) known as San Pedro and b) used as a ritual drug, is not currently known to the author.

Backeberg wrote numerous articles earlier which there has not been opportunity to review. As will be mentioned below there is, at the very least, indirect evidence he was familiar with this species as "*San Pedro*" as early as the 1930s and we expect to eventually uncover hard evidence, and hopefully a verifiable date, on this point.

Claudine Friedberg apparently first encountered "Huachuma" AKA "San Pedro" being used by herbalists in the Huancabamba area somewhere during the winter of 1958-1959 (November-January). [Friedberg 1965]

Some History Concerning San Pedro

As just mentioned, there was considerable confusion surrounding the identification of this plant as the ritual drug San Pedro until surprisingly recent times. Most of the initial pharmacological and analytical reports from South America identified their specimens as *Opuntia cylindrica*.

Most noteworthy are the reports of Carlos Gutiérrez-Noriega & Guillermo Cruz Sánchez from 1947 & 1948, where an amazing job of analytical and pharmacological investigation of San Pedro is detailed despite the misidentification. And despite their believing that while they thought it was mescaline they also did not feel they had proven it adequately.

Turner & Heyman 1960 identified it similarly in their chemical analysis of San Pedro. Despite doing less rigorous analytical work than Cruz Sanchez, they had no trouble pronouncing it to BE mescaline.

As did G.B. Marini-Bettòlo & Juan A. Coch Frugoni 1956 **[Note 29]** who used electrophoresis to separate and identify a wide variety of different alkaloids, including mescaline in an extract said to be from *Opuntia cylindrica*.

Pharmacologist Jacques Poisson 1960 was the first to isolate mescaline from a correctly identified plant of San Pedro.

The plants assayed came from material obtained in Huancabamba from Peruvian herb vendors by Claudine Friedberg. The Parisian report of mescaline in properly identified *Trichocereus pachanoi* was subsequently confirmed by Ines Gonzalez Huerta 1960.

Marini-Bettòlo & Coch Frugoni are the earliest reported isolation and published identification of mescaline, as such, which we have been able to locate that used, what most likely was, *Trichocereus pachanoi*.

The earliest reference to an isolation of what was presented as *probably* being mescaline **[Note 30]** (from what most *probably* was San Pedro) appears to be Guillermo Cruz Sánchez mentioned in 1947 (above) but published in the 1948 *Revista de la Farmacologia y Medicina Experimentale*.

Cruz Sánchez 1948 studied the drug called *San Pedro* or *Huachuma*, identifying the plant as *Opuntia cylindrica*, and obtained an alkaline liquid which formed a hydrochloride that melted at 150°. Identification was attempted via color reagents, nitrogen determination and preparations of different salts. The low mp observed for the hydrochloride by Cruz-Sánchez may have simply been a result of a crude and impure salt in need of recrystallization or having hydration problems.

While they initially only tentatively identified the alkaloid, it is very clear that they **believed** it was, in fact, mescaline. This is apparent in any of the other papers written during 1947 and 1948 authored by Gutiérrez-Noriega and/or Cruz Sánchez dealing with the chemical analysis and their assorted pharmacological assessments in human subjects.

In Gutiérrez-Noriega & Cruz Sánchez 1947 it is abundantly clear that they believed they were dealing with **mescaline** based on physiological and psychological responses to the alkaloid they obtained from '*Opuntia cylindrica'*. (In this paper it was described as having been administered to 32 people, mostly normal volunteers but including 10 chronic alcoholics, at dosage levels of 5 to 22.2 mg/kg. The youngest participant was 16 and the oldest was 53, most subjects were between 20 and 25 years of age.) The chemical and pharmacological studies were published as a dissertation in Cruz Sánchez 1948.

In 1950 Carlos Gutiérrez-Noriega authored an article entitled "*Área de Mescalinismo en el Perú*." in which he describes the use of the hallucinogenic *Opuntia cylindrica* in lunar rituals in the regions of Piura, Lambayeque and La Libertad. He hypothesized that its use was of great antiquity and it probably was used by the Nazca and Paraca, as it was depicted in ancient ceramic art. He notes it was '*indicated*' that it contains mescaline and that this was of interest not only to pharmacologists but to those studying American cultures.

Gutiérrez-Noriega compared and contrasted the plant and its use with that of peyote, perhaps his most important mentioned difference for our discussion being the observation that unlike peyote, San Pedro usage was practiced only in private and knowledge of the plant was considered a secret of the medicine people who use it. [Hardly surprising since, at that time, it was a crime in Peru not only to use the cactus but to practice this type of healing.]

He mentions that the preliminary chemical and pharmacological investigations were done at the *Instituto de Farmacología y Terapéutica*. The name *San Pedro* appears in the English summary. This article appeared in the 1950 *América Indigena* 10 (3): 215-220. He cites himself and Cruz Sánchez as references **[Note 31]**.

Turner & Heyman later mentioned that the facilities did not exist for adequate identification by Cruz Sánchez. Since their 1960 'identification' relied ***entirely*** on co-tlc and comparison of the melting points for the sulfate and picrate, while similar but even more intensive attempts at identification were made by Cruz Sánchez. (The analytical approaches available during the 1940's and used by Cruz Sanchez produced results just as definitive as co-tlc. In fact, the tests mentioned as being unavailable to Cruz Sanchez (carbon and oxygen determinations) were not used by Turner & Heyman either. To us, it appears that Cruz Sanchez was simply more cautious in his pronouncement of results due to what was felt to be an inadequate characterization and a bad melting point.

Image of a Nazca priest richly illustrated with San Pedro and associated personages; with a shape suggestive of a Nazca funerary vessel. Photograph by Carlos Ostolaza Fig 9 in Ostolaza 1997 *Quepo* 11:83

[The subsequent finding of mescaline in other chollas (sometimes called *Cylindropuntia* or *Austrocylindropuntia*) and *Opuntias* is fascinating, as is the purported & probably dubious incorporation of an unexamined *Opuntia* as an ayahuasca additive and its reputed potent hallucinogenicity when taken alone. See under *Opuntia* in *Sacred Cacti* 3rd ed. Part A or in *Sacred Cacti* 2nd ed.]

The origin of the misidentification poses a fascinating question. Certainly no botanist would have ever confused any Ceroid for an *Opuntia* even if they were dried specimens. Anyone who feels that the two cacti could be easily confused with each other, owes it to themselves to look at the color photograph of *Opuntia cylindrica* on page 43 of Olmos 1977 and compare it with his photograph of San Pedro on page 140. (Or see the examples herein.)

Another fascinating point is Carlos Gutiérrez-Noriega's assertion that its practice was done in private and that the plant was considered to be a secret of medicine people. One has to wonder not just how it was originally identified but also how it was that he became aware of this 'secret'.]

[Peter Stafford 1992 says the first mention of San Pedro as a ritual drug was in 1945 but offers no reference. He does include a very nice picture of a San Pedro in flower. LaBarre mentions that this was John Gillin 1945.]

Poisson also notes that a cactus occurring in the Huancabamba **[Note 32]** region and employed as a euphoriant and hallucinogen called *San Pedro* was mentioned by Friedberg 1959 It was described as 7 to 10 cm in diameter and 30 to 50 cm tall [Ed.: In reference to marketplace sections?].

Claudine Friedberg is apparently the first to describe, in the published literature, that the ritual drug known as San Pedro matched the description that Britton & Rose [1920: 134-135, figure 196] had given for *Trichocereus pachanoi*.

Friedberg 1959 was the first person to submit properly vouchered material for chemical assay (via the Parisian pharmacologist Jacques Poisson).

She is also credited as being the first person to publish and specifically identify the ritual drug known as San Pedro as being the cactus *Trichocereus pachanoi*.

This may need a closer look.

It is obviously unclear who was the first to become aware that San Pedro was active but it is clear that it was some millennia ago. Where and when the activity of *T. pachanoi* as a species became known to Westerners is also not clear.

Nor is it clear exactly when Backeberg became aware that the plant was called San Pedro **[Note 33]** or how much he knew about its use as a drug plant. Clearly he had at least some familiarity **[Note 34]**.

That same year (1959), in volume two of his masterpiece monograph, *Die Cactaceae*, Backeberg mentions that *Trichocereus pachanoi* was called *San Pedro* in northern Peru and that he was told by native Peruvians that it contained alkaloid "*like certain other Cerei*" **[Note 35]**. He does not elaborate, although he was familiar the plant was used by "*Brujas (Hexen) und Quacksalbern*" and evidently attributed its effects to the alkaloid.

We have botanist Curt Backeberg to thank for the ready availability of San Pedro in horticultural circles and commercial outlets. Considering that Backeberg 1959 states that his introduction of this plant into Western horticulture was in 1931, it seems unlikely he could ever have confused this plant with an *Opuntia*. [It is still favored by many growers for grafting due to its near lack of spines; Backeberg 1977]

On a side note, an interesting observation made by Backeberg is his mention of *T. pachanoi* growing in association with *Armatocereus godongianus* (AKA *Lemaireocereus godongianus* Britton & Rose) in Ecuador in the Chanchan Valley. **[Note 36]**

Dobkin de Rios 1990 notes that Towle 1961, mentions the presence of San Pedro on the south coast of Peru and asserts that *Cereus* cacti are frequently found in the art of the area.

Towle identified the plant depicted and present on the south coast as *T. cuzcoensis*, but calls it Giganton **[Note 37]**, a name used for San Pedro. (This is also where *T. cuzcoensis* occurs, as does San Pedro.) Towle noted that it grows not only in the highlands but also in the *quebradas* and on the sandy beaches of the coast. Based on her reading of Yácovleff & Herrera, she identified a number of motifs as *Cereus* or the columnar forms of Peruvian *Melocacti*. [Most *Melocacti* are globular but not all. Some Peruvian species resemble *Neoraimondia* species in general appearance. *Melocactus peruvianus* was purported to contain mescaline by Caycho but no meaningful reference was included]

One vessel was identified by Yácovleff & Herrera (her source) as depicting a *Mammillaria* or a *Lobivia*. This may be but readers might compare said vessel (Nazca), on page 319 of Yácovleff & Herrera 1934, with the photograph of *Trichocereus shaferi* on page 1123 of Backeberg 1959. Not to suggest this is the species depicted (the Argentinian *T. shaferi* does not occur in Peru), but, for an example of how difficult, and often impossible, it can be to identify many species from ceramic art. What is clear is that not only a number of different forms of *Opuntias*, but globular and

Trichocereus peruvianus **Peru 52.0762 (Berkeley)**
Notice that the flowering tip on the lower right is the column arising from the lower left

columnar cacti were represented as separate species. **[Note 38]**

YÁCOVLEFF & HERRERA also mention Oliva's and Cobo's descriptions of the use of some of the "*pitahaya*" cacti (a generic word widely used for many different species which yield edible fruit), called *achuma* which was used by the Indians of Peru for '*narcotic effects.*' **[Note 39]** While both of these accounts will be briefly mentioned below, YÁCOVLEFF & HERRERA's excerpts from the two are included here in a footnote. **[Note 40]**

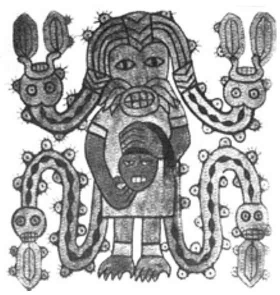


Figure from a Paraca ceremonial mantle (Paracas 290-45: Fig. 14) suggesting association with *T. peruvianus*
From a photograph by Carlos Ostolaza
Fig 8 in Ostolaza 1996 *Quepo* 10: 46

SCHULTES & HOFMANN 1992 mention that an early account from the Spanish priests described the use of a beverage called *achuma* made from the juice of a thick and smooth cactus in terms very similar to that used to also condemn the peyote cactus in Mexico. Needless to say they also attempted to label and destroy both the faith and the use of the plant as the work of the devil (i.e. read 'competing faith'). This was their normal practice applied everywhere else in the world whenever they encountered any real first-person hands-on religions or other natural forms of Holy Communion.

Douglas SHARON 1978 cites the 1631 account of Father Anelo OLIVA **[Note 41]** (mentioned by SCHULTES & HOFMANN above) and the 1653 account of Father Bernabe COBO **[Note 42]** (below) as evidence of the Christian bias against the use of the plant: (SCHULTES & HOFMANN 1992 similarly draws quotes from these)

"*This is the plant with which the devil deceived the Indians of Peru in their paganism, using it for their lies and superstitions. Having drunk the juice of it, those who drink lose consciousness and remain as if dead; and it has even been seen that some have died because of the great frigidity to the brain. Transported by this drink, the Indians dreamed a thousand absurdities and believed them as if they were true....One can use its juice against fevers...*"

The 1631 account of OLIVA is the earliest known written description of San Pedro usage.

GUTIÉRREZ-NORIEGA 1950 similarly asserted that the use of the mescaline containing San Pedro, by healers, was done to "*influence and deceive those that solicit their services*".

SHARON also mentions the fairly recent documentation of a 1782 legal case against a healer who was accused of healing with a brew of San Pedro (called '*giganton*'). Although the healer fortunately escaped, his paraphernalia and the description of his healing rituals closely resembled those seen today. **[Note 43]**

It has been noted by several sources that although these practices were persecuted vigorously, the toleration and even acceptance of such healers into the church also occurred so long as they were considered not to invoke the 'devil' in their practices. Considering the harsh & extreme punishments liberally doled out to any who opposed the Church (or even those suspected of not completely embracing the Christian party-line) I suspect this played a central role in the original adaptation of Christianity into the San Pedro ritual.

The origins of the San Pedro belief are not clear, but its use can be traced back to the early days of religious and artistic expression found in Peru.

SHARON 1978 shows a Chimú style vessel depicting a curandera holding a four ribbed San Pedro (three dimensional rendering)

In their amazing and beautifully rendered 'coffee-table book' *Plants of the Gods*, on page 154, SCHULTES & HOFMANN 1992 mention and show a ceramic pot from the Chimú culture (1200 AD) which seems to depict an owl eyed herbalist or shaman grasping a San Pedro section **[Note 44]**, appearing to have been cleaned of spines similarly to what we do today prior to juicing. We must stress that we have never encountered any indications of the indigenous removal of San Pedro spines in modern practice. **[Note 45]**

SCHULTES & HOFMANN point out that the herbalist/shaman women who sell San Pedro today are locally believed to be associated with the owl. They also mention Nazca urns dated to 100-500 AD found on the southern coast of Peru that depict San Pedro. SHARON 1978 describes some of these urns as appearing to be in the form of mummy bundles with a stalk of San Pedro on each shoulder. 5 such urns are known, all of which are present in the Museo Nacional in Lima, Peru. [photo; SHARON & DONNAN 1977, p. 56]

Unlike many ambiguous portrayals of plants on ceramic pottery, San Pedro renderings are often very clear and distinctly unmistakable.

DOBKIN DE RIOS discussed the Nazca [100-800 AD] culture's "rich heritage" of ceramics and textile leaving clear evidence of their usage of both *wilka* (snuff from the seeds of *Anadenanthera peregrina*, also spelled *vilca.* [Ed.: Another *Anadenanthera* species may actually have been used] and San Pedro in southern coastal Peru. The Mochica culture of northern coastal Peru [100 BC to 700 AD] is also known to have used San Pedro ritually. Its use was not limited to solitary shamans but was intricately woven into the social fabric of both of these cultures. [DOBKIN DE RIOS 1990] [**Many** examples of clearly shamanic and healing practices exist in Mochica art. See BENSON 1972 and DONNAN 1976 for some fine examples.]

Image from a Paraca ceremonial mantle (Paracas 290-45: Figure 10) with features that suggest cristation.
From a photograph by Carlos Ostolaza
Fig 6 in Ostolaza 1996 *Quepo* 10: 45

She also mentions the unpublished work of Dr. Cabieses, Director of the Museum of Health Sciences in Lima, who has assembled examples of Nazca ceramics showing representations of San Pedro cross sections and flowering buds (also other cacti.)

SHARON 1978 mentions that, in the Moche art of the north coast (around 100 BC-700 AD), San Pedro is often associated with a shawl-clad female figure in a curing context, frequently she bears owl features, as was noted above by SCHULTES & HOFMANN concerning a more recent piece. SHARON states that in one of the few instances where an object often seen held on her outstretched hands is clearly depicted, it is as a slice of San Pedro. There is one such clear example said to be in the Museo Larco Herrera in Lima.

crested *Trichocereus pachanoi* (MH)

SHARON 1978 also describes ceramic representations of 4 ribbed San Pedros done in the Salinar style of the North coast of Peru (around 400-200 BC). One type of these vessels has protrusions in the form of a San Pedro branch.

[While debated by some as simply symbolically powerful, it should be considered that four ribbed cacti may have once been more common. Certainly peyote was once more common and abundant before initial habitat loss and later harvesting pressures substantially reduced its population. If four ribbed plants were preferentially harvested over other plants **[Note 46]** then it could, over the millennia, lead to a situation where the less desired plants were more prolifically represented in wild and naturalized occurrence. It should be remembered that there is considerable evidence for the ritual use of San Pedro for, **at the very least**, substantially in excess of three thousand years (Its deliberate cultivation, and naturalized escape, is also known to be so ancient and so widespread as to obscure any hope of determining its original natural distribution.).

Their mythical stature may also reflect knowledge of the more potent 'San Pedros' from Bolivia which DO form four ribbed columns.

It may also be that they are just a rare variant, a non-normal mutation **[Note 47]**, like the 4-leaf clover that spontaneously appears once in roughly every 10,000 clover leaves formed, and, like true four leaf clovers, have never been common.]

SCHULTES & HOFMANN 1992 [page 154] show a Chavín stone engraving dated to 1300 BC (found in the Peruvian northern highlands at Chavín de Huántar **[Note 48]**) which shows their principle deity grasping a terminal section of San Pedro **[Note 49]** and further mention that the plant is also depicted in Chavin textiles in association with jaguar and hummingbird figures. [See CORDY-COLLINS 1982] [Hummingbirds or bird-'people' have frequently been associated with peyote, as well as with DMT/ 5-MeO-DMT and other shamanic healing practices.]

SCHULTES & HOFMANN also show an excellent photo of a stirrup vessel from the Chavín culture (1200 to 600 BC) with a high relief portrayal of a clearly mydriatic jaguar amidst stems of San Pedro, replete with swirls felt to be associated with its hallucinogenic action **[Note 50]**. As was the case with the vessel mentioned earlier under *Opuntia*, the jaguar's eyes are clearly dilated **[Note 51]**. SHARON 1978 mentions that 5 other Chavin vessels are known, from ~700 to 500 BC, which depict a spotted jaguar and spiral designs with four ribbed San Pedro.

[Many more examples of Chavín ceramics showing San Pedro exist than we will mention.]

A Chavín culture ceramic deer and San Pedro bottle from the north coast was thought to date to 1000-700 BC. Another interesting find noted by SHARON 1978 is what appear to be cigars made from cactus "*bark*" **[Note 52]**, thought to be San Pedro's, found in Chavin refuse dating from approximately 800 BC. [citing Rosa FUNG PINEDA 1969]

Panel from Chavín de Huántar
Photograph by Carlos Ostolaza
Fig 9 in Ostolaza 1995 *Quepo* 9: 79

This is indeed an interesting find but according to Rosa FUNG PINEDA 1969 the identity of the species was not determined and they were assumed to be for hallucinogenic purposes simply because the Chavín were known to have used cacti as hallucinogens. Mescaline is not known to be smoked for hallucinogenic purposes; (we have never been able to experience any activity via this route **[Note 53]**). From what we can determine, it is not clear that they had been burned, only rolled in the manner of cigars.

Mescaline concentrations have been determined to be highest in the cortex by Sánchez Cruz [mentioned in GUTIÉRREZ-NORIEGA 1950 (where it was translated into English as 'bark')] perhaps the skins were removed and used for tea as they were. Use of only dried cactus cortex could certainly produce a far more potent tea than whole fresh plant. As this was associated with a temple complex and *San Pedro* use was apparently an intimate part of their religious practices, such dried material would have been a very efficient way, not just to use, but to store the supplies necessary for regular mass consumption. Unfortunately, we know relatively little of their religious life and beliefs, beyond the fact that hallucinogens were commonly employed.

Alana CORDY-COLLINS (1980) points out that several early Chavín (Phase AB) stone heads show what appear to be thick cords of mucus discharging from their nostrils similar to what is still seen today among users of hallucinogenic snuffs such as are derived from *Virola* or *Anadenanthera*. She also notes that they appear earlier than and continue after the appearance of the earliest known depiction of San Pedro mentioned above (Phase B).

She believes that, as research suggests the original Chavín homeland to be the tropical lowland forests farther east in South America, San Pedro was made familiar to these particular people after their exodus (around 2000-1500 BC) into the Andean regions where San Pedro flourishes. [Ed.: Snuff usage and materials may also have come from the south, where other *Anadenanthera* spp. have an ancient history of human ritual use **[Note 54]**.] While incorporating San Pedro use, they maintained their usage of *Anadenanthera* based snuff. (Another example of thick cords exuding from nostrils of a sculpted Chavin deity's head can be seen on page 40, fig. 2 in Ralph E. CANÉ 1985)

In *Andes 2. Excavations at Kotosh, Peru 1960*. by Seiichi IZUMI & Toshiko SONO, several possible simple snuffing tubes (labeled "*cylindrical objects*"), found at a pre-Chavín culture site, are shown. Small metates and polished balls were also found.

Similarly, in Ecuadorian archaeological finds, it has been noted by several sources that small rounded bottomed "*idols*" showed wear as if they were used for grinding substances to a powder. The authors proposed "*probably for incense*" purposes.

It is perhaps coincidental but still interesting in this regard that modern day herb vendors in Belém, Brazil sell *Anadenanthera peregrina* seeds for use as a ritual incense. **[Note 55]**

Peruvian artifacts showing the cactus associated with the deer have been found which were made between 1000 and 700 BC. Others made several hundred years later show it associated with the jaguar. (SCHULTES & HOFMANN 1992)

[Peyote's similar association with the deer has been long known and documented. The association of the jaguar with various DMT and 5-MeO-DMT containing snuffs and drinks has also been documented (See our work on tryptamine containing plants for more details) A curious scene shows a deer hunt associated with what appears to be *Anadenanthera peregrina* [or a similar species.]

This is included as such by FURST 1972: page 65, and also appears on page 104 in DONNAN 1976.

The same picture is in YÁCOVLEFF & HERRERA 1934: page 292, fig. 20. They identify it as *Prosopis juliflora*, an important native food source in many desert regions of the Americas.

While it is hard to tell with absolute certainty; the shape of the pods certainly far more closely resemble the *Anadenanthera* and the lack of spines do not support its identification as *Prosopis juliflora*. (Although, not all of the South American *Prosopis* species have spines. **[Note 56]**)

Alana CORDY-COLLINS believes that *Anadenanthera* seedpods are also depicted on the Chavín textile mentioned above.]

[See SHARON & DONNAN 1977 for some excellent color photos of a few of the examples described above. SHARON 1978 also features some photographs. Walter ANDRITZKY 1989 shows a number of interesting shamanic artifacts and several examples of Nazca ceramics.]

This cactus has a long history of use in the northern coastal region of Peru for both diagnosis and cure of illness.

The use of the drink 'cimora' is apparently associated with "*moon rites*" of the religion surrounding its use. (LUNDSTRÖM 1971)

CRUZ SANCHEZ 1951 says women usually harvest San Pedro at the time of the full moon.

The drink '*cimora*' is another point in some serious need of clarification.

Richard Evans SCHULTES **[Note 57]** spoke of a reference to its use on the north coast of Peru by Cruz Sánchez. Besides San Pedro, "*cimora*" was said to contain a member of the genus *Cactus* [*Cactus cereus*], another cactus *Neoraimondia macrostibas* **[Note 58]** [as *Cereus macrostibas*] (CACTACEAE), *Isotoma longifolia* (CAMPANULACEAE), *Pedilanthus tithymaloides* (EUPHORBIACEAE) and *Datura stramonium* (SOLANACEAE).

Granite image of the elemental jagaur deity from within el Templo de Chavin. After TELLO 1929

CRUZ SÁNCHEZ referred to San Pedro as *Opuntia cylindrica*. Schultes appropriately notes this casts at least justifiable suspicions on his identification of the other species.

OTT 1993 includes a nice discussion not only of what is known surrounding *cimora* but of what is known chemically and pharmacologically about the above species; as well as related plants that are used in ethnopharmacology.

It is known that a number of plants may be used as additives to San Pedro and others, such as an often alcoholic aqueous extract of tobacco leaves administered intranasally, are used as part of the rites surrounding its traditional use.

There apparently is great variation between healers in terms of preparation and in potential components of the San Pedro brew. In most cases the plant is simply sliced and boiled in water. GLASS-COFFIN 1998 encountered Peruvian shamans boiling the cacti for anywhere from 2-7 hours.

DOBKIN DE RIOS encountered the use of admixture plants and lists *misha* **[Note 59]** (*Datura arborescens*) [AKA *Brugmansia arborescens*], *condorillo* (*Lycopodium* species) and *hormano* (unidentified) as additives, during her 1967 field work. She mentions this in a number of her works. She never refers to it as 'cimora'. [See DOBKIN DE RIOS 1990.]

SHARON 1978 says that while Eduardo Calderon was initiated by healers who used *Datura arborea* (AKA *Brugmansia arborea*) as an additive, he usually prefers not to do so, feeling it a drastic treatment that is not normally required.

In SHARON's account there are also potential additives in the form of medicinal plants or magic substances which may include powdered bones, cemetery dust and other materials, including a number of plants considered to possess magical potency. These additives are boiled separately and added to the prepared *San Pedro* solution later. They are normally added for magic induced illness and *San Pedro* usually is given alone. Four cacti from the local market are sliced and boiled in a 5 gallon can of water for 7 hours beginning at noon. [CALDERON & SHARON 1978 also discuss herbs (pp. 59-67) and other additives.]

Brugmansia aurea

A point to remember is that when these 'magic' additives are used they are then followed by other plants which are given specifically to induce vomiting.

It must be noted that the sections of *San Pedro* pictured are larger in diameter than most plants cultivated in the United States. I have never seen a weight range given but four of these sections must weigh well over 4 kilograms.

A friend worked with a San Pedro using shaman in Peru who incorporated *Erythroxylon coca* into his rituals.

Some modern users add *Banisteriopsis caapi* or *Peganum harmala* to permit the ingestion of smaller amounts of cactus. See comments on this in Part A or in *Sacred Cacti* 2nd edition.

Numerous plants have been claimed to have been incorporated and many identified and unidentified plants are discussed by DAVIS 1983 as magic and medicinal plants associated with *San Pedro*.

CRUZ SANCHEZ 1951 & RÄTSCH 1998 listed more plants [and common names] used as brew additives:

Brugmansia arborea [*misha rastera blanca*]
Brugmansia X *candida* [*cimora*]
Brugmansia X *candida forma* (*3* different *forms known as cimora oso*, *cimora galga & cimora toto curandera*]
Brugmansia sanguinea [*misha rastrera = misha colorada*]
Brugmansia spp. [*misha* (*= floripondio*)*; misha curandera*]
Cannabis sativa [*marijuana*]
Datura stramonium [*chamico*]
Datura stramonium v. ferox
Euphorbia cotinifolia [*timora*]
Fuchsia sp.
Hippobroma longiflora (*Isotoma longiflora*) [*cimora toro = misha veneno*]
Iochroma grandiflorum (*I. fuchsioides*) [*toro-maique*]
Ipomoea carnea "*borrachera*" [Used against alcoholism]
Iresine celosia [*timora* (= *cimora*?)]
Iresine sp. [*cimora* (= *timora*?)]
Lycopodium affine [*condorillo*]
Lycopodium magellanicum [*condoro*]
Lycopodium reflexum
Lycopodium saururus [*cóndor misha = hierba del cóndor*]
Lycopodium spp. (several different (?) *known as cóndor purga = huaminga oso = trenza shimbe = huaminga misha*, *hornamo lírio*, *hornamo loro*)
Lycopodium tetragonum [*condorillo de quatro filos*]
Niphogeton scabra [*hornamo toro*]
Onoseris sp. [*hornamo blanco*]
Passiflora sp. *"grenadilla"* fruit or leaf
Pedilanthus retusus [*misha* (= *cimora misha*?)]
Pedilanthus tithymaloides [*cimora misha = misha*]
Peperomia flavamenta
Peperomia galioides [*piri-piri = congona*]
Peperomia sp.
Pernettya sp.
Pleurothallis sp. (*Epidendron* sp.?) [*hornamo caballero = hornamo caballo*]
Senecio spp (?) [*hornamo*]
Senecio tephrosioides [*hornamo amarillo*]
Tillandsia sp. [*siempreviva*]
Unidentified sp. [*hornamo chancho*, *hornamo cuti*, *hornamo verde*, *espingo = ishpingo*]
Valeriana adscendens (*V. officinalis*) [*hornamo morado*]

Davis includes a nice discussion of the confusion surrounding '*cimora*' and its history. He determined that *Brugmansia* species are also referred to as types of '*cimora*' (the word having the generic meaning of '*something bad*'; a concept not infrequently linked with belladonna plants throughout the world) and that they may be ingested alone in particularly difficult cases, similar to what is encountered elsewhere in South America. He mentions FRIEDBERG 1960 did not feel that any cactus was a part of *cimora* and stated that '*cimora*' or '*timora*' was a species of *Iresine*. Davis determined that *timora* referred to *Iresine celosia* and *Euphorbia cotinifolia*. Davis drew the conclusion that '*cimora'* was a generic term that could be used for a number of plants, including *Brugmansias*.

Despite his work, which we have mentioned only bare fragments of, and the numerous vouchers he prepared, Davis was unable to unravel the mystery surrounding this plant and '*cimora* '. He quoted Dr. SCHULTES (1967) as stating:

"Here is one of the most challenging problems in the ethnobotany of hallucinogenic plants, and one which would not be difficult to investigate thoroughly."

The need for clarification still remains, in spite of the efforts of Davis and others.

CRUZ SANCHEZ 1951 discusses cimora in some detail; largely lacking in identified plants. He describes the composition of


Happy *Brugmansia* flowering in Oz

cimora as varying according to application so it applies to various beverages but San Pedro is usually the base

[For those seeking further information on *cimora*; OTT 1993 and DAVIS 1983 includes almost everything published to date on the subject and the appropriate references.]

Besides being taken for therapeutic purposes, diagnosis and divination, San Pedro is said "*to enable an individual to assume ownership of another person's identity*."

This statement came from LUNDSTRÖM 1971b citing SCHULTES 1969 and DOBKIN 1968b. [SCHULTES 1969 mentions this on page 251. It is not clear where Schultes got this last point from. He includes no reference with it in the text but does list FRIEDBERG 1959 in his references. I have not yet been able to obtain a copy of FRIEDBERG's 1959 paper. I could not locate anything similar in DOBKIN 1968.]

When discussing modern use in northern Peru, as observed in her 1967 field work, Marlene DOBKIN DE RIOS 1990 says San Pedro used for healing contains "*1.29 grams in a given sample*" [but does not clarify if this is all consumed.]

This 1.29 is probably a simple typo as, in FRIEDBERG 1965, 1.2 gm of mescaline is given as the amount found in a kilo of fresh cactus.

Both of these odd claims are also included in DICKSON's 1978 article in *Head*.

DOBKIN DE RIOS observed its major use to be the treatment of illness caused by witchcraft and mentioned that it also was employed as a revelatory agent.

James DUKE 1985 mentions that it is also used as a folk remedy for enteritis, gastritis, pneumonia and sterility. He cites himself as his reference.

Usually the rituals take place in a *tambo*, a wall-less shelter which frequently is depicted in ancient art, such as the work she includes as a probable example of the use of the San Pedro drink on page 93.


Brugmansia sanguinea

[A fascinating curing scene of an owl-faced healer wearing a shawl, modeled in ceramic with additional painted elements and involving not just San Pedro (a slice) but other plants, is featured in SHARON & DONNAN 1977: page 380 and SHARON 1978: fig. 4-10. It also appears in Hildegard Delgado PANG 1992: page 243, fig. 11.23, and in DONNAN 1976: pages 98-99, figures 80a-d. (All photographs show different views of the same vessel [Peabody Museum 30/F728].)

Owl-faced and or shawled female figures are frequently depicted in art of known users of San Pedro. Some nice examples can be seen in BENSON 1972 and DONNAN 1976. Also see some quite interesting observations by GLASS-COFFIN 1998]

A cloth, placed on the ground, is called a '*mesa*' **[Note 60]**. The composition of this Peruvian shamanic curing altar varies according to each practitioner but some elements can be generalized.

Iochroma fuchsioides

***Iochroma grandiflora* (*I. grandiflorum*)**

***Cannabis* (probably *sativa*X*indica*)**

***Datura* sp. (probably *inoxia*)**

Nicotiana rustica

Nicotiana rustica

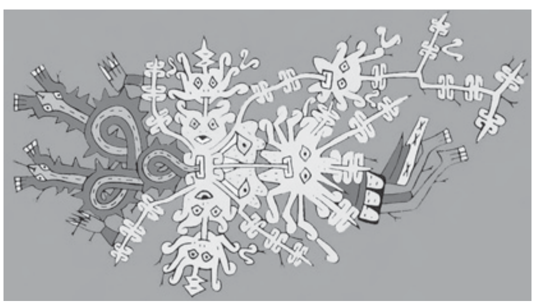
Polished shields and staffs are set up for protection along with other magical elements that are also placed on the mesa (often these are a mixture of both Catholic & pre-Colombian artifacts). The polished stones are said to assume the shape of people and animals that attack enemies. Such power objects or the ritual and magical elements within a mesa are commonly referred to as "*artes*".

The healer sings and whistles during the ceremony to invoke spiritual forces that will ensure the healing will occur and help in recognizing the disease.

Sharon 1978 and Calderon & Sharon 1978 discuss mesas and healing practices & philosophies in some detail. [A mesa picture from Sharon also appears in Donnan 1976 along with close-ups of ancient carved staffs and a nice grave scene featuring said carved staffs and multiple stirrup vessels. Andritsky 1989 also features pictures of another mesa and some more ancient carved staffs.] Glass-Coffin 1998 is another good resource on this topic.

When discussing the affiliation of music with hallucinogen use, Dr. Dobkin de Rios notes that stirrup vessels can be made to whistle. Many examples of both single and double chambered strap or stirrup vessels exist which were made with this function in mind.

At least at the level of the farmer and the fisherman, it is both clear and extensively documented that San Pedro use has been continuous from prehistoric up to modern times



from a pre-Nazca ceramic image in Tello 1940

San Pedro weight approximations:

For comparative purposes only; not absolute values.

Weights may vary based on many factors including health & recent history of available water.

All were center cuts; no branch tips.

# ribs	Length (inches)	Dia. (inches)	weight	Comment
8	4.5	3.25	471.4 gm	1 end callused
7	9.5	2.75	21.8 oz.	both ends callused
7	5.9	2.7	356.4 gm	1 end callused
6	3.9	1.4	73.6 gm	fresh cut
6	6	1.6	130.3 gm	fresh cut
5	4.2	0.8	44.4 gm	fresh cut

Measured by Trout

Gram weight: triple beam; Oz. wt: top loading baker's scale. (Approx. 28.3 grams in 1 ounce; 453.59 grams in 1 pound.)

Reported analysis of San Pedro

93.5% water by weight was reported by Poisson 1960

Published mescaline recoveries:

2% mescaline isolated from dry plant. Schultes & Hofmann 1992: page 156. [2 gm/ 100 gm dry wt]

2% of dried plant or 0.12% of fresh material. Schultes & Hofmann 1980: page 226. This is the amount determined by Poisson using Friedberg's material in 1960.

Turner & Heyman 1960 reported 0.9% from dried material [900 mg/ 100 grams dry wt]

Crosby & McLaughlin 1973 recovered 0.331% by dry weight. [331 mg/ 100 grams dry wt]

Agurell 1969a reported 0.04% from fresh plants (approx. 0.67% dry weight) [400 mg / 1000 grams fresh wt; 670 mg/ 100 grams dry wt.]

Bruhn & Lundström 1976a reported recovering 0.067%-0.079% by fresh weight.

Pummangura *et al*. 1982 found 0.15% (dry wt.) in the aerial parts and none in the roots (June harvest of foot long plants) Grafted plants showed approximately 3% less alkaloid than their controls.

Agurell 1969a:

Using cultivated plants Agurell obtained 0.395 grams of nonphenolic alkaloids from 875 grams of fresh cactus. The main component was mescaline.

3,4-Dimethoxyphenethylamine was present as 2% of the nonphenolic fraction.

[This is around 0.04% mescaline by fresh weight, or (if using Poison's ratio of fresh to dry) around 0.67% by dry weight. This is around a third of Poisson's yield but twice that of Crosby & McLaughlin.]

In the phenolic fraction (0.049 grams total phenolics):

The main phenolic component was 3-methoxytyramine (shown by comparative GC, MS and IR with a known sample.). This was thought to be the first identification of 3-Methoxytyramine in plants. Traces of tyramine (phenolic) and mescaline (nonphenolic) were also present in the phenolic fraction. They also found trace amounts of 3,5-dimethoxy-4-hydroxyphenethylamine (identified by GC comparison with reference material) but it was present in too low of amounts to enable them to compare IR spectra.

Other trace components in the phenolic fraction appeared to be tetrahydroisoquinolines (based on MS). The main component of the tetrahydroisoquinolines present was determined by GC and MS to be Anhalonidine. It was present as 0.01% of the total alkaloids.

Stig Agurell 1969a *Lloydia* 32 (1): 40-45

Agurell 1969b:

Agurell tabulated over 50 mg. of total alkaloid per 100 grams of fresh plant: (In this paper, Agurell tabulated his results by ranges rather than listing actual percentages of yield. "*Over 50 mg / 100 grams*" represents the highest total alkaloid range Agurell used.)

Mescaline (ms, ir, mp) (Present as over 50% of total alkaloid.) [i.e. over 0.03%*]

["Present as over 50% of total alkaloids" is the highest relative % range that Agurell included.]

3,4-Dimethoxyphenethylamine (ms, ir) (Present as 1-10% of total alkaloid.)
Hordenine (ms) (Detected as traces.)
Tyramine (ms) (Detected as traces.)
3-Methoxytyramine (ms, ir) (Present as 1-10% of total alkaloid.)
3,5-Dimethoxy-4-hydroxyphenethylamine (ms) (Detected as traces.)
3,4-Dimethoxy-5-hydroxyphenethylamine (ms) (Detected as traces.)
Anhalonidine (ms) (Detected as traces.)

Agurell 1969b *Lloydia* 32: 206-216

[* If Poisson's figures on water content hold true this range would represent a minimum content of well over one half of one percent (over 0.5%) mescaline by dry weight. This corresponds to the figure given in Agurell 1969a above.]

Agurell began by soaking the fresh material, homogenized in methanol (250 ml per 100 grams of fresh cactus) overnight at 4°, protected from air. The resulting methanol extract was dried at a low temperature and the residue dissolved in a mixture of 25 ml of 0.1N HCl and 25 ml chloroform. (He later substituted 3% acetic acid for the hydrochloric as he found that the hydrochlorides of some of the alkaloids in cacti were highly soluble in chloroform.

[As 3,4-dimethoxyphenethylamine is one of these, and as it has been found by numerous researchers to be difficult to separate from mescaline even when using preparative tlc, perhaps it **would** be a good idea to use hydrochloric acid at this stage of extraction if all that was desired in the end was mescaline.]

The chloroform was discarded and the aqueous solution was washed with an additional 5 ml of chloroform. It was then filtered and brought to pH 8 with ammonia. He extracted twice with 50 ml portions of chloroform, and once with Chloroform-Ethanol (3:1). He then raised the pH to 10-11 and extracted twice with 50 ml portions of Chloroform-Ethanol (3:1).

After drying with anhydrous sodium sulfate, the chloroform was evaporated to dryness. (While the account does not specifically state it, I suspect they combined their organic extracts and evaporated them after drying with the desiccant)

The residue was dissolved in 100 ml of chloroform and purified by use of a column of Celite (15 grams of Celite 545 and 4 ml of 0.5M phosphoric acid.). Nonbasic compounds were washed out with 100 to 200 ml of chloroform.

Chloroform saturated with ammonium hydroxide eluted the alkaloids from the Celite.

They then used a 1x20 cm column of Amberlite IRA-400 (OH-) ion exchange resin with the flow rate adjusted to 20 ml per hour to separate the alkaloids (dissolved in methanol) into phenolic and nonphenolic fractions. 100 ml of 30% aqueous methanol eluted the nonphenolic fraction. A mixture of 120 ml of methanol, 60 ml of water and 20 ml of glacial acetic acid eluted the phenolics. Most mescaline is with the nonphenolics where it belongs but a portion will get delayed and come off with the phenolic fraction.

Further purification was achieved using column chromatography on alumina (activity grade II-III). Elution was achieved by successively using benzene, benzene-chloroform, chloroform, chloroform-methanol, methanol, and methanol-water in varying proportions.

Agurell's procedure may have yielded less than total extraction due to his first step **[Note 61]**. For most plants it would have been an excellent approach. However, fresh San Pedro contains a thick slime which can interfere with extraction via solvents. [Cooking with acids and/or pressure will help reduce the slime substantially] If or how much this may have affected Agurell's results is not known. It may not have. He did use a good amount of solvent and homogenized his material. Although he did not state it, I would assume that he checked the marc to be certain it was exhausted.

Still, there is such wide disparity between recoveries reported in the literature that it would be prudent to ascertain whether the differences were due to variations between plants or procedures. [See also comment below on ion-exchange resins as a potential source of loss.]

Agurell noted that Willaman's survey contains an incorrect reference concerning the presence of mescaline in *Opuntia cylindrica* (*Austrocylindropuntia cylindrica*)
[i.e. misidentified San Pedro], namely *Gaz. Chim. Ital*. 86, 1305 (1956).
The correct reference is (1956) *Gazzeta Chimica Italiana* 86: 1324-1331, which is G.B. Marini-Bettòlo & Juan A. Coch Frugoni's paper on the electrophoretic separation of alkaloids, including mescaline from an extract of purported *Opuntia cylindrica* (i.e. San Pedro erroneously thought to be *Opuntia cylindrica*. **[Note 62]**)

Bruhn & Lundström 1976a:

Bruhn & Lindgren used plants weighing between 30-120 grams and reported a recovery of 20-90 mg of total alkaloid per plant. [0.067%-0.079% by fresh weight]

Fresh plants [30-120 grams] were first frozen then allowed to thaw for one hour.

After homogenizing in 200 ml of 5% acetic acid, the foaming slurry was filtered using a Buchner funnel.

Concentrated ammonia was added to raise the pH to 9-10.

The resulting basic solution was then extracted three times with 200 ml of chloroform. Rather than shaking it, the separatory funnel was gently rocked 10-20 times (to minimize emulsion formation)

The chloroform extracts were then combined, filtered through anhydrous Magnesium sulfate and finally evaporated to near dryness.

10 grams of Celite (diatomaceous earth) was stirred with 3 ml of 0.5M *ortho*-phosphoric acid until homogenous. chloroform was then added and the slurry placed into a 2x15 cm glass chromatography column with a cotton plug. The Celite was packed with light pressure and a cotton plug added to the top.

The alkaloid bearing residue was dissolved into 25 ml of chloroform and passed through the column.

The column was first washed with 100 ml of chloroform to remove any non-basic components (using an elution rate of 2 ml/ minute).

The alkaloids were eluted with 100 ml of chloroform saturated with concentrated ammonia (2:1).
The alkaloid fraction was recovered by evaporation of the solvent.

Jan G. Bruhn & Jan Lundström 1976a *American Journal of Pharmaceutical Education* 40:159-160.

CROSBY & MCLAUGHLIN 1973:

CROSBY & MCLAUGHLIN stated that mescaline was first identified in San Pedro in 1960 by TURNER & HEYMAN but they had misidentified the plant as *Opuntia cylindrica* and that mescaline was first isolated from authenticated *T. pachanoi* by POISSON.

This first point is not correct. Granted, TURNER & HEYMAN misidentified the plant, and granted, they identified mescaline but, as mentioned earlier, they were not the first to do either.

CROSBY & MCLAUGHLIN recovered 0.331% mescaline base from freeze dried plant material. [37% of TURNER & HEYMAN's yield and 16-17% of POISSON's return.]

They crystallized 3-methoxytyramine for a yield of 0.01%.

Their procedure began when they sliced, froze, freeze dried and reduced the cactus to coarse powder in a Fitzpatrick mill.

255 grams of dried cactus was defatted, basified & extracted by percolation with chloroform *as per* NEAL *et al*. 1971.

[NEAL *et al.* was J.M. Neal, P.T. Sato, C.L. Johnson and J.L. McLaughlin. Working with *Ariocarpus kotschoubeyanus* they had defatted (with 30-60° fraction petroleum ether), dried the defatted plant material, basified (by moistening with ammonium hydroxide-methanol-chloroform (1:2:2) and macerating in the same mixture, but with a 1:9:90 ratio, for 4 to 6 hours) and then extracted for four hours with chloroform using 2 large (10 x 50 cm) percolators with flow rates adjusted to 1 liter per hour. (Details not specified in NEAL *et al*. 1971 came from ***their*** "*as per*" references: BRAGA & MCLAUGHLIN 1969 and MCLAUGHLIN & PAUL)

4 liters of percolate was recovered which CROSBY & MCLAUGHLIN reduced to a viscous syrup.

This syrup was then dissolved in 1N HCl and processed via acid-base partitioning *as per* WEST & MCLAUGHLIN 1973.

[Working with *Mammillaria elongata*, WEST & MCLAUGHLIN took their aqueous extracts made of the residue remaining after removal of solvent (acid pH) and after filtering, extracted twice with equal volumes of chloroform and diethyl ether. The pH of the acidic aqueous layer was subsequently adjusted to pH 8.5, pH 9.5 and pH 10.5 with 7.5N NaOH. At each pH value the aqueous fraction was extracted twice with equal volumes of chloroform and diethyl ether. The combined organic layers were dried with anhydrous Na_2SO_4, and concentrated under vacuum.]

The alkaloid fraction was dissolved in ethanol and resolved into phenolic and nonphenolic fractions using Amberlite IRA-401 in hydroxide form *as per* MCLAUGHLIN & PAUL 1966.

[Working with peyote, MCLAUGHLIN & PAUL had used ~1 ml of ethanol for every 15 grams of dried powdered starting material (they did not use weight of residue for proportioning). It was filtered if necessary The resulting ethanol solution was added to Amberlite IRA 401 (OH) ion-exchange resin in a column using 20 grams of resin for every 100 grams of dried starting material. They let development proceed with a flow rate of 30 drops per minute.

They then washed the column with ethanol and increased the flow rate to 150 drops per minute. This washing was continued until the effluent was colorless (300 to 400 ml of ethanol per 100 grams of dried starting material)

The **nonphenolic fraction** was obtained as a residue from the ethanol which was removed using a steam bath and a current of air. Heating was omitted during the final stages of evaporation.

Using 200 ml of water per 20 grams of resin, they first rinsed excess ethanol from the column and then eluted the **phenolic alkaloids** with 1 N HCl (800 ml per 100 grams of dried starting material.) The phenolic fraction was obtained by adjusting pH to 8.2 with 7.5N NaOH and freeze drying the solution. The residue was extracted with ethanol-chloroform (1:9) by making a slurry using 40 ml of the solvent mixture for every 200 ml of the solution that had been freeze-dried, then filtering with suction and rinsing the residue twice with half this amount of solvent. This was repeated until the eluted solution was colorless. (Usually two or three times) After filtering the resulting solution was evaporated as with the nonphenolic fraction above.]

The residue from the **nonphenolic fraction** was dissolved in 0.5N HCl and taken through acid-base partitioning *as per* WEST & MCLAUGHLIN 1973. [See procedure specified above.] The resulting residue of free base was dissolved in a small amount of absolute ethanol. Addition of 5% (w/w) HCl in absolute ethanol reduced the pH to 2. Anhydrous ether was added to induce crystallization [cloudiness] and cooling enabled the crystallization of 963 mg. mescaline HCl.

The mother liquor was streaked onto five 1mm thick preparative TLC plates of $SGPF_{254}$ and developed in ethyl ether-methanol-conc. ammonium hydroxide (17:2:1). Elution of the major band with 5% conc. ammonium hydroxide in absolute ethanol and recrystallization as above recovered another 26 mg. of mescaline hydrochloride. (Total of 989 mg. mescaline [as hydrochloride] from 255 grams of dried plant.) Recrystallization of the combined mescaline above was from absolute ethanol-ethyl ether. [i.e. dissolving in a small amount of absolute ethanol and adding anhydrous ether to induce crystallization, then chilling.]

26 mg. of 3-methoxytyramine was recovered from the phenolic fraction.

D.M. CROSBY & Jerry L. MCLAUGHLIN (1973) *Lloydia* 36 (4): 416-418.

Cruz-Sánchez 1948 studied material obtained from the Lima Botanical Gardens. Despite calling it *Opuntia cylindrica*, the photo in his thesis is clearly *T. pachanoi.* (Perhaps a mislabeled specimen?) He reported isolating 5% by dry weight using only the outer parts of the plant. His alkaloid was most likely contaminated with DMPEA.

Guillermo CRUZ SÁNCHEZ (1948) *Estudio Farmacologico de la Opuntia cylindrica.*

Gonzales Huerta 1960 confirmed the results of Cruz Sanchez (using correctly identified material and only the green outer layers) but had trouble obtaining his yield when using the same approach. When using the approach of Folkers & Koniuszy 1939 she reported recovering 4.5% of an alkaloid salt which appeared to be mescaline.

Ines GONZALES HUERTA (1960) *Revista del Viernes Médico [Lima]* 11 (1): 133-137.

POISSON 1960:

POISSON used 180 grams of fresh cactus and found it contained 93.5% water content by weight. After drying and pulverizing, it was Soxhlet extracted with ethanol. After concentration (until the alcohol was removed) he dissolved it with 10 ml of 10% hydrochloric acid in the presence of 100 ml of ether. The acidic fraction was separated by decanting and then neutralized with ammonia and extracted several times with chloroform.

0.42 grams of crude alkaloid was recovered as a viscous residue (3.7% by dry weight.)

This was distilled at 80º at 0.01mm and 220 milligrams of a colorless basic oil with the odor of an amine was obtained. The yield was 2% by dry weight or 0.12% by fresh weight.

It was identified as mescaline by the mp and mmp of its hydrochloride and picrate salts as well as by IR spectral comparison with a known reference standard.

Jacques Poisson (1960) *Annales Pharmaceutiques Françaises* 18: 764-765.

[While it is unrelated, trivial and purely coincidental, it is interesting that the primary author of the team who had isolated and identified DMT from *Anadenanthera* (*Piptadenia*) *peregrina* seeds (the source of the snuff known as *wilka* or *cohoba*) just 5 years earlier was also named 'Fish' (M.S. Fish). (*Poisson* being French for 'fish'.) I do not remember who brought this to my attention. Jonathan Ott?]

Poisson's high rate of recovery stands in curious contrast to Turner & Heyman's or Crosby & McLaughlin's low returns (the latter ran less than 20% of Poisson's figure, the first less than half) or even to Pardanani's mescaline extraction from *T. peruvianus*, reputed to be far more potent than San Pedro. [Agurell 1969b, did not observe mescaline in his specimens of *T. peruvianus*, although mentioning two minor unknowns, perhaps reflecting varietal or age differences?

A friend in New Zealand reported similarly negative results in an assay performed using fairly young (1.5 year old) seed grown plants of *T. peruvianus*.]

[In M. Dobkin de Rios 1977 & 1982, it is stated that 1.29 grams of mescaline are contained in a kilo of San Pedro. This is mentioned during a brief discussion of observations from her 1967 field work. This is a mescaline content of 0.13%. We do not know where this originated as no reference is given. Her 1968 articles discussing her field work do not include this figure. It is probably a typo. On page 140 in her 1969 paper presented in *Mesa Redonda de Ciencias Prehistoricas y Anthropologias. Lima* 1: 139-149, "*En 1959, la etnobotánica Friedberg ha identificado el cactus San Pedro conteniendo 1.2 gramos de mescalino por c/kg. de materia cruda.*"]

Claudine Friedberg supplied correctly identified Peruvian plant material to Jacques Poisson for analysis.

As with peyote, it appears that the South American mescaline cacti have a similarly wide variability of alkaloid content. The factors involved are ripe for elucidation.

It is puzzling that researchers used such different approaches when obtaining lower yields than previously published.

Crosby & McLaughlin used freeze dried seed-grown material and a far more high tech work-up than Poisson. Oddly, they mentioned only the similarity of their percentage of yield to Turner & Heyman's report using *Opuntia cylindrica* (giving Turner & Heyman's recovery as 0.357%, which is nowhere included in Turner & Heyman's article that instead gave a higher figure) and never once mentioned Poisson's figure; only that he was the first to use authenticated San Pedro.

It might be wondered if Poisson's use of vacuum distillation during isolation played a role. His approach was also not as heavy handed and manipulative as that of Crosby & McLaughlin. Sometimes, simple is good.

I also must wonder if part of the alkaloid was lost during fractionation into phenolic and nonphenolic fractions. Retention of strongly basic alkaloids within OH^- ion exchange resins is not an uncommon source of partial losses. [See Ivor Smith.]

It would only seem prudent to repeat a work-up of the same material using procedures which had yielded a higher rate of return for others in order to ascertain whether the differences were varietal **[Note 63]** or procedural. Certainly age-related, varietal, seasonal and even nutritional differences would be relatively easy to examine. They could also prove to be very worthwhile to investigate if it was first determined that the disparate methodologies were not a significantly contributing factor. As the literature currently exists there is no way to even guess as to the origin of the broad discrepancies in published yields. [Ed.: Bioassays suggest high variability influenced by at least several factors; including strain, age, environmental conditions and nutritional history.]

Once again this emphasizes Dr. Richard Evans Schultes' point of the importance of properly vouchered specimens with data concerning points of origin. Researchers should include as many variables as possible when recording their work. Seasonal fluctuations **[Note 64]** are fairly well known in at least some cacti, as are substantial variations in alkaloid content between localities and varieties. (Even the pH within a single cactus specimen is known to show diurnal fluctuations according to Gibson & Nobel 1986)

Age of plants, part of plant (active growing tips versus older sections) and background of nutritional access may also play important roles. Additionally, I would suggest that soil samples or at least soil analysis results be included with vouchers.

Unfortunately, in our current era of PharmacoGnostic religious and spiritual repression and perceived political incorrectness this is not likely to be undertaken by the more established channels.

Crosby & McLaughlin 1973 stated that W.J. Turner & J.J. Heyman found 0.357% in whole (dried) plant. This is not supported by Turner & Heyman.

Turner & Heyman mentioned that Guillermo Cruz-Sánchez had derived an alkaloid from *Opuntia cylindrica* and administered it to 34 people ("*of whom two developed a brief psychotic state* ") in dosages ranging from 5 to 11.5 grams per kilogram **[Note 65]**. This is a misprint **[Note 66]** intending to say mg/kg. They further went on to state that "*some of its physical and chemical properties, the psychological changes, as well as the dosage of the alkaloid employed, suggested the possibility of the presence of mescaline*." [This is a gross understatement.]

Noting that the material was never adequately purified and laboratory facilities for accurate identification were unavailable **[Note 67]**, they stated that the only other reference to *Opuntia cylindrica* they had been able to find was in a review article by V. Buscaino (1949) *Gazzetta Sanitaria* 20: 417. [They obviously did not look in, at that time, recent if not current, *Chemical Abstracts*.]

Dr. Vincente Zapata Ortiz (University of San Marcos, Peru) provided them with an alcoholic extract for evaluation. They were subsequently supplied with dried whole plants via Dr. Leoncio Zapata, a physician on the staff of the Central Islip Hospital (Central Islip, NY) where Turner & Heyman worked in the research division. Where Dr. Ortiz obtained the plants is not stated nor is how they were identified. No botanist, not even a botany student, would have declared them *Opuntias*, even if seen only as dried specimens.

It is not clear where Crosby & McLaughlin arrived at the figure of 0.357%. At no point does Turner & Heyman give the weight of their product. In the few weights they listed was a 2 gram **aliquot** of one extraction which they weighed in order to estimate molecular weight via sulfate titration which yielded 1.31 grams of white semicrystalline residue. They gave 300 grams as the starting weight of their material. They evidently ran the procedure several times as they had been furnished with several kilograms of dry material and specifically stated in the experimental section that the maximum yield of crude base was 0.9%. They also found a very small portion of mescaline to be in the mother liquor and evidence of a trace amount of another alkaloid they did not identify.

Why Crosby & McLaughlin's figure is most puzzling is that in the text itself, Turner & Heyman ended by clearly stating, "*We have been able to identify the alkaloid present as mescaline, present in concentration of 0.9% of the whole dried plant. There is no more than a slight trace of additional alkaloids*."

Perhaps, spurred by the apparent disparity in Turner & Heyman's account **[Note 68]**, Crosby & McLaughlin may have considered the 1.31 grams of the sulfate as being the total yield from 300 grams of starting material, (which is *not* how it is stated **[Note 69]**) and, omitting the waters of hydration associated with formation of the sulfate, calculated the yield in terms of the free base. Our suspicion is that since this was in the ball park of what they had recovered, they assumed Turner & Heyman must have been mistaken about their stated percentage or erred in their math. It is odd they did not note their revision of Turner & Heyman as such.

It is also odd that they dismissed, or at least omitted, Poisson's figure and Agurell's figures. One point about Agurell's low return which must be considered is that he used plants cultivated in Europe. Crosby & McLaughlin also used plants which were cultivated (from seed, in California). Whether horticultural varieties, age or conditions of growth are factors is not known (I believe they may be, as subjective results in our bioassays suggest increased strength to be directly correlated with both age and history of good nitrogen access)

Turner & Heyman do not provide enough information in to determine where their plants originated, and, most importantly, whether they were cultivated plants or whether they were wild plants harvested for drug usage.

The evidence strongly suggests that they used material originating in Peru. In the case of Poisson, the description, which we know were Friedberg's, sounds very much like market place sections. She did field work in Huancabamba; noting extensive cultivation with selection for potency, which would imply that Poisson analyzed plant material specifically harvested for sacramental use. Reports from travelers who have sampled both these cacti and also the US or European domestic cultivars uniformly report that the material sold in the Peruvian markets is substantially more potent.

In no case can I determine age, although in the case of Crosby & McLaughlin there is a remote possibility that it may be accessible information if Abbey Garden has record of it. As there are no other data points with which to compare it, the information is currently of limited usefulness.

Obviously, as the plants were grown from seed they could not have been as large or from as old of specimens such as would be encountered in the wild or in areas where they are traditionally cultivated. Even young new growth on older established plants should not be automatically expected to be directly comparable to young seed grown plants.

The fact that Turner & Heyman's samples were provided as *Opuntia cylindrica*, the name under which the drug plant was then known by a number of people versus the proper binomial which was well known throughout the horticultural world, ***suggests*** their material originated via nonhorticultural Peruvian sources. [If the plants had been provided by a botanical garden or reputable horticultural supplier it might be assumed that they would either have been something other than San Pedro (namely bona fide *Opuntia cylindrica*) or else they would have been properly identified *as T. pachanoi*.]

authentic *Opuntia cylindrica*
Peru 64.0903
(Berkeley)

This is also implied by their first sample being supplied as prepared extract from a Peruvian source. [Turner & Heyman were provided with previously dried plant material while Poisson had started with fresh and dried it himself.]

Circumstantial evidence, in the form of a photograph in Cruz Sanchez's 1948 thesis, suggests a mislabeled specimen in the Jardin Botánico de Lima might have been the culprit.

Turner & Heyman 1960:

Turner & Heyman first moistened their dry material with Methanol-Ammonium hydroxide (20:1). They transferred this to a glass chromatography column fitted with a Soxhlet extractor and extracted with chloroform continuously for 24 hours. They partially evaporated the solvent with a stream of air (room temperature), treated the solution with an excess of 5% acetic acid and extracted with water. The aqueous solution was defatted with benzene and then brought to pH 7-7.6. A benzene extraction of the aqueous solution at this point gave evidence of an alkaloid (based on a positive reaction with ninhydrin) but it was trace amounts they could not isolate. [Mescaline will extract in small amounts at this pH.]

They then raised the pH to 10 (with NaOH) and extracted with benzene which removed all ninhydrin reactive material from the aqueous phase.

They washed the benzene phase with distilled water twice and evaporated it in a stream of warm air and then over phosphorus pentoxide.

The residue was dissolved in alcohol (10 ml of 95% per 2 grams of residue) and titrated with 1N sulfuric acid (6.19 ml. per 2 grams of residue). This was then dried. The remaining residue was extracted with benzene [to remove impurities?] and the resulting residue was a white semicrystalline material. They then recrystallized three times from water-ethanol.

They identified it as mescaline based on mp of the sulfate, mp of the picrate and co-tlc with a known sample.

William J. Turner & Jack J. Heyman (1960) *Journal of Organic Chemistry* 25: 2250-2251.

An interesting assay was done by Stanley D. Brown *et al.* 1968 who reported no predominate peaks in glc run on a sample of San Pedro collected in June from the Desert Botanical Gardens at Tempe Arizona.

This has sometimes been interpreted and presented to mean that alkaloids were absent during this period. It must be noted that they did not find any PREDOMINATE peaks. They did both observe and report peaks and also obtained positive alkaloid tests with Mayer's reagent on both the crude extract and the purified bases. They simply were unable to estimate a molecular weight for the base(s) present. There was not enough information included in their account to account for what they observed. [They specifically stated any instances when the plant material had no detectable alkaloid and this was **not** noted for San Pedro.]

The published presentation of this, in the counterculture literature, as meaning that alkaloids are absent during summer cannot be extrapolated from their data and additionally is completely unsubstantiated by several dozen bioassays involving 11 different people. These include only those known of firsthand. If anything, subjective responses have always seemed higher in late summer and fall than in spring. Just the opposite of peyote.

Two novel triterpenes named Pachanol A & Pachanol B were isolated by **Kinoshita *et al.* 1995** as aglycones from the saponin fraction after acid hydrolysis. These novel triterpenes were termed Pachanans.

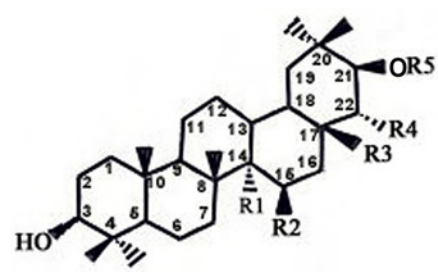
They were accompanied by Bridgesigenins A & B.

An enzymatic digest of the saponin fraction yielded Pachanols A & C and Bridgesigenin C.

Kinoshita *et al.* 1998 established antinociceptive activity in rodents for Bridgesigenins B & C and for Pachanol C.

All three outperformed their active control, aspirin, in the "*acetic acid writhing method*"

Just what that means remains to be seen. Antinociceptivity as measured by this test could variously reflect some type of actual analgesia and/or an antiinflammatory action and/or a decrease in activity/responsiveness and/or a psychological impairment.



Structure shared by Pachanols & Bridgesigenins

R	1	2	3	4	5
Bridgesigenin					
A	**Me**	**O–**	**C(O)–**	**H**	**H**
Bonds: 12=13; (Note: R2 & R3 are linked)					
B	**Me**	**O–**	**C(O)–**	**OH**	**OH**
Bonds: 12=13; (Note: R2 & R3 are linked)					
C	**Me**	**O–**	**C(O)–**	**H**	**Ac**
Bonds: 12=13; (Note: R2 & R3 are linked)					
Pachanol					
A	**H**	**Me**	**C(O)–**	**H**	**–O**
Bonds: 12=13 & 14=15; (Note: R3 & R5 are linked)					
B	**Me**	**Me**	**C(O)–**	**OH**	**–O**
Bonds: 11=12 & 13=18; (Note: R3 & R5 are linked)					
C	**Me**	**Me**	**C(O)OH**	**H**	**Ac**
Bonds: 12=13					

Reyna & Flores 2001 gave a detailed account of the folk use of San Pedro and the recent analysis by **Flores** 2000 showing, among other things, the presence of primary & secondary amines, alkaloids, triterpenes, saponins, and β-sitosterol.

That work determined 95.5% water content in *T. pachanoi*.

Material harvested at Chiclayo in January was found to contain 0.78% mescaline by dry wt; while that from Barranca which had been harvested in August 1998 had 1.4% by dry weight.

Víctor Reyna Pinedo & José Flores Garcés(2001) *Quepo* 15: 28-37.

Suggested Reading Concerning San Pedro

(Inclusion of the qualifier "*From*" means I wanted to include it as it was mentioned by another source as a reference but a copy was not obtainable so far.)

General history and usage

Marlene DOBKIN DE RIOS (1990) *Hallucinogens: Cross Cultural Perspectives*.

Claudine FRIEDBERG (1959) *Journal d'Agriculture Tropicale et de Botanique Appliquées* 6 (8-9): 439-450. "Rapport sommaire sur une mission au Pérou. (effectuée de novembre 1958 à juillet 1959)" Some list this as 6 (8-9):1

Claudine FRIEDBERG (1960) Comptes Rendus de la Société de Biogéographie 324: 46-56. "Ethnobotanique péruvienne : répartition des espèces utilisées par l'homme dans la médecine et la magie, et ses rapports avec les zones floristiques."

Claudine FRIEDBERG (1963) *Journal d'Agriculture Tropicale et de Botanique Appliquées* 10 (1-9): 33-52, 245-258 & 344-386 : illustr. with 8 plates "Mission au Pérou, mai 1961 - mars 1962."

Claudine FRIEDBERG (1964) *Sixth International Congress of Anthropology and Ethnological Sciences* [Actes du VIème Congrès International des Sciences Anthropologiques et Ethnologiques, Paris, 1960] (Paris: Musée de l'Homme, Palais de Chaillot) 2 (2): 21-26. "Utilisation d'un cactus à mescaline au nord du Pérou. (Trichocereus pachanoï Brit. et Rose)" [This appears listed as 1960; the date for the presentation of the paper itself.]

Claudine FRIEDBERG (1965) *Travaux de l'Institut Français d'Etudes Andines* 7: 65-94. "Rapport sur une mission au Perou: description du materiel recuelli, Exposé sommaire des recherches entreprises."

Claudine FRIEDBERG (1979) *Actes du XLIIème Congrès International des Américanistes. Paris, 2-9 sept. 1976* [Paris: Fondation Singer-Polignac] p. 427-443. "L'Imaginaire dans les thérapeutiques populaires : proposition de quelques thèmes de réflexion à travers l'exemple du complexe thérapeutique huancabambin (sierra de Piura au nord du Pérou)." Republished in Spanish as Friedberg 1980.

Claudine FRIEDBERG (1980) *Medicina Traditional* 3 (9): 29-44. "Lo imaginario en las terapias populares."

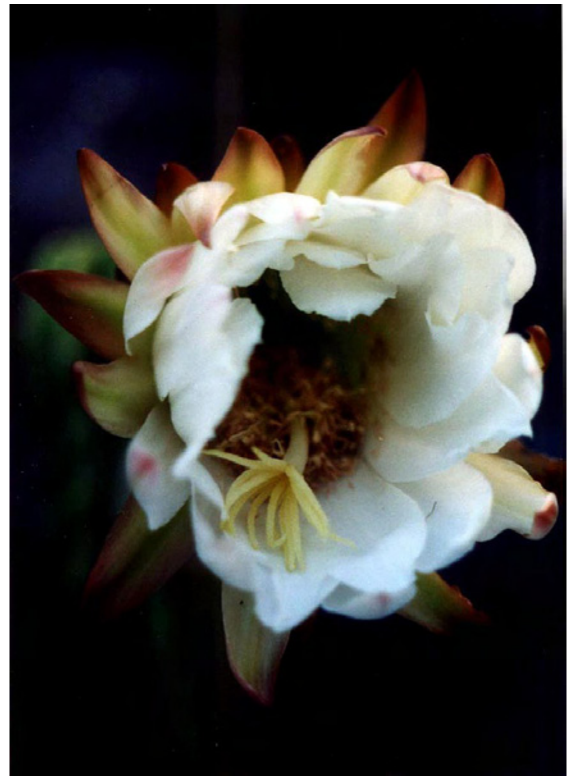
Jonathan OTT (1996) *Pharmacotheon. Second Edition Densified*. pp. 81-115 [If you already own a copy consider buying copies to give to public libraries which, in general, always seem to lack this mammoth work]

Richard Evans Schultes & Albert HOFMANN (1992) *Plants of the Gods*. pp. 154-157

Ancient Usage

Walter ANDRITZKY (1989) *Schamanismus und rituelles Heilen im Alten Peru. Band 2: Viracocha, Heiland der Anden.* (Included but not his focus.)

Ralph E. CANÉ (1985) *Boletín de Lima* 7 (37): 38-44. "Problemas Arqueológicos e Iconográficos-Enfoques Nuevos." (Nice short piece reviewing the shift in archaeological views, as the science struggles to break free of its fiercely defended Eurocentric, Judeo-Christian, intellectually limiting blinders. Includes some interesting portrayals of flying 'gods' with human feet. One has cactus spines and appears to be vomiting.)



Trichocereus pachanoi
Photo by Jon R Hanna

Alana CORDY-COLLINS (1977) "Chavín art: Its shamanic/ hallucinogenic origins." In Alana CORDY-COLLINS and Jean Stern (Eds.) *Pre-Columbian Art History: Selected Readings.* (from CORDY-COLLINS 1980)

Alana CORDY-COLLINS (1977) "Chavín art: Its shamanic/ hallucinogenic origins." In A. CORDY-COLLINS and J. Stearn (Eds.) *Pre-Columbian Art History: Selected Writings*. pp. 353-362. (from OTT)

Alana CORDY-COLLINS (1980) *The Masterkey* 54: 84-93. "An artistic record of the Chavín hallucinatory experience."

Alana CORDY-COLLINS (1982) *The Journal of Ethnobiology* 2 (2): 144-153. "Psychoactive painted Peruvian plants. The shamanism textile."

Marlene DOBKIN DE RIOS (1977) *Economic Botany* 31 (2): 189-203. "Plant hallucinogens and the religion of the Mochica-An ancient Peruvian people."

Marlene DOBKIN DE RIOS & Mercedes CÁRDENAS (1980) *Journal of Ethnopharmacology* 2 (3): 233-246. "Plant hallucinogens, shamanism and Nazca ceramics."

Carlos OSTOLAZA (1995) *Quepo* 9: 73-82. "Etnobotanica II. El Período Formativo."

Carlos OSTOLAZA (1996) *Quepo* 10: 42-49. "Etnobotanica III. La Cultura Paracas."

Carlos OSTOLAZA (1997) *Quepo* 11: 79-86. "Etnobotanica IV. La Cultura Nazca."

Carlos OSTOLAZA (1998) *Quepo* 12: 62-68. "Etnobotanica V. La Cultura Moche."

Carlos OSTOLAZA (1999) *Quepo* 13: 32-37. "Etnobotánica VI. Culturas Wari y Chimu."

Carlos OSTOLAZA (2000) *Quepo* 14: 18-23. "Etnobotánica VII. El Imperio de los Incas."

All are heavily illustrated.

Rosa Fung PINEDA (1969) *Dédalo (Sao Paulo)*. 5 (9-10): 5-207. ("*Cigar*" references are on pp. 43, 120 and 195.) "Las Aldas: su ibicación dentro del proceso historico del Perú antiguo."

Douglas C. SHARON & Christopher B. DONNAN (1977) *Archaeology* 30 (6): 374-381. "The Magic Cactus: Ethnoarchaeological Continuity in Peru."

Douglas C. SHARON (1978) *Wizard of the Four Winds: A Shaman's story*.

Douglas C. SHARON (1980) *El Chamán de los Cuatro Vientos.* [Translation of SHARON 1978.]

Douglas C. SHARON (2000) *Shamanism & the sacred cactus: ethnoarchaeological evidence for San Pedro use in northern Peru/ Shamanismo & el cacto sagrado: evidencia etnoarqueológica sobre el uso del cacto San Pedro en el norte del Peru.*

Douglas C. SHARON (2001) *Eleusis* 5: 13-59. "Ethnoarchaeological Evidence for San Pedro (*Trichocereus pachanoi*) Use in Northern Peru." A chronology of the unfolding of archaeological evidence; with many photos.

Margaret Ashley TOWLE (1961) *The Ethnobotany of Pre-Columbian Peru.* DOBKIN DE RIOS (1990) says she mentions the presence of San Pedro on the south coast of Peru and asserts that *Cereus* cacti are frequently found in the art of the area.

Towle does not mention San Pedro specifically but identifies plants as *Trichocereus cuzcoensis* when using the name 'giganton', a name of San Pedro.

Possibly more importantly, she discusses the representation of a variety of cacti including some low globulars. One was referred to as a *Lobivia* or *Mammillaria*.

The hunt continues on the globular front. Rumors of use are solid but the identity has proved elusive.

This and its contained references are the sole references I can find in the literature.

TOWLE 1961 should be considered required material for anyone studying ancient and modern plant use in Peru.

Many ayahuasca admixtures are also included but not discussed as such.

Modern Usage

Antonio BIANCHI (1991) *Annali dei Musei Civici-Rovereto* 6: 147-152. "Psicofisiologia dei rituali allucinatori dello sciamanesimo nord-peruviano." Discusses the role of the ritual context in producing a religious experience.

Antonio BIANCHI & Mario POLIA (1991) *Integration: Zeitschrift fur Geistbewegende Pflanzen und Kultur* 1: 65-70. "Ethnological evidence and cultural patterns of use of *Trichocereus pachanoi* BRITTON & ROSE among Peruvian curanderos." Also published in Italian: (1991) *Annali dei Musei Civici-Roverto* 6: 139-146. "Dati etnofarmacologici e modelli culturali dell'uso del *Trichocereus pachanoi* Britton & Rose tra I curanderos peruviani."

Eduardo CALDERON & Douglas SHARON (1978) *Terapia de la Curanderia*. (Discusses modern use in healing and philosophy. Discussion of other herbs pp. 59-67.)

Eduardo CALDERÓN *et al*. (1982) *Eduardo el Curandero: The words of a Peruvian Healer.*

Guillermo CRUZ SÁNCHEZ (1951) *Revista de medicina experimental* 8(1): 159-166. "Estudio Folklórico de Algunas Plantas Medicamentosas y Tóxicas de la Región Norte del Perú."

Face adorning a Chavin ceremonial vessel
After TELLO 1947

E. Wade DAVIS (1983)b *Botanical Museum Leaflets. Harvard University* 29 (4): 367-386. "Sacred Plants of the San Pedro Cult."

E. Wade DAVIS (1997) *One River. Explorations and discoveries in the Amazon Rain Forest.*

E. Wade DAVIS (1999) *Shaman's Drum* 52: 50-60. "San Pedro, Cactus of the Four Winds."

Marlene DOBKIN (1968)a *International Journal of Social Psychiatry* 15: 23-32. "Folk Curing with a Psychedelic Cactus in Northern Peru."

Marlene DOBKIN (1968)b *Economic Botany* 22 (2): 194-199. "*Trichocereus pachanoi* -- A Mescaline Cactus Used in Folk Healing in Peru."

Marlene DOBKIN DE RIOS (1973) *Psychiatry: Proceedings of the Fifth World Congress of Psychiatry.* Vol. 2. (R. de la Fuente & M. Weisman (eds.) (Mexico City) "Peruvian Hallucinogenic Folk Healing: An Overview."

Marlene DOBKIN DE RIOS (1977) *Economic Botany* 31 (2): 189-203. "Plant Hallucinogens and the Religion of the Mochica - An Ancient Peruvian People."

Claudine FRIEDBERG 1964 is said to describe ceramics she believed portrayed sorcerers carrying stumps of cacti and one in particular was San Pedro.

Claudine FRIEDBERG 1959, 1960, 1963, 1965, 1979, 1980

Bonnie GLASS-COFFIN (1998) *The Gift of Life. Female Spirituality and Healing in Northern Peru*.

Carlos GUTIÉRREZ-NORIEGA (1950) *América Indígena* 10 (3): 215-220. "Área de mescalinismo en el Peru."

Juan B. LASTRES (1951) *História de la Medicina Peruana.* Vol. 1. *La Medicina Incáica.* (From several DOBKIN DE RIOS articles including 1968b)

Mario POLIA (1990) *Quaderni di Avallon* 23: 59-69. "Alcune riflessioni sull'uso delle droghe rituali nello sciamenesimo amerindio."

Mario POLIA (1993) *Altrove* 1: 77-92. "L'uso del cactus mescalinico *Trichocereus pachanoi* nella medicina tradizionale andina."

Mario POLIA (1997) *Il Sangue Del Condor; Sciamani Delle Ande*.

Christian Rätsch (1995) "Eine bisher nicht beschriebene Zubereitungsform von *Trichocereus pachanoi*." pp. 267-281 in: RÄTSCH & BAKER (eds.) *Jahrbuch für Ethnomedizin und Bewußtseinsforschung.* Issue #4.

Víctor REYNA Pinedo & José FLORES Garcés (2001) *Quepo* 15: 28-37. "El uso del "San Pedro" (*Echinopsis pachanoi*) en medicina tradicional peruana."

Douglas SHARON (1972) "The San Pedro cactus in Peruvian folk healing." pp. 114-135. in: Peter T. Furst (Ed.) *Flesh of the Gods: The Ritual Use of Hallucinogens.*

Douglas SHARON (1972)b *Natural History* 81: 32-47. "Eduardo the Healer."

Douglas SHARON 1978 & 1980

Donna TORRES & Manuel TORRES (1995) "San Pedro in the Pressure Pot." pp. 283-284 in: RÄTSCH & BAKER (eds.) *Jahrbuch für Ethnomedizin und Bewußtseinsforschung.* Issue #4.

Chemistry:

Analyzed as *Opuntia cylindrica*:

G.B. MARINI-BETTÒLO & Juan A. COCH FRUGONI (1956) *Gazzeta Chimica Italiana* 86: 1324-1331. "Influenza del pH nella separazione elettroforetica su carta degli alcaloidi" ["The influence of pH on the electrophoretic separation of alkaloids on paper."] [CA (1958) 52: 653c]

G.B. MARINI-BETTÒLO & Juan A. COCH FRUGONI (1958) *Rendiconti. Istituto Superiore di Sanità* 21: 319-327 [cf. CA 49, 1280e] "Influenza del pH nella separazione elettroforetica su carta degli alcaloidi." [CA (1959) 53: 1633]

Juan A. COCH FRUGONI; *Anales. Facultad de Química*. [y farmacia (?)], *Universidad de la Republica Oriental del Uruguay*, in press] "The influence of pH on the electrophoretic separation of alkaloids on paper."

[From CA (1959) 53: 1633 which gives as *Anales fac. quím. y farm, Univ. rep. oriental Uruguay*.] All three of the above papers (at least some may be synonymous) measured and tabulated electrophoretic mobility of 68-70 alkaloids, including mescaline, and identified mescaline in extract of *Opuntia cylindrica*. *Chemical Abstracts* 1959 says Coch Frugoni separated mescaline from an extract of same. Unable to locate the specifics of when this was published. J.A. Coch Frugoni published a handful of papers during the next few years (several in the *Journal of Chromatography*) but this one has not been found to be listed (so far). [CITES lists him as J.A.C. Frugoni.]

Guillermo CRUZ-SÁNCHEZ (1948) *Revista de la Farmacologia y Medicina Experimentale* 1: 143[-?]. "Farmacología de '*Opuntia cylindrica*'." Also published as his thesis.

William J. TURNER & Jack J. HEYMAN (1960) *Journal of Organic Chemistry* 25: 2250-2251. "The Presence of Mescaline in *Opuntia cylindrica*."

As *Trichocereus pachanoi*:

Analysis:

Stig AGURELL (1969)a *Lloydia* 32 (1): 40-45 "Identification of Alkaloid Intermediates by Gas Chromatography-Mass Spectrometry. I. Potential Mescaline Precursors in *Trichocereus* species."

Stig AGURELL (1969)b *Lloydia* 32 (2): 206-216 "Cactaceae Alkaloids I." (also analyzed authentic *Opuntia cylindrica*.)

D.M. CROSBY & J.L. MCLAUGHLIN (1973) *Lloydia* 36 (4): 416-418. "Cactus Alkaloids. XIX. Crystallization of Mescaline HCl and 3-Methoxytyramine from *Trichocereus pachanoi*."

José FLORES G. (2000) "Estudio Químico del cactus San Pedro (*Echinopsis pachanoi* Britton & Rose)." *Thesis. Universidad Nacional de Ingeniería, Facultad de Ciencias*. [from REYNA & FLORES 2001]

Hans-Jörg HELMLIN & Rudolf BRENNEISEN (1992) *Journal of Chromatography* 593: 87-94. "Determination of psychotropic phenylalkylamine derivatives in biological matrices by high-performance liquid chromatography with photodiode-array detection."

Ines GONZALEZ HUERTA (1960) *Revista del Viernes Médico [Lima]* 11 (1): 133-137. "Identificación de la Mescalina Contenida en el *Trichocereus pachanoi* (San Pedro)."

Jan LUNDSTRÖM (1970) *Acta Pharmaceutica Suecica* 7 (6): 651-666. "Biosynthesis of mescaline and 3,4-dimethoxyphenethylamine in *Trichocereus pachanoi* Br. and R."

Jacques POISSON (1960) *Annales Pharmaceutiques Françaises* 18: 764-765. "Présence de mescaline dans une Cactacée péruvienne." [See also (1961) *Chemical Abstracts* 55: 8448.]

REYNA & FLORES 2001

Reviews and discussions:

OTT 1993 (1996) *Pharmacotheon*

Richard Evans SCHULTES & Albert HOFMANN (1980) *Botany and Chemistry of Hallucinogens*. *Second Edition.*

Richard Evans SCHULTES & Albert HOFMANN (1992) *Plants of the Gods*

Pharmacological Studies:

(Are surprisingly few and less than recent. Apparently all I could find considered the plant to be *Opuntia cylindrica* and while measuring some physiological responses, focused more on descriptions of experiences and evaluation of psychological effects. There are some real gems contained in their observations that should be included in any essay describing the effects of mescaline. It is also worth noting that they used dosages of the hydrochloride alkaloid fraction of San Pedro up to the 22.2 mg/kg level and their average dosage range was in excess of 10 mg/kg. That's >680 mg IV for a 150 lb human as their average dose. They described their high dose cases as experimental psychosis.)

[There probably are more papers published in Italian scientific journals that have not yet been located or listed.]

Carlos GUTIÉRREZ-NORIEGA & Guillermo CRUZ SÁNCHEZ (1947) *Revista de Neuro-Psiquiatría* 10 (4): 422-468. "Alteraciones mentales producidas por la '*Opuntia cylindrica*'."

Carlos GUTIÉRREZ-NORIEGA & Guillermo CRUZ SÁNCHEZ (1948)a *Revista de Neuro-Psiquiatría* 11 (2): 155-170. "Psicosis experimental producida por '*Opuntia cylindrica*'."

Carlos GUTIÉRREZ-NORIEGA & Guillermo CRUZ SÁNCHEZ (1948)b *Revista de Neuro-Psiquiatría* 11 (3): 390-401. "El test de Rorschach en la intoxicación producida por '*Opuntia cylindrica*'."

CRUZ SÁNCHEZ 1948

GUTIÉRREZ-NORIEGA *et al*. 1951

Description of Effects From San Pedro:

GUTIÉRREZ-NORIEGA & CRUZ SÁNCHEZ 1947 & 1948a

Biosynthesis in San Pedro:
(Studies and discussions)

Stig AGURELL (1969)a *Lloydia* 32 (1): 40-45. "Identification of Alkaloid Intermediates by Gas Chromatography-Mass Spectrometry. I. Potential Mescaline Precursors in *Trichocereus* Species."

Stig AGURELL & Jan LUNDSTRÖM (1968) *Journal of the Chemical Society. D. Chemical Communications* 1968: 1638-1639 "Apparent intermediates in the biosynthesis of mescaline and related tetrahydroisoquinolines."

Jan LUNDSTRÖM & Stig AGURELL (1969) *Tetrahedron Letters* 39: 3371-3374. "A Complete Biosynthetic Sequence From Tyrosine To Mescaline in Two Cactus Species."

Jan LUNDSTRÖM (1970) *Acta Pharmaceutica Suecica* 7 (6): 651-666. "Biosynthesis of mescaline and 3,4-dimethoxy-phenethylamine in *Trichocereus pachanoi* Br. and R."
Jan LUNDSTRÖM (1971) *Acta Pharmaceutica Suecica* 8 (3): 275-302. "Biosynthetic Studies on mescaline and related cactus alkaloids."
Jan G. BRUHN & Jan LUNDSTRÖM (1976) *American Journal of Pharmaceutical Education* 40: 159-160. "A Student Experiment in Pharmacognosy: Biosynthesis of Mescaline in the Cactus *Trichocereus pachanoi*."

Botany and Taxonomy:

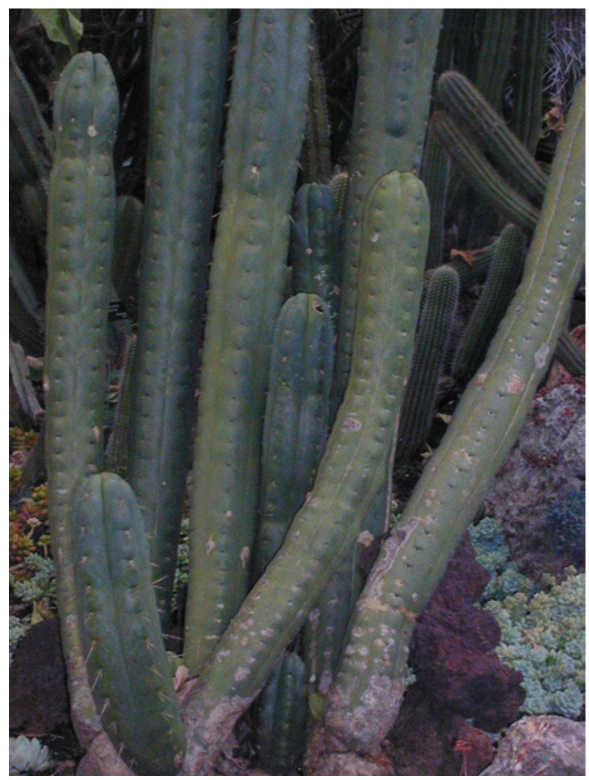
Curt BACKEBERG (1959) *Die Cactaceae. Handbuch der Kakteenkunde.* Band II. (Vol. II.) "Cereoideae (Hylocereeae-Cereeae [Austrocereinae])" Vol. II. is pages 639-1360.
San Pedro is pages 1117-1119.
Curt BACKEBERG (1977) *Cactus Lexicon*. Brief description.
Nathaniel Lord BRITTON & Joseph Nelson ROSE (1920) *The Cactaceae. Descriptions and Illustrations of Plants of the Cactus Family.* Volume 2: 134-135, figure 196 (*Trichocerei* pp. 130-146.]

probably *Trichocereus uyupampensis*
(unlabeled plant growing in Tom Juul's garden)

Heimo FRIEDRICH & Gordon Douglas ROWLEY (1974) *I.O.S. Bull.* 3: 96 [From MADSEN 1989] **[Note 70]**
Jens MADSEN (1989) *Flora of Ecuador No. 35*, "45. CACTACEAE."; pages 27-30: "5. Echinopsis ZUCC." [Merges with *T. peruvianus* characteristics]
Carlos OSTOLAZA (1984) *Cactus & Succulent Society Journal (US)* 56: 102-104. "*Trichocereus Pachanoi* BR. & R."
Friedrich RITTER (1981) *Kakteen in Sudamerica.* Volume 2: pages 1324-1325. [Merges with *T. peruvianus*]
Richard Evans SCHULTES & Albert HOFMANN (1980) *Botany and Chemistry of the Hallucinogens*

Cimora or San Pedro additives:

Guillermo CRUZ SÁNCHEZ (1948) *Revista de la Farmacologia y Medicina Experimentale* 1 (2): 253-258. "Informe sobre las aplicaciones de la Cimora en el norte del Perú." (From many sources.)
CRUZ SÁNCHEZ1951
DAVIS 1983
DOBKIN DE RIOS 1990
FRIEDBERG appears cited. She discusses *Iresine* (aka cimora/timora) & *Brugmansia* (aka misha), as regards their cultivation locally, mentioning therapeutic purposes in passing. We have found no indication that she discusses any admixtures for the San Pedro brew (at least not in the papers we have been able to access.)
OTT 1996 for an excellent discussion and overview.
Christian RÄTSCH (2005) *Encyclopedia of Psychoactive Plants*. English translation of Ratsch's (1998) *Enzyklopädie der Psychoaktiven Pflanzen* (Both are works of art. The 2005 version corrected factual errors present in the original.)
Richard Evans SCHULTES (1967) "The Place of Ethnobotany in the Ethnopharmacological Search for Psychotomimetic Drugs." pp. 33-57 in: *Ethnopharmacological Search For Psychoactive Drugs*.
Richard Evans SCHULTES (1972) "An overview of hallucinogens in the Western Hemisphere." pp. 3-54 Furst (Ed.) *Flesh of the Gods*.
SCHULTES & HOFMANN 1980 & 1992



***Trichocereus* sp. with no label (Huntington)**
Picture taken 4 years after image on page 24.

Tangential trivia:

ROTONDO 1943 reported on the psychiatric alterations produced by the clinical administration of mescaline. This work was performed in Lima, Peru using Merck-sourced mescaline provided by Dr. Carlos Gutiérrez-Noriega**.**

Some Pachanoids

The following are all most likely *Trichocereus pachanoi*, some form or variant thereof or else possibly some sort of a hybrid. Some might prove to be actual species but all were encountered without any further identification than is indicated. All merit in-depth taxonomic study and chemical analysis.

Trichocereus pachanoid **cv. Fox clone (RS)** is an unusual (probable) form of *T. pachanoi* that forms densely branching plants comprised of only short joints.
It needs analysis and apparently still lacks bioassays.

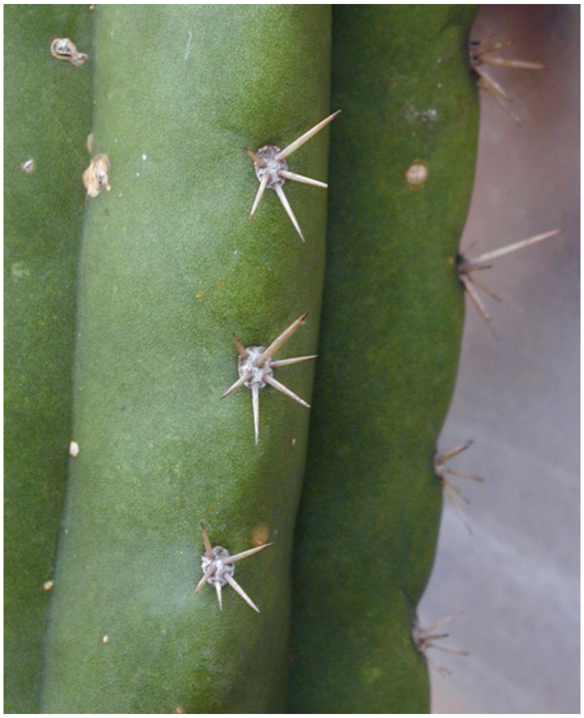
Trichocereus pachanoid **cv. Fox clone (RS)**
left column & lower right

Interesting but unlabeled *pachanoid* (Australia)

Unlabeled (Arizona Cactus Nursery; Australia)
above
Photo by Snu Voogelbreinder

***Trichocereus pachanoid* Los Baños, Ecuador (A)**

Encountered under cultivation in Ecuador at Los Baños. A beautiful stout form which shows an on-off monstrose growth with age.



***Trichocereus pachanoid* Los Baños, Ecuador**
above left; top & center right
[Do not confuse with the *peruvianus* from Las Banos, CA]

***Trichocereus* sp. Peru (Rob Montgomery)**

***Trichocereus* sp. Peru (Rob Montgomery)**
lower left &lower right

Spiny *Trichocereus pachanoids*

What makes a spiny pachanoid or a short-spined peruvianoid? Good question. There seems to be no agreed upon answer. Some few may prove to be actual species while the majority will no doubt turn out to be hybrids and intermediates. It is our current suspicion that many of these represent natural hybrids resulting from *Trichocereus pachanoi*'s ancient and widespread cultivation in the Andes, so assignments of *T. pachanoi* versus *T. peruvianus* may in fact be meaningless when applied to the intermediate materials.

We have therefore chosen to leave most horticultural offerings segregated according to their horticultural designation and their placement in one or the other category (ie *pachanoid* or *peruvianoid*) does not constitute any agreement as to their placement in that species.

The best that can be said about a good number of the *pachanoid* and *peruvianoids* is that no one really knows where they came from. We might add that the available evidence does suggest that Karel Knize is a not uncommon source.

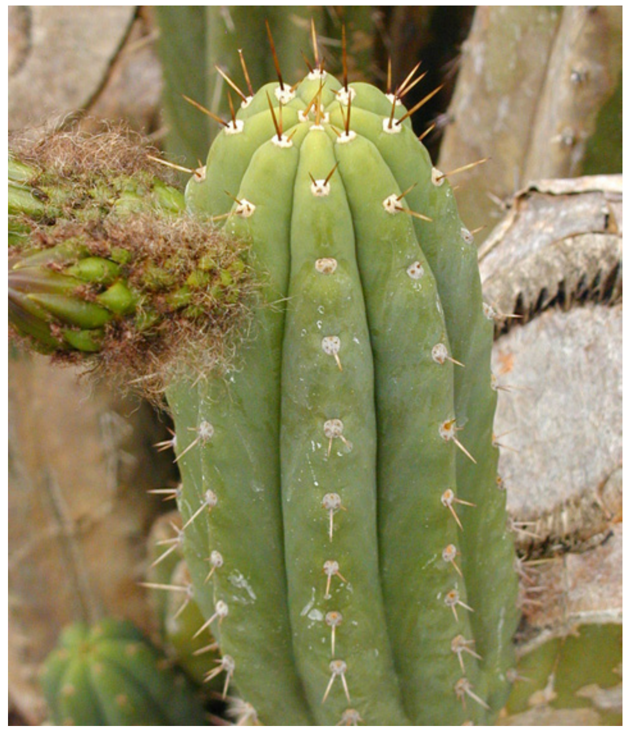
Trichocereus sp. Peru 57.0884 [P.C. Hutchison 1597]

Collected by Paul C. Hutchison on 10 October 1957

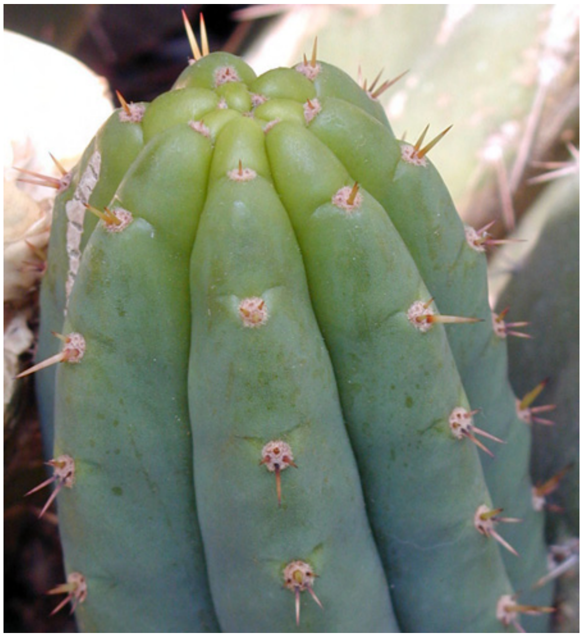
Huancabamba, Huancabamba Prov., Piura Dept., Peru. Elev. 2550 m.

Above and E of town along road to Piura.

A *pachanoi-peruvianus* intermediate that needs study and an analysis. (Labeled *Trichocereus pachanoi* until 2002)

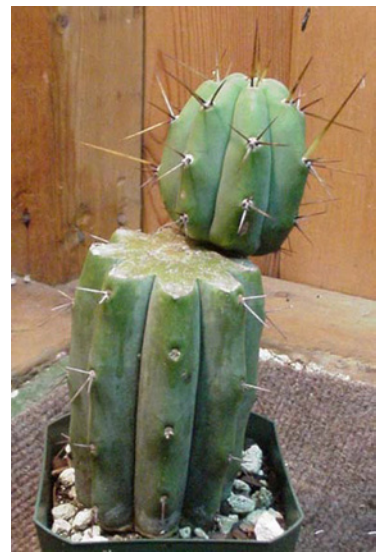


Trichocereus sp. Peru 57.0884



Trichocereus sp. Peru 57.0884

***Trichocereus* sp.**
Peru 57.0884



spiny *Trichocereus pachanoid*
(Desert Dan)
Photo by M.S. Smith

***Trichocereus pachanoid* Spiny wild form**

Two offerings from JL Hudson (seeds originating from Knize) but which apparently lack more information. Anecdotal reports exist that material identical to this was demonstrated to contain mescaline in human bioassays but it is not clear the material was actually synonymous and no details were included. Both need an analysis and taxonomic study.

Grows far more substantial spination with age.

See older columns on pages 289 & 328-329 .

Trichocereus pachanoid
Spiny wild form; Ecuador (JL Hudson)

Trichocereus pachanoid
Spiny wild form; North Peru (JL Hudson)

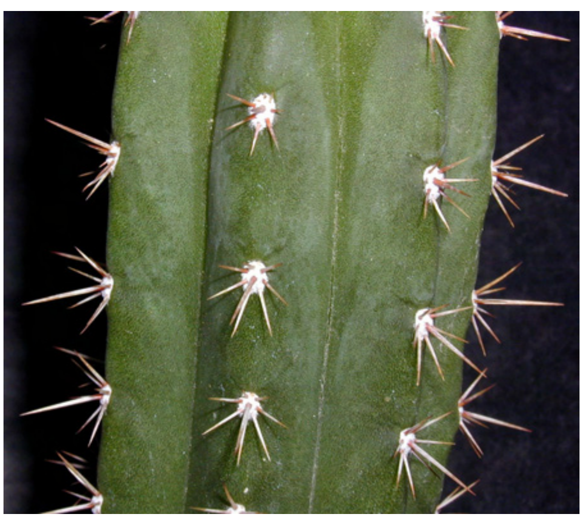
Several interesting *pachanoids*
Photo by Wakinyan Takonka

Sold as "*Trichocereus pachanoi*"
(Altman)
Photo by Wakinyan Takonka

a spiny v-marked *pachanoid*

The following arose in a lot of *T. pachanoi* seedlings; most of which did not show v-markings. The spination is not that unusual for *pachanoi* seedlings.

(Grown from *T. pachanoi* seeds sold through the first incarnation of Wildflowers of Heaven. They obtained their stock from Knize.)



Trichocereus pachanoi
(Wildflowers of Heaven)
Spiny seedling showing v-marks

Unlabeled spiny *pachanoid* (Australia)

Unlabeled spiny *pachanoid* (Australia) flowering (with *T. pachanoi* & *T. scopulicola*)

There are a wealth of these, some of which we included earlier.

Their potency appears to be like a normal *pachanoi*.

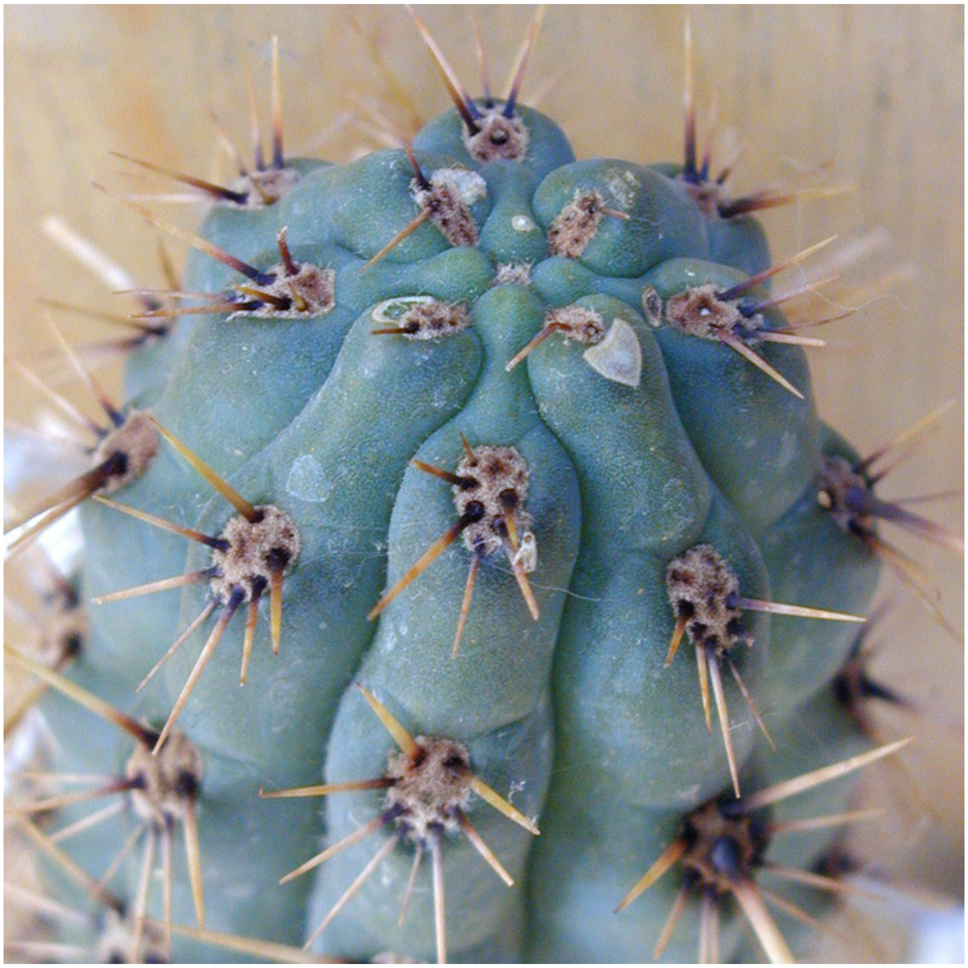
Knize is a common source for *pachanoid* and *peruvianoids* grown in Australia as are collections that have been grown there for decades.

Many huge *Trichocereus* specimens exist. Most of these plants probably originated from seed-grown stock.

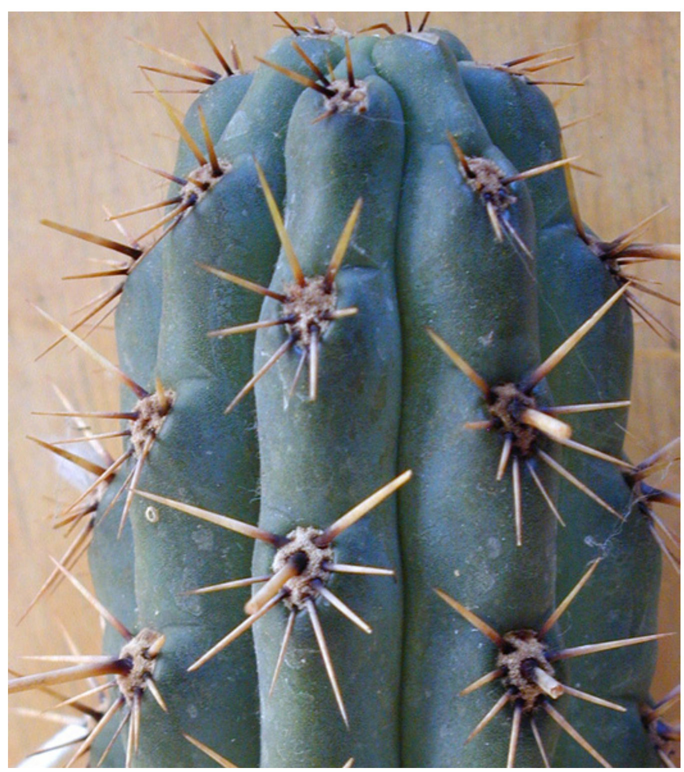
Photo above also includes *Trichocereus scopulicola* to permit a comparison of appearance and diameter.

See that species' entry later in this work (pages 211-216).

The specimen flowering is a wild collected *pachanoi* brought to Australia from Ecuador in the late 1930s. See more images elsewhere herein.



Mislabeled *Trichocereus pachanoi* (Atlanta Botanical Gardens)
Compare to some of the young *peruvianoids* pictured elsewhere here



lefthand image taken with flash

righthand and upper images taken without flash

Trichocereus pachanoids sold as "San Pedro"

Several unusual *pachanoids* are sold under the names **San Pedro** or ***T. pachanoi*** by Altman (and others) or sold without a good specific designation. The first one pictured has proven to be a potent mescaline container by human bioassays and is said to now be a favored choice by some shamans currently conducting San Pedro ceremonies in the southern US. (Anonymous 1999-2001)

Appearance suggests this may be a hybrid.

However it is unclear if these are species, simply varieties of something or perhaps simply unlabeled hybrids.

See a couple more under ***T. bridgesii***

Photo by Eel

Sold as "*San Pedro*" (Altman)

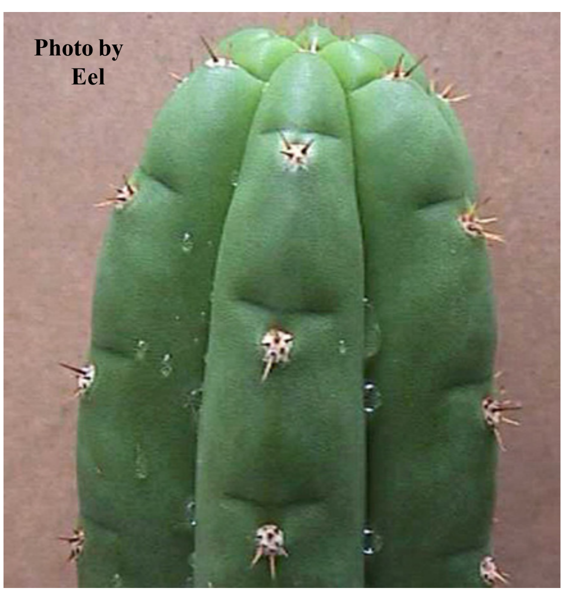


Photo by Eel

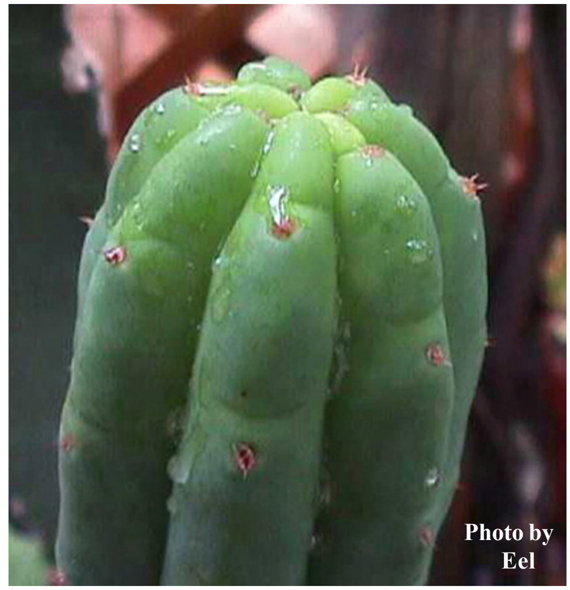


Photo by Eel

(Photo on lower left was Knize-sourced via Quality Cactus)

Unusual flower and flowering on *T. pachanoi*

***Trichocereus pachanoi* (SS)**
Photos by Kamm
Note the unusual epistillate flower

Unusual unlabeled *pachanoid* at the BBG

Flowerbud and tip photos by Geoffrey

***Trichocereus volcanensis* (RS)**

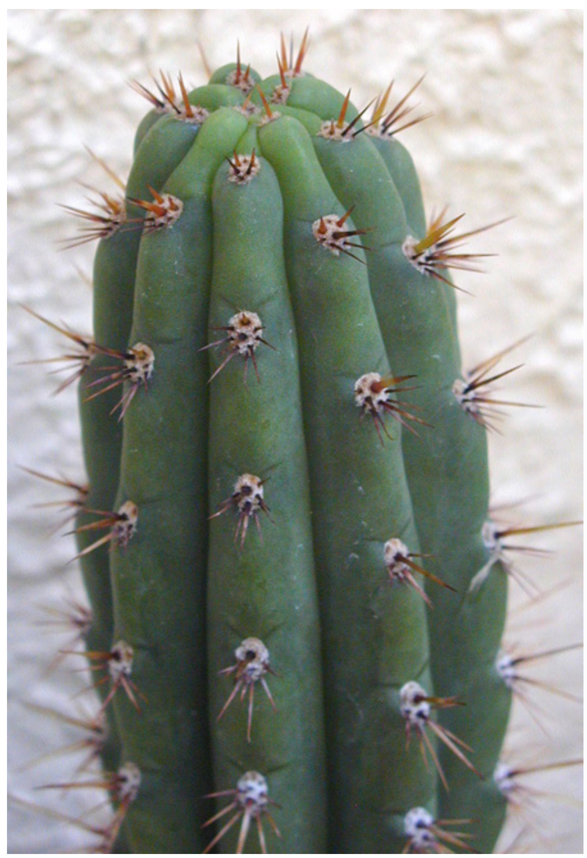
Name appears to be unpublished.

Reported to be inactive but it could also have been weak as only one (human) bioassay was performed using a not large amount.

Trichocereus volcanensis
(RS)

fat *pachanoid* purchased unlabeled at Target (Altman)

***Trichocereus pachanoi*X*peruvianus* (GF)**



***Trichocereus pachanoi*X*peruvianus* (GF)**

*Trichocereus pachanoi*X*peruvianus*

A number of deliberately produced hybrids exist.

Those which were raised to maturity and then bioassayed have been reported to be around *T. pachanoi*'s potency (i.e. active mescaline content but variable) or to lie in between the potency of the parents (when said potencies were known by the grower).

Most of what is available in horticulture have not been reported as ever having been bioassayed.

***Trichocereus pachanoi*X*peruvianus* (GF)**
All of these are F1 hybrids produced by GF.

[See *pachanoi* (GF) & *peruvianus* (GF)]

Trichocereus pachanoi**X*****peruvianus* (GF)**
All of these are F1 hybrids produced by GF.

*Trichocereus pachanoi*X*peruvianus*
(GF)
More F1 hybrids

Trichocereus pachanoi*X*peruvianus* (otj) See as *Trichocereus* sp. TJG X *peruvianus

Additionally offered is a naturally occurring **pachanoi-peruvianus intermediate**

Collected at 7200 feet near Huaraz, Matucana, Peru.

Said to be fast growing and able to stand some frost.

Do not confuse with the *pachanoi* X *peruvianus* hybrids produced deliberately by California cactus growers or with the "*pachanoi* X *peruvianus*" hybrid that is actually TJG X *peruvianus*.

There are far more hybrids produced than were tracked with accurate labeling.

The following *Pachanoi* X *peruvianus* was sold byKakteen Haage and is being cultivated in Germany

Trichocereus pachanoi*X*peruvianus
(Kakteen Haage)
Photo by Patrick Noll

obtained as *Trichocereus pachanoi*
(Spain)
Photo by Patrick Noll

Trichocereus pallarensis Ritter

Presence of Mescaline proven through human bioassays. See 1998 *Entheogen Review* 7 (3): 70-71.

It appears this was a Ritter *nomen nudum*, lacking formal description but appearing in the horticultural world at least partially due to H. Winter in Germany.

Fortunately Ritter 1981 briefly discusses this plant.

(Like *T. peruvianus*, *pallarensis*, was considered by Ritter to most likely be a form of *pachanoi*.)

Occurring around 2500-3000m in elevation in the wild.

Collected from Llacanora, near Catamarca, in **Pallar** and east of the Cordillera Blanca, Dept. Ancash, Peru.

Ritter assigned it FR 676.

FR1468 was said to be a form of pallarensis (Machac).

This is an always erect *peruvianus*-like plant up to 12 feet or more in height; clustering freely from the base.

Epidermis is bluish-green but older columns appear more green.

3-5 inch in diameter stems can have 5-8 ribs.

Areoles are variable in size and have a v-mark merged with the upper portion.

Spines are long, reddish-brown and whitish (yellow and reddish-brown when new).

2-7 spines per areole have been observed in material at the BBG but inadequate specimens have been examined to know what the actual max and min are. 3-4 per areole seems common. Sacred Succulents observed 3-5 radial spines and one or two 1.5-2.5 inch long centrals in the material that they examined.

Nocturnal flowers are scented and borne near apex. Observed flowering at the BBG in late summer or early fall. Fruit was ripe in October-November.

The fruit are wooly. "*oblong green fruit with black hairs*" [Sacred Succulents] Fruit at the BBG showed persistent long black hairs with frizzy brown and white wool.

Description based on examination of live material, multiple photographs taken at the Berkeley and on the entry in the Sacred Succulents "*Seed supplement 1*"

It differs from *pachanoi* by having 3-6 radial spines, 15-50 mm long, light brown, usually thinner;

Central spine is often missing or if present is a single strong and longer one.

All spines are often only few mm long.

The areoles are smaller and more closely spaced.

Ritter did **not** examine the flower.

Fruit 5 cm long and 4 cm thick, with ample greyer wool.

Seeds lack any clear difference.

Ritter 1981: 1325; figure 1187

Sacred Succulents notes that it is cold hardy to at least 20^{o}F.

(Also encountered misspelled *T. pallerensis*)

It is represented in the UC Berkeley Botanical Gardens as ***T. pallarensis* South America 61.0850**.

From seeds of F. Ritter 676; obtained, via the ISI, from H. Winter, Germany, in 1961. (Offered in 1961 catalog)

Said to be 1.5-2X the potency of San Pedro in human bioassays. Anonymous source

***Trichocereus pallarensis* Ritter 676**
entire page

Notice that there appears to be two distinct variants present in the UC Berkeley collection.

Trichocereus pallarensis **Ritter 676**
entire page

Lower right photo by Kamm

Photos in right hand column by Jon R Hanna

Trichocereus pallarensis **Ritter 676**
entire page

Fruit photo above by Geoffrey

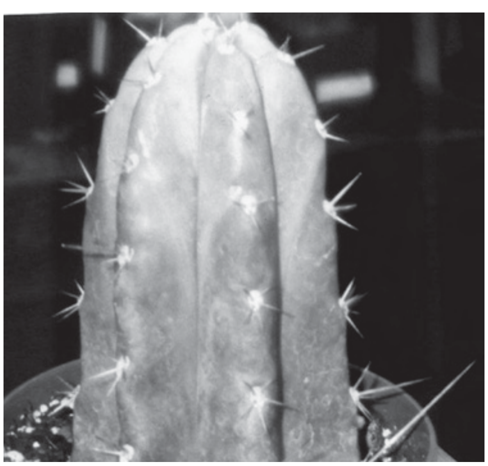
***Trichocereus pallarensis* RITTER 676**
entire page

Lower left photo by Jon R Hanna

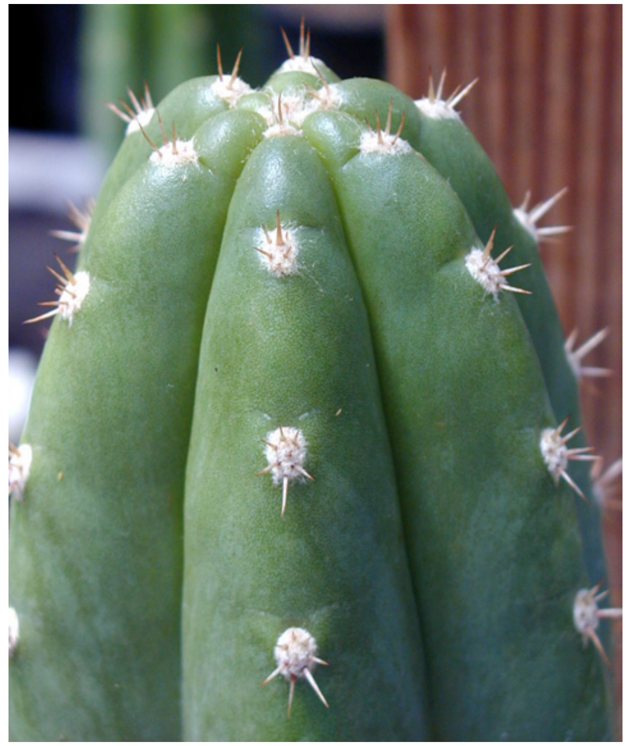
Trichocereus pallarensis in horticulture

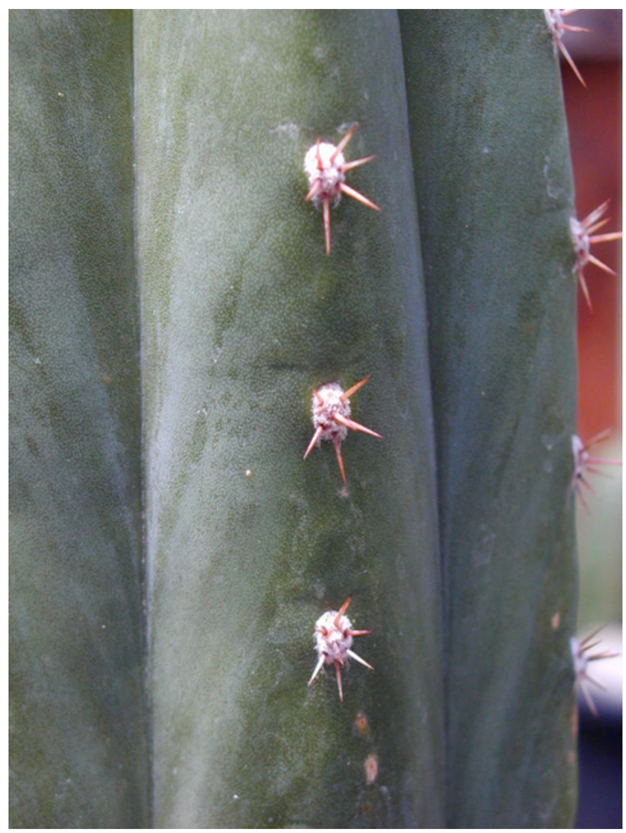
Trichocereus pallarensis seedlings
from commercial seed

Trichocereus pallarensis seedling
from commercial seed



Trichocereus pallarensis Ritter 676
from Berkeley's annual plant sale
Photo by Jon R Hanna





Trichocereus pallarensis seedling
This is said to be grown from collected seed
Therefore it is likely to be an open hybrid

Trichocereus peruvianus Britton & Rose

John Borg's 1937 first edition noted that this plant was (unsuccessfully) renamed *Cereus rosei* by Eric Werdermann **[Note 71]**. In Backeberg & Knuth 1935 this was spelled *Cereus roseanus* Werdermann.

Mescaline reported to be present in dry plant at 0.817% (3.268 gm. from 400 gm. of dry plant).

***Trichocereus peruvianus* (GF)**

[Agurell 1969b did not report any mescaline but mentioned the presence of two unidentified *minor* constituents. Other negative assays also exist.]

Counterculture literature and knowledge suggests far higher concentrations. Claims of 10X San Pedro are common. I remain unconvinced that this is anything more than unfounded mythology. See a complete discussion under ***Reported Activity*** farther below.

"*Cuchuma*", "*Peruanischer kaktus*", "*Peruvian torch*", "*Peruvian fencepost*", "*Prickly pear*", "*San Pedro*", "*San Pedro Macho*" have been given as common names applied to this species. Most of these are also used for other cacti as well.

Trichocereus peruvianus was originally collected in Peru, near and above Matucana, on the Central Peruvian Andean railway; 2,100 meters, by Dr. and Mrs. J.N. Rose on the 9th of July, 1914. [Rose & Rose 18658 (Holotype, NY)]
[Karel Knize reported collecting KK338 at around 10,000 feet (3200 meters) near Huancayo (see note on KK338 below), and KK242 at 4500 feet near Lima at Huaraz, Matucana (see comments on KK242 below).

This and other *Trichocereus* species are considered to belong to the genus *Echinopsis* by most (but not all) authorities.
Renamed as *Echinopsis peruviana* (Britton & Rose) Friedrich & Rowley in 1974 *I.O.S. Bulletin* 3: 97

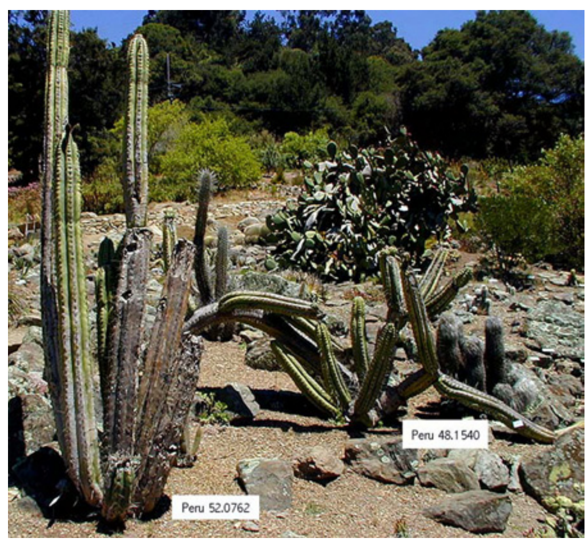
Some modern authorities consider *T. peruvianus* to be a more strongly spined form of *T. pachanoi*. While all sorts of intermediates and both natural and deliberate hybrids are known, this has done nothing but introduce more confusion to an already confused area since no type of clear definition of *T. pachanoi* and its purported *peruvianus* form(s) were ever included.

Glaetzle, Friedrich & Rowley apparently did not conclude they were synonymous in their study of seed coat morphology. They unfortunately did not include a photo for both; only *Echinopsis peruviana*.

A point ignored by most of the above is that this picture is quite complex due to the lengthy, extensive and intensively deliberate cultivation of *pachanoi* and the existence of *pachanoi* X *peruvianus* in the wild. My belief is that the two are separate species but much of what is in cultivation and in the wild are likely hybrids if not grex.

This majestic species grows erect at first, then it often becomes arching **[Note 72]** or even prostrate (See Backeberg 1959, page 1110: figure 1059, for an awesome picture of a large clump exploding out of a vertical rocky cliff face.) This highly specialized growth habit allows this species to successfully colonize rocky cliff faces; with its roots firmly anchored on ledges, and wherever adventitious roots can grab hold, the heavy columns happily grow to 5 meters or more in length while literally hanging down sheer cliff faces in western Peru. For a nice photo of this habit, see page 162, fig. 8.7, in Gibson & Nobel 1986.

Not all forms that are currently considered to belong to this species grow prostrate or sprawl. [Nor is this feature unique to *T. peruvianus*, for instance: *T. pachanoi* and *T. bridgesii* similarly grow adventitious roots and colonize cliff faces.] See also the photo on page 305.



Two forms of *Trichocereus peruvianus*

It grows [2-4 meters] up to 7 meters tall [23 feet], with numerous **[Note 73]** erect or ascending bluish-green frosted stems [15 cm] up to 20 cm in diameter [7.87 inches] [Borg describes as 6 to 10 cm thick, 2 to 4 meters tall and bluish green passing to green or dull greyish green.] Growth is glaucous when young.

Plants encountered in cultivation are often from 2 inches to around 4 inches in diameter. They can usually grow larger given the right growing conditions.

The 6 to 8[-9] broadly rounded ribs **[Note 74]** have a V-shaped notch over the areole **[Note75]**.

Its areoles are large, brown and woolly with 6 to 8 radial spines to 1 cm long and usually one central spine to 4 cm. long [The central is stout and rigid but not swollen at the base: Britton & Rose 1920] [Around 10 spines and areoles set around 2-1/2 cm apart according to Borg 1976. Material examined often has two centrals present.]

The unequal spines are honey colored below and darker above. [Most examples examined to date have shown yellow to yellowish spines with brown to brownish tips and/or bases. Most fade to greyish with age. Britton & Rose 1920 described them as brown from the first.]

Flowers are very large and white. Floral tube and areoles on ovary are hairy. Anderson 1998 says it is shy to flower but this may be a factor of locale. Anderson grows them in Arizona while friends in northern California have theirs in flower every year in late summer.

[Borg 1976 says 22 to 25 cm long and sweetly scented. Anderson says the nocturnal flowers will open to 15 cm and fade in morning's light]

Britton & Rose 1920 page 136 and Backeberg 1977 and Borg 1976 and Anderson 1998

Anderson 1998 includes a color picture of the flower on page 69

Britton & Rose 1920 describe *T. peruvianus* as resembling *T. bridgesii* but with stouter and darker spines. It is said to occur at lower altitudes than *T. bridgesii*.

***Trichocereus peruvianus* (GF) (Left & Center) & *Trichocereus pachanoi* (Right)**

Following Ritter's lead, Madsen 1989 rejected *T. peruvianus* altogether as simply a form of *T. pachanoi* with stronger spines. Many experts agree with him but I think this conclusion was premature and failed to take into account the many millennia that *T. pachanoi* has been planted and grown far outside of its original range.

Miles Anderson 1998 describes it as a lightly spined species that can reach 4.5 inches in diameter and grow in excess of 8 feet tall. His photos (page 69 and on the cover) show what appears to be a shorter-than-normal spined peruvianus form.

Friedrich Ritter 1981 was apparently the first to describe *T. peruvianus* as a form of *T. pachanoi* [*Trichocereus Pachanoi* f. *peruvianus* (Britton & Rose) Ritter; in *Kakteen in Sudamerika* 4: 1324]

Jens Madsen 1989 similarly presented it as a form of *Echinopsis pachanoi* in *Flora of Ecuador* 35: 27-30.

As did Lois Brako & J. Zarucchi 1993 (*Catalogue of the Flowering Plants and Gymnosperms of Peru*) and D. Hunt 1992 (*CITES Cactaceae Checklist*)

Ethnobotanical explorer Rob Montgomery has stressed that the observable characteristics of both *T. pachanoi* and *T. peruvianus* vary widely in the wild and appear to smoothly intergrade.

Like Ritter, he reported encountering every possible degree of variation and intermediate between the two in his extensive Peruvian travels and believes them to simply be divergent morphological peaks within a single highly variable species. [pers. comm. 1997]

Many experts share his view.

Carlos Ostolaza does not agree with them. He believes that as species they are quite distinct from each other; differing not only in the spination but also in the mescaline content. (Hunt 2000 agreed with him but was waffling by 2006.)

Many experts, and the majority of growers, myself included, agree with him.

Interestingly, Madsen 1989 based his designation of *T. peruvianus* as *E. pachanoi* forma *peruviana* at least partially on Friedrich & Rowley 1974 who considered them to be 2 separate and distinct species; *Echinopsis pachanoi* and *E. peruviana*.

I suspect that several other *Trichocereus* spp. are probably also in this complex of intergrading plants and further that a similar variable complex of often-potent mescaline containing species occurs in Bolivia and extending into both northern Argentina and Chile (and if we can count *E. forbesii* also Paraguay). It is quite possible that widespread cultivation of mescaline containing species may have played a role in this due to the ease with which hybridization occurs.

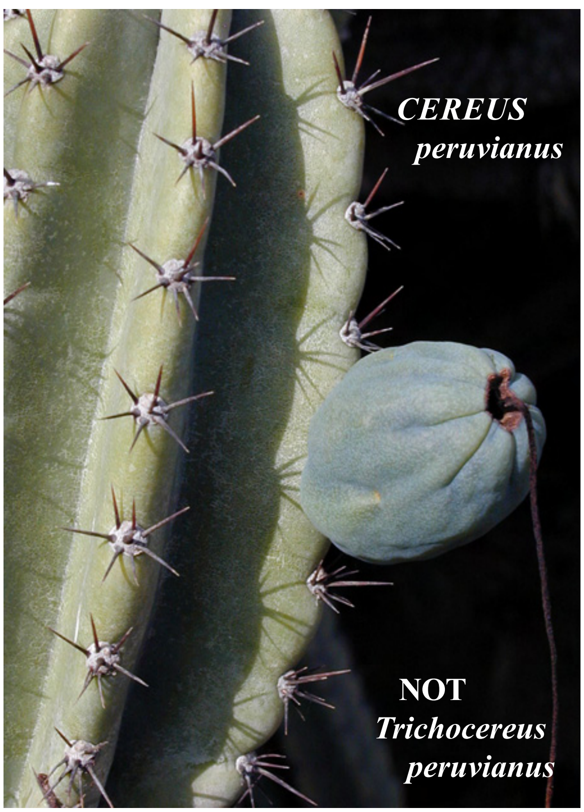
While I feel that there are in fact separate species, the actual number of these may presently be obscured by the grex-like sections within the continuum of intermediates (perhaps best considered as hybrid swarms?). It appears that *peruvianus* itself may need further division but much more study (hopefully involving some molecular systematicists) is called for before any firm conclusions are possible.

Note on felt color: While this species has brown or brownish new felt, this often fades rapidly becoming grey, whitish or even blackish.

T. peruvianus and *C. peruvianus* are frequently confused with each other but they are very different plants.

For the sake of clarification please compare and contrast the following photos:

Note the lack of broadly rounded ribs or hairs on the fruit.



At least three forms of *T. peruvianus* can presently be found at the Berkeley Botanical Gardens. (More have existed there and still sometimes appear at their plant sales)

All appear to be quite distinct from the Huntington material.

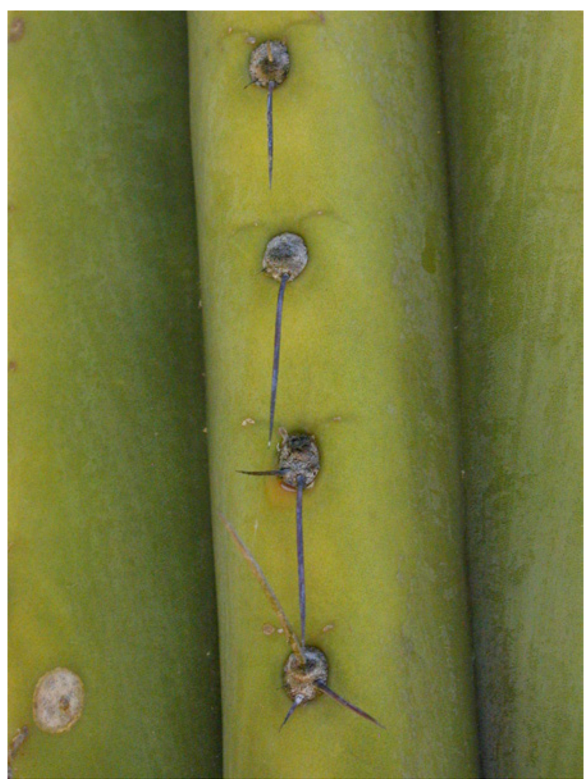
Trichocereus peruvianus **Peru 48.1540**

Both collector and origin are unclear.

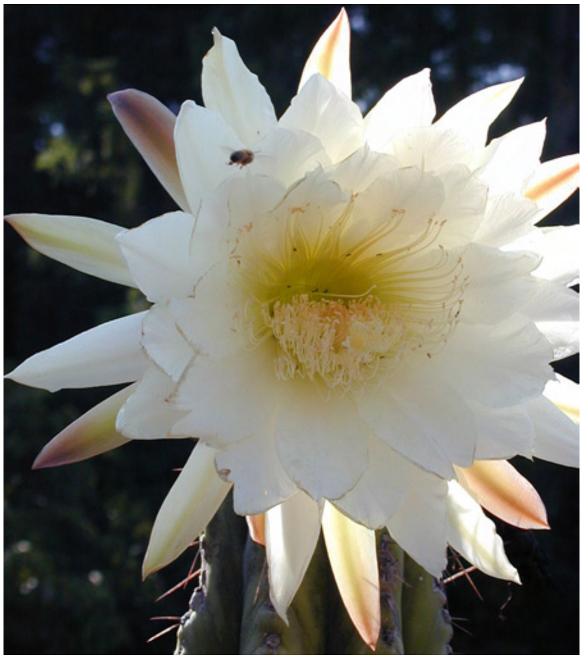
The acquisition records say "*seed found 1950 & sown 12-III, the pkt. was marked "X-119 M.H. 10-21-48". Evid. S. American mtl. re packaging.*"

Interestingly this form sometimes bears only 2 or 3 spines on some areoles.

Trichocereus peruvianus **Peru 48.1540**



Trichocereus peruvianus **Peru 48.1540**
(whole page)



Trichocereus peruvianus **Peru 49.1579 [an Ochoa s.n.]**

Grown from seeds collected by Ochoa near Matucana, on 1 February 1949. (Seeds lacked a collection number.)

Huarochiri Prov.: Lima Dept., Peru.

Canyon of the Rio Rimac: Km. 76 marker above Lima on the road to Huancayo.

Columns, over 2 m. tall, 12-14 cm. wide; 7 or 8 ribs.

Ovaries with abundant black hair; fruit is semi-globose & 5-6 cm. in diameter.

This appears to have larger areoles and longer & more numerous spines than does 48.1540.

Trichocereus peruvianus **Peru 48.1540**
top row: left & above

We suspect this is a plant that, when we saw it, grew to a certain height (8-9 ft?) and then fell over while continuing to grow but we are not certain.

It was present in 1997 but was not on public display in 2001. Possibly this was the result of a bad storm.

A small plant reappeared in the garden in 2006. See a photo in Part A.

Trichocereus peruvianus **Peru 49.1579**
bottom row: left & above

Trichocereus peruvianus **Peru 52.0762 [P.C. Hutchison 543]**

Collected by Paul C. Hutchison on 24 March 1952.

Huarochiri Prov.: Lima Dept., Peru.

Elevation: 1700 m.

Canyon of the Rio Rimac: Km. 70 stone east of Lima and west of Surco.

This is a stout decumbent species.

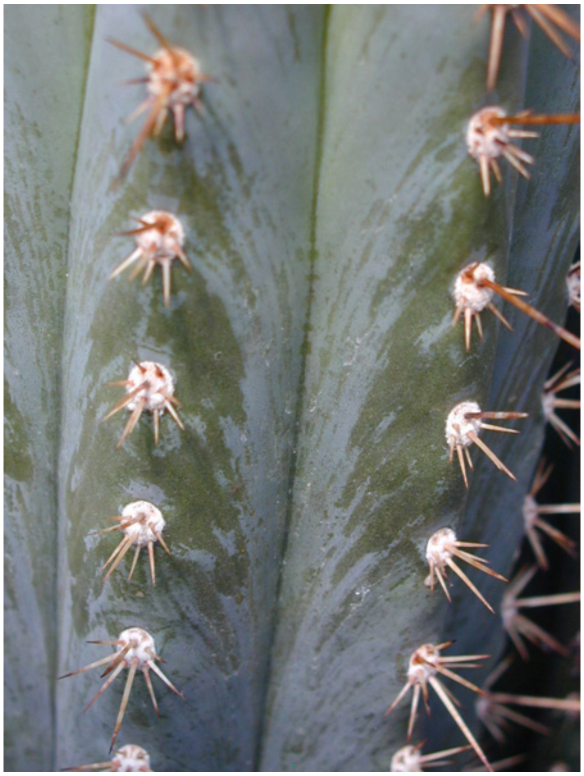
Trichocereus peruvianus **Peru 52.0762**

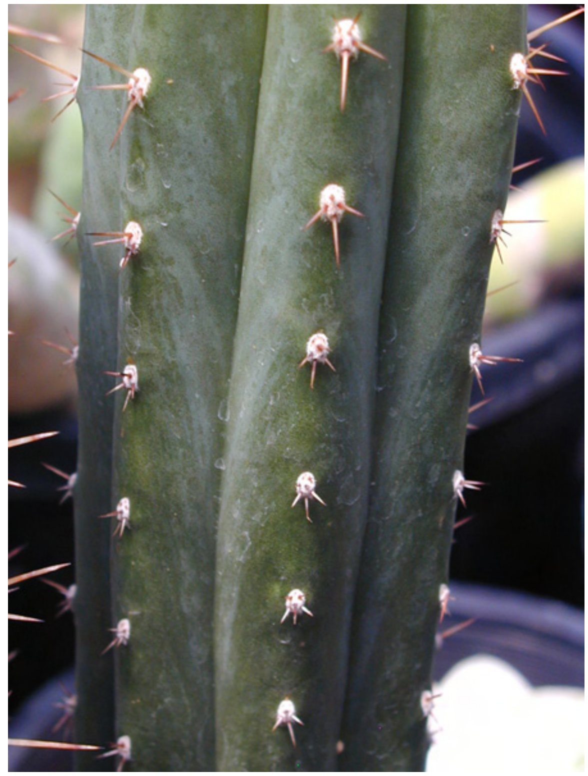
Trichocereus peruvianus **Peru 52.0762**

A couple of *Trichocereus peruvianus* photos from the BBG involving plants which appear to be no longer present.

Seedlings produced by BBG seeds suggest some hybridization

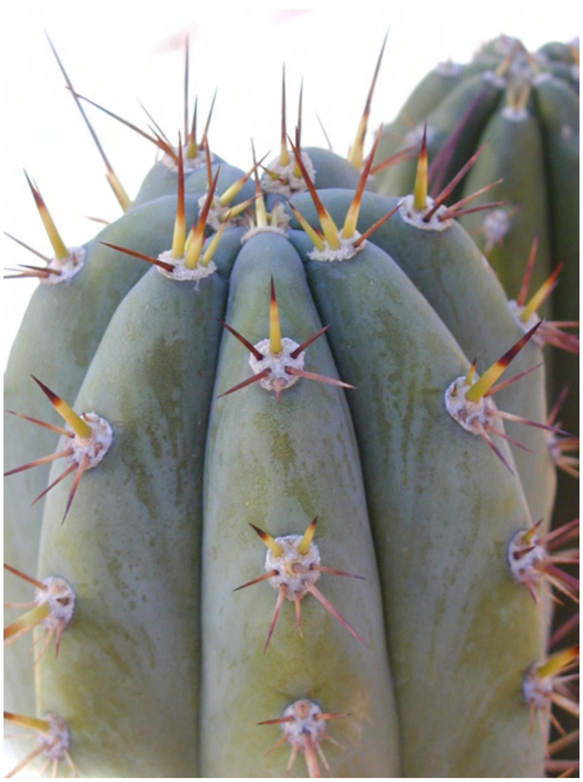
Trichocereus peruvianus **Peru 52.0762**
(grown from collected seeds)





***Trichocereus peruvianus* Peru 52.0762**
(grown from collected seeds; lower views of same plants on previous page)

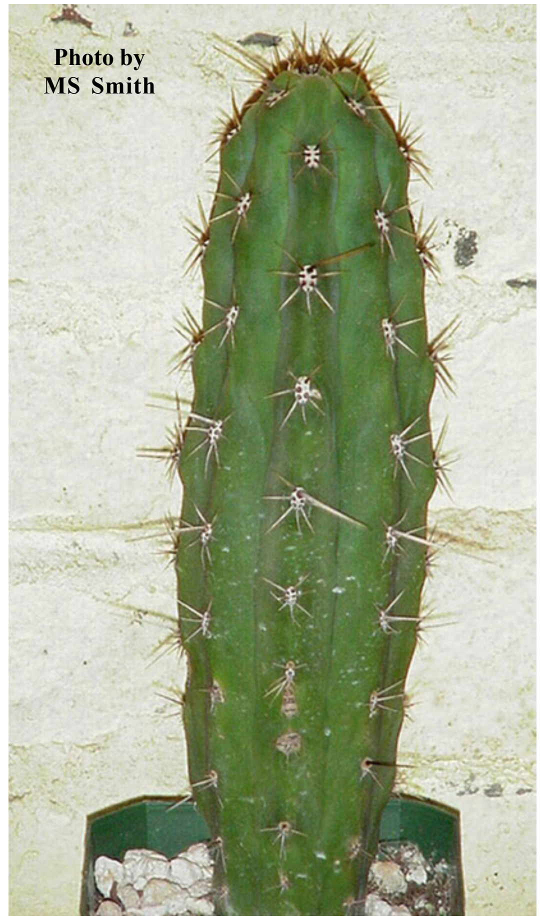
The next two are of unclear origin. Berkeley was the source for the purchase of both seedlings.
When queried, the curator of the Berkeley gardens commented that these numbers fall in between two Hutchison-numbered acquisitions in their collection but neither one of these numbers is listed within their records.
My best GUESS would be that these were a typo (perhaps intending 52.0762?) and that the 52.0776-1 seedling was produced from seed harvested by Berkeley. If so the plant on the right is likely to be an open hybrid (or possibly mislabeled?).



***Trichocereus peruvianus* Peru 52.0776**
Obtained in their annual plant sale

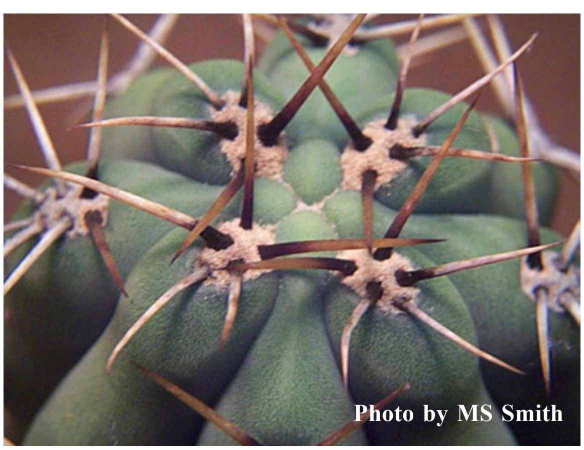
***Trichocereus peruvianus* Peru 52.0776-1**
Obtained in their plant store

Trichocereus peruvianus **Peru 52.0776-1**



Trichocereus peruvianus
(Boyce-Thompson)

Trichocereus peruvianus from the **Boyce-Thompson Arboretum**.

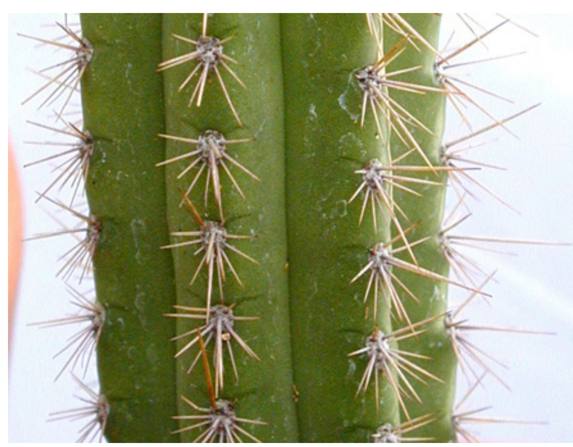


Trichocereus peruvianus **H14912 Peru (Huntington)**

We have been unable to learn anything solid about this plant's origin as the card containing the Huntington's acquisition data haseither been lost or misplaced.

Their staff *thinks* that this material was probably collected somewhere in Peru by Harry S. Johnson, Sr., in the 1950s but confirming proof for this data is unavailable.

New branches look nearly identical to some of the SEED GROWN material of KK242 examined to date or similar to the SS03 peruvianoid.



Trichocereus peruvianus **H14912 Peru seedling obtained through the Huntington's annual plant sale via JB**

Trichocereus peruvianus **H14912 Peru**
entire page

Trichocereus peruvianus **H14912 Peru**

(Strybig) All 3 photos

Trichocereus peruvianus **(Strybig)**

This is a probable ID as this plant was unlabeled.
Apparently absent in 2006.

Trichocereus peruvianus **(Tucson Botanical Garden)**

(Tucson)
Photo by Johnny B. Goode

Painted image from a ceremonial mantle (Paraca) suggesting an association with a fiercely spiny cactus (Paracas 290-45 in Museo de Antropologia, Lima) After Tello 1940

Trichocereus peruvianus* f. *Ancash
All 3 photos

Horticultural offerings of ***Trichocereus peruvianus***

A very partial listing

Generic Format used in our Labeling:
***Binomial* tradename [collection #] (Grower)**

Trichocereus peruvianus "**No. 427**"

Commercially available but lacking descriptive information. All we have seen were young seedlings.

Trichocereus peruvianus **(A)**

A *peruvianus* raised for sacramental purposes. Reported to be an excellent form but we are lacking details.

***Trichocereus peruvianus* cv. (A)**

Trichocereus peruvianus *forma* **Ancash**

Said by Knize to be a "*strong growing form*" collected at 8200 feet near San Marcos, Ancash Dept. in central Peru.

V-shaped marks seem shallower, fainter, or shorter (or even absent) than on most others but v-marks can be common on older material or plants with much sun..

A second company selling ***T. peruvianus* Ancash** gives it **KK1698** and describes it as very much like a standard *T. pachanoi* in appearance. We have not yet obtained a specimen of their material but that purchased from the first company as *forma* Ancash looks quite different from any *T. pachanoi* that we have seen suggesting there may be several different plants sold as *forma* Ancash.

***Trichocereus peruvianus* f. *Ancash* (JLH)**

Karel Knize lists KK1698 (in his 1982 seed list) as ***Trichocereus* sp. San Marcos**.

See also comments farther below concerning Knize's **KK1688** and see Knize's photo on page 8.

See also photos on page 153.

***Trichocereus peruvianus* f. *Ancash* (JLH)**

This next strain is said to be a Knize collection from around 1400 meters.

The single specimen that we were able to examine in person looked similar to seed grown KK242. It was much more bluish with minor differences in spination but we cannot reliably distinguish this from a seed-grown KK242 or many other *peruvianus* offerings.

(several forms are offered by this on-line company)

***Trichocereus peruvianus* cv. (Basement Shaman)**

***Trichocereus peruvianus* cv. (B & B)**
Another commercial offering with no available collection data.

***Trichocereus peruvianus* (B & B)**

Trichocereus peruvianus **(BH)**

Raised for sacramental purposes. Purported to be an excellent form but we are lacking details.

Trichocereus peruvianus (BH)

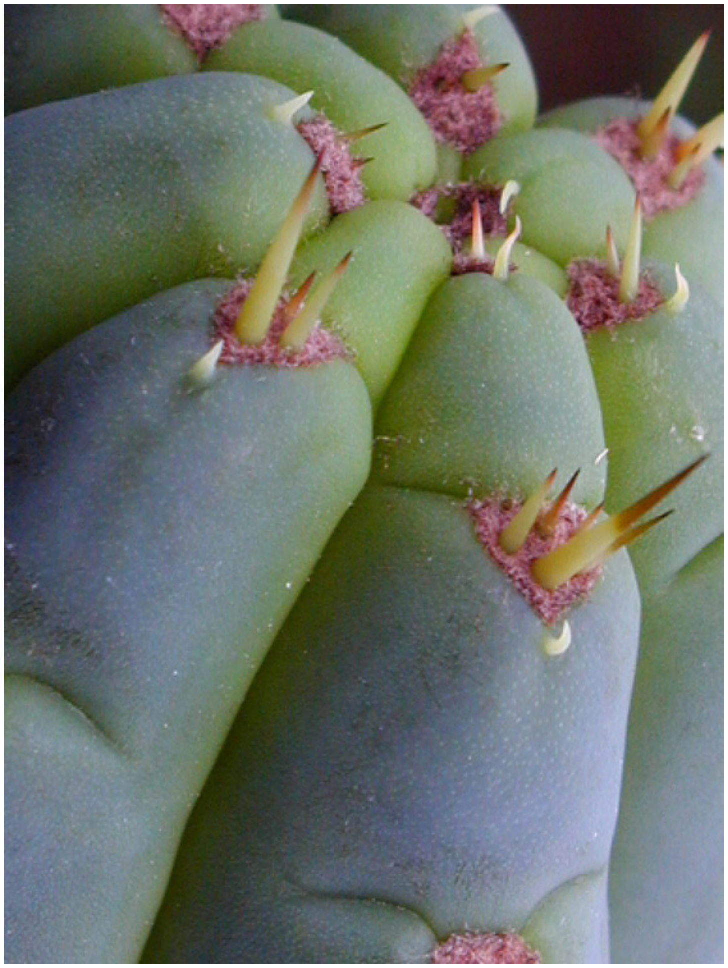
Thought to be either *peruvianus* RS0001 or RS003.

Trichocereus peruvianus (BH)

Trichocereus peruvianus **(Bob Wallace)**

A *peruvianus* grown by the late Bob Wallace. Appears to be an excellent form but we are lacking any information. The persistent hornlike leaves are the most pronounced we have encountered on any Trich so far.

While they are not always expressed, when they do exist they can persist long enough to leave dried remnants rather than being resorbed as is the usual case with vestigial leaves on *Trichocereus*.



Trichocereus peruvianus (Bob Wallace)
lower two images

Trichocereus peruvianus **(Bob Wallace)**

Trichocereus peruvianus *forma* **'Blue Form'***
Said to have more blue color on stems. While this may develop or become pronounced with age, no one located growing this has observed any more blue than on many other *peruvianus* forms.

Trichocereus peruvianus **'Blue Form'**
(JLH)
(Three images)

***Trichocereus peruvianus* (Carlyle)**
Another form about which we know nothing more. Encountered as ***Trichocereus* sp. Carlyle** (probably a *T. peruvianus* form) Needs analysis.

***Trichocereus peruvianus* (Carlyle)**
(RS)

***Trichocereus peruvianus* (Concord Collection)**
Yet another *peruvianus* about which we know nothing more.

***Trichocereus peruvianus* (Carlyle)**
(RS)

***Trichocereus peruvianus* (Concord Collection)**
(RS)

Trichocereus peruvianus *forma* **cuzcoensis***

Said to be collected near Cuzco at 10,000 feet [Seemingly this, and var. *cuzcoensis* are synonymous with *T. cuzcoensis*] Compare to NMCR plant listed as *Trichocereus cuzcoensis* (page 60).

Trichocereus peruvianus **var.** ***cuzcoensis***
(NMCR)

Trichocereus peruvianus **(Eltzner)**

Another fat blue *peruvianus* form. Believed to have been wild collected but the details are no longer available.

Proven to be an excellent choice in human bioassays.

Trichocereus peruvianus **(Eltzner)**
Above & lower two right-hand images

Trichocereus peruvianus **(ELF)**

Another *peruvianus*. Thought to be a good form but we are lacking details. Obtained as free material being given away outside and after an ELF meeting in the Bay.Area

Trichocereus peruvianus **(ELF)**

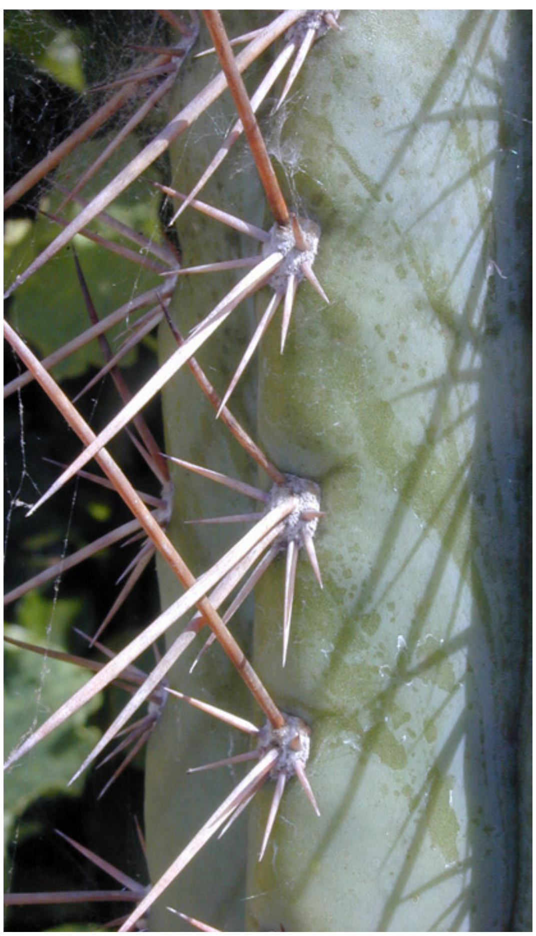
Trichocereus peruvianus **(Eltzner)**
entire page

This huge specimen was removed entirely during 2003.
Its trunk was nearly 10 inches in diameter at its base.
Branches and new pups are commonly 5.5 inches in diameter or fatter. This plant is always erect.
Its fruit is largely nude.

sold as *Trichocereus peruvianus* (GB)
See also page 266
The strongly reddish bases & black tips on new spines suggests possible hybridization.

Trichocereus peruvianus **(GB) (all on page except lower right)**
Compare to *T. pachanoi* behind it and to its right.

Trichocereus peruvianus **(GF)**
Tip below is easily 6 inches in diameter.
This photo shows one year's growth in the East Bay. (From the darker curved marks near bottom of the picture)



***Trichocereus peruvianus* (GF)**

Repeatedly demonstrated to be a reliably effective form in multiple human bioassays; this is what we consider to be a "*true*" peruvianus. It needs some taxonomic study to permit a detailed comparison and contrasting as regards the other forms of *peruvianus.* It also needs an analysis.

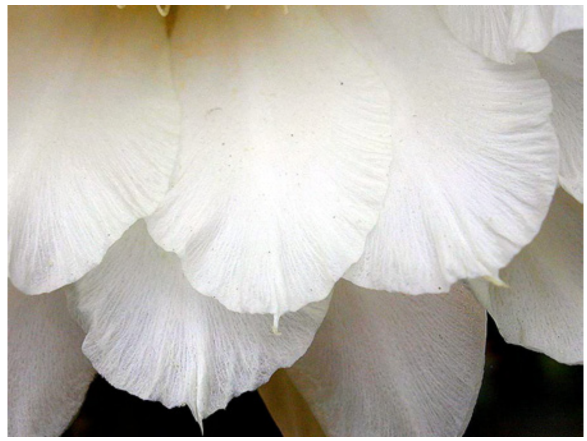
Very stout, bluish & reliably upright in habit.

At least most of these are synonymous with *Trichocereus peruvianus* (Eltzner) but it is unclear exactly how much as GF obtained most but not all of his material from Eltzner.

ANONYMOUS 2001 & 2002.

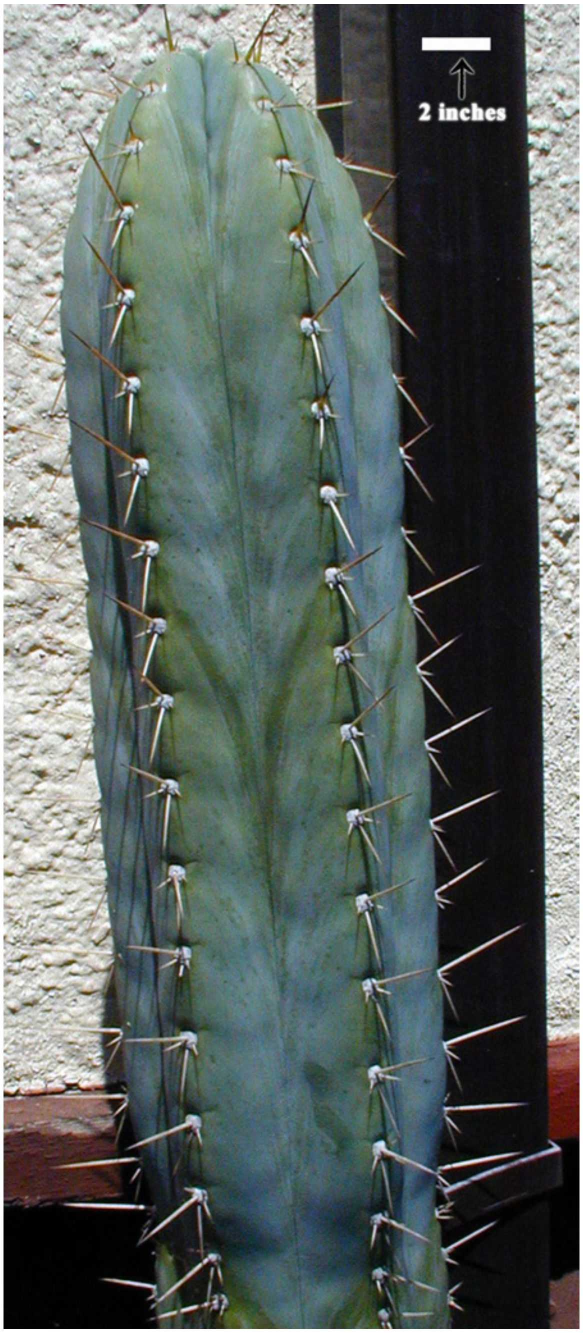
***Trichocereus peruvianus* (GF)**

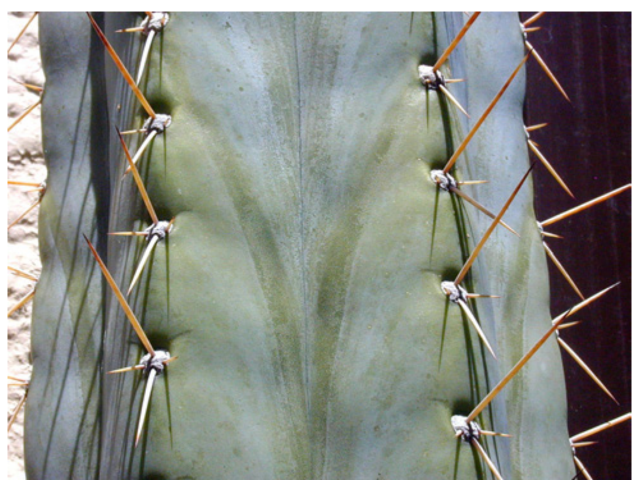
***Trichocereus peruvianus* (GF) cont.**



***Trichocereus peruvianus* (GF)**

***Trichocereus peruvianus* (GF) cont.**





***Trichocereus peruvianus* (GF)**

Trichocereus peruvianus **(HD)**

Several variants are regularly encountered at a large nationwide hardware chain.

The material that is shown with a lens cap and the now large plants resulting from the small seedlings pictured have been reported to be excellent in human bioassays. No further details were provided.

Trichocereus peruvianus **(HD)**

Trichocereus peruvianus **"Huancabamba"**

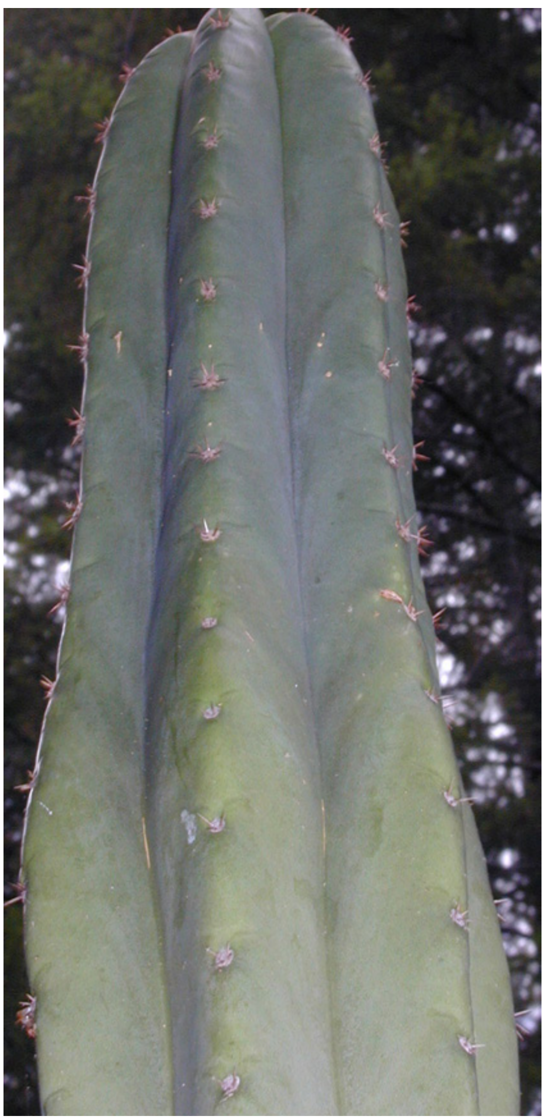
There is absolutely no reason that this should not be more properly identified as *T. pachanoi*.

Also commercially available and described by Mesa Garden as a blue-frosted, thick-stemmed form with short spines. Ours are still more green than blue but are sturdy and look promising.

Freely offsetting.

Seeds were collected from a plant in or near Huancabamba by a Dutch citizen but we lack further information.

The town and nearby areas are sacred to Peruvian shamans and renowned for high quality San Pedro clones. Whether this will prove to be reflected in the potency of this cactus remains to be assessed.



Trichocereus peruvianus
Huancabamba
(Mesa Garden via Oasis)
entire page

***Trichocereus peruvianus* Huancabamba**
(Mesa Garden via Oasis)

cv. [Jim Daniel]

This is a cultivar we have heard of but have not been able to locate or examine. D.M. Turner stated it was the strain that Daniel initially introduced into the US in the 1950s.

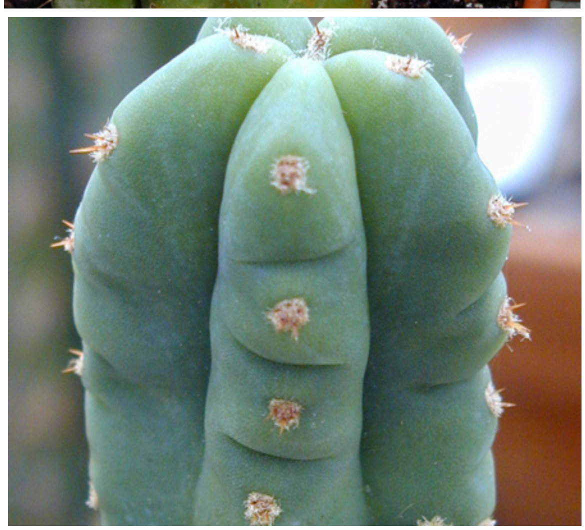
However, when he was asked, Jim Daniel stated that he first obtained this species from grower James Doman around 1970.

Mr. Doman was thought to have obtained his from Carl Eltzner. (Personal correspondence: Jon Hanna; 1999)

See *T. peruvianus* cv (GF) & cv. (Eltzner).

cv. Joel (RS)

So far as we can tell analysis and bioassay are either lacking or not reported. It was encountered neglected in a high humidity environment, covered with algae but thriving. Its origin is apparently not known.



***Trichocereus peruvianoid* cv. Joel**

***Trichocereus peruvianus* KK338**

Collected around 10,00 feet (mentioned above)

Despite being listed as *T. peruvianus* in the seed offerings of two companies, KK338 is designated as a variety of ***Trichocereus tulhuycensis*** [*tulhuayacensis*?] from Huancayo, Peru 3000m in Karel Knize's field collection number list.

In his later listings this was amended to being "*probably*" a *T. peruvianus* form; collected 3200m, Huancayo, central Peru, and is described as growing erect to 3 meters and having 2-3 cm spines. Knize also has given its collection from 2800m

***Trichocereus peruvianus* KK338**
Photo by MS Smith

***Trichocereus peruvianus* "KK242"**

This is described by Karel Knize's sales literature as being a green form. [It is what was reported as having been analyzed by Pardanani; grown in California from Knize-sourced seed.]

There are multiple forms of *T. pachanoid-peruvianoid* that are recognized as distinct and different forms of *Trichocereus peruvianus* KK242 ***by Karel Knize***. This claim is based on correspondence with Karel Knize in which he explictly stated this. Apparently, according to Knize, KK242 contains the *peruvianus* forms found growing within a given range of elevation in Matucana. (ie a locality not a single population)

One company claims to have discontinued doing business with KK after receiving several substantially different shipments **[Note 76]**; all sold to them as KK242.

One plant in our possession which was obtained directly from Karel Knize as a living plant KK242 has very short and thin spines with a dark bluish-green body.

Another grower wrote that a friend of theirs obtained what appeared to be a Juul's Giant that was sold to them by KK as a spineless form of KK242.

Confused enough yet?

In a 1999 *Trichocereus* cutting list, under KK242, Karel Knize lists a "*small type*" as being the "*original Matucana*" form and also offers a "*large*" form from the same locality. The latter is said not to grow erect but is found growing downwards on the rocks.

(See also pages 291, 333 & 337.)

KK242a var. Huancavelica is also claimed to be offered by Karel Knize. It is said to bear 3-4 cm long spines and be 8-12 cm in diameter.

We have never been able to obtain one (unless perhaps as one of the multitude of unlabeled cacti received from Knize.)

***Trichocereus peruvianus* R 403** was collected by Walter Rausch at La Mejorada, Huancavelica, Peru but we have no idea how or even if it relates to Knize's plant.

In a fax to us in 2001, Knize indicated he had 9 forms that he thought were distinct but designated as **KK242**.

At least 4 of these have short spines.

***Trichocereus peruvianus* KK242 Central Peru**
(Cutting obtained from Karel Knize)

A closer look Karel Knize's *Trichocereus peruvianus* KK242

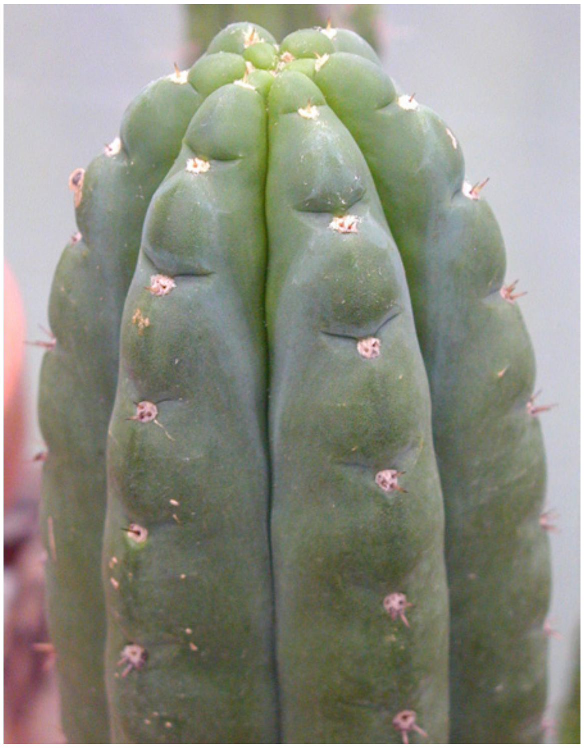
We attempted to obtain what we could for a closer look at KK242 as seen through the eyes of Karel Knize.
To illustrate, please study the following cuttings obtained through the mail from Karel Knize in Lima, Peru.

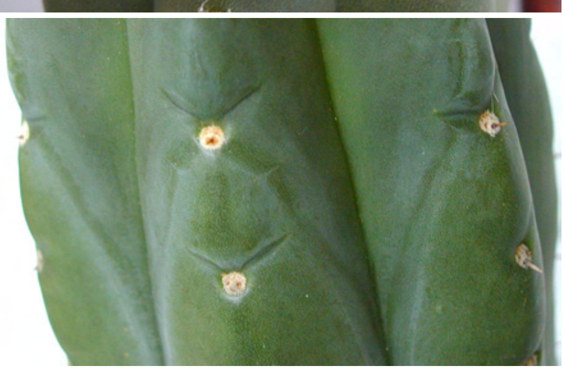
Knize recognizes **ALL** of these as KK242.
Spinier versions tend to be those grown from Knize seed.

Trichocereus peruvianus KK242 *f.* Langa
(Cutting obtained from Karel Knize.)
Lower picture shows new growth on the same tip.

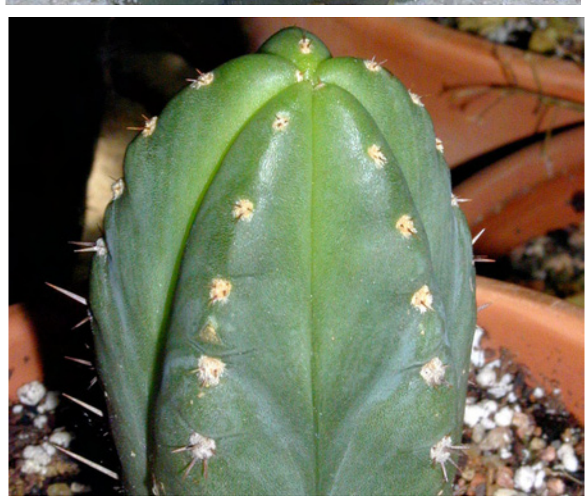
***Trichocereus peruvianus* KK242 *f.* Matucana**
(Cutting obtained from Karel Knize.)

In his 2001-2003 *Trichocereus* cutting listings Knize offered a **KK2147 *Trichocereus pachanoi* f. Langa C-Peru**.
This was said to be a "*strong type.*." What it is and what that comment means remains to be determined.
Knize's 2004 "field locality" page (see p. 291) lists **KK2147** as ***Trichocereus peruvianus* Rio Lurin, 2500m**.
Please compare Knize's photograph to the cutting that Knize sold us as **KK242 *T. peruvianus* Rio Lurin** (below)





Trichocereus peruvianus KK242 Rio Chillon
(Cutting obtained from Karel Knize)
Center & bottom keft photos show new growth.



Trichocereus peruvianus KK242 Rio Lurin
(Cutting obtained from Karel Knize.)
Lower picture shows new growth on the same tip.

KK242 grown from seed

The majority of domestic plants produced from Knize-sourced KK242 seed are fairly consistent and densely spined.

For this reason alone this is MOST LIKELY to be the source for the Abbey Garden-grown KK242 that was analyzed by Pardanani. Similar appearing plants without any point-of-origin information have been reported potent in human bioassays.

It is our belief that Knize was the primary source for the majority of the *peruvianus* offerings in horticulture.

Grown from *Trichocereus peruvianus* KK242 seeds obtained from Karel Knize

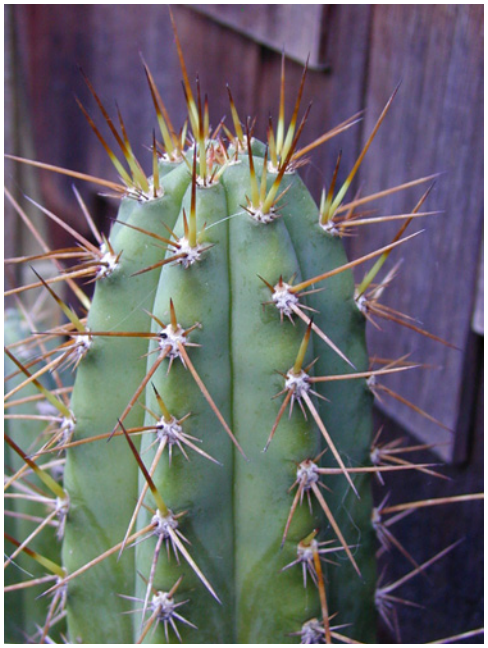
In an email sent to us in 2004, Karel Knize elaborated further concerning the *peruvianus* forms that he recognizes.
"*genuine: probably 5-7 basic, rest ca 30 - with horticultural 60 approx*."

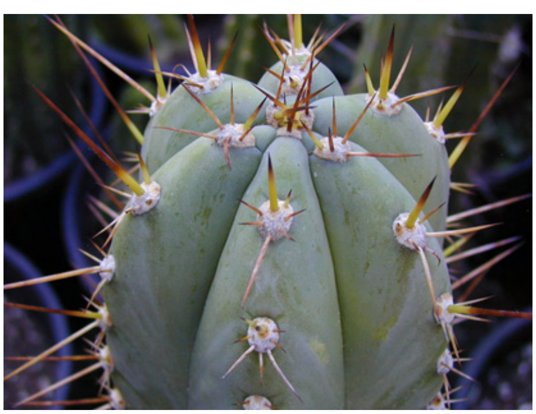
Plants shown on the next page were grown from Knize-sourced seeds labeled *Trichocereus pachanoi.*

(See more seedlings from Knize's *pachanoi* seed elsewhere here)

They are bluish and nicely *peruvianus*-diametered or intermediate as opposed to the spiny versions of KK242 shown above which often are around the same diameter as a typical *pachanoi*

More Knize-seed sourced plants





While on the subject of Knize's plants: (See page 291)

Another company offers the "***Knize collection***" of Knize collected seeds. This features multiple offerings (some with different prices) bearing identical collection numbers.

Please remain aware that many KK collection numbers apparently have multiple offerings each (only a couple of occurrences are noted). It is unclear what this means but it, and anecdotal reports from several growers, suggests that KK numbered seeds are from roughly the same geographic region or locality rather than being collected from the same plants. Knize stated to us this was the case with KK242 This would explain why they are not always reliably the same from batch to batch.

KK242 ***Trichocereus peruvianus f.*** [No description or indication of how and if it varies from the other KK242 seeds they also offer.]

KK340 (***Trichocereus peruvianus* var. *cuzcoensis***) [This would appear synonymous with *T. cuzcoensis* based on Karel Knize's collection number list. It MAY be.]

KK388 (***T. peruvianus***) [See note on KK338 above.]

KK388 (***T. peruvianus f.* Huancayo**) [Synonymous with the KK338 just mentioned?]

KK1688 (***T. peruvianus***) [Karel Knize lists this (in his 1982 seed list) as ***Trichocereus* sp. San Marcos**] & "*peruvianus form San Marcos, N. Per*u" (Knize's 2002 *Trichocereus* price list) See also comment on **KK1698** earlier**.**

Oddly in a handwritten note on a December 1999 price list of cuttings, Knize describes **KK1688** as "*probably*" a *peruvianus* variety from "*Ancash, San Marcos, 2500 m, erect*" and adds the unexplained comments "*related to culture Chavin, probably the original peruvianus.*"

Whatever that means. (See page 8.)

KK1688 (***T. peruvianus* f. North Peru**) **[Note 77]** [It is unclear if synonymous with the KK1688 just mentioned.]

KK1689 (***T. peruvianus* v. Puquiensis**)

We currently lack a description. Karel Knize lists this (in his 1982 seed list) as ***Trichocereus* sp. Trancas-Ocro**.

It was *T. peruvianus var. puquiensis* in a 18 March 2000 shipping inventory but became ***T. puquiensis*** in its 27 October 2000 rendering (both were the same order!) It was clearly NOT synonymous with *T. puquiensis* as described in the literature: See the ***Trichocereus puquiensis*** entry.

Knize has more recently listed: *T. peruvianus* **San Pedro de Pasco** 2800m & **Palca** 2500m

Some people have asked why we should even care at all what Knize says about anything is since he appears to show no consistency or even normal standards of definition.

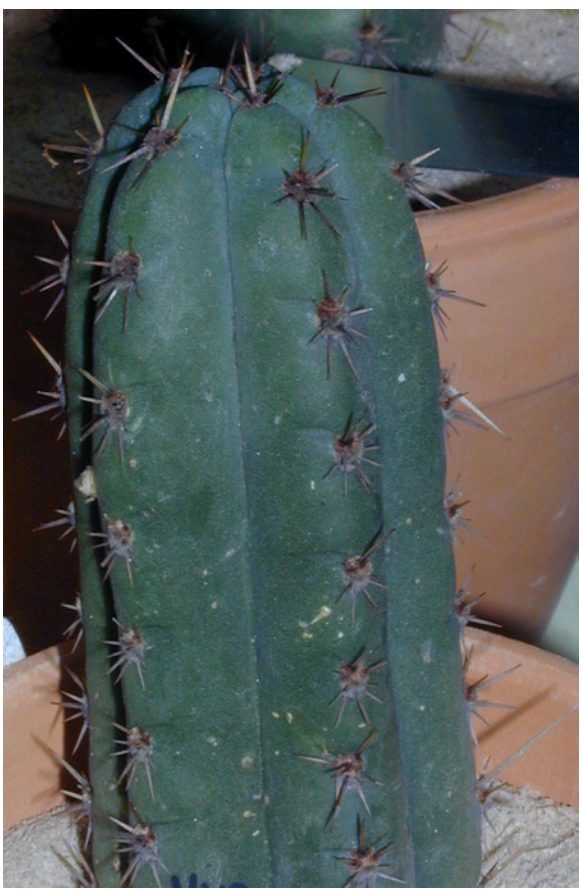
I would love to agree and in reality do on some levels.

It is also important to be aware of Knize and his multitude of beautiful plants. Knize is not only probably the single largest source for the wealth of taxonomic confusion surrounding *Trichocereus peruvianus* in horticulture but is also most likely the single largest source for the *T. peruvianus* (and many other *Trichocereus*) seeds and/or clone-produced plant materials currently available in Western horticulture. He has been a **major** wholesale supplier of both cuttings & seed stock for ***many*** commercial cactus dealers around the world for several decades (fast approaching 40 years).

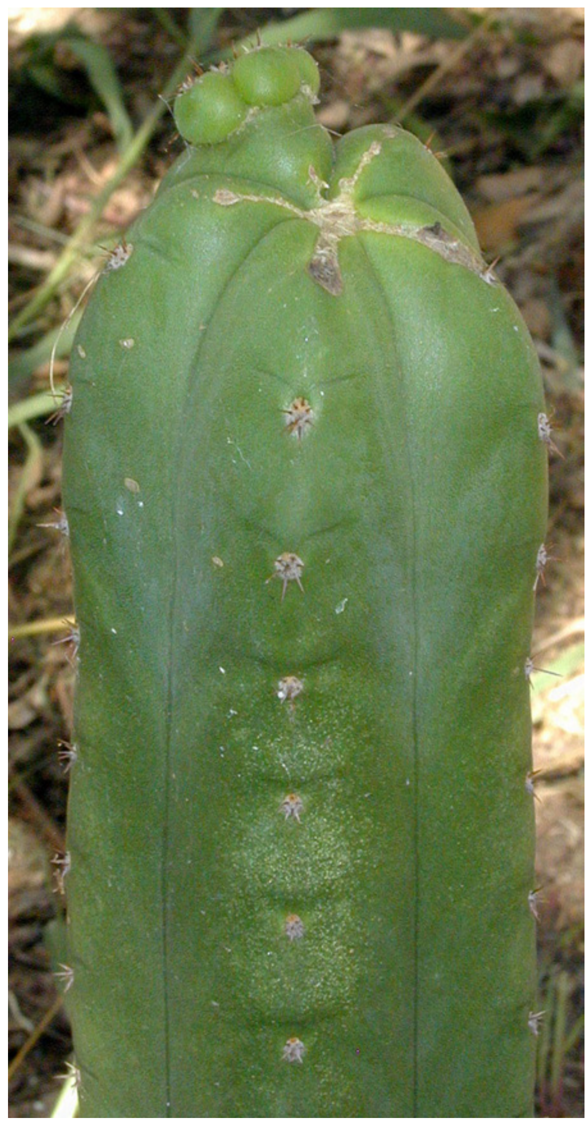
Karel Knize made a noteworthy comment. "*I believe* [...] *many are localities* [...] *introduced during 5000 years as special plant curative, medicinal and cultural item from many human groups, cultures here*[...]"
(Email received from Knize in 2004)

Knize-sourced ***pachanoid-peruvianoid*****s**

Knize would probably have called these *T. peruvianus*; if they had labels. Only the one at lower right had a label.



A few cactus cuttings shipped by Knize labeled *T. peruvianus.*



Faxed invoice listed the plant at lower left as *T. tulhuayensis* KK337.

The top row were said to be *T. cephalomacrostibas* KK1421 S. Peru.

The botttom right cutting on the previous page was given as *T. cephalomacrostibas* KK1421 Rio Tambo.

None matches the published descriptions. All three of these had a handwritten "*T. peruvianus.*" label rubber-banded to each one.

Lower right was from Knize via Quality Cactus as *T. peruvianus*.

Trichocereus peruvianus* var. *knuthianus

Yet another one in horticulture that seems to be lacking a published description. It may or may not be synonymous with *Trichocereus knuthianus*. It SEEMS to be another Knize-originating offering sold through NMCR.

Photo by MS Smith

Trichocereus peruvianus* var. *knuthianus
(NMCR)

Trichocereus knuthianus
(SS)
top right

Trichocereus knuthianus
(Hobart Botanical Gardens)
Photo above by R. Kundalini

unlabeled *Trichocereus peruvianoid* (Las Banos, CA)
(SS)
center and bottom right

***Trichocereus peruvianus* (LER)**

One of several *peruvianus* forms offered for sale.

Their *T. peruvianus* specimens apparently were primarily obtained from Knize

Photo by MS Smith

***Trichocereus peruvianus* (LER)**

Knized!

A look at a lot of mixed pachanoid and peruvianoid cuttings originating as live material from Karel Knize.

Cactus cuttings from Knize

Matucana & f. Matucana

Rose & Rose described the species based on a specimen found growing near the railway above Matucana.

Knize's KK242 analyzed by Pardanani was said to be from Matucana; with their Knize-sourced Peruvian seeds being grown in California by Abbey Gardens.

There are several plants being offered as **f. Matucana** or **var. Matucana** or simple ***T. peruvianus* Matucana**.

They largely appear to be distinct from each other.

Without some type of additional information the qualifier "*Matucana*" means little other than the material purportedly originated from or near Matucana.

Knize's quite different short-spined view of *T. peruvianus* **KK242 f. Matucana** was depicted earlier.

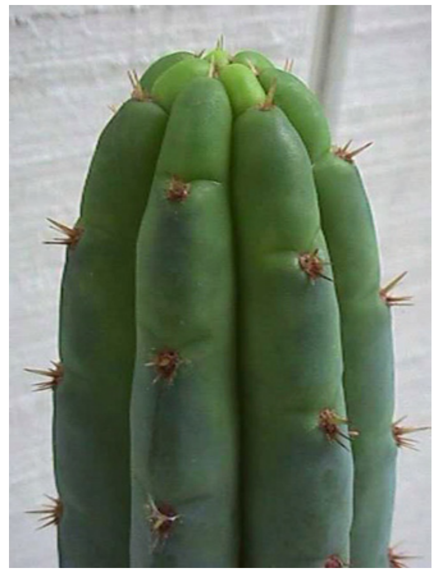
It is noteworthy that the very stout and very blue spiny *T. peruvianus* that can be harvested near Matucana is extremely potent. The dried flesh as is available in commerce can exceed 1% by dry weight. (Using only the sun-dried, despined, peeled, peripheral chlorophyllaceous parts)

***Trichocereus peruvianus* above Matucana**
Photo by IcarosDNA

The above and next two images are what we consider to be classic *Trichocereus peruvianus*. These are growing within the same populations as were encountered by Britton & Rose above Matucana.

***Trichocereus peruvianus* NM942**
Said to have been collected around 2000m, Matucana, Peru. We first noticed it in the 1981-82 Cactus Gems catalog.
This form is apparently presently being sold as var. **Matucana**. Do not confuse with **KK242 Matucana** or with the short spined **KK242 *forma* Matucana**. (Both are in cultivation via KK!) See both elsewhere here.

***Trichocereus peruvianus* (NHE)**
One of several *peruvianus* forms they offer for sale; this clone originated from Karel Knize as a cutting.



***Trichocereus peruvianus* (NHE)**
Photo by Eel

***Trichocereus peruvianus* (NMCR)**
One of several *peruvianus* forms offered for sale by New Mexico Cactus Research. Many of their *T. peruvianus* specimens were produced from Knize-sourced seeds. They are responsible for a wealth of the Knizioids in cultivation in the US and elsewhere.

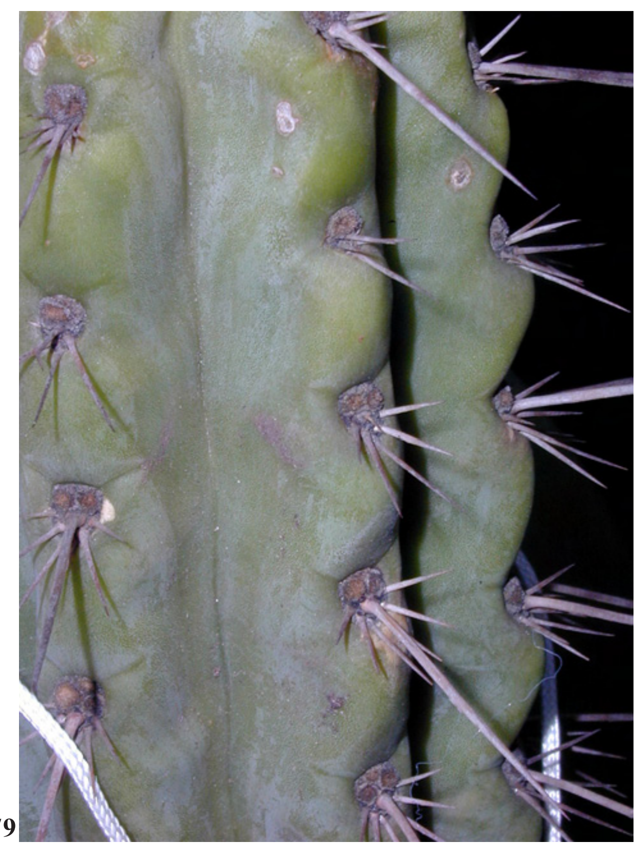
***Trichocereus peruvianus* above Matucana**
Photos by IcarosDNA

***Trichocereus peruvianus* (NMCR)**
Photo by MS Smith

(See also KK2151 on page 291)

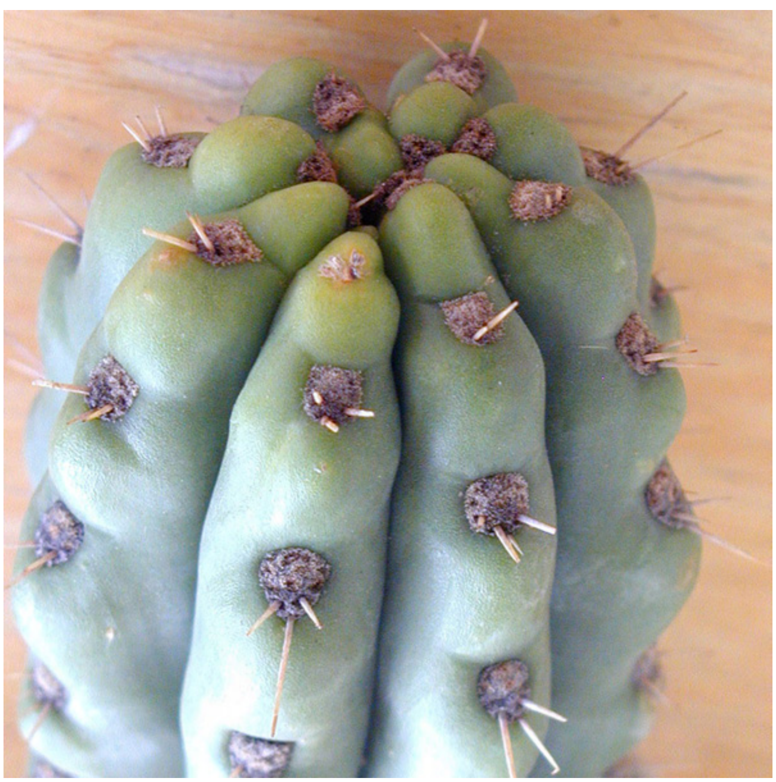
Trichocereus peruvianus
cv. Ayacucho (above)
cv. Huanuco (below)
(Middleton)

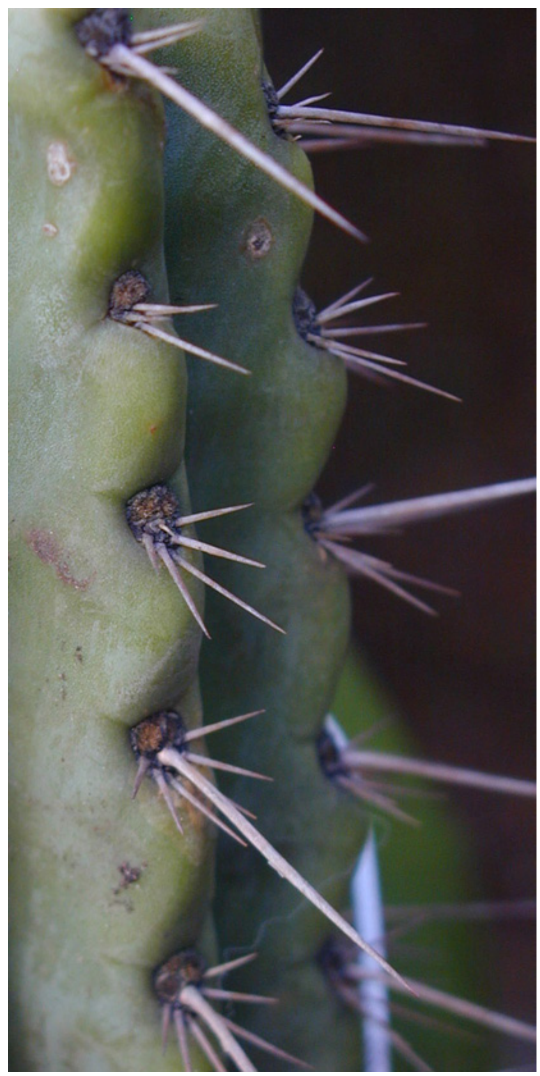
Two forms collected from the wild in the early 1950s by M. Middleton in Ayacucho and Huanuco, Peru, respectively.



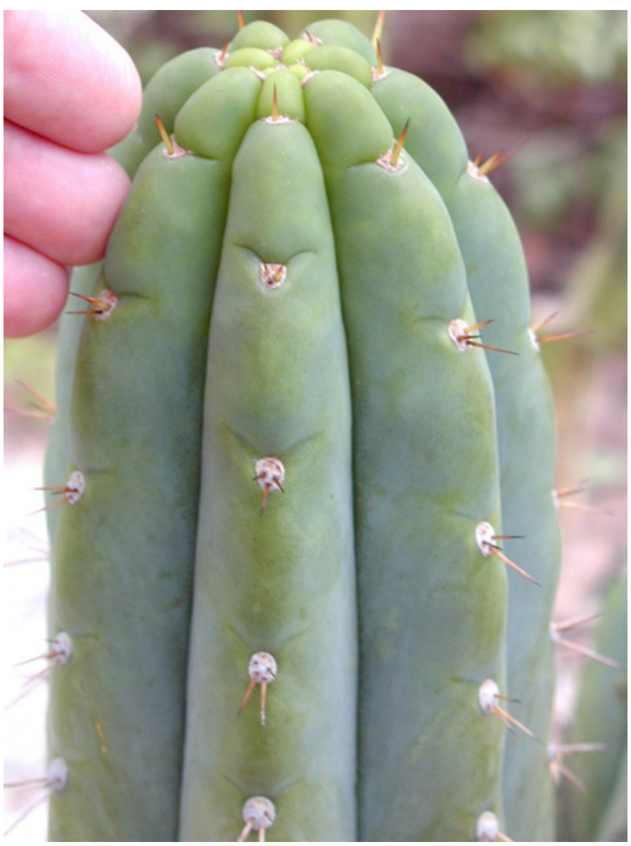
Trichocereus peruvianus cv. Ayacucho
(Middleton)
upper row

Trichocereus peruvianus cv. Huanuco
(Middleton)
lower row





***Trichocereus peruvianus* (Oz)**
Assorted *peruvianus* forms encountered in Australia.
Said to be around the same potency as their *pachanoi*.



***Trichocereus peruvianus* (Oz)**

forma **Pamacoche**

Seeds are commercially available but lacked descriptive information We have never knowingly encountered actual plant material.

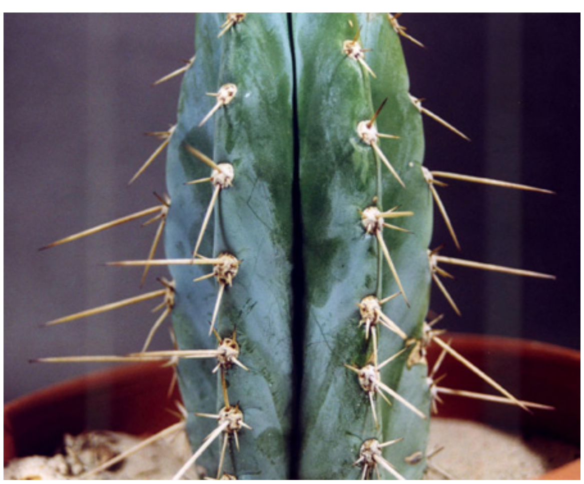
***Trichocereus peruvianus* cv. RS0001**

A beautiful *peruvianus* strain.

In contrast with the yellow and brown spination of many of the others here, it has decidedly yellow and often fierce spination turning whitish and grey. It also is very bluish blushed.

It is proven to be reliable in human bioassays.

An 8" x 4" in diameter cutting was reported equivalent to in excess of 500 mg of mescaline.



***Trichocereus peruvianus* cv. RS0001**
(righthand column & lower left)

***Trichocereus peruvianus* cv. RS0001**
entire page

***Trichocereus peruvianus* cv. RS0002**

Appears quite similar to RS0001 but the material examined has more strongly downward deflected and longer centrals, and, unlike RS0001, is said to have a granular appearance to its flesh when cut. It is said to have comparable activity to RS0001 but to not be as slimy. Interestingly, new growth commonly bears persistent leaves similar to ***macrogonus* cv. RSFat4** and some **TJG** specimens.

See new growth photo on the next page.

***Trichocereus peruvianus* cv. RS0002 (Left above)**
notice the leaves

***Trichocereus peruvianus* cv. RS0003**

Another stout variety that can show variability in both skin color and spination. It too can show leaves but they seem to be smaller and more rapidly resorbed.

It apparently bioassays well but I know nothing more about it.

***Trichocereus peruvianus* cv. RS0003**

Photo by Jon R Hanna

cv. RS0003
notice the leaves

***Trichocereus* sp. Peru 65.0715 [P.C. Hutchison & J.K. Wright 3427, 1 Jan., 1964]**

Known by common name of *San Pedro* (locally in Peru.)

Collected 15 km. E of Olmos, Lambayeque Province.

Elevation 1150 m.

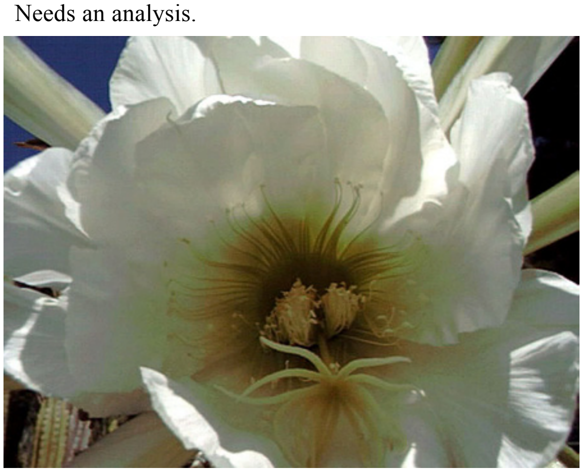
"(5 59 05S, 79 44 43W) on Marañón Hwy, vicinity of restaurant El Salvador."

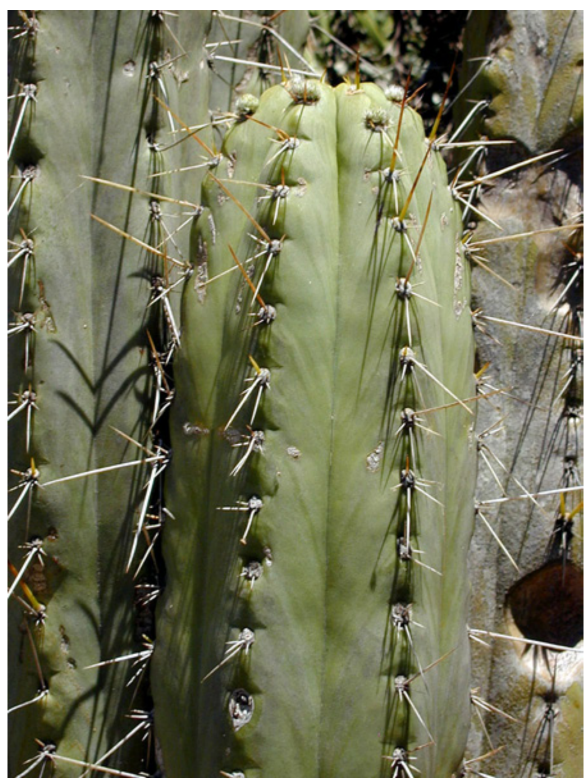
Plants originated as living material.

Flowering was observed during July in Berkeley, California.

The common name San Pedro suggests it may be a potential mescaline container; possibly with human usage.

Needs an analysis.





All 3 flower photos by Geoffrey

***Trichocereus* sp. Peru 65.0715**

cv. (Stafford)

Peter Stafford gave it to Shulgin some years ago. We know nothing else.

***Trichocereus* sp. Peru 68.0235 [P.C. Hutchison 4175]**

Collected as living material in Junin Dept., Peru.

Mislabeled as *Cereus* species. Needs analysis. Does not seem to grow tall.

***Trichocereus* sp. Peru 68.0235**

***Trichocereus peruvianus* (Stafford)**

forma **Tarma**

This is said to be a more spiny form that was collected near Tarma, Peru. We havebeen unable to locate a *bona fide* specimen.

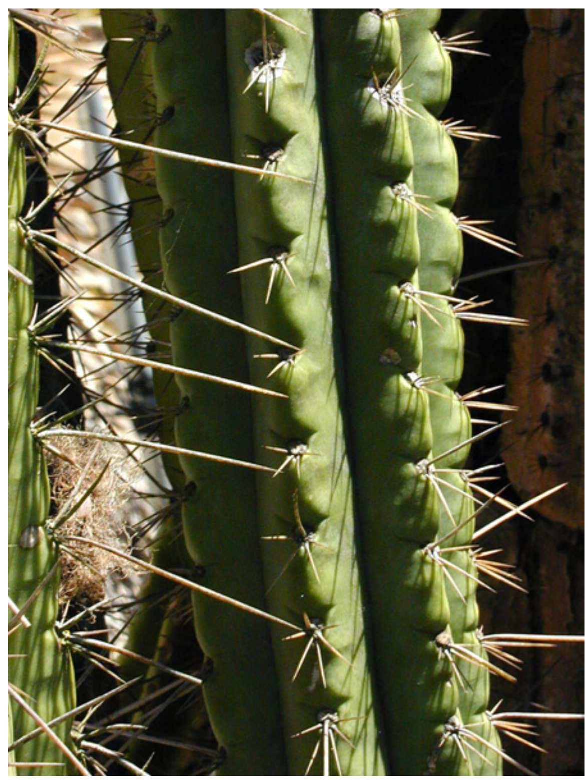
For some speculative grins, see pages 389-390.

We are unsure if Knize's *forma* Tarma is synonymous with *Trichocereus tarmaensis* but that would be in line with his renaming everything similar as a form or variety of *peruvianus*. It lacks any bioassay or analysis that we are aware of.

See KK2148 on page 291.

Hunt considers ***T. tarmaensis*** to be a form of *T. peruvianus*.

Ritter (1981: p. 1326) considered it to be synonymous with *T. knuthianus* Backeberg.



Trichocereus tarmaensis **[P.C. Hutchison 1046]**
Peru 57.0600

Collected by Paul Hutchison near Tarma, Tarma Prov. in Junin Dept., Peru.

Elev. ca. 3000 m.

Collected on an easterly facing slope of hill immediately south of town.

Said to also be abundant down canyon north of Tarma.

Topotype of *Trichocereus tarmaensis* Rauh & Backeberg.

Trichocereus tarmaensis
(SS)

Unlabeled but probably *bridgesii* holding lens cap in its spines.

Rest of this page is assorted *peruvianoids* in Oz
Top row and upper center photos above by R. Kundalini
Other four photos are by Snu Voogelbreinder

Photos above are by Snu Voogelbreinder

Unlabeled *peruvianoids* in Oz Some of these are unclear or possible hybrids

Two photos above & to right by Dutchie

Bottom 2 photos by Zenat

Unlabeled *Trichocereus peruvianus* (MH)

***Trichocereus peruvianus* (MH)**

Unlabeled *Trichocereus peruvianus* cv. (Webb Farm)

***Trichocereus peruvianus* (Webb Farm)**

***Trichocereus peruvianus* cv. 'Vanilla Flower' (RS)**

Another *peruvianus* form said to have flowers with a strongly vanilla scent.

***Trichocereus peruvianus* 'Vanilla Flower' (RS)**

***Trichocereus peruvianus* (WOH)**

Material obtained from Knize as a cutting of KK242.

***Trichocereus peruvianus* (WOH)**

some more *peruvianoids*

Mislabeled specimens that appear to be peruvianoid or macrogonoid

Mislabeled as *T. fulvilanus* or
T. peruvianus* var. *fulvilanus

Cutting obtained from Knize as *Trichocereus glaucus* KK336 Knize nomen nudum, or more correctly **nomen confusum.** (Inexplicably Knize calls this plant collected near Arequipa a nomen nudum despite *Trichocereus glaucus* being a perfectly good name and an entirely different cactus.)

(See also page 259)

Sold mislabeled *Pilosocereus pachycladus*
(Altman)

***Trichocereus glaucus* Knize nomen confusum**

Additional available horticultural material that either falls within this species or close to it:

***Trichocereus peruvianus* f. *giganteus* nn Hort. (K.Knize)**
AKA *Trichocereus giganteus* nn Knize (KK1094; Otavi, Bolivia; 3200m or **KK1094 sp. n. C-Bolivia)**
AKA *Trichocereus peruvianus* var. *giganteus* Hort. (NMCR)
AKA *Echinopsis gigantea* nn Knize

This last name was published in Friedrich & Glaetzle 1983 despite Knize ***never*** using this name. Interestingly this suggests that they viewed it as distinct from both *peruvianus* and *macrogonus* based on its seed coat morphology.

This is another of Knize's invalid *nomen nudums*. It is sold directly by Knize and was also seed-grown by NMCR.

Due to prior usage within the genus (both as *Echinopsis gigantea* R.Mey. and *Trichocereus giganteus* Hort. *sensu* Britton & Rose), the name *giganteus* is invalid and needs another selected.

***Cereus giganteus* Engelmann** is a name applied to the Saguaro, ***Carnegiea gigantea* Britton & Rose**.

Benson 1982 considers it the preferred designation since Engelmann published his description 60 years prior to Britton & Rose creating the monotypic genus *Carnegiea*.

Friedrich & Glaetzle renamed this *Echinopsis gigantea* Knize n n.

I have no idea how they could casually rename a plant that lacks any published description or a holotype designation or any type of vouchered material (Knize seemingly can't provide material that is consistent with itself) and preserve a name which violates the Rules of Nomenclature forbidding the reuse of names within a given genus or within accepted synonyms.

Some growers are calling it ***Trichocereus peruvianus* var. *giganteus***.

At best this beautiful *nomen nudum* is presently another *nomen confusum*. If it turns out to merit specific stature it needs another name.

I know little else about it except for noticing that it shows a rougher surface texture than most others (similar to *T. scopulicola* in texture).

It otherwise appears to look like a typical blueish-green *pachanoid/peruvianoid* but no adult material has yet been examined by the author.

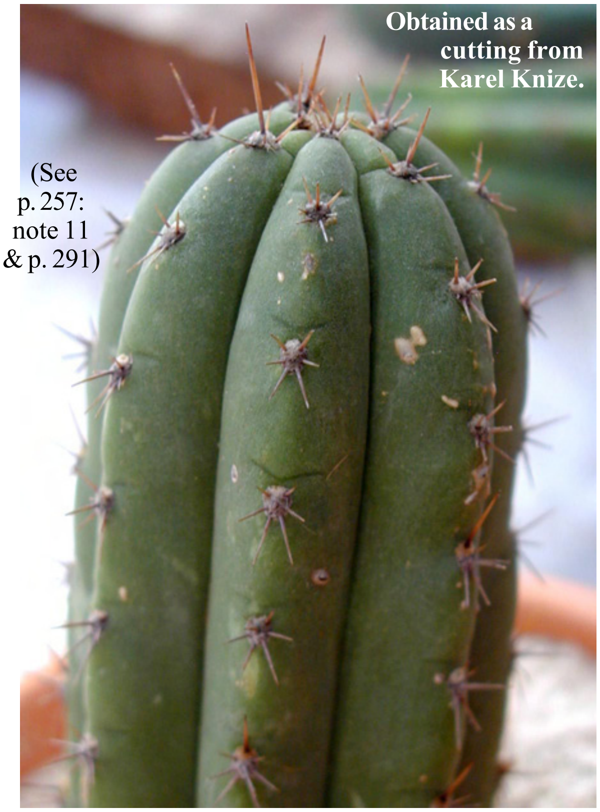
Needs an analysis and some taxonomic study.

More likely to BE a mescaline container than not.

The *peruvianoid*
***Trichocereus giganteus* Knize nomen confusum**

Knize's **nomen nudum *Trichocereus longispina* KK1670**
This appears to be another *Trichocereus peruvianoid.* Knize lists Ritter as describer but this name was not published.

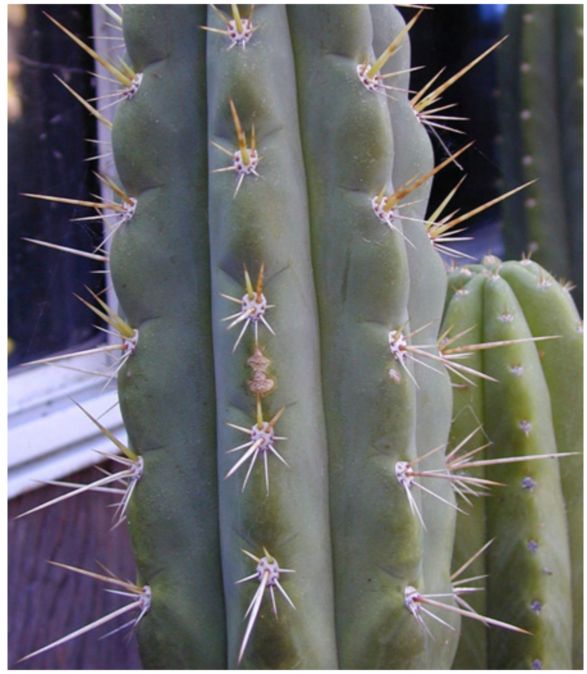
(See p. 257: note 11 & p. 291)

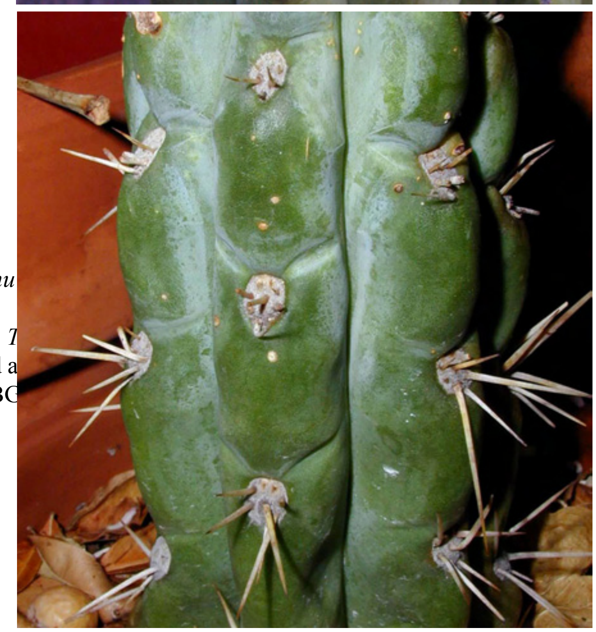


peruvianoid "Trichocereus longispina"

***Trichocereus* sp. SS03** [For **sp. SS01** See under the *macrogonu* entry; For **sp. SS02** See under the *bridgesii* entry.]
As far as I can tell this spiny plant matches the description for *T. peruvianus*. It resembles the material growing at the Huntington and a Melbourne more than either *peruvianus* form represented at the BBG

Bioassays of SS03 are reported similar to a decent *pachanoi*.





***Trichocereus* sp. SS03**
compare to the lower *pachanoi*X*peruvianus* on page 135 and with images on page 189

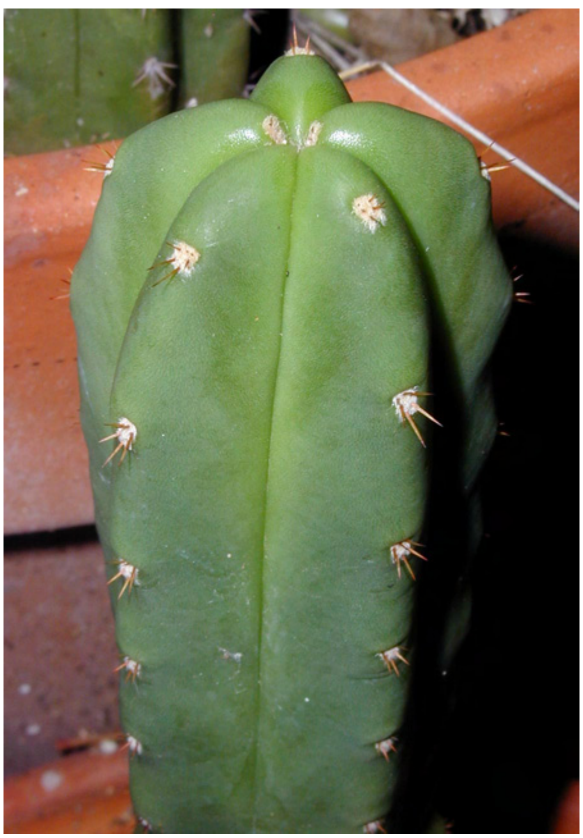
Additional material sold as *T. peruvianus*:
See more under *T. pachanoids* and under TJGoids.

I should also mention a **short spined *T. peruvianus*** kindly provided to us by MS Smith; this plant looks like a *T. pachanoi* with spines only slightly larger than normal .

Of course, there are also the assorted *T. pachanoi* specimens with v-marks so one can't help but wonder if all of these specimens might not be intermediates or hybrids.

MSS recently pointed out how similar this material appears to new growth on *T. huanucoensis*. Older growth however varies markedly between these two.

An easy source of error in horticulture arises when making species determinations from sterile growth. One friend had several very different appearing *peruvianus* forms acquired from several sources. Once they were planted side-by-side their new growth became indistinguishable.



short-spined *Trichocereus peruvianus*
(Bob Smoley via M.S. Smith)

short-spined *Trichocereus peruvianus*
(Bob Smoley via M.S. Smith)

short-spined *Trichocereus peruvianus*
(Cactus Corral via M.S. Smith)

***Trichocereus peruvianoid* (CCC) short-spined**

This is very short spined (with occasionally a single longer spine per areole) and shows deeply incised v-grooves.

Branches are very dark green and commonly in excess of 5 inches. (Around 12 living specimens, a handful of photos of rooted cuttings and single columns and two photographs of large established plants have been examined.) It almost resembles a *Stenocereus* in both skin color and texture. The same color and texture was also observed on an intergeneric hybrid between *Cereus peruvianus* and some sort of *pachanoid* or *peruvianoid Trichocereus* species (in Oz).

So far branches with 5-7 ribs have been observed. The branch tips commonly form a knobby appearance similar to a monstrose *T. pachanoi*.

The monstrose portions may form terminations on columns OR the plant can alternate between the two. In at least one case a crest also arose.

It strongly resembles the material sold in 1999 by LOEHMAN's as monstrose *T. pachanoi* except for consistently having a more robust diameter and spines.

However, we have some doubts whether or not this actually represents *T. peruvianus*. Pictures of an adult may still be found at the California Cactus Center's website. http://www.cactuscenter.com/r_15 html

When contacted, the grower told us that this was the only *peruvianus* they were familiar with.

It appears to show absolutely no tendency towards prostrate growth even when huge. Like the Loehmans material it has a strong and woody vascular bundle.

Compare the vascular bundle of CCC to one from a *T. pachanoi* with the same diameter stem

It also appears to probably be identical to "*T. peruvianus*" sold by Jim Nelson's Cactus Corral.

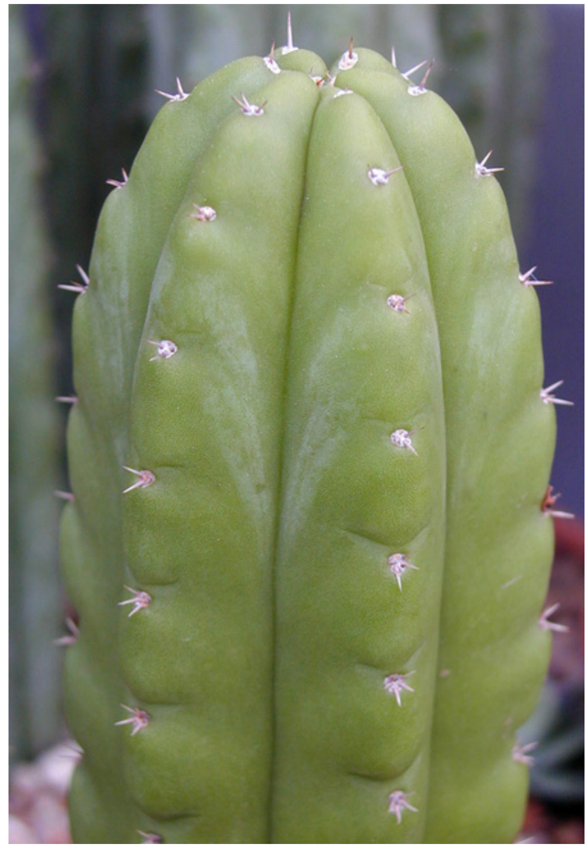
And, while overall similar to Tom Juul's Giant, we are convinced that this is a different plant.

[A few observable differences can be found noted under TJG.]

A club shaped tip cutting from a 7 ribbed plant (3.25 to 3.75" dia. and 14.75 inches long) weighed 1864 gm.

The single bioassay we have heard (second-hand) reported a foot-long section to be mescaline containing but weak. This would have weighed more than a kilo.

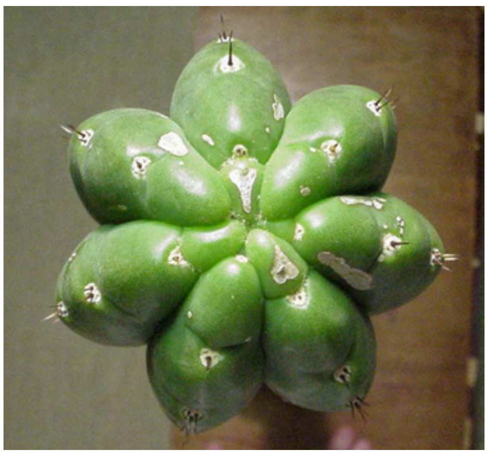
Normal growth



Normal growth

Monstrose growth

short-spined *Trichocereus peruvianus* (CCC)
entire page



short-spined *Trichocereus peruvianus* (CCC)
Photos above by MS Smith

There is also an odd, very blue-blushed, peruvianoid or macrogonoid plant on p. 41 in Innes & Glass 1991 that is clearly **mislabeled *Cereus peruvianus***. Interestingly its origin is given as **Argentina**. Whether this latter point is also an error or if it reflects something in need of further exploration is not clear. See comments on page 20 concerning "*Cereus*"/*Trichocereus argentinensis*.

Water content:
Around 90% water by weight

[A 0.8 inch thick fresh slice from a 1.3 inch in diameter *T. peruvianus* Blue Form was found to weigh 12.2 grams. Allowed to dry at room temperature for 5 months, it lost 69% water by weight (3.8 gm). It was then heated in an oven at 140°F for 20 minutes, after which it was determined to weigh 1.2 grams. Trout 1997-1998.]

A specimen that was obtained as a short spined *T. peruvianus* (mentioned above) proved to lose 86% water by weight in an extremely woody 1 inch slice of a 5 inch diameter section. This plant is so woody it required a saw to cut it. As mentioned, we have some doubts whether or not this represents *T. peruvianus*. Trout 1999

Reported analysis of *Trichocereus peruvianus*
Tyramine (tlc, ms, mp, mmp, ir)
3-Methoxytyramine (tlc, ms, mp, mmp, ir)
Mescaline (tlc, mp, mmp, ir, ms)
3,4-Dimethoxyphenethylamine (tlc, ms)
3,5-Dimethoxy-4-hydroxyphenethylamine (tlc, mp, mmp, ir, ms)
2-Chloromescaline (extraction artifact) (tlc, mp, mmp, ms, uv, nmr, mikes)

Mata & McLaughlin 1982 cited Agurell 1969b & Pardanani *et al*. 1977.

Pardanani *et al*. 1977 also cited by Ott 1993, p. 114.

Agurell (1969)b Lloydia 32: 206-216, <u>did not</u> observe the presence of mescaline.
They found a total alkaloid content of 1-10 mg/100 grams of fresh plant.
Tyramine was present as over 50% of the total alkaloid.
3-Methoxytyramine was detected in trace amounts.
They observed two unknowns forming a total of less than 10% of the total alkaloid.
MS was used for verifying the identification of alkaloids.

Agurell used plants cultivated in Europe. [As mentioned in passing under San Pedro, a researcher analyzing young *T. peruvianus* (1.5 years old) grown from seed in New Zealand, did not detect the presence of mescaline. Whether age, variety or other factors were variables remains to be seen. It should be noted that Pardanani's 400 grams of material would have required close to 4 kilos of fresh material or close to 500 grams of fresh plant for a 400 mg mescaline equivalency.]

Pardanani and coworkers extracted 400 grams of dry pulverized plant grown **in California** from seed collected in Peru. [KK242] [Age was not given.]

Defatting with petroleum ether removed 7 grams of lipids (1.7%).

Moistened with chloroform-methanol-ammonium hydroxide (2:2:1), packed into percolator, macerated with 1.5 liters of chloroform-methanol-ammonium hydroxide (9:0.9:0.1) and then extracted with 18 liters of chloroform.

Separated into fractions *as per* Ranieri & McLaughlin 1976.

Used anion exchange chromatography (Amberlite IRA-401S resin in hydroxide form) to resolve into phenolic and nonphenolic fractions *as per* McLaughlin & Paul 1966.

[See under Crosby & McLaughlin for San Pedro. McLaughlin's group loves these *as per* procedural citations. All refer to a team and paper that included Dr. McLaughlin. (He is one of the foremost experts in the world on cactus alkaloids and cactus chemistry.)]

Used preparative TLC to resolve the phenolic fraction.

Recovered tyramine hydrochloride (34 mg. 0.0085% yield)

3-methoxytyramine hydrochloride (40 mg 0.01% yield)

3,5-dimethoxy-4-hydroxyphenethylamine hydrochloride (14 mg. 0.0035%)

From the nonphenolic fraction:

Dissolved nonphenolic fraction into 50 ml of absolute ethanol and acidified to pH 2 with 5% w/w hydrogen chloride in absolute ethanol. Adding anhydrous ethyl ether till cloudiness was induced and when cooled 2.868 grams of mescaline hydrochloride crystallized. Used preparative TLC to recover an additional 400 mg from the mother liquor. [See note on their solvents under "*Useful manipulations*" in *Sacred Cacti* 3rd edition. Part A or in *Sacred Cacti* 2nd edition.]

Total yield was 3.268 grams or 0.817% from dry cactus

Also identified 3,4-Dimethoxyphenethylamine but they were unable to purify as it co-crystallized with mescaline

They additionally recovered 65 mg of chloromescaline which had been formed as an extraction artifact.

Pardanani *et al*. (1977) Lloydia 40 (6): 585-590

Dr. Douglas Sharon has been quoted as claiming, in a taped 1986 workshop entitled "*Mind, Molecules and Magic*", that *T. peruvianus* is not used traditionally due to the presence of "*very toxic alkaloids*". See the 1995 ***Entheogen Review*** 4 (1): 13.

He apparently came to this conclusion based on the lack of recorded hallucinogenic cactus use during the reign of the Inca and the known occurrence of *T. peruvianus* in the region.

I am at a loss to know exactly how he reached this conclusion but his assertion appears to have NO support on either point.

Traditional use does in fact seem to be indicated (by other people; see discussion earlier) and many have reported bioassay results with glowing praise without any mention of toxic side-effects.

Many have actually commented that it had less side-effects for them than *T. pachanoi.*

As far as we can tell, **no one** has analyzed wild or old plants (except possibly Djerassi).

Djerassi *et al*. 1955 found a trace of a terpene but reported finding no alkaloid. However, Djerassi's procedure would have detected only ether soluble alkaloids. Mescaline is not ether soluble. See comment on Djerassi under *Stenocereus eruca*.

[Ed.: Apparently misrepresented, variant, hybrid or intermediate plants are not infrequently being offered as this species. We see little point in discussing them until further clarification is done. The largest problem appears to be that the members of the genus *Trichocereus* are for the largest part either very poorly/inadequately defined or else they have never been described. The attempts to label collected cacti on the basis of previously defined species has no doubt lead to much of the problems we encounter today.

At least one plant that otherwise keys to *T. peruvianus* just fine, forms up to 9 ribs and shows WHITE felt on the areoles. The actual identity of this material is not known to me. It is claimed to be inactive in bioassays.

Many plants sold as *T. peruvianus* appear to have little or no mescaline and it is very possible that many of these are, in fact, *T. peruvianus*. Reports we have heard indicating both extremely successful and totally ineffective bioassays using material sold as this species seem to be running about equal. Perhaps the ineffective responses hold a slight edge. No verifiable report from the field comes anywhere near the mythological stature its activity seems to have attained. This is not to say that what is properly (& agreed upon as) identified as *T. peruvianus* is not active with around a 4" diameter X 4" plus section.

Trichocereus pachanoi that was many times stronger than other *pachanoi* & peyote that was over sixty times stronger than other peyote has been reported. It would almost be surprising if a similarly wide range did not exist for the assorted cacti that we know as *Trichocereus peruvianus.*

Reported activity of *T. peruvianus*:

It has been ***claimed*** that a half inch slice (of 6-8"?) [name withheld by request] or a 4-1/2" section of 4 inch in diameter material [D.M.Turner 1995 as quoted in the 1998 *Entheogen Review* 7(1): 18] would yield 500 mg of mescaline. Let's look at these values closer:

If weights can be extrapolated from comparison with TJG slices, 4.5" of 4" diameter material would weigh in the neighborhood of 699-720 grams. [By fresh weight this would suggest 0.0715-0.069% mescaline in the wet plant]

If this is true, it would indicate a concentration that was even LOWER than that of Pardanani and associates.

[Their 0.817% dry implies around 0.08% fresh; i.e. 612 grams of cactus [3.8" of a 4" diameter stem] for a 500 mg mescaline equivalency]

If a 6-8 inch diameter slice yielded 500 mg of mescaline this would require a concentration of 0.3-0.4% by fresh weight or 3-4% by dry weight or nearly twice as strong as the strongest reported *T. pachanoi*. This would also be far stronger than the majority of peyote now available to the NAC. We remain unconvinced this has ever been established as a fact.

Bioassays conducted by Justin Case in 1998 indicated that 8 inches of a 4+ inch in diameter plant produced results equivalent to 500 mg of mescaline. This amount weighed over a kilo; suggesting less than 0.05% by fresh weight.

Since then, Case reported bioassaying other *peruvianus* forms ranging from around twice as potent to half as potent.

Health Canada performed an unpublished hplc on "*T. peruvian*" in 2004. Mescaline was the second most abundant alkaloid; estimated at 0.056% dry wt. They quantified 8 unidentified phenethylamines and 3 other unidentified alkaloids. One of the latter was the major alkaloid (0.093%).

However, it must be stressed:

As far as we can determine, the current taxonomic key is woefully inadequate, no taxonomic study is being undertaken, a methodical collection of vouchers apparently has never been performed and no systematic (or even broad based) chemical analysis of the horticulturally available material has been done (at least not published). In other words NO conclusion can be drawn unless you are certain you are discussing the exact same material.

It is also known that ***T. pachanoi* X *T. peruvianus*** and ***T. peruvianus* X TJG** hybrids exist (at least one has been determined to be synonymous due to the commonly held belief that TJG is a form of *T. pachanoi*) and available as seeds and/or plants; their chemistry is unevaluated.

Complicating the picture is the fact that much of the *T. peruvianus* appears not to be a true species with all possible degrees of intergrades with *Trichocereus pachanoi* existing. Even simple identification of exactly what is or is not within this complex or within this "*species*" is nearly impossible with any degree of certainty for a great many of these plants due to the inadequately defined and differentiated nature of the *Trichocereus* species.

This also is an area where chemical evaluations for almost all appears to be lacking. This topic is ripe for evaluation.

There, as mentioned earlier, are short spined forms of this species and a totally spineless, ribless, heavily frosted, grey-green monstrose form that exists in horticulture.

Similarly, there are crested forms in cultivation.

Some unclear *peruvianoids*

Trichocereus collosus Hort.

AKA *Trichocereus colossus* appears to be growing in the Berkeley Botanical Gardens.

However, a closer look shows that a plant at this location was grown from Ritter's ***Cereus colloseus*** **Bolivia 66.0159** seeds obtained from H. Winter (in Germany) in 1966.

Their records also clearly state that the plant at that location is now deceased. (*Cereus colloseus* is available in horticulture and is most decidedly a *Cereus* species.)

Whatever is now growing in this spot at present is apparently anyone's guess but most of us have followed Bob Ressler's lead and refer to it as *Trichocereus collosus*.

Its location between *T. puquiensis* and Peru 65.0729 (both of which have been seen blooming together), the proximity of a sprinkler and the existence of good nurse plants have lead to our speculation that it might be a spontaneous hybrid.

It is unlikely anything will ever be known with certainty.

Photo by Kamm

The three columns intruding from the left are *puquiensis.*

Photo by Jon R. Hanna

***Trichocereus collosus* Hort.**

This name apears in horticulture but the reality is those plants arose from collected seed.

Similarly the "*T. sp. fat spineless*" in horticulture is sometimes presented as being synonymous with sp. Peru 64.0762.

However it should be stressed that both actually entered horticulture when a cactus grower pocketed their seed pods from the UC Berkeley Botanical Gardens one September and then distributed some of the resulting seedlings among a number of cactus collectors.

As the *Trichocereus* species are largely self-sterile, these are most likely of an unclear hybrid parentage.

This situation is the general case for most *Trichocereus* seeds nicked from botanical gardens.

***Trichocereus* sp. "*Fat spineless*"**

Trichocereus huanucoensis
(Berkeley)

***Trichocereus huanucoensis* Hort., H.Johnson, Sr.**

This apparently variable plant is said to be "*allied to T. peruvianus*" but I have learned little more. The single human bioassay that I am aware of used around half a kilo (6 inches of a 3.5 inch column) and reported distinct stimulant activity which was believed not to involve mescaline.

There appear to be two forms represented at the BBG; one of these (which is often assumed to be a mislabeled *pachanoi*) looks similar to many *pachanoi* specimens and reaches only a similar diameter. The other form (and the form at the Huntington) gets larger in diameter.

Interestingly BOTH forms flowered together in 2002 at the BBG but were entirely out-of-sync with the *pachanoi* clones also in the area.

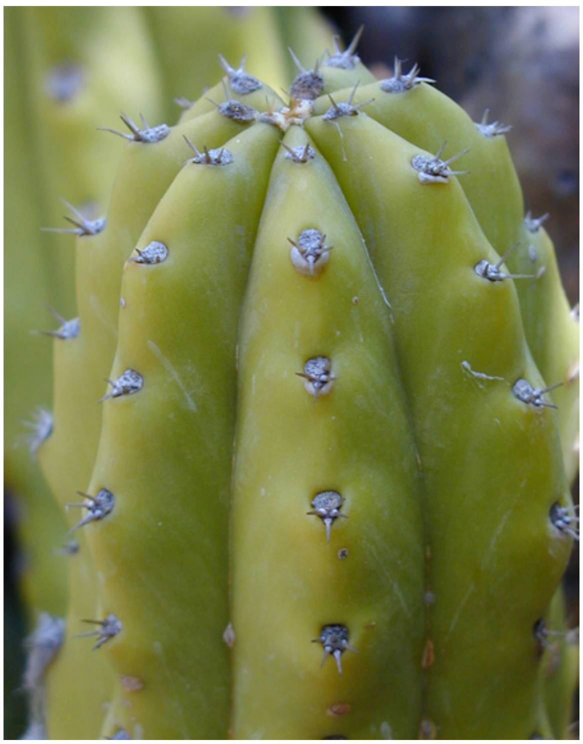
***Trichocereus huanucoensis* (front bed)**
(all three photos on this page)
Berkeley

Both of these forms are at Berkeley

Trichocereus huanucoensis
(front bed)

Trichocereus huanucoensis
(back beds)

Photos on top right & top left by Tania



***Trichocereus huanucoensis* (front bed)**

***Trichocereus huanucoensis* (back bed)**
(all 3 photos above)

***Trichocereus huanucoensis* (back beds)**

Trichocereus huanucoensis **HBG18562 seedling obtained through the Huntington**

Trichocereus huanucoensis
(Huntington)

Trichocereus huanucoensis
(SS)
This version can exceed 6 inches in diameter

Trichocereus huanucoensis
(SS)
Top right photo is of new growth.

The so-called ***T. peruvianus*** var. ***trujilloensis***

This also available in the horticultural market but seemingly lacks any information. It was collected in northwestern Peru and first sold in the US by NMCR, followed by …OF THE JUNGLE.

See RÄTSCH 1998 for a color picture.

It seems VERY likely that this plant may have been placed under *T. peruvianus* improperly and may not even belong in the genus *Trichocereus*.

From its appearance, *Browningia* or another genus seems more likely. [Bob RESSLER and M.S. SMITH have soundly suggested that it might be a *Rauhocereus* species, possibly *riosaniensis*; the "*low altitude*" form. *Rauhocereus* was splintered from *Browningia*.]

Rauhocereus riosaniensis
above
Photo by Kamm

'*trujilloensis*'

Trichocereus puquiensis Rauh & Backeberg

Echinopsis peruviana ssp. puquiensis (Rauh & Backeberg) Ostolaza according to Hunt 2000 **[Note 79]**

Plants branching from near the base (2 inches above base rather than at ground like *peruvianus* according to Bob Ressler) or adjacent to injury.
Erect in habit, growing to 4 meters in height.
Bluish-green branches to 15 cm in diameter, appearing swollen.
The 8-10 ribs are not surmounted by a transverse furrow but are somewhat swollen around the areoles. Ribs are around 2 cm in height.
Areoles are round, ~1 cm in diameter (Backeberg), 5-8 mm diameter. (Ritter)
Spines are chestnut brown to start, later fading. Spines number from 10 to around 12.
There are up to 10 radial spines that are 1-2 cm long.
Usually 2 central spines; one of which is more erect and up to 10 cm long, the other directed downward up to 5-8 cm long.
Fragrant white flower 14-16 cm long (Ritter) [15 cm Backeberg], opening to 8-10 cm (smaller on both counts than *pachanoi*.)

Has thickened spines similar to cuzcoensis but differs from it due to having more ribs and longer spines.
Grows on western slopes in contrast to *cuzcoensis* growing on eastern slopes.

Ritter assigned his collection FR 155b
Published photos: Fig. 1189. in Ritter 1981 &
fig. 1061 in Backeberg 1959

Description compiled from
Ritter 1981 *Kakteen in Südamerika* 1325
Backeberg 1959 *Die Cactaceae* 1108-1109: #8
Backeberg 1977 *Cactus Lexicon* 496

Points at variance in examined *T. puquiensis* (BBG plant and Bob Ressler cutting):
There is clearly a transverse depression above the areoles.
There also seems to be at least 2 branches with only 6-7 ribs but again the photo does not allow for certainty.
7 ribs on cutting.
Very light transverse depressions but no distinct furrow. (It IS swollen above the areole slightly.)
Some areoles have faint and short v-marks.
No areole approaches 1 cm although tip cutting is still only a couple inches in diameter.
Spines are mostly darker tipped. Some have VERY dark bases.
New spines are rarely entirely brown - if they are it is much darker than chestnut colored.
Some do have chestnut brown but this is mostly tips and a few bases.
There does not usually seem to be one central directed downward but this is not clear in the photos of BBG material.
There seems to be mostly one central spine.
The longest spine is not always placed as a central but if considering the longest spines to BE centrals then there are mostly 2 per areole.
The longest spine is occasionally directed downward.

Floral tube is up to 10 cm long and to 2.5 cm in diameter with brownish-black hairs.
Petals are white, 48-62 mm long, 22-30 mm wide. (Smaller than on *pachanoi* and not spreading as broadly open.)
Sepals are reddish-green beneath and green above.
Style is 8.5-10 cm long (smaller than *pachanoi*) with 17-20 spreading stigma lobes.
Filaments and stamens are green with yellow anthers.

Endemic to Puquio, Dept. Ayacucho in southern Peru. Ritter 1981
("above Puquio": Backeberg 1977; "Puquio-valley, 3300m": Backeberg 1959)

Appearance and flower indicate it is extremely close to both *T. pachanoi* and *T. cuzcoensis*.

Material furnished in 2000 by Karel Knize as *T. puquiensis* **KK1689** did not match the published description nor did it resemble material at the BBG.
Points at variance with Knize's cutting: Everything that can be measured presently:
Spine count, rib count, areole size, spine color. See photographs on page 206.

The monstrose form of this species was reported to be of medium potency in human bioassays.
The normal form was purportedly analyzed but we have been unable to locate any actual publication of the results.

Both photos:
***Trichocereus puquiensis* Peru 60.1135 (BBG)**
Lower photo was by

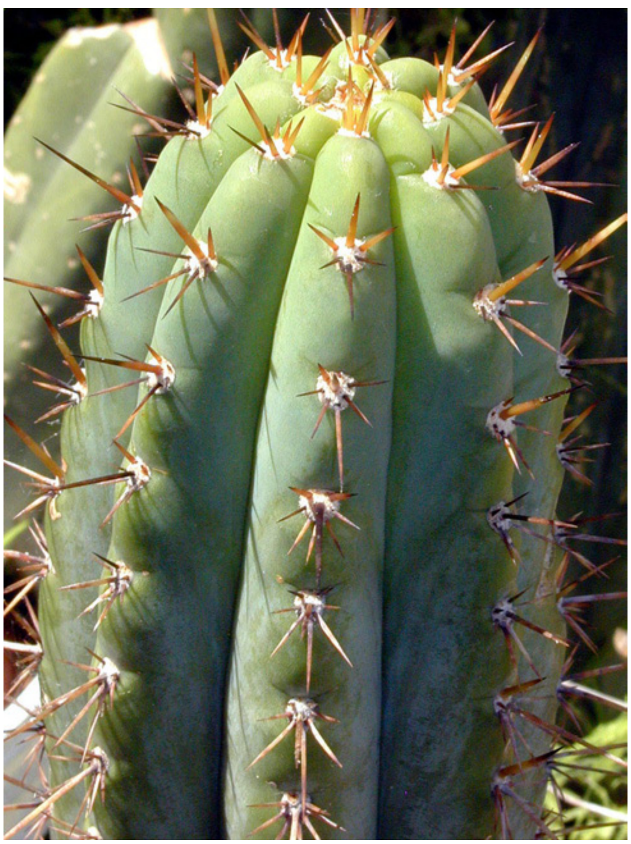
said to have been grown from seeds stolen from
Trichocereus puquiensis Peru 60.1135
(BBG)
Is this a hybrid?
(above)

Trichocereus puquiensis Peru 60.1135 (BBG)
Both images above

Trichocereus puquiensis (BR)
lower right & center right

Trichocereus puquiensis (BR)

Now for something completely different...



Trichocereus puquiensis (RS)

***Trichocereus puquiensis* KK1689**
Cutting obtained from Knize
Lower photo shows new growth on same tip

(See also KK1689 on page 259)

Trichocereus santaensis Rauh & Backeberg

[*Echinopsis santaensis* (Rauh & Backeberg) Friedrich & Rowley]

Like so many of these species, this plant has NEVER had an adequate description published.
Rauh & Backeberg "*described*" this as a new species despite never having observed the flowers.
Ritter made *some* floristic comments but only as a generalized comparison with *pachanoi* (which he merged with *peruvianus*) and did not provide any meaningful description that is capable of serving in the creation of a taxonomic key.

Presence of mescaline has been established in human bioassays but it lacks any published analysis.
Plant to 5 meters tall; branching from base.
Stems can sometimes reach 15 cm (6 inches) in diameter.

Trichocereus santaensis OST 92701
(RS)
(Grown from MG cat. # 1283.557 seeds)

Epidermis is greyish-green; sometimes bluish-green on young tips.
6-7 ribs are broad, flat, distinctly furrowed horizontally with a decided v-shaped notch above the areole.
Horizontal furrowing is much less pronounced on young growth.
Areoles are more or less shield-shaped, white-felted, up to 5 mm in diameter.
The brown or brownish spines are few or absent.
Usually there is 1 central spine from a few mm up to 4 cm long.
2-3 radial spines are often rather short but can reach 2 cm or sometimes a bit longer. Radial spines are often absent.
Flower buds are hairy dark brown or black.
Flowers were not observed by Backeberg & Rauh.
Blooming in the vicinity of the apex, with flowers borne obliquely towards the top.
Flowers are around 18-19 cm long but only opening to around 12 cm wide. Sides of the blossoms are more straight in spreading, similar to a shallow bowl, rather than curving outwards as would be the case with *T. pachanoi*.
Nectar chamber was 19 mm long (a little shorter than *T. pachanoi*), without any clear intervals and lacking or nearly lacking nectar.
Floral tube around 6 cm long; to 2.5 cm wide (longer and wider in *T. pachanoi*).
Petals are somewhat shorter and narrower than on *T. pachanoi*, the petals and the sepals are almost adjoining (rather than being strongly bent outwards).

Endemic to Santa Valley, at 2000 m and vicinity, Depart. Ancash, Peru. Ritter 1981.
Rio Santa Valley, Puente Bedoya, Huayanca, around 3000 meters. Backeberg 1959 & 1977**.** Backeberg 1959 hinted at a broader distribution but Ritter 1981 disagreed with this.

Description composed from:
Backeberg 1959 _Die Cactaceae_ 2: 1110-1111.
Backeberg 1977 _Cactus Lexicon_ 496
Ritter 1981 _Kakteen in Sudamerika_ 4: 1325 [Floral comments are from Ritter.]

Also published in:
Rauh & Backeberg 1956 *Descr. Cact*. Nov. 20.
Rauh 1958 *Beitr. peruan. Kakt*. 361

Published photos:
Backeberg 1959: illustration 1063 (tip detail) & plate 78 (plant)
Ritter 1981: Fig. 1188 (page 1551)

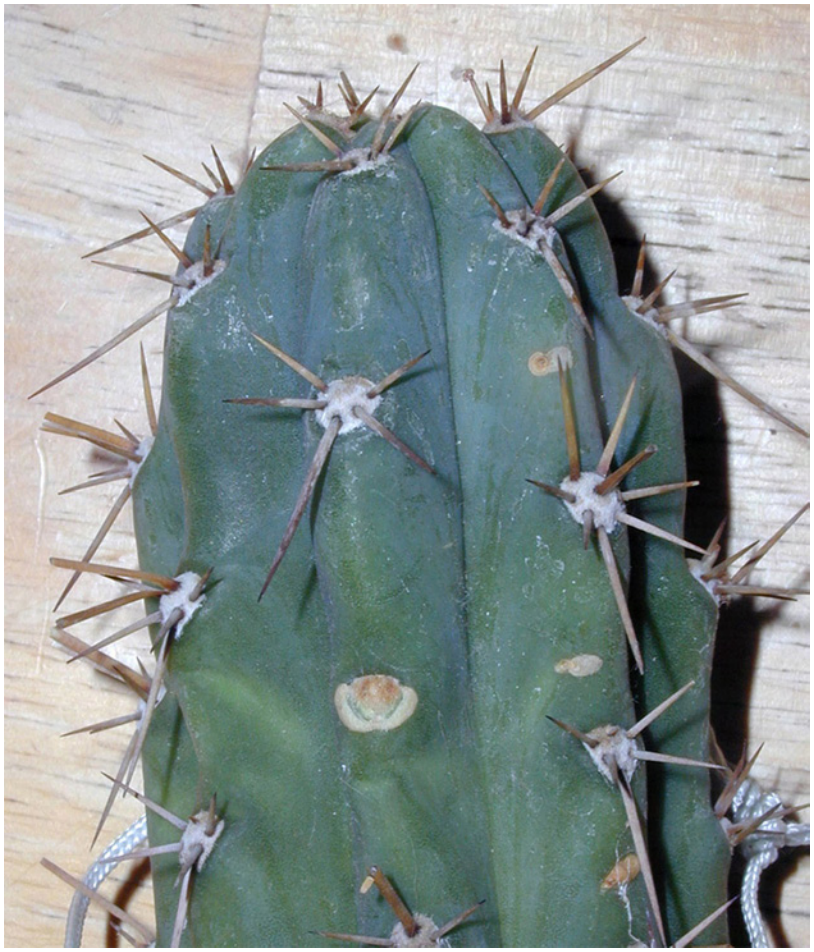
Ritter's collection was designated **FR 567a.**

Activity
Reported to be active in human bioassay.
Anonymous friends found that approximately a pound (6 inches) of their material was a perceptible dose.

The only published analysis appears to be what is within the 1972 doctoral dissertation of Dr. Manuel Palomino Yamamoto (Universidad Nacional Mayor de San Marcos. Lima). This paper details the process he used for isolating alkaloids, describes their physiological effects on mice (with results similar to Cruz Sanchez 1948) and described the plant as being of "*low toxicity.*" (Meaning low alkaloid?)

It is oddly never mentioned how he identified the plant or where it was obtained or what the alkaloids were.

The claim for the presence of mescaline was made by Caycho Jimenez 1977 (page 91), and also on page 92 where he claims three other alkaloids were also found, but no specific reference accompanied the claim. In his references he included "M. Palomino 1972". This paper proved to be unavailable to any referencing service. Our thanks to Dr. Carlos Ostolaza for the truly amazing detective work required in completing the details of this obscure botanical reference.



Trichocereus santaensis resembles *Trichocereus cuzcoensis* but is less glaucous than *T. cuzcoensis*. *Trichocereus santaensis* does not possess as thickened of spine bases, and it has fewer spines and shorter radial spines. [Ritter 1981]

Trichocereus santaensis resembles *Trichocereus peruvianus*, but, unlike *T. peruvianus*, *T. santaensis* is always upright in habit. [Backeberg 1959]

Trichocereus santaensis resembles *T. pachanoi* but *T. pachanoi* is more of a grass-green to bluish green, has 5-8 ribs (occasionally up to 10 or more) and it also has more of a simple horizontal depression above the areole. *T. pachanoi* has a slightly longer nectar chamber, a longer receptacle, a flower that opens more widely (to around 20 cm) and curves outwards more, sepals that recurve strongly away from the petals, and it presents its flowers at more of a right angle to the stem as does *T. santaensis*. [Ritter 1981]

Trichocereus santaensis **(Huntington)**
(RS)

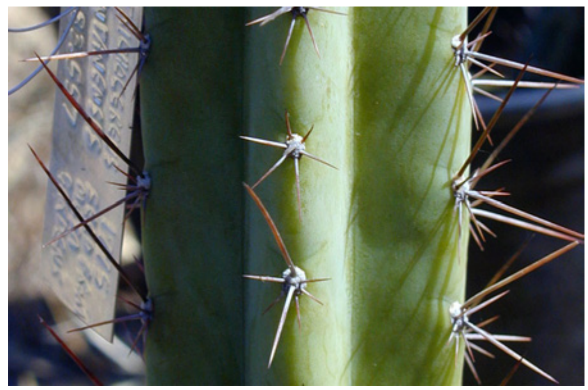
***Trichocereus santaensis* OST 92701**
(Oasis)
(via RS)

Carlos Ostolaza collected this at ca. 3000 meters in the Santa Valley.
Grown from Mesa Garden seeds.
[1995 cat.# 1283.557]

OST 94701, when encountered in horticulture, is a typo.

See more images on pages 348-350

Trichocereus santaensis **OST 92701 (SS)**
left-hand column & above



Trichocereus santaensis **OST 92701 (RS)**

Mention should be made of an odd picture featured in SATO 1996 that is labeled "*scoprina*". This appears to be *T. scopulicola* but the origin of this odd name is presently a mystery to me (best guess would be reliance on a poorly handwritten or damaged label).

It is given in quotation marks like the other 2 RITTER trichs that are included but unlike the rest of the trichs pictured.

One of the other RITTER trichs that SATO pictures similarly appears to be misspelled.

Trichocereus santaensis
(Huntington)

Trichocereus scopulicola Ritter

Echinopsis scopulicola (Ritter) Mottram (another descriptionless naming. See Mottram 1997) **[Note 80]**
Name appears to mean "*living among rocks*" or something similar.
"*Easter lily cactus*" (Hewitt)

Presence of mescaline has been reported in human bioassays but it lacks any published analysis.

Trichocereus scopulicola
(Tropical Fruit World)
Photo by Dutchess

Holotype: The type (FR 991) was collected by Ritter near Tapecua, O'Connor province, Bolivia.
Occurring at approximately 1000-1500 m.

Its habitat is rocky slopes in mountainous virgin forests in Dept. Tarija (in Southern Bolivia). [Ed.: At least this seems the best translation of "*Blockhalden*" [literally meaning "*block waste dumps*"] but I might note that in Cactus (Paris), Ritter gave "*Rocky hills*" and in-habitat pictures of similar trichs commonly show them growing in mountainous terrain strewn with boulders. Ritter may have been referring to this type of country.]

Backeberg 1977: p. 497, stated simply "*T. scopulicolus Ritt. (FR991): no description available.*" Notice that Backeberg altered Ritter's spelling.

***Trichocereus scopulicola* (Oz)**
Photo by Snu Voogelbreinder

T. scopulicola was discovered in May of 1959 and assigned collection # FR 991.

Ritter claimed that a voucher was deposited in the Herbarium of Ultrecht University.

It needs both taxonomic study and analytical work.

Mottram 1997 soundly commented it is not closely related to *T. pachanoi* but provided no rationale for that conclusion.

The flower is distinct but its appearance and chemistry are very similar. We would like to see a cladistic study perfomed for the entire genus.

New tip of *Trichocereus scopulicola* (Gardenworld) (left) compared to *Trichocereus pachanoi* (right)

(Observations in parenthesis are those of Ritter unless noted otherwise)

Dark green stems growing erect, up to 3-4 meters tall, 8-10 cm in diameter [Said by Australian growers to commonly reach between 4-5 inches in diameter at maturity]. Columns may be simple or else branching near the ground.

"*Impressive columnar cactus*" (Hewitt), to 8 feet (2.4m) tall with spread of 3 feet (90 cm) (Hewitt), can reach over 3 meters in height and up to 15 cm in diameter (Collectors Corner).

Dull green (RB) to dark or olive green **[Note 81]** (Trout) epidermis is thick & matte (Hewitt).

Not glaucous; surface is rougher than *T. pachanoi* overall (except at growing tip) RB.

NMCR material grown from FR991 seeds showed glaucous patterns only at transition between recent and older growth. (Trout)

Under a 10X loupe the skin can be seen to be coarsely grainy (larger grains and wider spacing) in contrast to the fine & closely packed grains observable on *T. pachanoi* skin. (Trout)

The mature plants have 4-6 ribs; usually 5. Occasionally 7. Branches showing more than 5 ribs will often lose a rib as they grow. Whether they can form more ribs is not known to the author.

The ribs are 3-4 cm across, broadly rounded and blunt; almost without indentations. While *scopulicola* often lacks indentations or grooves above the areoles (causing the edges of the rib to have a smoother profile than *T. pachanoi*), it does develop outward and downward sloping depressions under (or through) the areoles. This can cause a somewhat wrinkled appearance. (Snu Voogelbreinder; pers. comm. 2000-2006)

Branch tips are more club shaped than *T. pachanoi* (RB).

The grooves between the ribs are straight (Ritter), deep (Hewitt) & more indented than *T. pachanoi* (RB).

The areoles are rounded to oval, low and somewhat sunken, with some white felt. They are 1-3 mm long, 1 mm wide and set from 15 to almost 30 mm apart.

Flowering areoles are larger: around 4-5 mm in diameter.

Larger plants can have approximately 3-5 spines per areole but they may be absent. Spines are brown, awl-like and often only 1 mm long. The spines are much less dissimilar in lengths than is common on *pachanoi*

Seedlings have 6-7 ribs with areoles from 1 to over 1.5 mm in diameter; set 3-5 mm apart. The areoles have 7-13 whitish or brownish spines, of which 1-2 are placed as centrals. Their 2-5 mm long spines are needle-shaped and whitish or brownish. [Spines on seedlings are barely visible & often nearly indistinguishable from those of *T. pachanoi*: RB. [This is rather common on stock encountered in the US.])

Flowers are usually borne near the apex; sometimes lower. They are 16-20 cm long (Ritter).

The flower is around 15 cm. (Collectors corner)

"*Huge*" [white] flowers open up to 10 inches (25 cm) across (Hewitt); nocturnal flowers in summer.

Flowers are white & fragrant; opening at night and remaining open during the cooler hours of the morning. (Ritter)

Ovary is green, bearing bracts with large podaria approx. 1 cm in diameter, upwardly running into 1-2 mm long greenish triangular scales, the axils bearing white woolly hairs; in addition there are black hairs above.

The nectar chamber is brownish-white, surrounding the style very closely. It is around 2 cm in length and contains nectar.

Floral tube is almost funnel-shaped; 6.5-8.5 cm long with the superior portion around 3 cm wide. It is light green inside and out. The scales are up to approximately 25 mm long and 15 mm wide. (Arranged in increasing size.) Scales are green; reddish-brown where passing into the petals.

There is the presence of black with white frizzy-woolly hairs.

Stamens are pale green lower and upwardly yellowish. They are 7-9 cm long (those of the hymen are 4-5 cm). The lower ones are inserted on approx. 4 cm.

Anthers are brownish.

The style is pale-green, 14-18 cm in length. Of this length, approximately 2 cm contains the 12 light-yellow & spreading stigma lobes.

White petals are 6-8 cm long x 2.5-4 cm wide. The base is narrow; their tips are rounded, with or without small points. The upper portion is wider than the lower.

Sepals are not as wide. They are white with a green mid-stripe.

Begins to flower at 4 feet (1.2m) (Hewitt).

Woolly flower bud (Hewitt).

Delicious fruit is green, and 4.5 cm wide & long with a surface like the ovary.

Seeds are almost kidney shaped. They are 1.8 mm long x 1.3 mm wide x 0.8mm thick. The surface is black, brilliant and lightly tubercled. The brownish hilium is oval and very inclined.

Description composed from:

RITTER **(1966)** ***Cactus (Paris). Organe de l'Association Française des Amateurs de Cactus et Plantes Grasses. Paris.*** **21(87): 14-15.** (includes a poor photo of stem with flower: on page 14.)

RITTER **(1980)** ***Kakteen in Sudamerika*** **Volume 2: 452; fig. 443** (photo of flower but dark and showing little discernible detail of the body.)

HEWITT **(1997)** Entry page 70, has good picture of plant with flower and a dead flower. Small picture page 39.

COLLECTOR'S CORNER (Australia) (Correspondence with a friend)

"**RB**" (Relayed by MS SMITH Aug. 1998)

TROUT (examination of available photos & living material obtained from NMCR via YARROW, from ALBERT via RS [as two forms originating with NMCR], examined while visiting friends near Nimbin & Mullumbimby, NSW, and from COLLECTOR'S CORNER (AKA GARDEN WORLD) [example provided by Snu VOOGELBREINDER]

It seeds readily in Australia. (COLLECTORS CORNER)

"Excellent" (RITTER) "good" (HEWITT) grafting stock.

See a color picture at:
http://www.collectorscorner.com.au/Plants/Landscaping%20Pictures/JCPFS93.JPG

Material provided from COLLECTORS CORNER in Australia (aka GARDENWORLD) showed very dark skin and spines that were far shorter than either *T. pachanoi* or the NMCR material. Apparently the color starts very dark and grows lighter , even to a yellowish-green, with age or sun.

The material from NMCR showed this mainly on younger seed grown material and older branches, even younger growth on older plants, more closely resembled the Australian versions.

RITTER felt that the type is closely related to *Trichocereus bridgesii* and closer still to the similar but more spiny *Trichocereus crassicostatus* RITTER spec. nov.

This appears to be part of a complex of similar Bolivian plants, which are so far largely proving active in bioassays. (See page 215.)

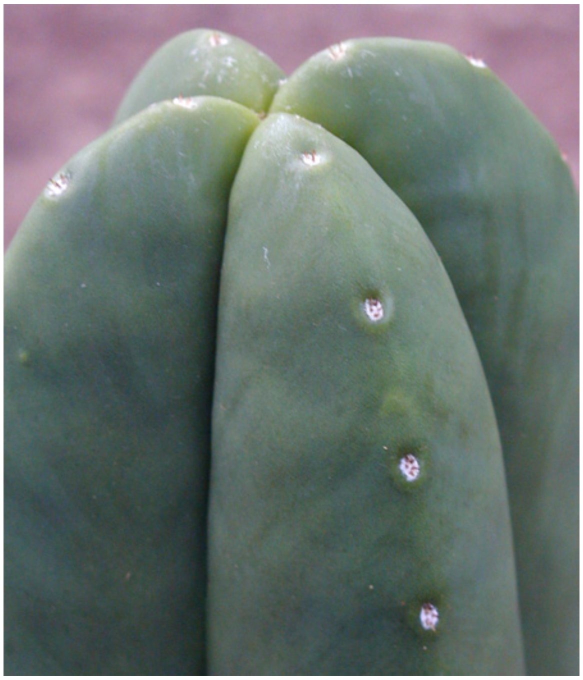
Trichocereus scopulicola **FR991 seedlings (NMCR)**

Reported to be "*2X*" as strong as San Pedro in human bioassays (NMCR-originating material grown from seed in the US). ANONYMOUS1999 (personal communication with kt; June 1999)

Trichocereus scopulicola **FR991 (NMCR)**
First photo is of new regrowth; both are the same clone.

Another source (Snu VOOGELBREINDER) reported some Australian plants to be equivalent to San Pedro and suggested an 800-1000 gram dose was potent. (COLLECTORS CORNER material grown from seed in Australia.)

More recently VOOGELBREINDER and others have commented that the species can show great variability in its potency ranging from quite strong to very weak.



***Trichocereus scopulicola* (Oz)**

See more images on pages 268, 269, 352 & 355

***Trichocereus scopulicola* (Oz)**

Correction to the 2004 printing:
The image appearing in the spot this note now occupiesand also the first image on page 215 were originally believed to be a spinier variant of *T. scopulicola*.
However, we more recently (January-2006) learned that this is actually a *T. pachanoi* clone that was collected from the wild in Ecuador during the 1930s and brought into cultivation in Australia.

It is more robust, more coarsely skinned and much less freely offsetting than a typical *pachanoi*.

Its spines are longer and more dissimilar in length than is typical on *Trichocereus scopulicola*.

Cultivation comments for *T. scopulicola*:

Sun loving with rapid growth (Hewitt); moderate growth rate when compared to *T. pachanoi* (RB).

Described as growing around 1 foot in five years if in a pot and around 7 feet in 10 years if in a bed outdoors (Hewitt).

The growers at the Australian Collector's Corner report their juvenile seedlings to thicken to 10 cm by the time they reach 30 cm tall. (They produce their own seed.)

Hewitt recommends a 41°F (5°C) minimum.

Anonymous relayed an observation that *T. scopulicola* is less spiny, hardier and much sturdier than Juul's Giant with age when grown out of doors in the Sonoran Desert.

Unlike TJG, *T. scopulicola* appears hardy enough to survive Tucson, Arizona winters. They seem to have no trouble with the freezing weather of northern California winters or winters in Austin, Texas with freezes near 20°F. This has proven true even for smallish seedlings of the NMCR FR991 material.

Material labeled *Trichocereus cordobensis* is in cultivation and resembles *scopulicola* but I have not located a published description or a describer.

There is also an *Echinopsis cordobensis* but that plant was described by Spegazzini as growing to 50 cm tall, 30-35 cm in diameter and possessing 13 ribs. This is clearly not that same plant.

There are claimed to be two forms in cultivation:
"var. Rio Mizquensis Ritter (Bolivia) "
"var Cordobensis B110" [We assume from near Cordoba?]

However, we have located no further information about either one actually being described as a variety of *scopulicola*.

Ritter 1980 (pp. 563-564; ill. 444) described ***T. riomizquiensis*** (**FR 856**) as being similar to *T. scopulicola*.

From Chuyllas & the Rio Mizque, Campero Prov., Bolivia.

Oddly NMCR sells both *riomizquiensis* and *scopulicola* var. *riomizquiensis*. The only published photo encountered to-date (Sato 1996) does not resemble the NMCR material.

Ritter collected the similar but much longer spined ***T. crassicostatus*** in March 1931 (described in 1966). Said to be widely distributed in Tarija Dept. but always very rare. (Ritter 1980: 562-563; ill. 442)

FR 853 was collected at the Rio Tarija, south of city of Tarija, Cercado Prov., Bolivia. [Synonymous with **FR 615**.]

***Trichocereus scopulicola* var. *Cordobensis* (NMCR)**
(AKA *Trichocereus cordobensis*)
Both photos by MS Smith

Trichocereus scopulicola* var. *Rio Mizquiensis
(AKA *Trichocereus riomizquiensis*)
(NMCR) seedling photo above
See also image on page 347.

Trichocereus strigosus (Salm-Dyck) Britton & Rose

Traces of mescaline reported.

***Trichocereus strigosus* DJF 174**
(SS)

Has variously been placed in *Cereus* and in *Echinocereus*. [Both as *strigosus* and as *intricatus*.]

Western Argentina (Mendoza; San Juan)
Said to be very common in foothills of Andes W of Mendoza.

Plants to 60 cm tall and 6 cm in diameter [sometimes more than one meter and 5-7 cm wide according to Borg]; offsetting from base [also for some distance above the ground; Borg] to form bushy colonies over 1 meter across. The stems start prostrate then grow erect.
Stems pale green turning greyish-green.
15-18 very low [Backeberg], flat [Pizzetti], obtuse, rounded ribs with 1-18 large very closely set areoles. Bearing much white wool when young; losing it and turning grey with age.
Hardly any differentiation between radial (usually 1.5 cm) and longer central spines (up to 5 cm); the longest resembling a central pointing downward. Many [~20 (Pizzetti)] sharp acicular spines from 1-5 cm in length. Spine coloration can be highly variable; white through yellow to pink, yellowish-red, red, reddish-brown and black have been reported, as has *"almost orange if they have the right amount of light.*" [Pizzetti] Old spines are yellowish-brown or reddish-brown finally turning grey.
Flower buds emerge from tuft of golden brown hairs.
White to light pink "*very beautiful*" nocturnal flowers up to 20 cm long with brownish hairs; borne from sides of old stems near apex. Inner petals set in 5 rows; spreading or recurved with a delicate satiny texture. Ovary and tube are hairy.
Variable reports on whether or not they are scented. Backeberg suggest this may result from the timed release of scent similar to that known from some other species. Borg believed it to be form dependent. Borg describes the perfume as resembling that of Magnolia flowers.
Glossy black seeds are 2 mm in length.
Backeberg 1977 page 498
and **Borg 1937** page139
and **Borg 1976** pages 181-182
and **Pizzetti 1985** Entry #295 [Includes picture with flowers.]

Borg lists several varieties in horticulture:
var. ***intricatus*** Web. Tortuous stems with dark-tipped long crimson young spines.
var. ***longispinus*** Hort. Nearly blood-red young spines; very long.
var. ***variegatus*** Hort. Young spines reddish-yellow or yellowish; tipped with brown.
[Backeberg proposed that plants with lilac-pink coloration be known as var. ***roseo-albus***.*]*
A few different collections are commercially available as seeds and/or plants.
Examples:
"**north of Chilecito, Catamarca**, **1000 meters**"
"**La Rioja, Arg., 700 meters**" [spines needle-like]
"**DJF174 north of Mendoza**" [sharp dense spines]
"**DJF337 Puntilla Blanca**, **San Juan**"
"**DJF419 north of Santa Barbara, Salta**" [yellow spines]
"**Mazan-Catamarca**" [very spiny]
"**ZJ098 Sra. Villicum, San Juan**" [shaggy spines]
var. ***rufispinus*** Rümpler (as *Echinocereus strigosus* variety) [also by Salm-Dyck (as *Cereus strigosus* variety)]
var. ***spinosior*** Rümpler also exists.

[See also Backeberg 1959: Entry #29, pages 1132-1134; photo in figure 1094, with flowers: figure 1095.]

Pizzetti describes the species as slow growing but branching freely; while Borg notes it of "*fairly quick growth and easy cultivation but flowers sparingly.*"

Trichocereus strigosus (SD) Br. & R. (Neither of the workers below noted the variety they analyzed; Nieto stated they analyzed material from Mendoza and San Juan Prov., Argentina while Agurell used German nursery stock.)
Hordenine (10-50 mg/ 100 grams fresh weight. Found to be sole alkaloid present by Agurell *et al.* 1971b; 0.138% by dry wt. [138 mg / 100 gm dry] Nieto *et al.* 1982)
Candicine (0.11% by dry weight) [Ed.: Agurell would not have detected quaternary amines like candicine.]
Mescaline (trace)
Tyramine (trace)
Nieto *et al.* 1982 [Also reported an unidentified base.]

Trichocereus strigosus **MG 1283.62 (Mesa Garden)**

***Trichocereus strigosus* Argentina 60.0691**
top and lower right

Trichocereus cv. (Tom) Juul's Giant

Mescaline is at least sometimes present (based on human bioassays and gc-ms) but there is also a claim (from two separate people) that there is some type of additional activity. The cause is unknown.

At night with flash above; next morning below

Photos by Kamm

I am presently unclear about the exact status of this plant (I often refer to it as TJG).

The correct spelling according to various "*experts*" has variously been Tom Jewel's Giant or Jules' Giant **[Note 82]** or Tom Juul's **[Note 83]** Giant (We also encountered it spelled Jull's and Juels')

Juul's Giant is correct as it was named for San Francisco butcher Tom Juul; a serious cactus (& literature) collector.

This attractive species has variously been rumored to be a form, variety or hybrid of *T. pachanoi*, a form of *T. peruvianus*, a *T. peruvianus* X *T. pachanoi* hybrid, an unspecified *T. peruvianus* hybrid, and "*a distinct species* (*possibly **T. scopulicola**).*" In our mind, this is most likely a separate species presently lacking either a properly published name or description.

It is clear that *T. scopulicola* is an entirely different plant. (See entry for *T. scopulicola*.)

Most people who have actually studied this issue believe this to be a separate and apparently undescribed species.

The flowers and fruit are as at least as distinct from San Pedro as are those of several recognized species, such as *T. bridgesii*, *T. cuzcoensis*, *T. peruvianus* or *T. puquiensis*.

Despite the overall general similarity of TJG to San Pedro, its fruit clearly are distinct and lack the woolly covering of hair seen with *T. pachanoi* fruit. (See the comparative photographs of fruit bearing San Pedro & TJG.)

I have thus far been unable to directly compare the flowers in a side by side dissection, but representatives of each in photos appear to be distinct.

The most common origin myth (at least the most common response after "*I don't know*") claims that this arose as stock propagated from an unusual mutant offshoot spontaneously arising from an unspecified "*Echinopsis*" species in the possession of the now defunct Cactus Gems Nursery and was developed by them as an improved in-house selection. The name was chosen to honor "Tom Jewel" [sic], a friend of the plant propagator (Jim Daniel).

This story has been disputed for several reasons:

1) The time frame when this purportedly occurred was surprisingly brief.
2) Plants appearing to be Jewel's Giant have been observed in Lima and at the Arequipa airport in Peru.
3) No reversion has ever been observed in any of the known stands of Juul's Giants.

Thanks to the amazing efforts of my good friend Jon Hanna, we have learned the truth from the mouth of Jim Daniel himself.

It is unclear exactly where Tom Juul got this plant (One of the UC South American Cactus collection expeditions is suspected. This was during the days when they were jointly funded & conducted in collaboration with private and commercial growers.)

It is believed by some growers that Juul's Giant lost its collection data during its transit to the US but this is presently hearsay.

We do know that Jim Daniel got his from a huge plant which Tom had growing in his yard.

Tom Juul lived on Forrester Street in San Francisco. We had been told that the mother plant had been removed but in 2005 discovered it was still alive and growing along with several additional plants obviously produced from cuttings.

See images of Juul's plants in ***Sacred Cacti* (Part A)**.

Description (drawn from observations of living material growing in the ground, multiple cuttings from many different sources, a flower specimen furnished by Kamm & measured by Jon R Hanna, augmented by photographs and verbal descriptions from several growers including Jim Daniel):

Living material: all came from parents originating from material obtained either from Tom Juul or else from Jim Daniel; this latter material either obtained directly from Cactus Gems or else Cactus Gems' material that was established for some years in a cactus patch that used to exist in Sebastopol, CA. (**ALL** of Jim Daniel's material came from a plant that Tom Jull had growing.)

Large columnar erect cactus, freely branching from the base ("reliably and rapidly" DANIEL 1999). In cultivation in the US (San Francisco, California) forming plants 10 feet tall with a 7 foot spread. Plants at least 9 (12?) feet have been reported in Sebastopol, California but the maximum height in the wild is presently unknown to the authors. Branches can become fragile if exposed to excessive wet and wind. (This is what was said to be responsible for Juul's plant shedding multiple huge branches. That biomass produced the mother plants Daniel used for sourcing all of the horticultural material of cv. Juul's Giant which he released through his nursery, Cactus Gems.)

More robust in habit than *T. pachanoi*.

Epidermis overall is an olive-green color that is often heavily mottled in appearance (ranging from a lighter green to an almost lime-skin green).

Glaucous haze; branches appear heavily waxed and lightly buffed (shiny but dull at the same time), often shiny on new growth. Some specimens are distinctly hazy; especially on recent growth but not on the youngest portion at the apex of the growing tips.

New growth is much brighter green than older growth and can become decidedly bluish blushed & beautifully frosted, before assuming a more green coloration. Many times this bluish blush will not appear even if a haze is present. This seems especially true if grown outside of a greenhouse.

More coarsely grained under 10X magnification than *T. pachanoi* but less than *T. scopulicola*.

Stout branches are commonly 3.5 to over 5 inches in diameter and are commonly slightly club-like towards the tips. They are said, by grower Jim Daniel to reach around 6 inches but I have so far not examined any in excess of 5.5 inches.

5-10(-?) broadly rounded ribs (up to 38 mm wide on the specimens examined and measured). 6-8 ribbed branches are the most common. Ribs are often more acute on new growth. However, narrow and deeply defined ribs are present on some older sections while others can become so broad as to flatten out into broad shallow depressions between indistinct ribs similar to what is common on older sections of *T. bridgesii* var . *longispina* columns.

Oval to rounded areoles up to 3 mm wide and 4 mm long. (May be larger following flowering.) They are commonly set from 11-25 mm apart.

Upper portion of the areoles are sunken more than the bottom. (Areole is surrounded by a gentle oval depression that is deepest above the areole.) Some areoles are sunken or flush but a few swelled slightly. Areoles post-flowering were larger.

Much less indentation above the areoles than *T. pachanoi* but the occasional presence of sometimes faint, often-curved v-like marks, or more commonly, a short horizontal line has been observed. The latter are especially prevalent on new growth or grafted plants. Many older areoles do not show a mark but usually at least one per column can be found.

Light tan to light brownish (occasionally very brown) felt soon turning whitish or, more commonly, grey with age. Felting is usually light except for flowering areoles which may be filled with whitish hair. This also may fall off entirely.

0-1-3(-9) spines up to 12(-?) mm long on the material examined first hand. Spines up to 25 mm have been reliably reported but not witnessed by this author.

5 spines are fairly common on new growth but 2 or more soon fall off.

Usually the longest spines are solitary. Paired spines are shorter (usually less than 5 mm and noticeably awl-shaped) and fairly close in length to each other.

3 spined areoles are noticeably dissimilar in length (less than 1 mm to 6 mm is common).

It has been reported by growers that some columns can express 5-6 spines per areole with regularity but I have only observed this on the newest growth on some specimens. (This is very common on grafted material.)

Spines often start yellowish or whitish tipped with brown going light grey and tan with age or starting more brownish with darker tips turning grey tipped with brown with age; both color forms can occur on the same branch. New spines on new growth are often more brownish (sometimes entirely dark brown at the start) and sometimes have a slightly reddish cast.

Spines are generally straight but several were noticed with a sharp bend at their base and one solitary instance of a long curved spine was found. Decidedly curved spines have been observed on a number of new pups but it is presently unclear how frequently they reach maturity versus dropping off.

Flowers are large, funnel-shaped, white, showy & perfumed.

Whole flower from its base to petal tip was 25 cm long and ~5 cm in diameter at widest point.

The pericarpel, 30 X 22 mm, was covered with medium green scales bearing 25 mm long hairs on the axils. Hairs starting dark brown and fading to white.

The floral tube is 100 mm long by 30 mm in diameter (at its widest), is curved and has fewer, longer scales that are slightly lighter green in color, with darker tips; these axils have shorter all-brown hairs 5 to 15 mm long.

The perianth segments form 10 helicoidal rows. (10 petals form the first row surrounding the opening.)

The first external tepals are medium green with a reddish border, the second external tepals are more reddish than green overall, both are strongly recurred backwards, from 50 mm to 110 mm in length, 10 to 12 mm wide, and 2 to 3 mm thick. The 8 intermediate leaves are generally longer and thinner, white with a light green tinge, 100 mm long and 13 mm wide. The inner petals are in 2 rows, shorter, thinner, whiter, and broader.

The nectar chamber appears to be of the open type. All of the primary stamens are inserted at the same height, with definite upper limits, and the filaments are only slightly inflected. It reaches 35 mm and 4 to 6 mm in diameter.

The ovary's outside measurements are 20 mm X 33 mm, and it's inside measurements are 16 mm X 11 mm. It is full of white funiculi and ovules, clearly visible using a 16X magnifying loupe.

The style on the example dissected was 145 mm long and 3 to 4 mm in diameter and greenish white.

The stigma is 30 to 35 mm long, creamy white with felt-like surface and ~15-19 lobes spreading mostly outwards.

The numerous anthers are creamy yellow, 3 to 4 mm long and 1.5 mm wide.

The 100 (exact count on this specimen) upper stamens near the petals are about 40 mm long, free-moving until they become attached to the throat of the receptacle, at which point they continue for 40 to 50 mm. The 400± (estimate based on 1/2 flower count) lower ones are 70 to 80 mm long, and these arise attached at different altitudes in the receptacle.

Flowers are often borne in multiples within a few areoles of the branch tips.

Can begin flowering once columns reach 3-4 feet.

Said to flower freely, even in pots, once it reaches 5 feet. DANIEL (Personal communication with J. HANNA; June 1999.)

Ovoid green fruit has sparse hair leaving most of the skin exposed. Podaria are large and well defined.

The surprising weakness (and apparent non-woodiness) of the vascular bundle in the TJG specimens examined suggests that it may become prostrate or fragile with age but absolutely no instances of any prostrate or even leaning plants have been located.

ALBERT commented that the TJG in a friend's collection in Arizona "*grows about 9 feet tall and then collapses. T. scopulicolus is now that tall and very sturdy*." This might suggests that specimens of Juul's Giant be kept pruned to a lower height in similar climates. (Jim Daniel noted that overly wet specimens are susceptible to wind damage) However, there are at least two other reliable reports indicating that this plant can remain sturdy. These reports come from people who have witnessed a large number of these plants established covered in the ground in northern California until growing beyond its enclosure and experiencing too hard of a freeze. The mother plant at Juul's had one branch towering in excess of 15 feet tall.

The material in our possession showed a vascular bundle that was easily less than half as thick as *T. pachanoi* (thickness of the wall not the diameter.) Sections showed a vascular bundle that was wavelike and not at all round; bringing to mind the bundles encountered in some sections of monstrose offshoots from *T. bridgesii* var. *longispina*. I should stress that EVERY plant I have examined growing was solidly erect, quite sturdy and showed no indication of any prostrate tendencies.

They are hardy in the ground in northern California and have been reported by growers to survive both snow and mild but not overly-serious freezes. They have apparently not proved as hardy in Arizona.

A picture of what appears to be a **TJG** flowering but mislabeled as *Cereus peruvianus* is featured in Danny SCHUSTER's 1990 *World of Cacti* on page 80.

Activity:

Reports have been highly variable. Reported bioassays have so far included inactive, weak, 1.5X and twice as potent as San Pedro.

6" to a foot (around a pound to a kilo) have been reported to produce powerful effects yet reports of weakness or inactivity also exist. In one case a person who obtained their material directly from Tom Juul reported consuming 2 feet and having no effects.

I have heard and agree that there may be additional active agent(s) in this plant besides mescaline.

GC-MS showed an unidentified possibly novel THIQ as the major alkaloid. Mescaline was present as less than 10% of the alkaloid content.

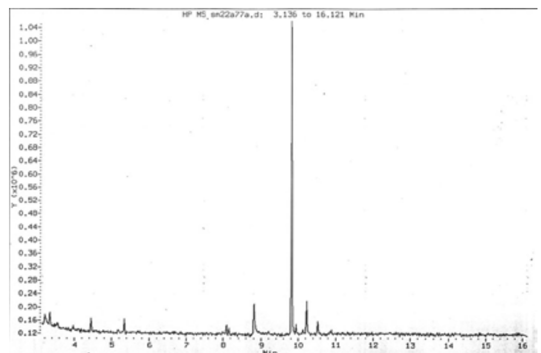
Whether the THIQ is active on its own or if it has some sort of activity that enables the mescaline to be more potent or other wise synergize with it is presently unknown.

At least 2 forms are in cultivation.

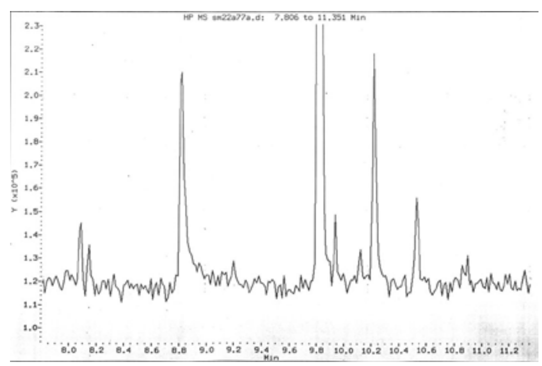
GC-MS by Shulgin showed different results even though the original source was believed to be identical (Jim Daniel): (Additional samples showed still more variation.)

Juul's Giant (A):

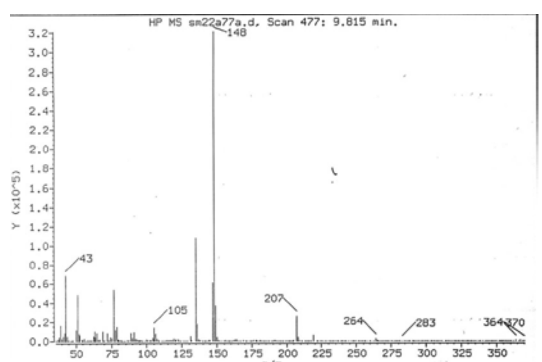
Unknown isoquinoline was 90%.
Mescaline less than 10%.
minor isoquinoline (not identified).
3 trace isoquinolines (not identified).



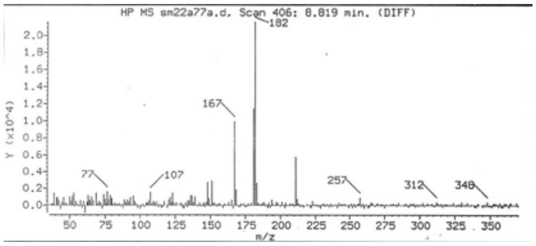
Chromatographic spectrum



Same but first 10 minutes blown up



Fragmentation of major component (unidentified isoquinoline)



Fragmentation of mescaline

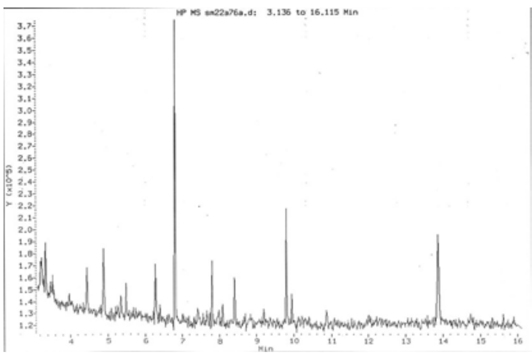
Juul's Giant (JM):

Major alkaloid is an unknown compound.

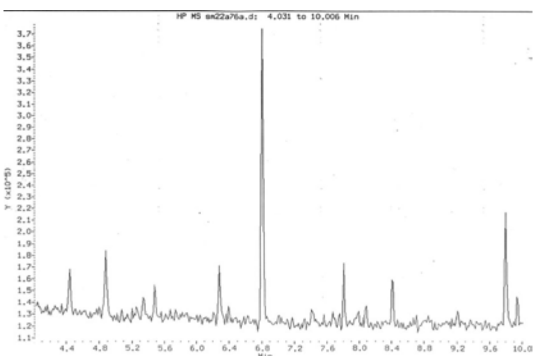
Mescaline does not appear to be present.

Second largest peak in the graphs appears to be a lab artifact.

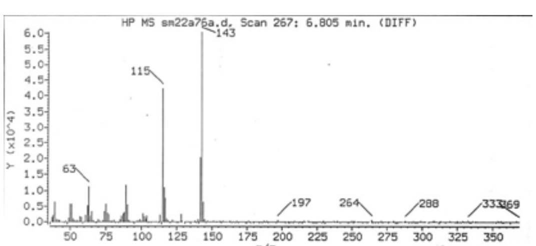
Also observed some sort of phenylethanol.



Chromatographic spectrum



Same but first 10 minutes blown up



Fragmentation of major component (unknown)

It has variously been described by people who know it well as "*a woman's plant*" and "*a moon plant.*"

A fair amount of confusion apparently surrounds what is and what is not cv.[?] 'Juul's Giant' so this may be expected to factor into the disparate reports. Still, I might add that at least one inactive report and one positive report used the same material.

When slicing 2 inches from the bottom of a healed cutting (3.2" diameter; 8 ribs) to address a brown ro,; it was found to weigh 257.5 gm.

Fresh material taken from a second specimen averaged 170 grams per inch for a 4.25 inch 6-ribbed section.

A one-inch slice taken, for the same reason as the first, from the base of another specimen (6 ribs: 4.25 inches in diameter) weighed 165.3 grams, a two inch slice necessary to reach only healthy tissue weighed 330.4 grams.

These values gave us a rough approximation of gram weight as:
(Diameter of the column in inches) X (39-40 grams) = (Approximate number of grams per linear inch)

Additional weight evaluations using a baker's scales:

6 ribs: 3.75 X 7.75 inches weighed exactly 2 pounds.

6 ribs: 3.75 X 5.5 inches weighed 31.75 ounces.

7 ribs: 3.25 inches wide at largest end (ranging from 9.5 to 8.5 inches long) weighed 19.5 ounces.

Seeds for TJG are seemingly unavailable (evidently they are only rarely produced in horticulture except as hybrids; a feature at least suggesting a clonal origin). The plants themselves are only slightly more commonly offered but their availability is slowly growing.

Juul's Giant (A)

Juul's Giant (A)
entire page

3 photos on the left are by Kamm

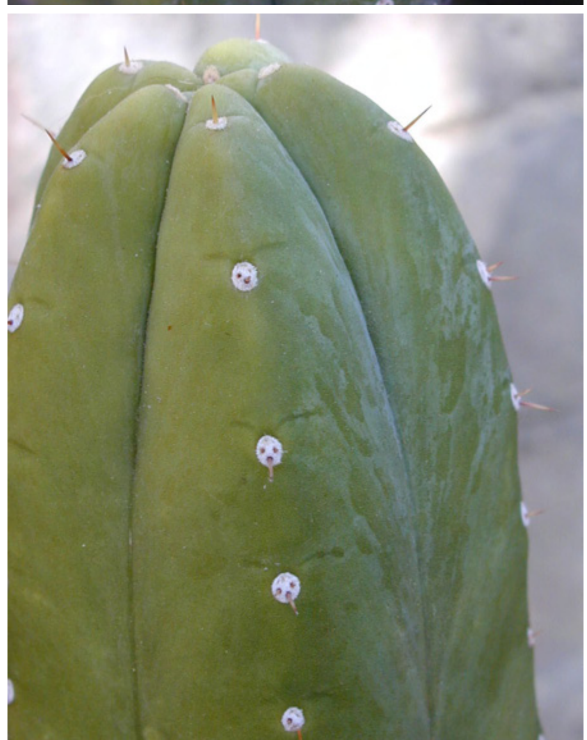
Juul's Giant (A)
Grafted using Superglue.

Juul's Giant (A via NS)

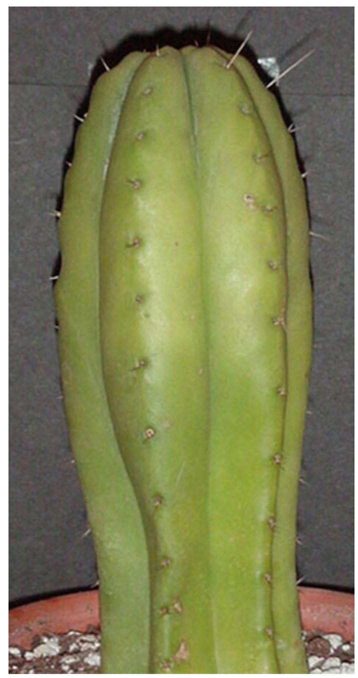
Juul's Giant (A)
(via NHE)
Photo by Eel

Notice the leaves on the new growth.

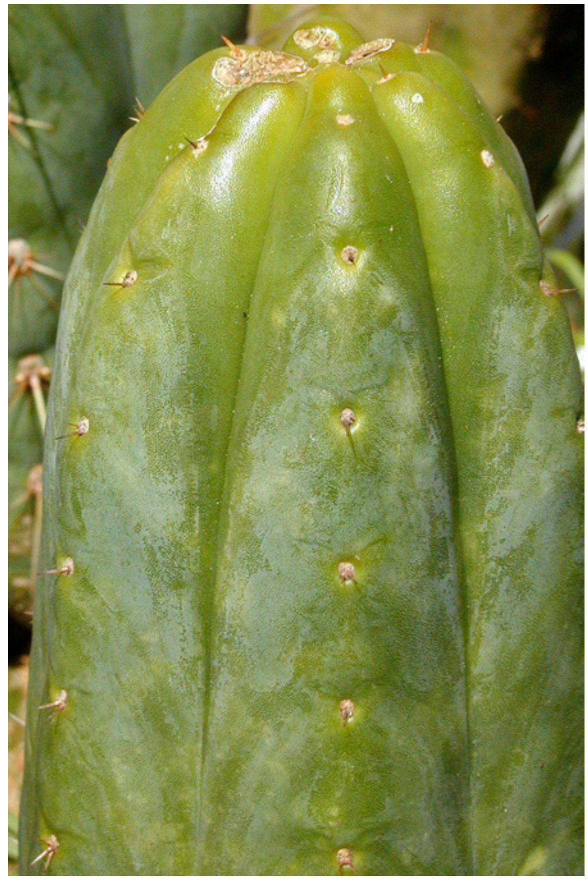
Juul's Giant (A via Yarrow) above



Juul's Giant (DP)
Lower left & entire righthand column

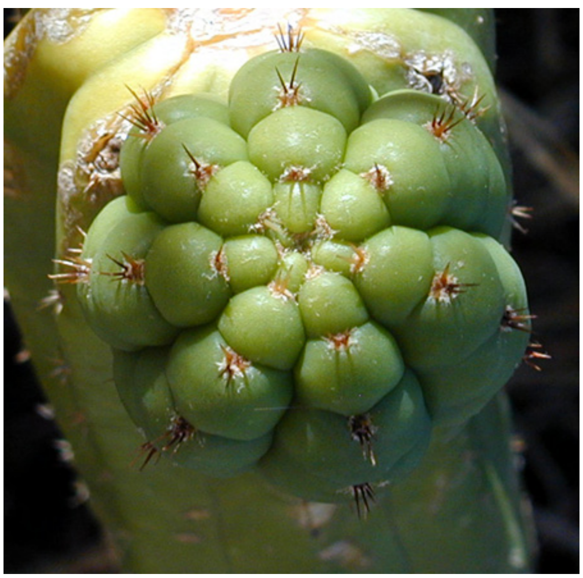


Juul's Giant (JM)
entire page
Lower 2 right -hand photos by MS Smith



Juul's Giant (Oasis)

Juul's Giant (RS)



Juul's Giant
(RS)
entire page

notice the leaves on new growth

Juul's Giant (A)

Features to aid in distinguishing sp. TJG from *T. pachanoi*, short spined *T. peruvianoids*, *T. scopulicola*, and similar appearing species:

T. pachanoi generally has more spines (almost always 3 or more per areole), lighter colored felt on the areoles (usually whitish or light tan going whitish), much hairier fruit and is not nearly as robust. *T. pachanoi* only rarely exceeds 4 inches in diameter.

The presence of horizontal depressions above the areoles of *T. pachanoi* cause it to be rather "*stepped*" in appearance if the ribs are viewed in profile. In cross section, the ribs on *T. pachanoi* are more acute and not as broadly rounded as is common on TJG. (Some stem sections of TJG DO show fairly narrow ribs.)

The very slight indentation above the areoles and the greater angle that the areoles themselves present to the horizontal (on *T.* sp. TJG) cause the ribs in profile to appear smoother if compared side by side.

Despite heavy wax on TJG, it often lacks the glaucous markings common on *T. pachanoi* except on newer tip growth. In a greenhouse however, expression of these marking can become more pronounced.

Color overall is usually much darker blue green on *T. pachanoi*. (Color on San Pedro can be highly variable.) Unless attacked by sucker bugs or viruses, the epidermis itself on *T. pachanoi* is rather solidly colored (usually) as opposed to the noticeably mottled appearance of tjg .

Short spined *T. peruvianoids*: Pronounced v-marks or grooves are common above the areoles. Areoles may be large and hairy. (While TJG can express these features it usually only affects a few areoles or a young actively growing branch, not the entire plant. In those instances where v-marks are common on new growth, they usually disappear as it grows larger or else are more smooth in profile than can be the case with many *peruvianoids* where a visible horizontal depression is above the areoles.) Felt is commonly brown to dark brown (occasionally white). See assorted photos earlier in this work.

Juul's Giant (above)
compared to
***Trichocereus pachanoi* (below)**

See more ***T. pachanoi*** photos elsewhere here.

TJGoids

Monstrose *T. pachanoid* or *peruvianoid* plants can sometimes also be similar.

These generally bear distinct and well incised marks above the areoles with regularity and, with age, form branches that end in lengths of rounded tuberculate formations rather than continuing with distinct ribs.

See photos under *T. peruvianus* short-spined and under *T. pachanoids*.

See more photos of the ***T. peruvianoid* CCC** material under ***T. peruvianus*** entry.

Trichocereus scopulicola tends to be more matte in appearance (appears more coarsely grainy to the naked eye; markedly so under 10X); color is generally darker (almost a military drab green) and, unless bearing a patterned surface blush from luxurious growth conditions, is very uniform in contrast to the mottled coloration of TJG.

T. scopulicola also is much less waxed than TJG. ITs spines are much shorter than sp. TJG (except for those ill-defined *scopulicoloids* sold as var. *cordobensis* & var. *riomizquiensis*.)

***Trichocereus scopulicola* FR991 (NMCR)**
above

***Trichocereus scopulicola* FR991 (in Australia)**
lower right

See more ***Trichocereus scopulicola*** images pictured within its entry on pages 211-216.

Unknown C CAN resemble TJG except for having occasional pairs of longer spines on some areoles, a lighter color, a grainy surface texture more reminiscent of *scopulicola* and larger, much more heavily felted areoles (pale brown).

Growth forced by grafting more strongly resembled *T. bridgesii* than did its parent. Its color is similar to that common to *T. bridgesii* var. *longispina*.

See photos on page 50 under the ***bridgesii*/*bridgesioid*** entry.

Other TJGoids:

Trichocereus* aff. *huanucoensis can also be quite similar but possesses distinct curving v-marks with more regularity than do most TJG. It visually appears in-between some of what is at the BBG (below) and TJG. It was reported to be active in human bioassays.

Trichocereus* aff. *huanucoensis
above (more images on page 20 in the opening section *)*

Trichocereus huanucoensis sometimes produces growth similar to TJG but due to its skin and spination is generally easy to distinguish.

Trichocereus huanucoensis
(Huntington)

See more photos on pages 200-203 under *T. peruvianoids*

Plants represented in horticulture as a result of the UC South American Expeditions:

A specimen *appearing* almost identical to TJG is represented at Berkeley labeled ***Trichocereus* sp. Peru 64.0762.**

[P.C. Hutchison, J.K. Wright & R.M. Straw 6212]

Collected on 8 Aug. 1964 in the canyon of the Rio Marañón above Chagual, 5 km below Aricapampa.

Huamachuco Prov., La Libertad Dept., Peru.

Elev. 2740 m.

Found growing shaded, on the vertical sides of quebrada with a stream in it.

The primary differences are that sp. Peru 64.0762 shows v-marks with regularity, has much shorter spines and has white felted areoles. It also shows less extensive branching than TJG.

***Trichocereus* sp. Peru 64.0762**
lower right

Trichocereus huanucoensis
(Huntington)

Flowering has been observed in early July and in mid-late August in Berkeley, California.

Needs an analysis and taxonomic study.

Seed grown material from 64.0762 has been reported to have from 6-10 ribs on columns around 5-6 inches in diameter.

Trichocereus sp. Peru 64.0762

See more photos on pages 353, 354 & 361.

Spines are very short; born on small areoles. It apparently lacks the long single spines common on some TJG.

Fruit has been ripe around September.

Trichocereus sp. Peru 64.0762

Kamm noted the similarity of TJG to both sp. Peru 65.0729 at the BBG and also to an unnamed specimen at the Strybig. (Images of both follow.)

Trichocereus sp. Peru 65.0729 appears even more similar. [P.C. Hutchison & J.K. Wright 4013; 3 February, 1964]

It shows very wooly white areoles that are lacking in TJG. Its fruit appear to be hairier than normal for TJG.

This was collected at 1480 m. along the Rio Utcabamba, Bongara Province, Peru.

15 km. below Caclic at the 18 km stone.

"Under trees."

Their material started out as 3 cuttings taken from one living clone.

Flowering has been observed in July in Berkeley, California.

This is another TJGoid that needs an analysis.

Images are on the following page.

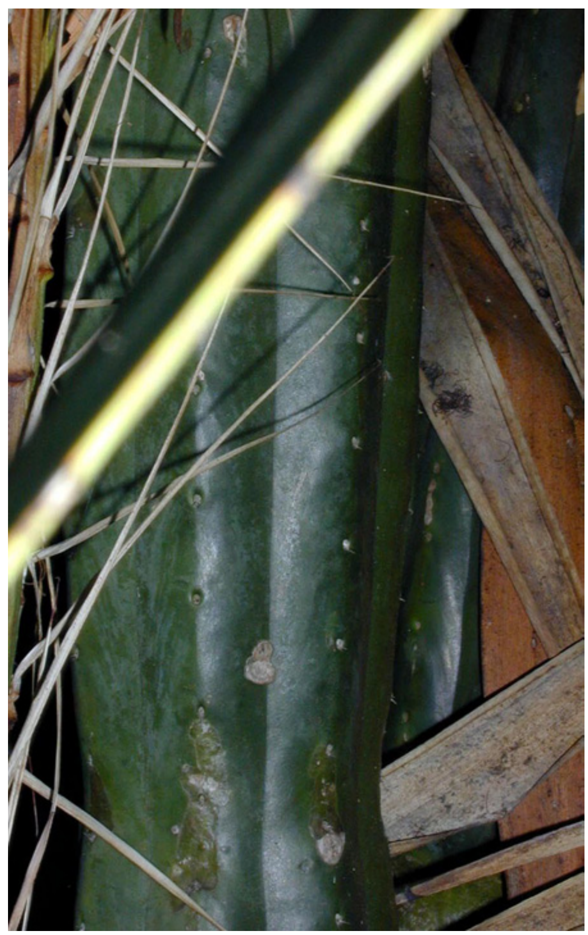
Trichocereus **sp. Peru 65.0729**

The so-called ***Trichocereus colossus*** appears to be very similar in appearance but has longer and more numerous spines.

It has wooly fruit in contrast to the nearly denuded fruit of TJG.

See more details and photos under *T. peruvianoids*.

All 4 of the above need analysis. All are likely to be active.



Unnamed TJGoid at the Strybig right-hand column

Unnamed TJGoid at the Strybig (2002 above; 2006 below)

Juul's Giant
Small plant (above) & mother plant (below)
Growing at Tom Juul's former home

I should add that at least one person in the US has received what appears to be either TJG or else a very similar plant which originated in Peru and was purchased from Karel Knize as a spineless form of *T. peruvianus* KK242.

We received the cutting on page 234 from Knize unlabeled: It has some general similarities but we do not think that it is Juul's GIant. See example on the next page.

See also pages 361-363.

Unlabeled *pachanoid* from Knize

Hybrids:

TJG X *pachanoi* and TJG X *peruvianus* are presently in cultivation (as of 1998). They are commercially available as plants (some were assigned clone tracking numbers by the breeder) or seeds.

Both hybrids are F1 so show substantial variability.

As of 2006 larger plants were available for study. See ***Sacred Cacti* Part A**

The TJG X *Peruvianus* and *Pachanoi* X *Peruvianus* offered some years earlier by …*of the jungle* are identical plants. Their names arose when it was still believed that TJG was a form of *T. pachanoi* and the designation of their offering was changed to reflect this.

It is also important to be aware that this was a spontaneous hybrid so the identity of the father was assumed based on what had been observed flowering.

Do not confuse with the surprising number of *pachanoi* X *peruvianus* hybrids (spontaneous and deliberate) or with a commercially available, naturally occurring, *pachanoi* X *peruvianus* hybrid collected from the wild in Peru.

It is hardly surprising that the Juul's Giant hybrids are reported to be active but I lack details of the amounts used in the evaluations.

See also pages 364-366.

***Trichocereus* TJGX*pachanoi* (SS)**
top 2 rows

Trichocereus **TJGX*peruvianus* (SS)**
Offspring from F1 seed planting. (entire page)
Crests arose naturally; grafting was performed to accelerate production of commercial stock.

top imagedid not use a flash; bottom image used flash

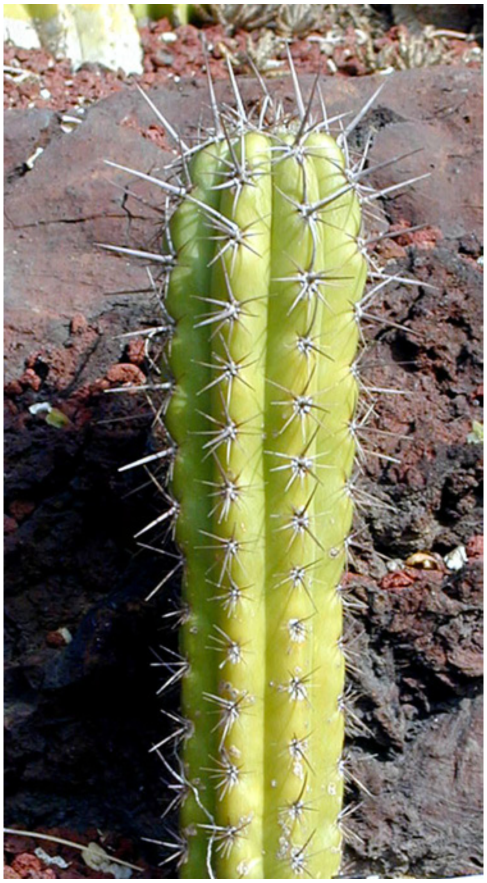
Grafted using superglue
(lower left)

***Trichocereus* TJGX*peruvianus* (otj)**
whole page

Two photos by MS Smith
(lower right)

Trichocereus taquimbalensis Cardeñas

Mescaline present at 5-25+ mg. per 100 grams fresh.



***Trichocereus taquimbalensis* Bolivia 53086;**
M.Kimnach *et al*. 2760B
(Huntington)

Trichocereus taquimbalensis was originally collected in Bolivia (Cochabamba, Taquimbala).
It is now placed as a subspecies of *tacaquirensis* suggesting that *tacaquirensis* should be targeted for analysis.

Grows as simple columns or else branches from below. Sometimes it branches from the flank naturally or possibly this occurs only if damaged. The cactus grows up to 2.5 meters tall and lacks a real trunk.

The dark robust green branches (yellowishgreen color seen in photo above is the result of growing in full sun) are up to 15 cm. in diameter with 9 ribs and whitish areoles, 1 cm. in diameter and 1.5 cm. apart.

There are [5-]8-13 radial spines **[Note 84]** to 2 cm long, which are subulate and radiating with one stout central spine to 6 cm. long, which is porrect or directed downward. All spines thickened below, light brown at first, then grey.

It has white flowers to 23 cm. long with dark brown hairs.

The dark green fruit are 4 cm. in diameter and have glossy black seeds.

Backeberg also recognizes a variety *Trichocereus taquimbalensis* var. *wilkae* Backeberg, which has radial spines to 2.5 cm. long that in part are stoutly subulate, appressed and curving, sometimes more or less hooked. The central spines are thick-subulate, sometimes they are compressed on their lower surface, they are much thickened towards their base. Spines are sometimes all dark at the base and tip.

Collected originally fromTupiza, Bolivia.

This is perhaps the most frequent form in cactus collections.

They are not fast growers but very easy and quite attractive. Keep somewhat on the dry side.

[Ed.: Analysis has not been reported for the variety.]

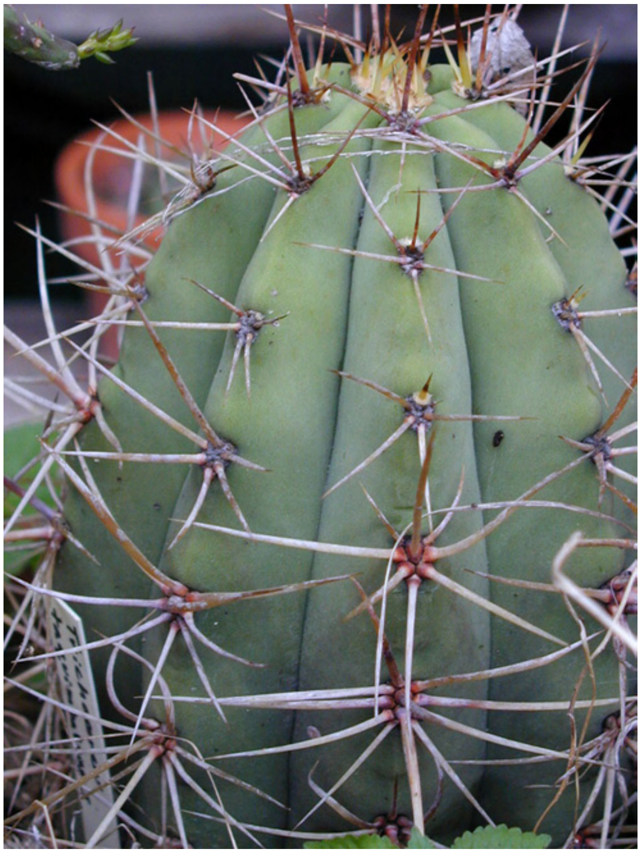
Backeberg 1977

Backeberg 1959 has a photograph of the plant on page 1114, fig. 1064 and one flowering on the same page in fig. 1065. Var. *wilkae* is pictured in fig. 1066 on page 1115.

M.Kimnach *et al*. 2760B; ISI 92-20 via SS
upper right

***Trichocereus taquimbalensis* (Mesa Garden)**
lower right

Trichocereus taquimbalensis **HBG 68146 R. Kiesling *s.n*. (ISI 98.21)**
Collected in southern Bolivia



***Trichocereus taquimbalensis* (Mesa Garden)**

Reported analysis of *Trichocereus taquimbalensis*

Agurell found 10-50 mg of alkaloids per 100 grams of fresh *T. taquimbalensis*, of which:

Mescaline formed over 50% of total alkaloid.

Hordenine was present as 1-10% of total alkaloid.

3,4-Dimethoxyphenethylamine was present as traces.

3-Methoxytyramine was present as traces.

Agurell *et al*. 1971b

Using 50% as an estimation for the mescaline proportion, a 400 mg dosage of mescaline would be represented by 1.5 (maximum amount if 25 mg or more was present per hundred grams of fresh) to 8 kg of fresh material (maximum amount if only 5 mg of mescaline was present per 100 grams of fresh).

Once again this is a huge range.

If one studies this carefully, mescaline could predominate. (i.e. potentially well in excess of 80%.) If this was true then this might be a usable plant *IF* the total alkaloids were present at the upper end of the range given. (i.e. if all things were ideal this could have less than a 1 kg. dosage with a very good profile.) However, this is purely speculation and we offer it only to stimulate those in a position to do so to analyze this plant in more detail.

Agurell's plants were obtained from a grower in the Netherlands.

See also pages 371-372.

Trichocereus terscheckii (Parmentier) Britton & Rose

[Note 85]

Mescaline reported at 5-25 mg. per 100 grams of fresh plant.

***Trichocereus terscheckii* Argentina 56.0229**

Trichocereus terscheckii was originally collected from N. Argentina (Catamarca; La Roja; Tucumán; Salta; Jujuy). ["*high valleys of northwestern Argentina*" Reti & Castrillón 1951.]

They eventually become "*more or less tree-like*" up to 12 meters tall [39 ft.; Innes & Glass]. The trunks are up to 45 cm. in diameter with intense green branches over 15 cm. in diameter, parallel and ascending. ["*branching into many thick stems, 10 to 20 cm. in diameter*": Borg 1937. Branches about 6 inches thick, from base or above; Innes & Glass 1991.]

It has 8-14 ribs [pale, dull green, rounded (Borg) with narrow furrows (Borg and Innes & Glass)] with the large [yellowish-brown: Borg] [pale-brownish: Innes & Glass] areoles 1.5 cm. in diameter [2/3 inch in dia.: Innes & Glass] and up to 3 cm. apart [2-3 cm apart: Borg; set at 1 inch intervals: Innes & Glass]. [Ed.: Spines are fiercest on the lower trunk of adults.]

There are 8-15 subulate [Borg describes as very strong and awl-shaped] yellow spines up to 8 cm. long. [Up to 10 cm. long: Borg; 3-4.4 inches long: Innes & Glass.] [Ed.: Several year old seedlings that were examined in detail, as a handful of specimens from at least two localities, had light brown, almost sienna, spines. The plants originated from the Quebrada del Toro or else had no origin listed. Adult plants were observed at UC Berkeley Botanical Gardens.]

The white flowers are 15-20 cm. long and 12 cm. in diameter, with brown hairs. [White with brown exterior parts: Innes & Glass] [Mainly at top of stem: Borg] [Flowering October-December. Reti & Castrillón 1951] [Nocturnal flowers in summer: Innes & Glass]

Backeberg 1959 shows a picture thought to be the species on page 1104 fig. 1051 and the variety mentioned below is pictured in figure 1050 of the same page.
Britton & Rose 1920 shows a picture on page 140 figure 204.
Borg 1937 Entry pages 140-141.

Trichocereus terscheckii **seedling**
(Quality Cactus)

Inge Hoffmann 1984 mentions a *Trichocereus terscheckii* var. *catamarcense* but we have been unable to locate any published description.

She found these growing as a small colony between Andalgala and Catamarca; describing their most noticeable difference as a habit of branching closer to the ground. A picture can be found on page 57 (fig. 12).

Backeberg recognizes a *Trichocereus terscheckii* var. *montanus* Backeberg, with obliquely ascending branches of a lighter green. Collected from Salta [Quebrada Escoipe]. (Noting that some of the areas he listed for the species are actually the latter variety.)

Native names (used for both varieties): "*Cardón Grande*" and "*Cardón del Valle.*"

Backeberg 1977

Around Chorillos (Quebrada del Toro) *T. terscheckii* is predominate but 15 km farther north (higher in elevation), only *T. pasacana* is found.

An intermediate or hybrid between *terscheckii* & *pasacana* exists. (Ressler 2000, pers. comm.)

See comments on Ritter's view on page 242.

Said to need good light with a minimum temperature of 50°F by Innes & Glass 1991. [They have an entry with a photograph (with flower) page 298.]

Growers in the Southwest have reported theirs hardy to 6°F and one commented that his lived through a flood that had completely submerged them for over a day.

Trichocereus terscheckii **Argentina 56.0229**
right-hand column

***Trichocereus terscheckii* Argentina 56.0229**

***Trichocereus terscheckii* (RS)**

The specimens growing unprotected, outdoors, in the UC Berkeley Botanical Gardens are both old and healthy. Similarly healthy specimens have been witnessed growing unprotected in cactus gardens in northern California which had survived both some snow and freezing weather.

Mine have survived ice and wet down to 18ºF with only minor scarring, except to the occasional seedling.

***Trichocereus terscheckii* (Paul's Desert)**
during a Texas winter
upper right

Reported analysis of *Trichocereus terscheckii*

Moisture content:
Reported to contain 92-95% water by Reti & Castrillón 1951.

Trichocereine (N,N-dimethylmescaline) (mp)
Mescaline (tlc, ms, ir)
Anhalonine (-)

Mata & McLaughlin 1982 cited Agurell 1969b, Herrero-Ducloux 1932b, Reti 1939, 1950 & 1953 and Reti & Castrillon 1951.

Herrero-Ducloux had reported small quantities of a non-phenolic base in 1932. Reti 1939 was the preliminary report on the new alkaloid they encountered.

Ott 1993, page 114, cited Agurell 1969b and Reti & Castrillon 1951.

Shulgin observed N-methylmescaline in at least onspecimen.

Reti & Castrillón found the ratio of trichocereine to mescaline to be 5:1. They noted this to be the first instance of the isolation of mescaline from a non-peyote cactus.

The plant material was collected from the wild in Argentina during flowering (October-December). They found concentrations in dry material ranging from 0.25 to 1.2%.

In some of the higher alkaloidal material Reti & Castrillón could detect no mescaline.

Other alkaloids were present but they did not elaborate.

They found the alkaloids to be primarily located in the cortical parenchyma.

The green epidermis gave 29% of the total alkaloids and the central parts gave 45%.

As we mention elsewhere, this has confused some people.

There are two important points to remember:

1) The green epidermis (and outermost layer of parenchymal tissue) weighs far less than the central parts. This indicates that while alkaloids are present in good amount in the rest of the body, the outermost layer does have the highest concentration.
2) The 'central parts' include <u>most</u> of the parenchymal tissues (storage cells which accumulate alkaloids and also such things as calcium oxalate crystals.) Parenchymal tissue is found on the OUTSIDE of the vascular core and comprises much of the tissues in the cortex that are not connective, structural or vascular.

From 10 kg. of dried and powdered branches they recovered:
20 grams of trichocereine as the hydrochloride
and 4 grams of crude mescaline.

(Potassium carbonate used as their base during extraction which may have reduced their recovery of mescaline.)

Mescaline was determined by comparing the mp of various salts with synthetic material and by analysis of its elemental constituents.

Trichocereine was determined by degradation, synthesis and comparison with synthetic. [Reti & Castrillon synthesized it.]

Reti & Castrillón 1951

Agurell 1969b did not evaluate for quaternary phenethylamines or for isoquinolines.

They found 10-50 mg. of alkaloid present per 100 grams of fresh plant of which mescaline formed over half.

MS and IR were used to identify it.

[In Agurell 1969a only mescaline was mentioned.]

I wonder if either the variable percentages noted in different specimens of *T. terscheckii* or if their use of potassium carbonate as a base during extraction accounts for Reti & Castrillón's lower proportion of mescaline observed.

Their procedure for isolation certainly was not the best to use for a quantitative analysis, especially if mescaline is involved. They also stated they found a wide range of alkaloid content, with no mescaline detectable in the higher content specimens. What they published quantitative results for was from the lower end of what they mentioned.

It must also be noted that Reti & Castrillón's overall yield does fall within the lower end of the range reported by Agurell 1969b.

Reti & Castrillón analyzed wild plants. Agurell used cultivated plants obtained from European suppliers. Whether the differences are age related, varietal, local, seasonal, nutritional or procedural is currently unknown.

If Agurell's figures hold true for wild plants, a 400 mg dosage of mescaline would be represented by 1.5 to 8 kg of fresh material. Our figures come from using 50% as an estimation for the mescaline proportion.

An intriguing note included by Agurell 1969a stated that this species "*proved to contain rather exclusively mescaline*." but offered no details. Neither this paper nor Agurell 1969b mentioned detecting any trichocereine. A similar situation was reported in gc-ms of California grown *T. terscheckii* (not published).

Clearly this is a species which is in need of more work to delineate the parameters of mescaline occurrence and concentration.

There are multiple reports of successful human bioassays but all except for one lacked the amount ingested or any further details. That lone account reported it equivalent to *T. pachanoi* but used 1 foot of an 8-9 inch in diameter column. This would surely weigh several kilos suggesting it was weaker than most Pedros.

It is reported that some clones are highly effective, others are less so and yet others are inactive as a hallucinogen. Some of those are said to be active as stimulants.

This species is in need of additional work to better define its chemistry and the activity of the known forms.

Ingestion of 0.55 grams [550 mg.] of trichocereine had no effects in a bioassay performed by Ludueña.

Ludueña 1936 reported that the only effect noticed from the oral administration of 9 mg/kg of the hydrochloride of N,N-dimethylmescaline (trichocereine) was a heaviness in the stomach (human bioassay).

In animal studies hehad found it slightly toxic ["*...est un alcaloïde peu toxique*."], with lethal dosages slightly higher than mescaline.

N-Methylation of hallucinogenic phenethylamines invariably destroys their hallucinogenicity. **If** activity remains, it is generally as a mildly amphetamine-like stimulant. **[Note 86]**

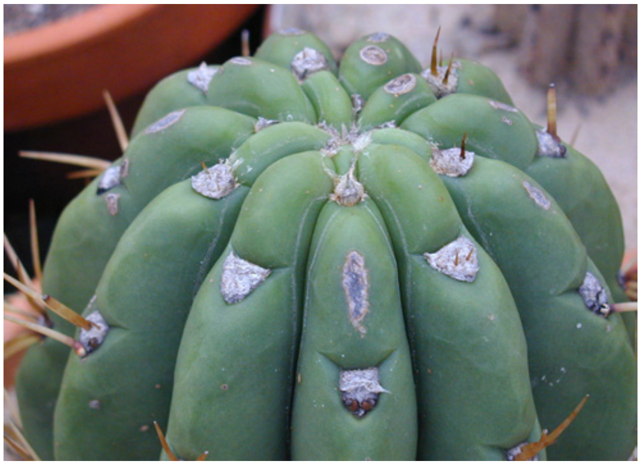
Shulgin has has observed the variable presence of mescaline, N-methylmescaline & N,N-dimethylmescaline (in gc-ms). (Personal communication).

Note concerning Ritter's view of *Trichocereus terscheckii*:

Ritter split *terscheckii* into a more northerly ***terscheckii*** and a southern ***terscheckioides***.
While this has largely been ignored, the following seemed appropriate to mention:

Feature	***terscheckioides***	***terscheckii***
Height	3-6 m	7-12 m
Maximum diameter	25-40 cm	40-70 cm
branching	1-2 m or higher	basal
# of ribs	13-19	Usually 8 (Salta) 8-12 (Tacuarandi)
Rib height	~3 cm	4-5 cm (Tacuarandi)
Areoles (largest dia.)	12-15 mm	8-12 mm
Areoles separated	15-25 mm	~30 mm
Color	Honey yellow or brown yellow	Yellow-brown until black brown
Radial spines	10-15 2-6 cm	3-6 1-4 cm
Central spines	2-8 3-16 cm	0-2 3-7 cm
Seed	Shiny,	Almost dull,
Flower	20-23 cm long	Opens 15 cm wide 15-20 cm [Br&R]

Hunt 2000 renamed *terscheckioides* "*Echinopsis sp.*".
There are a wealth of plants around *terscheckii*, *tacaquirensis, werdermannianus* and *pasacana*, and of course probably also hybrids. A number of intermediates are known.



Probably *Trichocereus terscheckii*
this was sold mislabeled as "*Lobivia* sp."
(RS)

***Trichocereus forbesii* version 1**

There is also ***Trichocereus forbesii***
[*Echinopsis forbesii* (LEHMANN) DIETRICH]
(HBG 561 at the Huntington.) [Br. & R. III 62 was their reference.]

These two plants are said to have originated from Paraguay.

They were acquired as seedlings from the Cactus Seed Importing Co. in May 1930; making these solitary columnar plants in excess of 75 years old.

***Trichocereus forbesii* version 1 (under nurse plant)**

***Trichocereus forbesii* version 2 (full sun)**

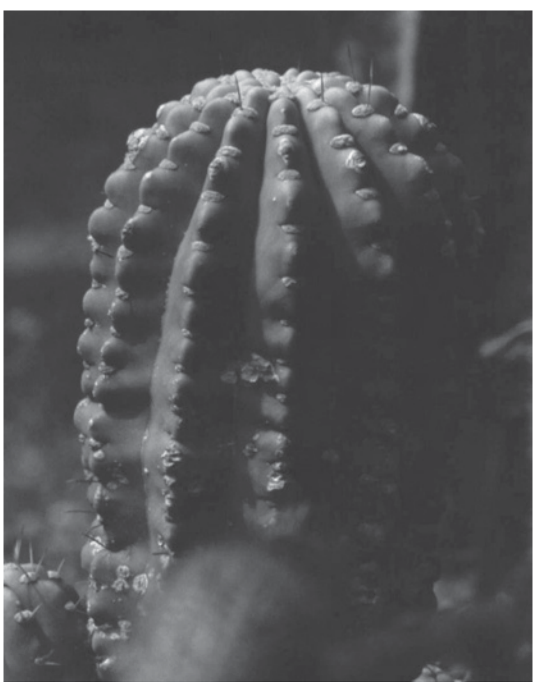
Notice the two plants bearing this label. One may reflect its growing through a nurse plant and thus being in more shade versus full sun?

Trichocereus robinsonianum
[*Echinopsis robinsoniana* H65318]
above right & center left

We have no clue where, or if, these were actually published or how they fit into the *tersckeckii*/*terscheckioides* mess.

***Trichocereus forbesii* version 2**

Similarly needing clarification are those specimens labeled ***Echinopsis robinsoniana* & *E. robbinsoniana*** (both at the Huntington).



Trichocereus robinsonianum
[*Echinopsis robinsoniana* H65318]
lower left

Open hybrid with *Echinopsis ro[b]binsoniana*
H65318
lower right

Trichocereus thelegonoides (Spegazzini) Britton & Rose

Mescaline present in trace amounts.

***Trichocereus thelegonoides* Argentina 56.0227**

It is unclear if this species will prove to be like *terscheckii* and range from inactive to potent or if it will prove to merely be another weak *terscheckioid* that people may encounter.

Trichocereus thelegonoides was originally collected near Jujuy in northern Argentina (on dry hills).

The body of the plant is thick and cylindrical; growing to 18 cm in diameter and "*more or less*" branching above. The trunk can reach 4-6 meters in height.

Branches grow to 8 cm in diameter with up to 15 low, rounded ribs. Branches are ascending and "*more or less*" curved. They are obtuse at the apex.

Ribs have transverse depressions between the areoles causing them to appear strongly tuberculate at first. This disappears with age.

The small, round felted areoles bear 8-10 short, bristly yellow or brownish spines; 4-8 mm in length.

It has white flowers to 20-24 cm. long that are greenish on their outside.

The petals are acute and oblanceolate.

Ovary bears scales.

"*Flower tube is hairy in their axils.*"

Backeberg 1959; page 1107
Backeberg 1977; page 498
Britton & Rose 1920; page 131

***Trichocereus thelegonoides* Argentina 56.0227**

Reported analysis of *Trichocereus thelegonoides*:

Hordenine (Sole alkaloid; 10-50 mg/ 100 grams fresh) **Agurell *et al.* 1971b**

Mescaline (traces) **Siniscalco 1983**. **Not** reported by Agurell *et al.* 1971b.

Trichocereus validus (Monville) Backeberg

Mescaline present (over 25 mg. per 100 grams of fresh plant.)

Trichocereus validus is thought to have originally been collected in S.E. Bolivia. It has long been claimed to be synonymous with *Echinopsis valida* Monv. [This last point needs some amendment as there appears to be several (2-3) distinct plants lumped under this name including at least one(-2) low clump former.]

Backeberg notes it may possibly become treelike but so far has only been observed as stout erect green columns with stems to 35 cm. in diameter (13.77 inches). [Grey-green 8" stems according to JL Hudson.]

There are around 10 ribs [8-10 are reported in seed grown material] with fairly large areoles up to 3 cm. apart. Few spines are present at first or else weak ones form at the apex; later they develop in the lower half of the areole.

The spines are pale yellow, sometimes darker above, with 7-10 radial spines up to 3.2 cm. long, the bottom ones being the longest; and one or two central spines to 7 cm. long.

The white flowers are up to 14 cm. long and have light grayish-brown hairs.

The fruit is ovoid and woolly.

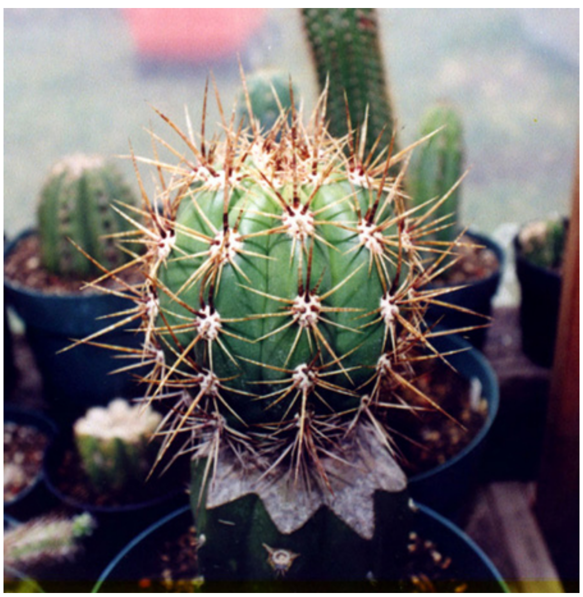
Backeberg 1977

Reported analysis of *Trichocereus validus*:

Mescaline (tlc, gc-ms)

Mata & McLaughlin 1982 and Ott 1993: 114

cited Agurell *et al*. 1971b



Trichocereus validus
Photo by Kamm

Agurell *et al*. 1971b:

Found over 50 mg of alkaloids per 100 grams of fresh plant, of which:

Mescaline formed over 50% of total alkaloid in *Trichocereus validus*.

I know no one personally who has successfully bioassayed this plant, or of anyone else who has ever assayed it. The minimum mescaline content indicated is the same range Agurell reported for San Pedro.

Using the lowest possible rate of approximation for Agurell and coworkers' given range (i.e. 25 mg per 100 grams of fresh), and assuming this was done using plants which were representative of what is available, the **maximum** it would take to obtain a 400 mg dosage range is 1600 grams of fresh plant material.

No details were provided on what constituted the other less than 50% of the alkaloid fraction, nor what actual percentage was as mescaline. As no graphic representation of the gc results were presented, the actual mescaline concentration or potential presence of other alkaloids is anyone's guess. There were no unknown alkaloids that were mentioned as present but this is not proof that they were absent. [As Ott has said; "*absence of evidence cannot be considered as evidence of absence.*" (BPC seminar, Maui.)]

This is certainly the cleanest published profile in the literature and quite intriguing.

Clearly this is a species in need of further analysis especially involving older wild plants. If Agurell's relative ratios as compared with other *Trichocerei* hold true, this could be an excellent source of mescaline. [Agurell's plants were obtained from the Kew gardens.]

Hunt 2000's perplexing **"= ?*Echinopsis uyupampensis*"** nearly defies comment as it is lacking a reference or indication as to the rationale or to a description upon which to base this clearly erroneous claim of synonymity. Please compare the photos of *validus* and *uyupampensis*.

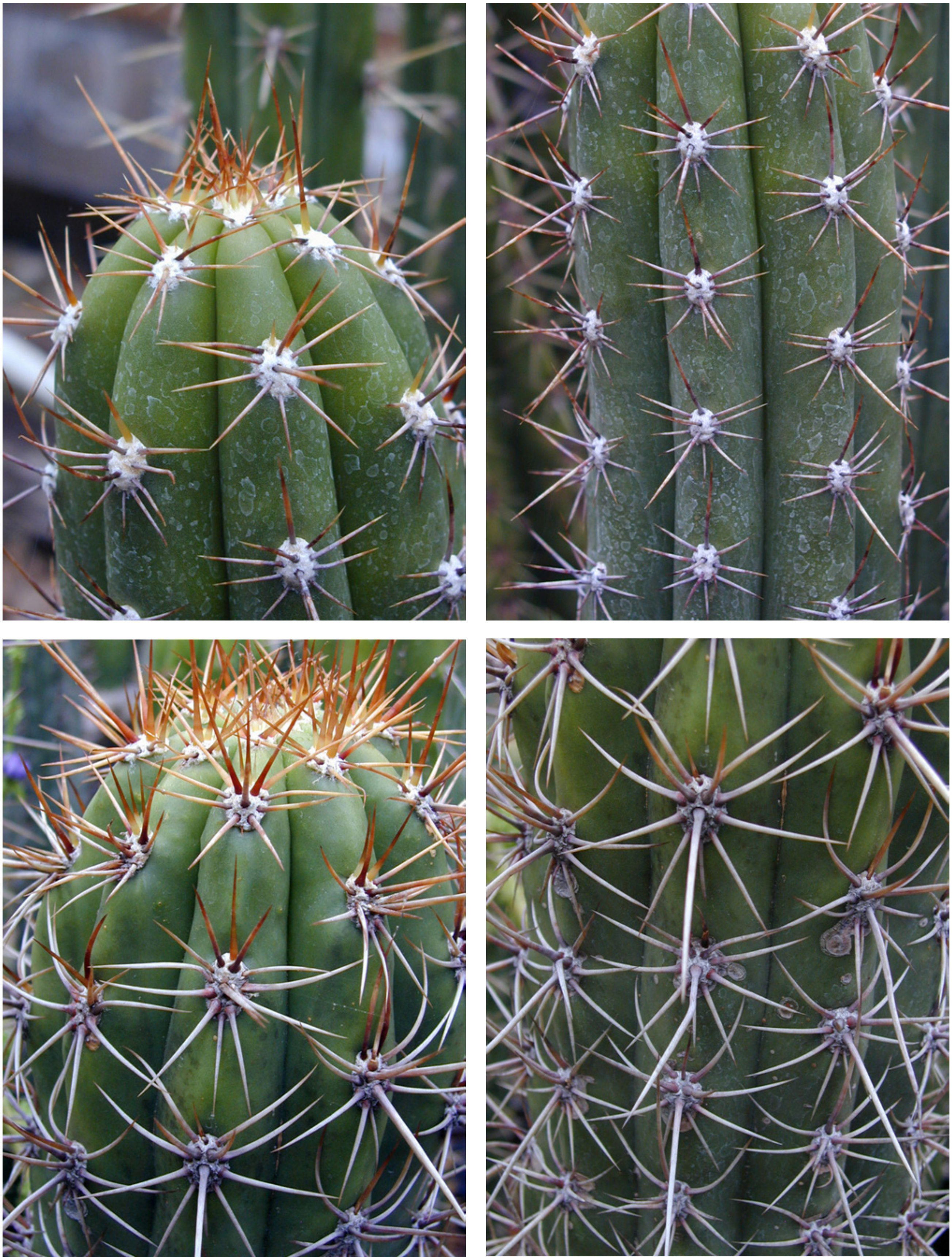
At least Hunt recognized that the columnar *Trichocereus validus* was NOT synonymous with the far shorter *Echinopsis valida* which he redesignated "*Echinopsis sp.*".

The material most frequently offered commercially as this species is described as "*short stems, clumping*", "*low growing clump formers*" or "*clumping stems to 4', bright red flowers*" Compare this with Backeberg's description above.

Is this the source for the third-person rumors of this plant's ineffectiveness in bioassays? [Unconfirmed anecdotal rumors of activity also exist for the species itself.]

In previous works Trout has published a photo of a large columnar *terscheckioid* cactus labeled *T. validus*. We no longer include it as we believe that it was a mislabeled photo.

See also page 379.



Trichocereus validus
Two forms of the columnar version

Trichocereus vollianus Backeberg

Mescaline present in trace amounts.

probable *Trichocereus vollianus* obtained mislabeled as *T. cochabambensis*

Trichocereus vollianus
Both flowering photos by Joylene Sutherland

Trichocereus vollianus

Trichocereus vollianus was originally collected in Bolivia (Arque-Cochabamba).

Grows as an erect shrubby plant, branching from the base.
The glossy, light green branches are up to 10 cm. in diameter with around 13 rounded ribs that are around 7 mm across and 5mm high. Its areoles are spaced around an inch apart.
The 8-11 radial spines are thin, sharp and radiating (up to 7 mm long). Single central spine can reach 2.5 cm. All spines are amber in color.
It has white flowers to 12 cm. long.
The fruit is oblong and hairy.
Backeberg 1959; page 1123.
Backeberg 1977; page 499.

Trichocereus vollianus
Photo by Joylene Sutherland

Backeberg describes this species as resembling *T. spachianus* but having more open spination and glossy skin. It is said to make an excellent grafting stock but has very sharp spines.

Backeberg also recognized a variety *Trichocereus vollianus* var. *rubrispinus* Backeberg, which has reddish-brown spines.

Reported chemistry:
Mescaline (traces by dry weight)
Siniscalco 1983

Interestingly, an unlabeled plant that looks like this species was described as "*good*" in a human bioassay. This and its identity needs confirmation.

Trichocereus werdermannianus Backeberg

Mescaline reported to be present at 5 to 25+ mg. per 100 grams of fresh plant.

Trichocereus werdermannianus was originally collected from S. Bolivia. (Tupiza, Charcoma Valley, probably to Chuquisaca.)

Eventually this forms a large tree; often over 5 meters tall (16.4 feet). It can have a trunk to one meter long and 40 cm. in diameter (15.74 inches). [2 ft in diameter according to JL Hudson.]

There are around 10 ribs when young then 12 or more, [6-14 according to JL Hudson] with areoles set 2.5 cm. apart.

New growth has 10 spines per areole with little difference between axial and central spines. Later the spines are present in increasing number. Spines are yellowish, horn colored or brownish and grow to 7 cm. long. [To 3 inches: JLH.]

White flowers up to 20 cm. long, with black & white hairs.

Fruits are 3.5 cm. in diameter, with 1.3 mm. seeds that are long and rough.

Backeberg 1977

Backeberg 1959: photograph on pg. 1106, fig. 1054.

Here he says stems can reach 60 cm (23.62 in.) in diameter, and sometimes have 14 or more ribs.

Said to intergrade with *T. terscheckii* [JL Hudson]. This probably underlies Hunt 2000's renaming of this species AS *Echinopsis terscheckii*. As was the case with Hunt's earlier merger of *pachanoi* and *peruvianus* (a view that is now abandoned by Hunt), this will also probably prove to be a too-hasty lumping based on the existence of natural hybrids.

***Trichocereus werdermannianus* flowering**
All 3 photos above by Eric Carso

Horticultural offering also include:
KK917 Tupiza, Bolivia 2800m
var. ***lecorensis*** **Knize n.n.; KK922** Lecori, Bolivia, 3000m
var. ***wilkae***

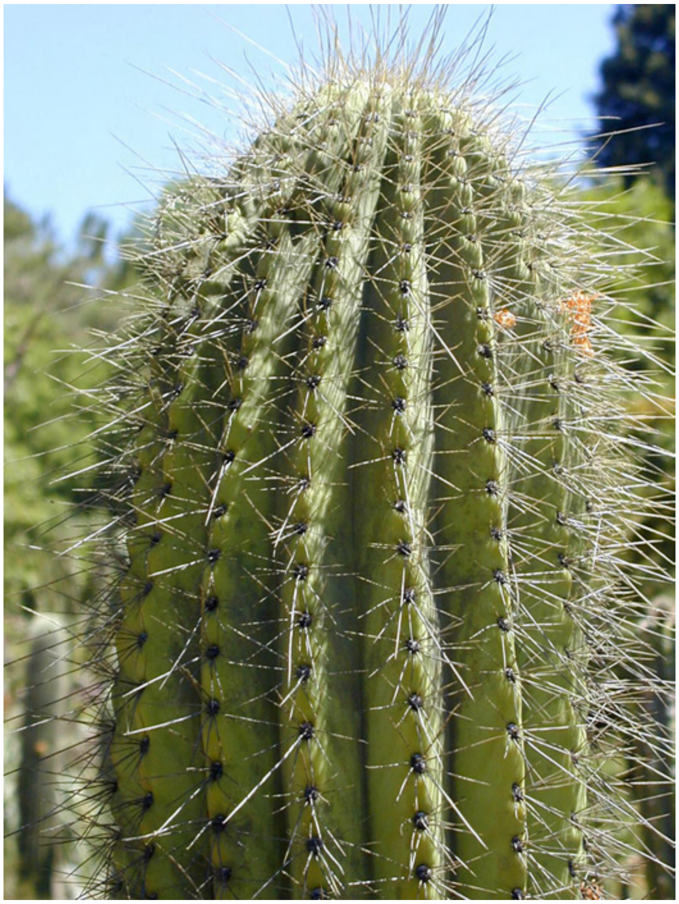
The species is highly variable in appearance and potency.

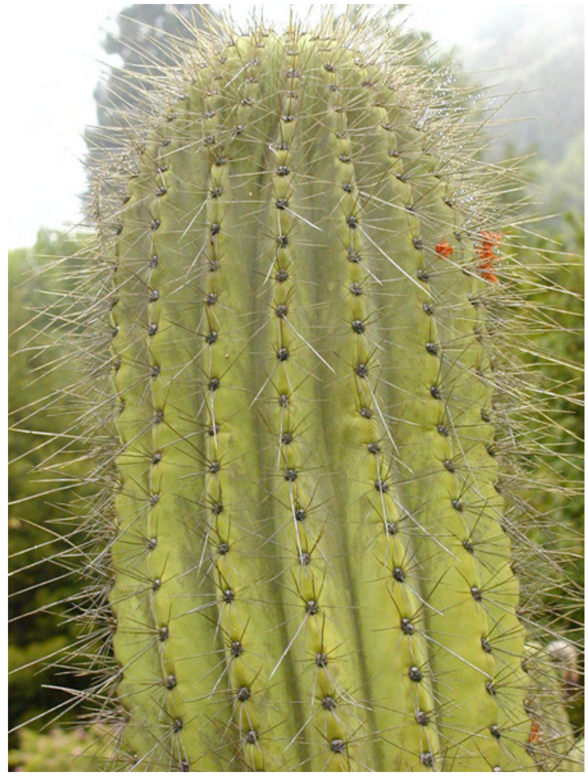
Many collections and forms are known but seemingly none are adequately defined.

***Trichocereus werdermannianus* Bolivia 50.1998**

Trichocereus werdermannianus **Bolivia 50.1998**
entire page

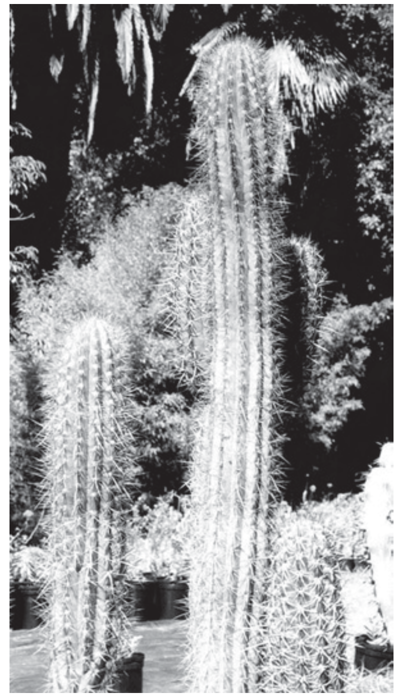
Be certain not to confuse with the globular and quite different ***Echinopsis werdermannii*** Fric ex Fleischer. See photos page 12..

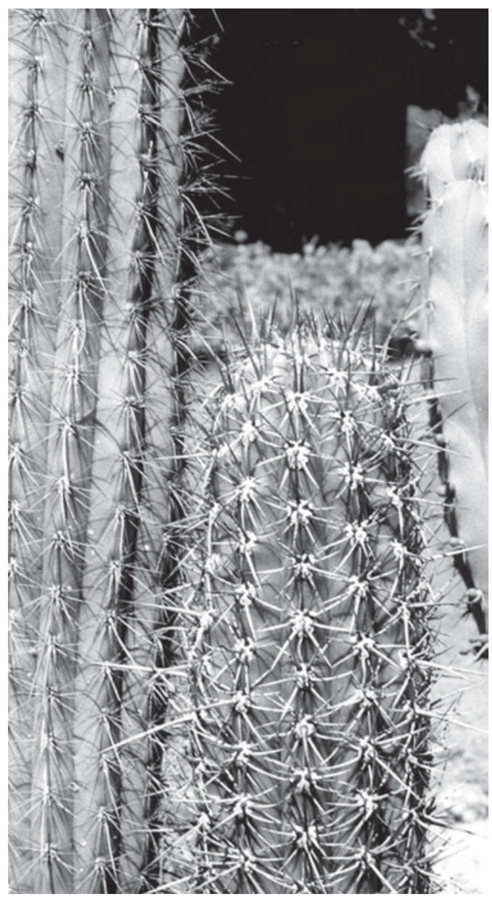




Trichocereus werdermannianus
Bolivia 71.0083
entire page

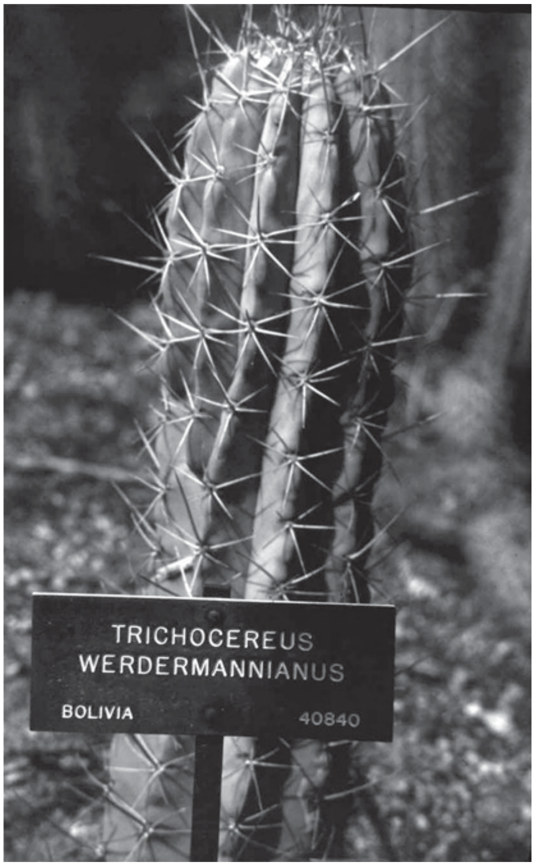
Red flowers visible in the upper right image were dropped from a neighboring shrub.





Trichocereus werdermannianus H40840 Bolivia
(Huntington)
Both photos above by Kamm

Unlabeled *Trichocereus werdermannianus* (Big Sur)
Both images above



***Trichocereus werdermannianus* H40840 Bolivia (Huntington)**

Trichocereus werdermannianus or *tercheckii*?

As mentioned earlier, in the proposed reunification of *Trichocereus* with *Echinopsis*, *T. werdermannianus* became *Echinopsis werdermanniana* (Backeberg) Friedr. & Rowley.

More recently it ceased to exist as a valid species when it became declared synonymous with *Echinopsis terscheckii* in Hunt 2000.

However, so far as I can tell, David Hunt did not publish any reasoning for his merger or cite a meaningful supportive reference.

In fact his only reference (Friedrich & Rowley 1974) preserved these two as separate species. (As did the seed morphology study of Friedrich & Glaetzle published in1983.)

This appears to be an example of good-old-boyism where acceptance is expected based not on merit but on stature of the authority. This rapidly forms a cancer of data integrity if tolerated.

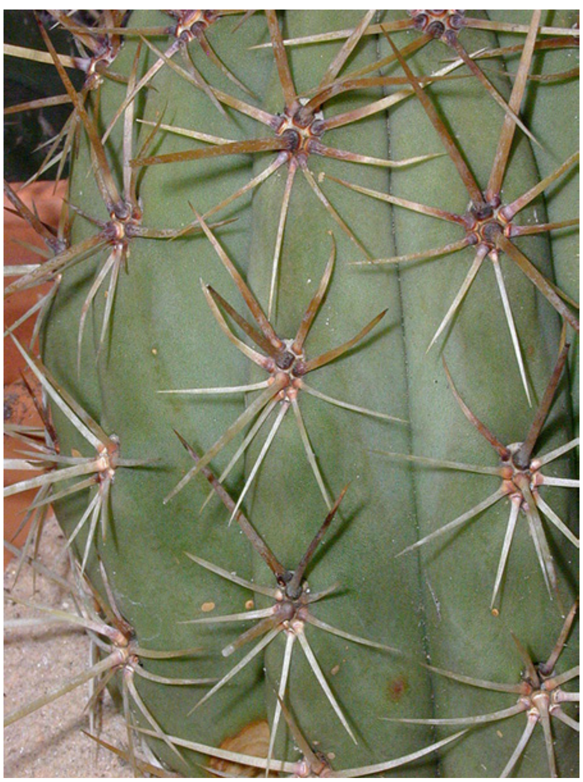
Science requires presentation of supportive published evidence and does not accept the the naked utterance of opinions in its lieu. Until there is some further published information, or we are provided with the means of locating supportive evidence that was published but not mentioned, Hunt's renaming needs to be disregarded due to its illegal methodology.

Readers are invited to compare the growth habits, spinartion, areoles, flowering habits, flower buds & flowers for themselves. A good number of images detailing most of these features can be located within this work.

Photo by MS Smith

***Trichocereus werdermannianus* (NMCR)**

***Trichocereus werdermannianus* forms (RS)**
Center and lower right



Trichocereus werdermannianus **(RS)**
Left column

Unlabeled *Trichocereus werdermannianus* (Strybig)
Above

Reported analysis of *Trichocereus werdermannianus*

Agurell 1969a recovered 120 mg of nonphenolic and 19 mg of phenolic alkaloids from 287 grams of fresh plant.

Mescaline was found to be present in far larger amounts than any other alkaloid present. It was found to be the major alkaloid in the nonphenolic fraction and was also present at low levels in the phenolic fraction.

[Mescaline is nonphenolic but frequently shows up at low levels in phenolic fractions when separated via ion exchange resins. This is due to its binding with the ion exchange resin.

There is some question as to whether even more of the mescaline is not retained and only poorly eluted from such resins. There is experimental evidence for this beyond the readily observable low values reported by chemists using said resins. Chemists: see any of Ivor Smith's works on Chromatography for his comments on this subject. They certainly are easy and effective for separating alkaloid mixtures despite this potential loss.]

3-Methoxytyramine was the major alkaloid in the phenolic fraction.

These figures coupled with his gc results as shown on page 43 of Agurell's article suggest that between 1.2 and 1.5 kilograms would be an effective dosage level to approximate a four hundred milligram equivalency if using fresh plant material. If making an acidified expressed juice, this could result in close to a quart of liquid for a dose. While this may sound like a lot this is not more than is required if using the branches of many cultivated San Pedro clones.

Assuming a 90% water content, this concentration represents roughly two thirds of what Crosby & McLaughlin reported for San Pedro.

However, what is also interesting is that the nonphenolic fraction which he isolated from San Pedro was 395 mg from 875 grams of fresh plant. This is only a slightly greater recovery than from *T. werdermannianus*. As the percentage of 3,4-dimethoxyphenethylamine is less than 10% of the total in each of these, this plant actually tested not much lower than San Pedro as far as alkaloid content. This needs much closer scrutiny.

Mata & McLaughlin 1982 cited Agurell 1969a**; Ott 1993: 114**, cited Agurell 1969b.

Agurell 1969b observed 10-50 mg. of total alkaloid present per 100 grams of fresh plant.

Mescaline (ms, ir, mp) (Formed over 50% of the total alkaloid present.)*

3,4-Dimethoxyphenethylamine (ms, ir) (Present as 1-10% of total alkaloid.)

Tyramine (ms) (Detected as traces.)

3-Methoxytyramine (ms, ir) (Present as 1-10% of total alkaloid.)

3,5-Dimethoxy-4-hydroxyphenethylamine (ms) (Detected as traces.)

Agurell 1969b

[*Well over from the looks of the gc in Agurell 1969a.]

In spite of it appearing to have a moderately low alkaloid content, as mentioned, due to the 'range' method of presentation, there is a good chance that this is misleading. It clearly appears to be towards the top of the given range.

I have heard from a number of people reporting on successful bioassays performed by themselves and others.

It has been reported that some clones are weak to inactive while others can be 2 or 3 times as potent as *T. pachanoi*. As has been the case for *bridgesii* and *macrogonus*, it is claimed that a potent, low-slime clone exists.

Whether this variability is simply a matter of individuals or whether there are in fact several chemical "*races*" as has been suggested by people who are familiar with the species firsthand is an issue in great need of further work.

(In regards to his range of 10 to 50 mg per 100 grams of fresh plant, this was obtained from 48.43 mg of total alkaloid per 100 grams as opposed to his figure of 50.74 mg of total alkaloid per 100 grams for San Pedro. Even taking into account that the (minor) phenolic alkaloid fraction is around 10% lower in San Pedro, the differences in nonphenolic concentration between San Pedro and *T. werdermannianus*, as given by Agurell, still works out to 0.05% versus 0.04%.)

Also, the alkaloid profile itself (viewed as relative ratios) is quite good. As with San Pedro, mescaline is **by far** the most abundant alkaloid present. In spite of its inadequacy for generating real figures, the available data is quite interesting.

All of this is really intriguing. If a person lived where these were of natural occurrence (Bolivia) and *IF* alkaloid distribution was highest under the skin as has been reported for Peyote, San Pedro and *T. terscheckii*, a more concentrated harvest and tea could be made by using only the green portions of the plant or drying it before use. **[Note 87]** Even plants growing outdoors in the Bay Area (CA) can get huge although not like what is pictured in Backeberg.

Considering that the plants can grow 16 feet tall and can bear multiple branches (I have thus far only witnessed tall single columns with a few short branches here in the US), this could be done without inflicting too much damage to the plant. If they are like most large branching cacti, broken limbs may be not uncommon, although it might also be worthwhile to comparatively assay actively growing branch tips on older specimens in contrast to older sections of branches. In the photograph by Cardeñas which Backeberg includes in Volume Two of *Die Cactaceae* (mentioned above), the plant dwarfs a person standing beside it; even the branches appear huge in comparison. In California, however, they appear to offset more sparingly.

Agurell assayed plants obtained in Europe (probably both propagated and cultivated there). There are no published studies involving either wild plants or old specimens. (Agurell's evaluation involved a mere 287 grams of fresh plant for his first paper on the subject. This could easily have been represented by a single seed grown specimen. It is not clear if he evaluated an additional sample for his second paper or not.)

While this discussion is purely conjecture based on anecdotal accounts of human bioassays and two lonely chemical analyses, only one of which contained graphic gas chromatographic information, clearly this is a plant in need of much closer evaluation.

See also pages 383-386.

Endnotes

Note 1: KK#1094 Otavi, Bolivia 3200m. Karel Knize's *Index to Field #s of Collected Specimens 1967-1977.*

Note 2: A similar suggestion might be made of what they call the *pasacana* species: these include the known (sometimes but not always low) mescaline containing *T. terscheckii*, as well as *E. pasacana* (CARD.) FRIEDR. & ROWLEY, *E. conaconensis* (KNIZE) FRIEDR. & ROWLEY, *E. orurensis* (CARD.) FRIEDR. & ROWLEY, *E. herzogianus* (CARD.) FRIEDR. & ROWLEY [Backeberg calls these *Helianthocereus* which brings up another genera of plants which might be suspected of yielding some low mescaline species.] and *E. escayachensis (*CARD.) FRIEDR. & ROWLEY. Just a thought.

Note 3: Other papers of potential interest listed in FRIEDRICH & GLAETZLE:
FRIEDRICH 1974 in *Kakt. u.a. Sukk.* 25: 50, 80
RITTER 1980 *Kakteen in Sudamerika* 2: 452.

Note 4: I am puzzled at some elements of this. Namely, where is their description for *E. macrogona* and what criteria do they use for separating it from *E. peruviana*? They obviously seem to view them as distinct species.

If we limit ourselves to the meager descriptions published earlier, the only real and meaningful dividing point is their geographical point of origin. Even major botanical gardens seem confused with regards to these two plants, as can be witnessed when comparing the two forms of *T. peruvianus* at the Berkeley Botanical Gardens with the *T. macrogonus* and *T. peruvianus* at the Huntington. BOTH species appear to have prostrate and erect forms.

If Friedrich & Rowley want to rename these plants, fine, but they should at least be bothered to include or at least refer to some sort of meaningful published description.

One can only wonder how they can preserve Knize's *nomen nudum* giganteus considering it lacks not simply a description and consistency but violates the Code of Nomenclature due to its previous use within the genus.

Note 5: The photograph does not provide enough detail for clarity. It could easily be any one of a handful of *Trichocereus* species. Its ribs are in excess of what is described for either *T. pachanoi* or *T. peruvianus.*

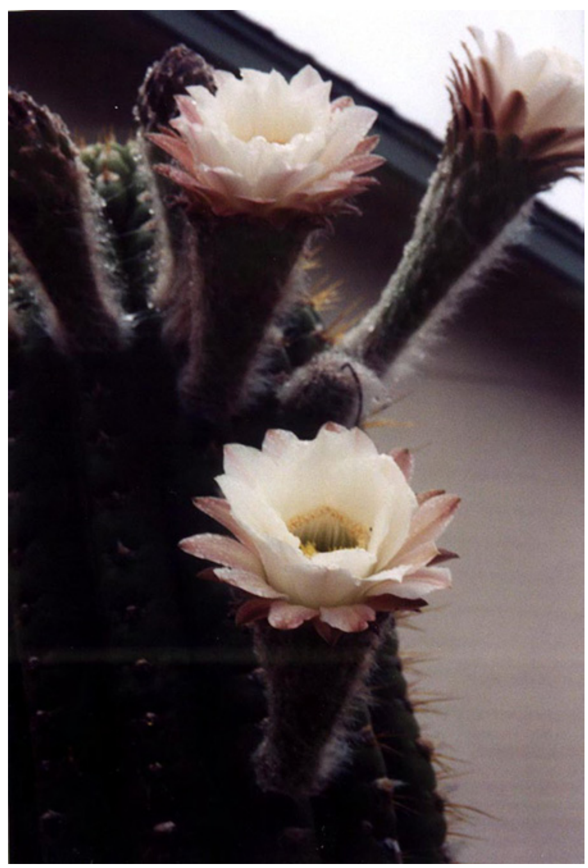
Note 6: All reported it to be vastly superior to a typical San Pedro.

Note 7: To give a sense of the degree of importance that religious freedom is held by those who consider peyote a dangerous drug we would like to offer the following quote: (After noting a peyoteist (Big Sheep) was IMPRISONED in 1926 for distributing the sacrament):

"*Lastly, it may be added–though it is only a trivial matter– that there was a "peyotl dispute" in the United States about 1950, and that certain ethnologists protested strongly against the idea that the use of peyotl should be prohibited, stating that the Native American Church is a legitimate organization with the same right to religious freedom as other churches*." Anonymous 1959, writing in the *Bulletin on Narcotics*, cited the *Monthly Narcotics Intelligence Bulletin*, 15 September 1957 (a US Treasury Department Publication). [Even LABARRE considered Western user's beliefs to be "*bogus*". Apparently his opinion was based entirely on the fact that they are Westerners!]

In my few encounters and discussions with the 'authorities', the idea that peyote can be considered a religious issue has always been dismissed similarly as trivial and unworthy even of consideration. They have, on two separate occasions, seriously proposed that if peyote could be considered as sacramental, or even as being somehow religiously valid, then ***heroin*** would have to be as well. They also insisted that the fact they were Christians (all we spoke with claimed to be) did not bias, affect or enter into their opinion. I was always told that if I did not like the law, I should change it.

The equating of peyote with narcotic drugs by anti-peyote activists is a firmly held and frequently encountered belief. A wealthy New Yorker who had moved to Taos, married an Indian man, and then became a fairly rabid and influential anti-peyoteist, stated in a letter written to Harold Ickes, then Secretary of the Interior, "*Do you really mean that you are defending self-government when you take the side of a few drug addicts against the efforts of the pueblo officers to eradicate the usage of the peyote drug? These officers are trying to deliver the Indians from their bondage to narcotic and you try to encourage them in their use of it. The Catholic Church does not recognize the "Native American Church." Would you stand for hashish, cocaine, or morphine and defend them on the grounds of religious liberty?*" From STEWART 1987.



Trichocereus terscheckii
Photo by Kamm

Unlabeled variegated *Trichocereus terscheckii*
Photo by Snu Voogelbreinder

Note 8: If using Poisson's figure of 0.12% wet wt., this would require ingestion of almost 7 kilograms of fresh cactus. Using Crosby & McLaughlin's figure of 0.331% in dry SanPedro this would require ingestion of around 39 kilograms of fresh plant material. If peyote of average strength was used (0.1 to 0.2% fresh weight) this is the equivalent of a person eating 4 to 8 kilos of fresh material or around 400 to 800 grams of dried buttons (hundreds of buttons). The person who ingested this amount of mescaline was reported to suffer "*no apparent toxic effects*."

Note 9: We know of two anecdotal accounts of intense and unmescaline-like reactions from individuals eating *T. bridgesii*. One used fresh material and the other dried.

Note 10: Unless monstrose.

Note 11: The *Trichocereus longispina* appearing in cultivation is NOT a form of *T. bridgesii*. The collection number **KK1670** appears with a locality of "*Cuzco, Pisac*" in Karel Knize's listings. It is said to have 4-8 cm long spines. This appears to be another *nomen nudum.* Knize calls it a Ritter *nn* stating in correspondence that Ritter told him about this "*many years ago in Chile*".

Knize first listed it in his catalog in 1967. However, Ritter apparently did not feel this was a valid name or at least did not consider it worthy of including in his work on Peruvian cacti (published in 1981). Whatever the reality, Ritter did not ever publish this name.

Material bearing this number was provided by Knize in 2000. It appeared to be simply a form of *T. peruvianus*. See photographs on pages 194 & 291.

Note 12: We have observed 6 spines only in photos. 2-5 spines were present on material examined in person. It appeared to be very similar in appearance to material said to be a Knize collection from Matucana, Peru at around 1400 meters except for it having a darker brown felt on many areoles, a slightly lighter body color and fewer spines/ribs than said Knize collection.

Note 13: It is said that Link & Otto had used some variant of this name prior to 1840 but it was never described
Cereus macrogonus Otto was said by Britton & Rose to be the type species for *Trichocereus* but I cannot determine that Otto's description was actually published anywhere.

Note 14: See in Schumann 1897

Note 15: Torres & Torres reported that "*high altitude wild*" *T. pachanoi* harvested in the Atacama Desert of Northern Chile provided a strong trip lasting 12-15 hours from use of a 30 cm by 8-10 cm section. This is likely to have weighed in excess of a kilo.

This is the only report so far encountered claiming wild populations of San Pedro in Chile suggesting another fruitful area for exploration as *T. pachanoi* is not otherwise reported from Chile.

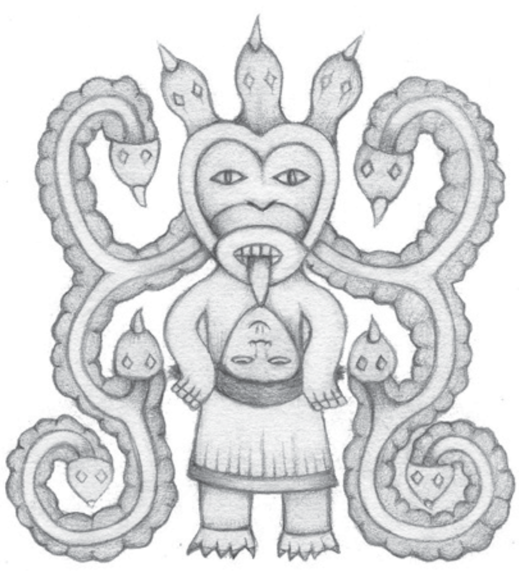
***Trichocereus* sp. N. Chile: Torres & Torres**
Younger (top) & older growth (bottom)

***Trichocereus* sp. N. Chile: Torres & Torres**

Note 16: Glass-Coffin cited the *Archivos Arzobispales de la Diocese de Trujillo*, Trujillo, Peru as her source of information.

Note 17: *Cereus peruvianus* (Linnaeus) Miller [*Piptanthocereus peruvianus* Riccobono] is a very common, widely grown and popular species. It is often mistakenly thought synonymous with *Trichocereus peruvianus*.

They are very different species and plants.



Painted image from a ceremonial mantle (Paraca)
Rendering by Mango Frangipani.
See photograph on page 108.

Note 18: San Cipriano is believed to be the patron saint of Peruvian shamans. Glass-Coffin 1998. San Cipriano apparently was a black magician who converted to Catholicism.

Note 19: Karel Knize lists Chan Chan, Ecuador as the place of origin for ***T. pachanoi* KK339.**

Note 20: San Pedro is a common and very successful colonizer of sheer cliff faces above river valleys.

Note 21: In early chemical and psychiatric studies San Pedro was consistently misidentified as *Opuntia cylindrica*, until Friedberg noted (in 1959) that it matched Britton & Rose's description and Poisson isolated mescaline from a correctly identified San Pedro and published his results in 1960, the same year Turner & Heyman reported the isolation of mescaline from the plant they presented as *Opuntia cylindrica*.

We are unable to determine with any certainty the origin of the confusion. G. Cruz Sánchez is the earliest example of confusion that we have found in the literature but it is unclear where he got his information. As noted earlier in the text, due to his included photo we suspect a mislabeled plant in the Lima Botanical Garden was the source.

Clearly he should have asked a botanist (or even a cactus collector) to confirm the identity of the plants. Backeberg, Borg and others knew San Pedro as *T. pachanoi* AT THE VERY LATEST by the early 1930s.

This amazing perpetuation of errors, which we describe in some detail, underscores Dr. R.E. Schultes' point, stressed repeatedly over the years, emphasizing the critical need for including herbarium vouchers for ANY and ALL phytochemical and/or ethnobotanical work. Lack of a proper voucher & its authentication is simply poor scientific methodology.

Note 22: Many people including Backeberg, consider *T. pachanoi* to be the best grafting stock. [It should be added that many peyote growers prefer *Myrtillocactus geometrizans* while others prefer various *Cereus* or *Stenocereus* species.]

Hylocereus trigonus is often used commercially, but it is shorter lived, much more cold sensitive and not nearly as hardy as *T. pachanoi*. *Hylocerei* will often abort grafts if the temperatures drop below 45º F. Grafts so lost will not retake unless new surfaces are prepared. *Hylocerei* also have a tendency in cool weather to develop an orange color at the base which becomes rotten tissue.

Note 23: In Mario Polia 1997 it was mentioned that "*The San Pedro of four vientos is very rare in nature and it is a symbol of election: they retain that who found it is a great shaman or destined to become it*." (As translated by the friend who brought this to my attention.)

[Page 19: "Il *sanpedro* di quatro *vientos* è molto raro in natura ed è simbolo d'elezione: si ritiene che chi lo trovi sia un grande sciamano o sia destinato a diventarlo."]

See the picture in Polia, on page 11. While the focus is a bit fuzzy and the angle of presentation inadequate for a positive rib count, this appears to be a 4 ribbed plant. A point to note are the extremely short spines. This is also true of my friend's 4 ribbed plant.

Note 24: Pale yellow spines with brown tips and/or bases are also commonly encountered in cultivated plants.

Note 25: Reddish spines on new growth and reddish brown spines overall are not uncommonly encountered in seed grown material.

Note 26: Spines of up to 2 inches are not uncommon in large plantings of seeds according to several growers.

Note 27: Not surprisingly, as this appears to be the main characteristic that Backeberg selected for.
A number of spiny forms exist and two are sold as the "*wild types*"; one from Ecuador and the other from North Peru. (Reported to be as active as regular *T. pachanoi*.)

Note 28: It probably WILL prove to be the general case that active strains of true *T. peruvianus* are more potent than typical *T. pachanoi*; at least in material presently under cultivation in this country.

sold as *Trichocereus pachanoi* (Germany)
Photo by Patrick Noll

Hybrids are reported to show a range of variable potency similar to their parents.

Note 29: Marini-Bettòlo & Coch Frugoni 1956 *Gazzeta Chimica Italiana* 86: 1324-133 and 1958 *Rendiconti. Istituto Superiore di Sanità* 21: 319-327 [*Chemical Abstracts* (1958) 52: 653c also lists Coch Frugoni; *Anales. Facultad de Química.* [y farmacia (?)], *Universidad de la Republica Oriental del Uruguay*, in press.]
Chemical Abstracts gives this as *Anales fac. quím. y farm, Univ. rep. oriental Uruguay*. The only publication title listed in standard periodical abbreviation texts was as given as a question in brackets above as we could not find the title as abbreviated..

Note 30: As far as I can ascertain, the first ***verifiable*** isolation of characterized mescaline from a cactus other than peyote was from *Trichocereus terscheckii*. The preliminary findings were first presented in a paper by L. Reti in 1939, (although it is clear from Ludueña's experiment published in 1935, that the isolation had to have actually occurred some years earlier). The details of some of his investigations were later published, in English, in the 1951 *Journal of the American Chemical Society*. (See more details under in TN#C-9 or TN#C-13, Trichocereine, and, in this work, under *T. terscheckii*.)

E. Herrero-Ducloux 1930b had isolated small amounts of alkaloids from *Gymnocalycium gibbosum* some years earlier and identified one as mescaline using chemical tests. He similarly identified mescaline in *Gymnocalycium leeanum* (same paper) and observed a "*mescaline-like*" alkaloid in *Gymnocalycium multiflorum* [Herrero-Ducloux 1932a]. None of these were actually characterized.

[It is also claimed in a secondhand listing by Kapadia & Fayez that Herrero-Ducloux reported mescaline in 1931 from several *Trichocereus* species. Their further claim that he also reported DMPEA in this same paper suggests this may all be in error but the publication cited is seemingly unavailable so this is presently unresolved.]

Apparently, however, no truly definitive isolation and characterization was ever performed by Herrero-Ducloux. Chemical tests are as accurate, if not more so, than tlc but, like tlc, they cannot be considered true proof of an alkaloid's identity; just strong indications of probable identity. Like tlc, they can prove what it is not but not what it is. Chemical science is a real stickler when it comes to what constitutes actual 'proof' and it must always remain that way to be a science. [The UT library is missing volumes 1-6 of the first journal and lacks all early issues of the second so I am still waiting to learn the details. Details were from Reti.]

DeVries' investigation of *Gymnocalycium leeanum* apparently did not confirm the presence of mescaline. Once again our library is lacking the first several volumes of the journal this appears in.

Starha's 1997 work on *Gymnocalycium* detected mescaline in several species but could only find N-methylmescaline in *G. gibbosum*.

We should stress that Starha's lack of positive results CAN NOT be regarded as any indication that Herrero-Ducloux did or did not find mescaline in HIS samples.

See ***Sacred Cacti*** **Part A.** under *Gymnocalycium* for what little we could learn.

Note 31: Gutiérrez-Noriega & Cruz Sánchez (1947) *Revista de Neuro-psiquiatría* 10: 422; (1948) 11: 115 & 390; Cruz Sánchez (1948) *Rev. Farm. y Med. Exper*. 1: 143 & 253.

Note 32: Huancabamba is the name of a mountain town in northern Peru. Glass-Coffin 1998. The areas surrounding it contain important sacred lagoons and other ritual sites regularly utilized by San Pedro using shamans.

Note 33: As Backeberg is the person who first introduced San Pedro to Western horticulture and Borg 1937 [1st edition] clearly gives San Pedro as the common name used in Peru for *T. pachanoi*, it seems highly likely that Backeberg also knew it by this name during the 1930s. I am still seeking several of Backeberg's early works to try and find out.

Note 34: In Backeberg 1958 [Vol. 1] page 10, he writes; "*So erzählte man mir vom Trichocereus pachanoi, der von S-Ekuador bis N-Peru (nur angepflanzt?) vorkommt, daß er bei Brujas (Hexen) und Quacksalbern eine geheimnisvolle Rolle spiele; vielleicht handelt es sich auch hier um Alkaloidwirkungen.*" This sounds very similar to Guttierez-Noriega.

Note 35: On page 1119, Backeberg 1959 states: "*.., in N-Peru* „San Pedro" *genannten Spezies*, ...; *außerdem lassen mir von Eingeborenen erzählte Einzelheiten daruf schließen, daß die Pflanze wie auch einige andere Cereen, ein Alkaloid enhält*." Friedberg 1964, a paper first presented in 1960, quoted Backeberg 1959: "*Il s'agit partout jusqu'en Bolivie de spécimens redevenus sauvages de cette espèce nommée San Pedro. D'après ce que m'ont raconté les indigènes, la plante contient un alcaloïde.*"

Note 36: E. Wade Davis 1983 describes *Armatocereus laetus* (AKA *Lemaireocereus laetus*) being called *pishicol* and claimed it was used similarly to San Pedro for making a hallucinogenic drink by local shamans. It was said to be considered to be as strong but analysis was lacking. Davis stated that vouchers were prepared and that an alkaloid study was underway and planned for future publication. Communication with Davis in 2004 determined that an analysis had never been performed. [Djerassi *et al*. 1955 found no ether soluble alkaloids in this species.]

Davis also mentions that two other *Armatocereus* species occur in the Huancabamba region of Peru, *A. rauhii*

Armatocereus laetus **Peru 54.0897**

Backeberg and *A. ghiebreghtii* (K.Schumann) Ritter var. *oligonus* (Rauh *et*. Backeberg) Ritter. Analysis is also apparently lacking on these species.

Note 37: Other names given include *Aguacolla-aquisca* (citing Betanzos, c. 16), *Avacollay* (citing Cobo IX, 17) and *Jahuackollai*. It appears to be discussed more in terms of food (fruit) than anything else.

There is also a mention of two types of *Gigantón*; one (*Gigantón grande*) called *Ahuaruncu* growing near water and the other *Gigantón* called *Ahuakolla* having large or numerous spines. (citing Holguín)

Note 38: While mescaline has not been identified in any of the species so far examined, the genera *Cereus*, *Lobivia*, *Mammillaria* and *Melocactus* all contain species from which alkaloids have been reported.

Note 39: "*Oliva y Cobo aseguran que hubo una clase de pitahaya que era apreciada entre los indios por los efectos narcóticos tóxicos que produce. Se llama achuma.*"

Note 40: "*La achuma es cierta especie de cardón.....crece un estado de alto y a veces más, es tan grueso como la pierna, cuadrado y de color de sávila; produce unas pitahayas pequeñas y dulces. Es ésta una planta con que el demonio tenía engañados a los indios del Perú en su gentilidad; de la cual usaban para sus embustes y supersticiones. Bebido el zumo della, saca de sentido, de manera que quedan los que lo beben como muertos, y aun se han visto morir algunos a causa de la mucha frialdad que el cerebro recibe. Transportados con esta bebida los indios, soñaban mil disparates y lo creían como si fueran verdades...*" (citing "Cobo (V, 7)"

"*.....Para saber la voluntad mala o buena que se tienen unos a otros toman un breuage que llaman Achuma que es una agua que hacen del zumo de unos cardones gruesos y lisos que se crían en valles calientes, bébenla con grandes ceremonias y cantares, y como ella sea muy fuerte luego los que la beben quedan sin juico y privados de su sentido, y en visiones que el Demonio les representa, y conforme ellas juzgan sus sopechas y de los otros las intenciones....*" (citing "Oliva (I, 4)".) Page 322, Yácovleff & Herrera 1934.

On this same page they also mention that some "*cardóns*" were said to be used by the Indians for treating wounds. In light of the frequent presence of hordenine in many Cereoids this may have a sound pharmacological basis.

Note 41: given in Oliva 1895 *Historia del Reino y Provincias del Perú* pp. 115-124.

Note 42: as given in Mateo 1956

Note 43: citing Dammert Bellido 1974

Note 44: An almost identical object is held in the hands of a wide-eyed figure on another stirrup vessel shown on page 5, in issue no. 6 of *Cuadernos de Arte Antiguo del Perú* (1938). Author Luis Eduardo Valcárcel offers it as an example of a musical instrument, while Donnan 1976 on page 101 (fig. 82) says his is holding strings of *espingo* seeds. It is far from clear which is true. I tend towards Schultes' interpretation.

Note 45: Although the observation mentioned by Sharon & Donnan 1977, that San Pedro spines were incorporated into mud bricks found associated with a temple structure at Garagay near Lima at least suggests that this may have occurred in earlier times in order to have generated and accumulated large enough volumes to actually use in building materials. They also note that San Pedro often does not have spines.

San Pedro does not usually have long ones. It might be added that there was no indication of how the actual species was determined or who made the determination.

It was recently brought to my attention that an unidentified and apparently spiny *T. peruvianus*-like cactus with spines and areoles sliced off in long lengthwise strips are sold in some Peruvian markets. See comment under *T. cuzcoensis*.

Note 46: One point encountered repeatedly in the literature is that 6 ribbed plants are considered to somehow be evil and 7 ribbed plants are preferred. If one looks at the plants for sale in the many photographs of cacti stacked in markets, they will see 6 ribbed plants to predominate. If they look closely at sections of plants featured as being prepared for consumption, almost always it is as six ribbed plants. Skinny ribbed plants are also said to be preferred. I have noticed that 7 ribbed plants have a higher frequency of skinny ribbed plants (at least in what I have cultivated). Since mescaline concentration is highest on the periphery of the plant (it IS present in the rest of the plant) the increased surface area resulting from skinny ribs and 7 versus 6 ribs, may be a very practical issue related to maximizing alkaloid level. I do not know whether a four ribbed plant would have fat or skinny ribs, as I have never seen an entire plant with 4 ribs. 5 ribbed plants have shown both with about equal frequency for us. Even with 6 ribbed plants, skinny ribs are not uncommon.

Some have argued that spiritual aspects are more important than alkaloid content but IF this was really true, then ANY cactus with the correct 'symbolism' could be used just as effectively.

[Even a wooden stick or a consecrated rock carved with the right symbolism would be *EQUALLY* effective if this was actually the entirety of the story.]

I would point out that these plants are used BECAUSE of their alkaloids, not in spite of them. Our perceptual interface is purely chemical in its design so it should be obvious that anything real or meaningful MUST have an underlying chemical basis.

Traditional users incorporate these plants into their practices because they work. They work because the plants are active. Indigenous people's understanding is often quite sophisticated even though they may not express what they are doing and why in such western scientific terms as concentration or alkaloid content.

Many people reject the idea of alkaloids being responsible simply because in their mind this trivializes something marvelous and sacred by reducing it to a fragmentary and profane Western view.

Perhaps those readers should be gently reminded that the Mazatec healer, Maria Sabina, sampled pure SYNTHETIC psilocybin tablets made by Sandoz and reported them to be every bit as effective as wild *Psilocybe* mushrooms in her healing ceremony but ONLY after she had ingested an adequate dosage level.

The alkaloids are what enable the activity, not the symbolism. Symbolism, expectations, and beliefs shape and direct the subsequent experience. Alkaloids form the pharmacological foundation and enable the experience.

They quite literally form the bridge (or interface) between the human and the plant; creating what is in many ways a symbiotic relationship between the two species.

It is not essential to ingest alkaloidal material to have a spiritual experience, (potent hallucinogenic alkaloidal substances are capable of being produced naturally within the human nervous system), but some, like mescaline, can enhance our sensitivity and range of perception.

The fact that one can ingest mescaline and NOT have a spiritual experience does not alter this any more than would the failure of an individual to achieve their desired results during a meditation session. Set, setting, preparedness and personal capacity are all factors in shaping the resulting experience. [This malleability is one reason that symbolism and ritual can play such important roles in shaping the final result of sacrament ingestion.]

A person can certainly go to church or even partake of Holy Communion without any accompanying spiritual experience.

A criticism has been leveled at me for equating the two, stressing that Communion is not performed for attaining a spiritual experience. Let me get this straight, I can enter into Holy Communion with my Creator via means regarded as a sacred rite, ingesting sacramental material that is variously claimed to be either the literal body and blood of Christ or else a symbolic representation of it, and somehow this is NOT considered to be a spiritual experience?!

A book, work of art or movie can still be powerful and important, or even a masterpiece, regardless of whether I as an individual enjoy or appreciate it. We are all individuals. That our subjective experiences may vary does not change or affect the nature or reality of what is potentially there. Nor does the fact that some people are apparently incapable of spiritual experience no matter what approach is taken.

A sacred plant or site or act is sacred in and of itself. It does not depend upon the definition of observers to allow it to be so.

Note 47: While all mutations can be considered "*non-normal*", most are also fatal. This phrase is used in biochemistry and microbiology to indicate a viable (nonlethal) mutant that visibly deviates from the norm and, like 4-leafed clovers, occurs at a relatively constant and observable rate within any large enough population.

Most spontaneous mutations are nonviable and prove lethal to the hopeful organism that possesses them.

Note 48: For more details on Chavín sculpture and the temple at Chavín de Huantar, see Julio C. Tello 1960

fasciated/monstrose *Trichocereus bridgesii*
collected in Bolivia
Photo by Murple

Chavin. Cultura Matriz de la Civilización Andina. Primera Parte. It does not concern San Pedro, but has great art sculptures and some incredible architectural examples clearly demonstrating their conduciveness for supporting, if not enhancing, altered states.

Note 49: This is depicted in many sources; a good photograph can also be seen in ANDRITSKY 1989 and a drawing in CORDY-COLLINS 1980. Rosetta offers it as a great T-shirt.

Note 50: OTT 1993 mentions a snail was proposed to become hallucinogenic after feeding on San Pedro (and thus responsible for a 'sacred snail' motif frequent in Moche art) by BOUERGET 1990. However, there does not appear to have ever been any human evaluation of this claim by bioassay.

Note 51: Another excellent picture of thissame vessel (Coll. Munson-Williams Proctor Institute, Utica, N.Y.) can be found on page 115 in Douglas SHARON 1972.

Note 52: 'Bark' is one possible interpretation of the word 'corteza' but I would like to suggest that, in this case, 'cortex', or even 'skin', would be a more preferable translation.

4000 year old puma bone tryptamine pipe
Torres 1996
after Fernandez-Distel 1980

Note 53: Many people claim that cacti are active when smoked.

It is generally stressed that the effects are not hallucinogenic but that some type of vaguely defined psychoactivity results.

This has been reported for San Pedro, Peyote, *T. bridgesii*, *Epithelantha micromeris*, *T. peruvianus*, *Echinocereus triglochidiatus* (including at least one report of some type of vague activity resulting from smoking the alkaloids isolated from this species!) and others but none appeared to produce hallucinogenic effects, all were stressed not to produce the same effects as ingestion of mescaline and most were very unclear as to exactly what they meant by "*psychoactive*" or "*active*". [Reports received in correspondence from Robert Anton Wilson & a handful of psychonauts requesting anonymity.]

While neither myself nor David Aardvark were able to confirm psychoactivity regardless of volume or form used, this is an area in need of further investigation. Perhaps we are just 'hardheads' but I suspect the point of contention here is one of semantics.

Note 54: Another possibility suggested by early reports of snuff use in areas of western coastal South America where no botanical material can presently be found may involve the loss of trade routes or alliances that once existed.

It might also indicate that the source of the snuff no longer existed. It would be relatively easy to entirely exterminate *Anadenanthera* within a localized area either through prolonged drought or deliberate efforts.

Note 55: See VAN DEN BERG 1984

Note 56: An interesting coincidence can be found in the observation that the enzymes necessary for the formation of DMT-like substances are known to be present in at least several *Prosopis* species (most are presently unexamined). DMT has not yet been found in any *Prosopis* species, unlike several closely related indole alkaloids: Tryptamine, serotonin (5-hydroxytryptamine), N-acetyltryptamine and N-methyltryptamine. Phenethylamines, similarly substituted (i.e.: Unsubstituted, N-Methylated and 4-Hydroxylated), have also been reported, (separately and concurrently), as have the β-carbolines, harman and eleagnine. See our works on Tryptamines, the LEGUMINOSAE, or *Prosopis* for more details and references. SMITH 1977 includes most.

TORRES (1995) (1996) mentions the interesting find, at the Inca Cueva site in the Puna de Jujuy in northwestern Argentina, of a Feline bone pipe containing DMT residue. While the date of 2130 BC places it among the oldest dates for verifiable hallucinogenic drug use by smoking (as confirmed by forensic analysis), what is more fascinating is that it was found with both *Anadenanthera* and *Prosopis* seeds. Analysis of the *Prosopis* seeds is apparently lacking. [citing AGUERRE *et al*. 1975 & FERNANDEZ DISTEL 1980; see image on page 258.]

Additional pipes with detectable alkaloid residue, but lacking plant material, were found at the nearby Huachichocana site and dated to around 1400 BC.

The research in this area suggests that, in northern Argentina, smoking of tryptamines preceded the use of snuff and was eventually replaced by it.

Note 57: SCHULTES 1967 pp. 33-57 (also subsequent papers and books; see a partial listing under '*cimora*' in the references of interest listed for *T. pachanoi.*)

Note 58: LAMB & LAMB 1969 have a color photo in habitat. See ill. 309

OTT 1993 points out that *Neoraimondia arequipensis* var. *roseiflora* (Werd. and Backebg.) Rauh, formerly considered a variety of *Neoraimondia macrostibas*, was found by MA *et al*. 1986 to contain no mescaline and only traces of
3,4-Dimethoxyphenethylamine and
3,5-dimethoxy-4-hydroxyphenethylamine.

Neoraimondia macrostibas itself was reported to contain no alkaloids by DJERASSI *et al*. 1955. [See our comments on *Djerassi* elsewhere here.]

N. macrostibas is now considered a form of *Neoraimondia arequipensis* in HUNT 1999.

The report of Ma and coworkers is interesting as it does show that, while mescaline was absent, *Neoraimondia* species **genetically contain the appropriate enzymes** for both ring hydroxylation and subsequent O-methylation. The second compound mentioned is a known mescaline precursor and only one short step from it. While alkaloids present were at trace levels this is no guarantee that all *Neoraimondia* species must prove the same (or even that all individuals of these two species must always show similar analytical results; remember that *Lophophora williamsii*, *T. pachanoi*, and *T. peruvianus* can all vary from almost ineffectual to very potent). Most occurrences of mescaline in *Trichocerei* are low. Plants considered to be closely related varieties are as likely as not to show varying and sometimes radically differing levels of similar or identical alkaloids. Similarly, most *Trichocereus* species do not contain mescaline at all. Seasonal peaks or geographical chemical variants are also possibilities.

The work by Djerassi and coworkers used ether to extract the residue resulting from an alcoholic extract; a procedure unlikely to recover mescaline even if it was present in substantial quantity.

They also reported no alkaloids from *Trichocereus peruvianus*, *T. cuzcoensis*, *Machaerocereus eruca* and a wide variety of *Lemaireocereus* species, including *L. stellatus*, *L. treleasei*, and *L. laetus* (*Armatocereus laetus*) over the course of several papers.

It should be pointed out that alkaloids **have** been detected, and often isolated, by other workers in every one of the species just mentioned as being tested by Djerassi and coworkers, except for *L. laetus* for which additional published analysis is apparently lacking. (See Davis's observations concerning *Armatocereus laetus* elsewhere here.) See the *Machaerocereus* and the *Lemaireocerei* mentioned, except for the *Armatocereus*, listed in ***Sacred Cacti*** **Part A** as *Stenocereus* species.

While not particularly promising so far, the *Armatocerei* (Backeberg's classification for South American *Lemaireocerei*) and *Neoraimondias* should be looked at in greater detail. **It will be surprising if at least trace amounts of mescaline are not eventually found.**

Note 59: Word meaning 'multicolored'. Name commonly applied to *Datura* and *Brugmansia* species Glass-Coffin 1998.

Note 60: Literally meaning "table".

Note 61: In our (Appleseed & Trout) tlc screenings of plants, we experienced a considerable increase in sensitivity when Johnny did not use solvent extraction as the first step but rather first extracted with hot acid, neutralized it with strong base and then solvent extracted the aqueous basic solution for assay.

Note 62: Agurell tested authenticated *Opuntia cylindrica* and found it to contain no alkaloid. He does mention that, while only 40% of the cactus they tested showed alkaloid, their criteria considered any plant which contained less than 0.5 mg of alkaloid per 100 grams of fresh weight to contain no alkaloid (i.e. a cutoff point of $5x10^{-4}$ % total alkaloid. A very functional convention.) Mescaline has been found by later workers even lower than such trivially low concentrations in several cacti. Including *Opuntia spinosior* which was found to contain $4x10^{-5}$ % mescaline.

Note 63: Using HPLC, Helmlin & Brenneisen 1992 photometrically estimated 0.109-2.375% by dry weight in 6 specimens purchased in Swiss retail outlets or from private collections in Switzerland. No details were included about which tested highest and lowest despite the 22-fold disparity between min and max. (Or, perhaps it may have been omitted because of this?)

Note 64: Alkaloid content varying substantially, seasonally and by time of day, and influence effected by light levels, weather conditions, water access or temperature are well known for other plants; these might also be worthwhile notations for future workers.

Note 65: Citing Cruz Sánchez 1948a, Gutiérrez-Noriega & Cruz Sánchez 1947 and Gutiérrez-Noriega & Cruz Sánchez 1948a. They gave the drug to 32 people in dosages ranging from 5 to 22.2 mg. per kilogram. Two people received dosages which amounted to 11.3 mg/kg and 10.7 mg/kg. (i.e. they used a 600 mg. dosage, apparently as the hydrochloride salts of cactus isolate.)

Dosages of 5 to 11.5 mg/kg were administered to eleven subjects in Gutierrez-Noriega & Cruz Sánchez 1948b. In most cases the subjects were normal but in the study using 32 people, 10 were chronic alcoholics. The rest were primarily medical students and staff members.

Note 66: Fairly rapid death would be likely at 5 grams per kg.

Note 67: One point we cannot understand is that since Cruz Sánchez had obviously purified it in enough quantity to evaluate it on dozens of people, why he had not sent a sample of his purified material to another lab for independent testing? We hoped to be able to reconstruct the picture in greater detail but so far have been hampered by lack of available literature access. Over a dozen years had passed between his report and the analysis by Turner & Heyman. As we have mentioned, there were several other published reports (Italy, Argentina and Uruguay) of the presence of mescaline in *Opuntia cylindrica* during this time.

Note 68: i.e. mescaline was said present at 0.9% with only slight traces of other bases being present while at the same time, the maximum yield of crude base is given as "0.9%."

Note 69: "*Exactly 2 g. of one extraction at this point dissolved in 10 ml. of 95% ethanol and was titrated to pH 3.0 with 6.19 ml. of 1N sulfuric acid, brought to dryness, and the residue extracted with benzene. The white, semicrystalline residue weighed 1.31 g....*" An interesting approach to crystallization that was expanded upon as Gottlieb's presented mescaline isolation procedure.

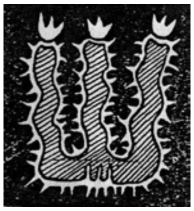
Note 70: Interestingly, after finally obtaining a copy of this publication, it turns out to be a simple list of names. As appears to be the case with the **entirety** of the *Echinopsis* names now assigned to the *Trichocereus* species, not a single reassignment included any description of any sort, even if they lacked a decent description to begin with.

Note 71: To honor Rose but mainly because *Cereus peruvianus* was a name already in use for *Piptanthocereus peruvianus* non *Cereus peruvianus* (L.) Mill. this was attempted to be renamed *Cereus Rosei* Werdermann in Backeberg 1931 *Neue Kakteeen* 73, 101 (This was given as as *Cereus roseanus* in Backeberg & Knuth 1935).

This needs to be viewed in light of the fact that Werdermann was attempting to reassign *Trichocereus* to the genus *Cereus*.

Note 72: While the difficulty of determining species from ceramic depictions should be stressed, an interesting picture said to be San Pedro can be seen on page 41 of Cané 1985: figure #3. (See our not-to-scale adaptation the next page.)

Due to the arching habit and pronounced spination I must wonder if what is shown may not have been *T. peruvianus*. For instance, consider the growth habit of *T. peruvianus* Peru 52.0762 or similar forms. [However, we have occasionally observed bent spines on cultivated *T. peruvianus* and *bridgesii*, but never on an entire plant.]



Drawing by Seler; from YÁCOVLEFF & HERRERA 1934

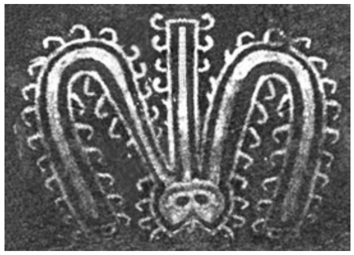
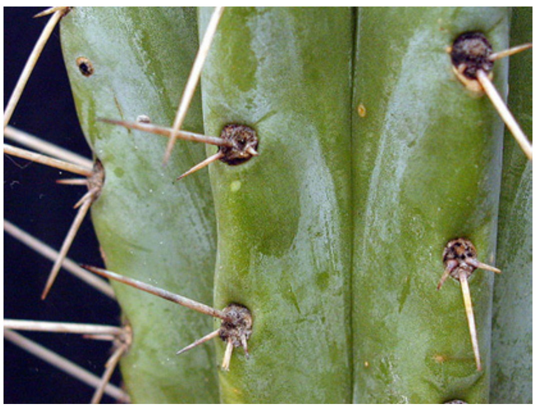


Image on right modified from Cane The uneven width of the central lines is an artifact of having been taken from the round using Photoshop.

The chronicler HOLGUÍN made reference to 'Ahuakolla' as a type of 'Gigantón' with large spines.

A Nazca depiction, Fig. f, on p. 321 of YÁCOVLEFF & HERRERA 1934, also suggests *T. peruvianus*.



***Trichocereus peruvianus* RS0003**

***Trichocereus peruvianus* Peru 52.0762**

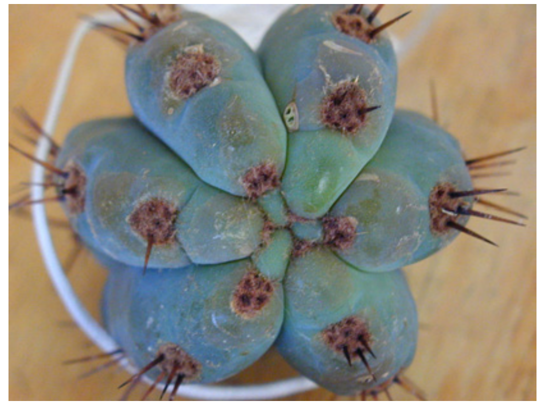
Ostolaza shows two pictures of Paracas deities; one with spiny snakelike imagery resembling the appearance and habit of *T. peruvianus* (see p. 107) and another suggestive of a cristate *pachanoi* (see p. 108).

Comments on a smooth cactus were made by several of the early invaders. YÁCOVLEFF & HERRERA 1934 show several figures which resemble *T. pachanoi.*

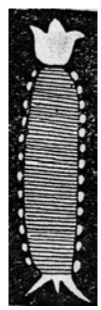
Note 73: ANDERSON 1998 notes them as clustering sparingly, also my experience in Texas, but this is highly variable as evidenced by the large clumps that can be encountered in cactus collections and landscapings in California and the wild.

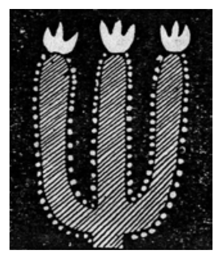
Note 74: As with *T. pachanoi*, rib numbers have been encountered violating the published descriptions.

The "*BROADLY rounded*" qualifier here is the easiest way to differentiate *T. peruvianus* from ANY of the *Cereus* species often confused with it. See photos on this page.

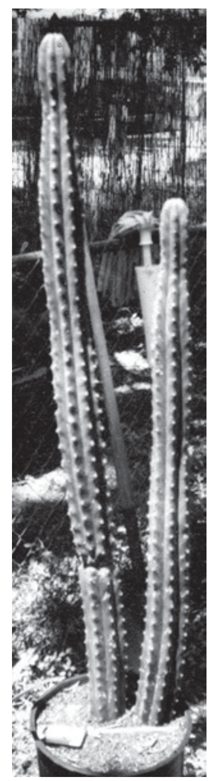


Uninvestigated cutting mislabeled as a *Cereus* species (Bancroft)





Drawings above by Seler; from YÁCOVLEFF & HERRERA 1934



Trichocereus pachanoi
Photo by Mark

Note 75: As does many examples of *T. bridgesii*, *T. macrogonus*, *T. pachanoi*, and numerous other *Trichocereus* species.

Note 76: Others have commented on what a dedicated and reliable cactus supplier he is.

My few dealings with Knize have been so peculiar as to have left me wondering if he is sane.

Note 77: This number is listed for plants sold as *T. pachanoi* North Peru or Ecuador (2 similar spiny wild forms) but I cannot determine if these are the same or if it's use was in error in this latter case. Regardless of where they end up, this form is reported to be as strong as normal *T. pachanoi*. [Note 78 was deleted.]

Note 79: This still lacks a published description according to personal communication with Dr. OSTOLAZA. He did write a proper description but it never saw publication.

***Trichoereus peruvianus* Peru 52.0762**

Note 80: This name was given in Hunt 2000 to bring it in line with the *Echinopsis/Trichocereus* merger.

According to personal communication from Roy Mottram, he had submitted a response to the David Hunt's "*Consensus Query*" stating this to be a good species and not synonymous with *pachanoi*. See Mottram 1997.

Note 81: The older sections on most of the NMCR material and the new tip growth on the Collectors Corner material was very dark green. The first produced new growth that was much lighter (indistinguishable from *T. pachanoi*). The second was said by Voogelbreinder to grow lighter in age.

Note 82: Jewel's and Jules' are said by growers to be the two most frequently encountered names on plant labels.

Note 83: Tom Juul's Giant: Information relayed by MS Smith in Dec. 1998. One of his correspondents had inquired of Myron Kimnach (at the Huntington) about a *Trichocereus* named 'Juel's Giant" or "Tom Jewel's Giant'.

Dr. Kimnach confessed to never having heard of the plant but went on to venture that he believed it must have been named for Tom Juul, a resident of San Francisco originally from Denmark. Tom Juul was one of the founders of the ISI before its association with the Huntington and a serious collector of cactus specimens and old cactus and succulent literature. (Died: 1980s) This provided us with the right information to start asking meaningful questions.

Note 84: In several specimens examined as commercial plants grown from seed collected at Villazon-Eschayachi, Bolivia.

This material had 8-9 ribs. The longest central was 38 mm. Both were probably around 2-3 years of age; body: ~7 cm tall and around 5 cm wide. Both still had juvenile globular form and had not yet begun to resemble the mature columnar specimens at Berkeley Botanical Gardens.

On one specimen, the felt started white and rapidly turned dark grey. On the other, it started out yellowish and soon went white; eventually grey.

Note 85:

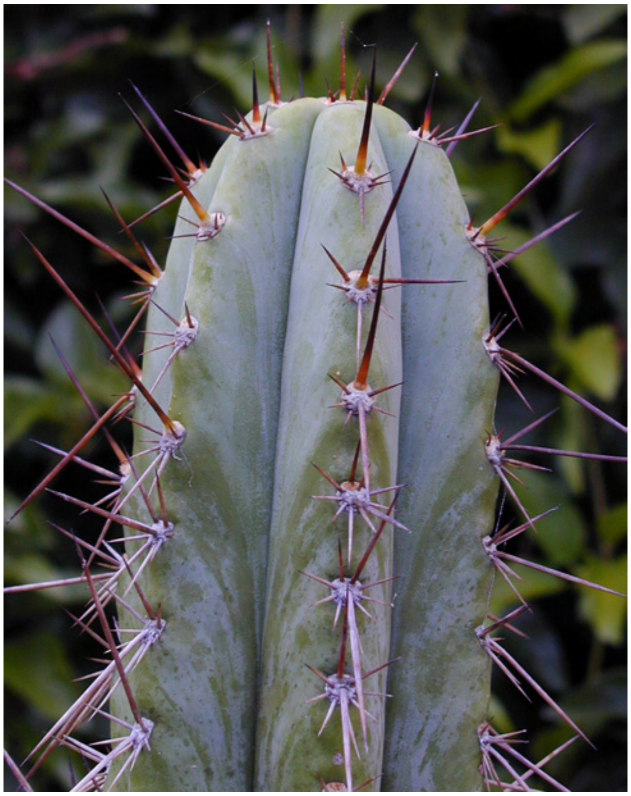
Described in 1837 as *Cereus terscheckii* Parmentier.
Has also been called:
Cereus fulvispinus Salm-Dyck
Pilocereus terscheckii Rümpler [in Förster 1885]

Note 86: Macromerine and normacromerine have been reported as potential exceptions but neither has seen pharmacological evaluation in humans, relying instead on extrapolations from animal studies and hyperbolic distortions in the lay press. Hopefully someone will eventually care enough to clarify this issue. See more detailed comments in any version of our work on cactus cultivation.

Note 87: This does not mean that they are absent from the tissues beneath the outer layer. The issue is simply one of the outer layers having a higher concentration meaning that less mass is required per given dose.

Note 88: This is in at least partial conflict with the results of other workers. See *Sacred Cacti* 3rd ed. Part A or *Sacred Cacti* 2nd ed or *Cactus Chemistry: By Species*.

***Trichocereus terscheckii* (Paul's Desert)**
Flowering photo by Dennis



sold as *Trichocereus peruvianus* (GB)
Same tip shown on page 161 but 3 months later

***Trichocereus rosei* (*AKA T. peruvianus*) (Australia)**
Photograph by Joylene Sutherland

Trichocereus taquimbalensis
M.Kimnach *etal* 2760B
[HBG 53086 BOL]
ISI 92-20
(SS)

***Trichocereus* sp. Peru 57.0884**

Comments towards unravaged gardens

We would like to think that this would be unnecessary but apparently comment is warranted.

Please note photos on page 90 and consider the struggle of that poor little San Pedro. This should be a nice specimen rather than a meager stubby thing. Take a careful look and ponder upon the extent of harvesting from the plants pictured in photos taken at botanical gardens. [For example, see pages 17, 31, 32, 64, 187, 142, 147, 148, 151, 185, 187 & 266]

We would like to urge any person who takes cuttings from botanical gardens or takes their seeds for obtaining specimens for their own collection to stop doing so and figure out some alternative.

It is in fact true that pieces of viable tissue go to rot in botanical gardens and that many times their *Trichocereus* seeds are not collected and go to waste.

This is not always the case, many botanical gardens collect and trade seeds they have for seeds they want. A similar picture exists for the living biomass in their possession. In a disturbing number of such arrangements, when harvest season rolls around no seed is available for trading due to thievery.

There are many other reasons why it is important not to steal from botanical gardens.

1) In the event that the law changes and any of the *Trichocereus* species become a Schedule 1 controlled substance, these will be among the few places left in this country with a chance of retaining their specimens for future generations once sanity has returned.

2) It is stealing. No matter how it gets justified it is stealing a living resource that belongs in part to the whole public. (It is similar to stealing library books or their pages rather than using a photocopy machine or locating a copy for sale.)

3) MANY times that cuttings are taken it is at a bad time of year, in the wrong weather, with ill-timing with regards to the garden's watering schedule, or without appropriate tools. Look at the photo below; it looks like the column was just broken off and carried away without any concern for the mother.

Broken or hacked-off cuttings can permit assorted types of rot or insects to enter the plant, often disfiguring and sometimes even killing the mutilated mother plant.

4) Almost all botanical gardens have plant shops and/or annual plant sales. Most if not all of the plants that people want usually end up there at some point; assuming the plant's available growth permits it and was not defeated by thieves.

5) Most of these or their equivalent can be easily procured through legitimate plant sellers.

6) They grow easily and rapidly in most cases.

7) Besides, in the case of the *Trichocereus* species, most seeds will be hybrids between the mother and whatever was flowering near it. If self fertilized, nonviable seed is the norm. One friend told us that their deliberate attempts to get Backeberg's clone to form seed resulted in less than one ripe fruit per thousand hand pollinated flowers.

8) Botanical gardens are not simply collections of plants. They are home to many types of research and study activities.

We would like to suggest that when anyone learns of a stolen origin for other people's plants, be it from a botanical garden or a park, that they give them a hard time about it.

It was a growing lack of toleration for this sort of irresponsible action, on the part of the plant collecting community, that was the primary driving force in both the decrease of popularity for field collected plants and the growing embarrassment to possess a plant procured by raping the wild populations and stripping them of sometimes ancient plants.

Twenty years ago these were shown by their owners with pride; now it is most often with apologies for owning them.

This change of consciousness has not occurred in some countries or for some people within this country.

We would suggest asking for seed that is obviously unwanted and being wasted, or for salvage permission for some scrap of nearly dead tissue. We know it can be heartbreaking to watch plants and seeds rot due to neglect.

We would suggest that an offer be made to pay for the time of their staff or the material itself.

However, I have heard horror stories where well intentioned people who would never steal were honest enough to approach the garden staff to ask about obtaining permission to procure one of many of clearly rotting cactus seedpods. Instead of being heard, there were rude accusation of being a plant thief; in one case including a demand never to return to that garden.

Thieves steal plants. They generally do not ask permission.

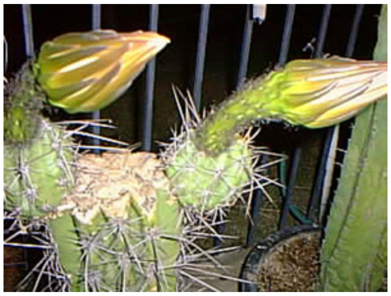
Creating acceptable means for procuring excess seed might go far towards reducing the numbers of people who steal them. People who take cuttings are another story. We doubt anything would impact the behavior of some people.

It has been mentioned botanical gardens are not commercial operations; yet they often charge admission, normally have some level of plant sales, if not an actual plant store, and ask for memberships or donations to help offset their operating costs. Surely, any excess seed waste would be better utilized if somehow harnessed towards fulfilling their needs?

Cactus collectors and growers have long been an important part of cactus conservation and species protection efforts. This is a serious and complex issue that the cooperation of everyone involved will be required to solve.

***Trichocereus* sp. Peru 57.0884**

Trichocereus scopulicola
(Oz)



Trichocereus werdermannianus

variegated
Trichocereus pachanoi

Trichocereus peruvianoid

Trichocereus pachanoid

Trichocereus peruvianus

short-spined
Trichocereus peruvianus

Photos above & lower left
by Eric Carso

sold mislabeled as
Trichocereus macrogonus
(Gillette)
See flower photo in Part A

Unlabeled *Trichocereus* (this appears to be *T. scopulicola*)
(Australia)
Photograph by Joylene Sutherland

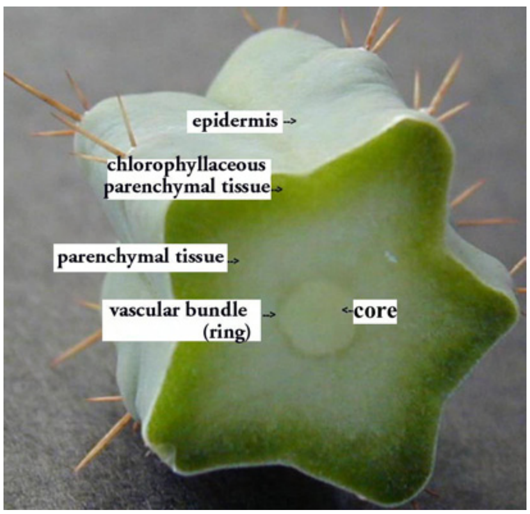
Distribution of alkaloids within cacti

Surprisingly there has been very little serious work published on this topic.

Alkaloids in *pellote* were reported by Janot & Bernier 1933 to be almost exclusively in the internal cells of the cortical parenchyma at top of plant.

In *Trichocereus candicans* alkaloids were found by Niedfeld to be mainly in the chlorophyllaceous cortical parenchyma. (Niedfeld used microchemical methods to determine this) Reti 1950 cited Niedfeld 1931.

In *T. terscheckii*; alkaloids are primarily in the parenchymal tissues, 29% were found to be in the green epidermis (dry), while the central parts (dry) including cortical parenchyma contained 45% of the total alkaloid content [please note that this included the vast majority of the parenchymal tissues and the total weight of that portion of the plant is much higher than that of the green epidermis. This indicates a lower concentration for the central parts than in the green portion but potentially useful concentrations nonetheless.] Reti & Castrillón 1951



Anderson cited Todd 1969 as finding little difference [qualitative] between the alkaloids of root and top in peyote except for hordenine which was only present in the root **[Note 87]**. While true in most aspects, this is a little misleading as concentrations in the roots are far lower than in the tops. Please see more details under the *Lophophora williamsii* entry. [In ***Sacred Cacti* 3rd ed. Part A** or in ***Sacred Cacti* 2nd ed**.]

This is also in at least partial conflict with the reports of other workers.

Todd collected his samples during June. Curiously, lophophorine was apparently observed as the major alkaloid in *L. williamsii*. [See also comments on the seasonal fluctuations of alkaloids in peyote.]

Guttierrez-Noriega 1950 (citing Cruz Sánchez 1948) claimed that the alkaloids are primarily in the "bark" of *T. pachanoi*. His word, *corteza*, translated in the English summary as *bark*, also means 'cortex' or 'skin' in Spanish.

Apparently Cruz Sanchez worked with the outer layer due to the slime resulting from use of the whole stem interfering with his extraction procedure. He reported 5% in the dried outer layer.

Parenchymal tissues are highly specialized thin-walled storage cells that exist within in the thick outer layer on the plant. They are the site of many metabolic processes and also store such things as water, calcium oxalate crystals and often alkaloids. Calcium oxalate crystals are said to be stored in abundance in some peyote specimens.

As far as I can determine, the parenchymal tissues extend from near the skin to the vascular bundle; including most of the tissues other than vascular, structural or connective.

Cortical parenchymal tissues are those towards the outside. Chlorophyllaceous just means that they have chlorophyll (are green.)

Obviously, when a peyote button is sliced into two horizontal portions, they will be slightly more prevalent in the top half of the button than the bottom half of the above ground portion due to the relative percentage of tissue which is occupied by the central vascular tissues and by the outer layer. Published analytical work reflects this (see under *Lophophora williamsii* chemistry.)

A similar picture was reported for triterpene glycoside distribution within the flesh of the organ pipe cactus *Lemaireocereus thurberi*.

Tissue	**% of total Methanol soluble product**
Epidermis	4
Photosynthetic layer	42
Transition zone	28
Cortex	12
Pith	10
Wood	3

From Kircher 1972

Since there is considerably more weight to the central parts than the green portion, Reti & Castrillón 1951 gives some support to the idea that the highest mescaline concentration is on the green periphery of the plant.

"*Less*" does not mean that there is no alkaloid in the whitish tissues beneath it. All evidence suggests that there is ample alkaloid contained in these parts. It is also likely there is even less in the central vascular bundle and core itself.

Another interesting result was noted among Smolenski and coworker's multitude of general alkaloid screenings. When testing *Pachycereus pecten-aboriginum* they reported **Roots: ++**, **Stems: –** and **Ribs: +++.** As slicing off the ribs would remove most of the cortical tissues this is in line with the above observations. Their account provides no further information on tissues evaluated (samples provided to them as a previously prepared extract).

There is additional support for this; Djerassi *et al.* 1953b determined that the majority of the alkaloid content in *Lophocereus schottii* was in the green epidermis (6.7% crude alkaloid); only a minor portion in the cortex (1.1% crude alkaloid) and almost no alkaloid in the core & pith (0.2% crude alkaloid).

By *cortex* Djerassi means the epidermis, by *green epidermis* Djerassi refers to the chlorophyllaceous parenchyma. Djerassi was a natural products chemist not a botanist.

The casual and nonconsistent use of the words *epidermis* and *cortex* has caused confusion for many readers who did not stop and ask what was being actually meant by the user of those particular words and instead translated them based on what they themselves would have meant by those words.]

This area needs further work. While many alkaloids may indeed be higher towards the outside of the plant there are known exceptions. Hordenine being observed in the root rather than the top (in peyote) is a good example. Its highest concentrations being in the root was reported again in *Mammillaria microcarpa* by Knox and coworkers.

It is noteworthy also that **all** of the alkaloids measured by Knox were much higher in the cortex itself as compared to the chlorophyll rich tubercles and several were higher in the vascular tissues than in the tubercles.

We were informed by an *Entheogen Review* reader that they had found an unspecified amount of the cores of San Pedro to be active but they provided inadequate information for us to understand HOW they actually determined this or how much they observed.

This should not be any surprise should a person ingest a large enough amount.

Pummangura *et al*. 1982 reported that mescaline did not transmigrate between grafted *T. pachanoi* and *T. spachianus* regardless of which was used as stock and scion. Their conclusion was that mescaline was locally produced and noncirculating.

While it may or may not be true that transmigration of alkaloids does not occur, Siniscalco 1983 reported that the normally mescaline-free *Myrtillocactus geometrizans* was found to contain 0.3% mescaline by dry weight after having previously been grafted with *Lophophora williamsii*.

Many questions immediately arise.

None are presently answered.

***Trichocereus scopulicola* FR991**
(NMCR)
from Ritter's seed

It is almost unbelievable that no one has looked into the matter of alkaloid distribution within cacti more thoroughly.

A flowering *Trichocereus peruvianus* KK242
Photo by Flip

Notice how the flower is at least suggestive of hybridization in this particular KK242.

Trichocereus pachanoi
Variant growth

In an e-mail we received in 2004, Karel Knize commented "*Some flowers are used (cont ca 4%) plant itself 2-3.5%*" "*the strongest type are 9-12 ribs or 3-4 ribs*"

He did not elaborate further.

In recent years, friends experimenting with the ingestion of aborted flower biomass (including the green ovary) from *peruvianoids* and *terscheckii* have reported excellent results.

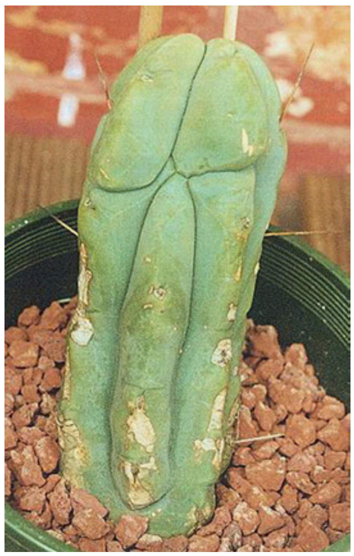
The reported distribution of mescaline containing species within the family Cactaceae

Nonbold face type for a specific name indicates it is not considered to be an accepted name

If following Friedrich & associates reassignment of the genus to *Echinopsis*, the former *Trichocereus* species would fall into what is below listed as the subtribe Echinocactinae rather than Cereinae (along with the only other known high mescaline producer.)

Bear in mind of course that the designations for many levels of taxa will also be changed.

Family: **Cactaceae**
Subfamily: **Cereoideae**
Tribe **Pereskieae**-
Pereskia corrugata
Pereskia tampicana
Tribe **Opuntieae**-
Pereskiopsis scandens
subtribe **Cylindropuntia**
Opuntia acanthocarpa
Opuntia echinocarpa
Opuntia imbricata
Opuntia spinosior
subtribe **Opuntia**
Opuntia basilaris
Opuntia ficus-indica
Tribe **Cacteae**-
subtribe **Cactinae**
Pelecyphora aselliformis
subtribe **Cereinae**
Polaskia chende
Pterocereus gaumeri
Stenocereus beneckei
Stenocereus eruca
Stenocereus stellatus
Stenocereus treleasei
Stetsonia coryne
Trichocereus bridgesii***(all forms*)
Trichocereus bridgesii f. monstrosus*
Trichocereus cuzcoensis***
Trichocereus fulvilanus
*Trichocereus huanucoensis**
Trichocereus macrogonus***
Trichocereus pachanoi***
Trichocereus pachanoi f. monstrosus*
Trichocereus pallarensis*
Trichocereus peruvianus***
Trichocereus peruvianus f. monstrosus*
Trichocereus puquiensis
Trichocereus puquiensis f. monstrosus*
Trichocereus santaensis*
Trichocereus scopulicola *
Trichocereus sp. W.Baker 5452**
Trichocereus cv. SS01, SS02, SS03*
Trichocereus cv. TJG*
Trichocereus sp. Torres & Torres: N. Chile*
Trichocereus cv. "Unknown C"*
*Trichocereus sp. aff. huanucoensis**
Trichocereus strigosus



monstrose *Trichocereus bridgesii* (Australia)
Photo by Snu Voogelbreinder

Trichocereus taquimbalensis
Trichocereus terscheckii***
Trichocereus thelegonoides
Trichocereus uyupampensis * (Note added in 2006)
Trichocereus validus
Trichocereus vollianus
Trichocereus werdermannianus***
subtribe **Echinocactinae**
Aztekium ritteri
Gymnocalycium achirasense
Gymnocalycium asterium
Gymnocalycium baldianum
Gymnocalycium calochlorum
Gymnocalycium carminanthum
Gymnocalycium comarapense
Gymnocalycium denudatum
Gymnocalycium gibbosum
Gymnocalycium horridispinum
Gymnocalycium leeanum
Gymnocalycium mesopotamicum
Gymnocalycium monvillei
Gymnocalycium moserianum
Gymnocalycium netrelianum
Gymnocalycium nigriareolatum
Gymnocalycium oenanthemum
Gymnocalycium paraguayense
Gymnocalycium quehlianum
Gymnocalycium ragonesii
Gymnocalycium riograndense
Gymnocalycium stellatum
Gymnocalycium striglianum
Gymnocalycium triacanthum
Gymnocalycium uebelmannianum
Gymnocalycium valnicekianum
Gymnocalycium vatteri
Islaya minor
Lophophora diffusa *** (but not usual case)
Lophophora fricii ***
Lophophora jourdaniana ***
Lophophora koehresii
Lophophora williamsii***
Lophophora williamsii var. *echinata**
Turbinicarpus lophophoroides
Turbinicarpus pseudomacrochele* var. *krainzianus
Turbinicarpus schmiedickianus* var. *flaviflorus
Turbinicarpus schmiedickianus* var. *schwarzii

Please note that this system of organization is not accepted by all authorities.

Most of the species listed contain only trace amounts.

Species marked * lack formally published analytical work but have successful human bioassays reported.

Species marked ** have unpublished analytical work confirming mescaline's presence as well as successful human bioassays reported.

Species marked *** have both published analytical work & successful human bioassays reported.

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Trichocereus peruvianus

(fruit interior: sliced lengthwise)

Index

bold italic page numbers denote a photo or an illustration

Symbols

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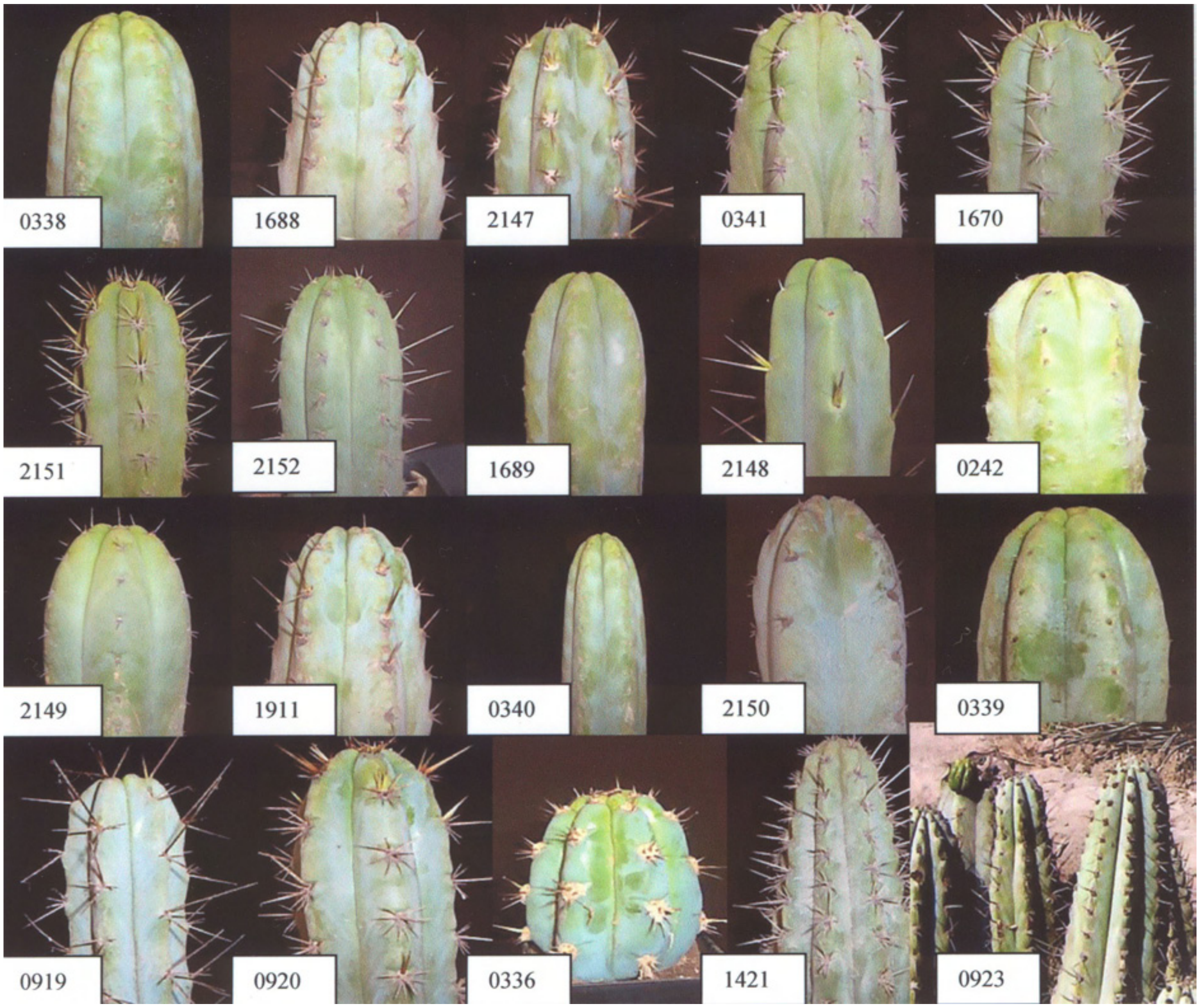
cultivated under the name *Trichocereus pachanoi* spiny wild type North Peru (Knize seed distributed by JLH & grown by SS)

More illustrations

This page was e-mailed to us in 2004 by Karel Knize. It is reproduced here with his permission.



242	Trichocereus	peruvianus Br& R.	Matucana,2000m	Pe
336	Trichocereus	glaucus Ritt.	Arequipa,Rio Tambo,1500m	Pe
338	Trichocereus	peruvianus Br& R.	Huancayo,3000m	Pe
339	Trichocereus	pachanoi Br.& R.	Huigra,Chanchan,2000m	Ec
340	Trichocereus	cuscoensis Br.& R.	Cusco,Huachac,3200m	Pe
341	Trichocereus	uyumampensis Backbg.	Cusco,Uyupampa,2500m	Pe
919	Trichocereus	bridgesii (SD) Br.& R.	La Paz,Rio Abajo,2900m	Bo
920	Trichocereus	bridgesii (SD) Br.& R.	La Paz,Rio Abajo,2900m	Bo
923	Trichocereus	macrogonus (SD) Ricc.	Cieneguillas,3000m	Bo
1421	Trichocereus	cephalomacrostibas (Werd.&Ba)B	Matarani,300m	Pe
1670	Trichocereus	longispinus Ritt.	Cusco,Pisac,2800m	Pe
1688	Trichocereus	peruvianus Br& R.	Ancash,San Marcos,2200m	Pe
1689	Trichocereus	peruvianus v.puquiensis Ra &Ba	Puquio,2800m	Pe
1911	Trichocereus	knuthianus Backbg.	Rio Marañon,Llamelin,1800m	Pe
2147	Trichocereus	peruvianus Br.& R.	Rio Lurin,2500m	Pe
2148	Trichocereus	peruvianus v.tarmensis Backbg.	Tarma,3000m	Pe
2149	Trichocereus	rubriflorus Knize n.n.	Cusco,Paucartambo,1600m	Pe
2150	Trichocereus	pachanoi Br & R.	Ayabaca,2000m	Pe
2151	Trichocereus	peruvianus Br.& R.	Ayacucho,2600m	Pe
2152	Trichocereus	peruvianus Br.& R.	Huaraz,2800m	Pe

Trichocereus bridgesii **seedling (Italy)**
Photo by Bobby Brown

monstrose ***Trichocereus bridgesii***

Comments on Knize's photo page

Note how many of Knize's *Trichocereus* examples suggest local hybridization with *T. pachanoi.* For examples:
Trichocereus cuzcoensis KK340*
Trichocereus peruvianus KK338*
Trichocereus peruvianus KK242
Trichocereus puquiensis KK1689
Trichocereus tarmaensis KK2148
Trichocereus rubriflorus KK2149
Trichocereus peruvianus KK2152

So far as we have been able to determine, *Trichocereus longispinus* was neither described nor mentioned anywhere in print by Ritter. See image & comments on pages 194 & 257 (Note 11)

Photos of KK1688 and KK1911 appear to be identical.

*The images of KK338 & KK340 also are of a single tip although one was resized and stretched.

Compare these photos to other photos of Knize-sourced plants elsewhere in this work.

Our requests for further clarification on these and other points were unanswered.

bridgesioid **sp. SS02**
Photo by Anonymous

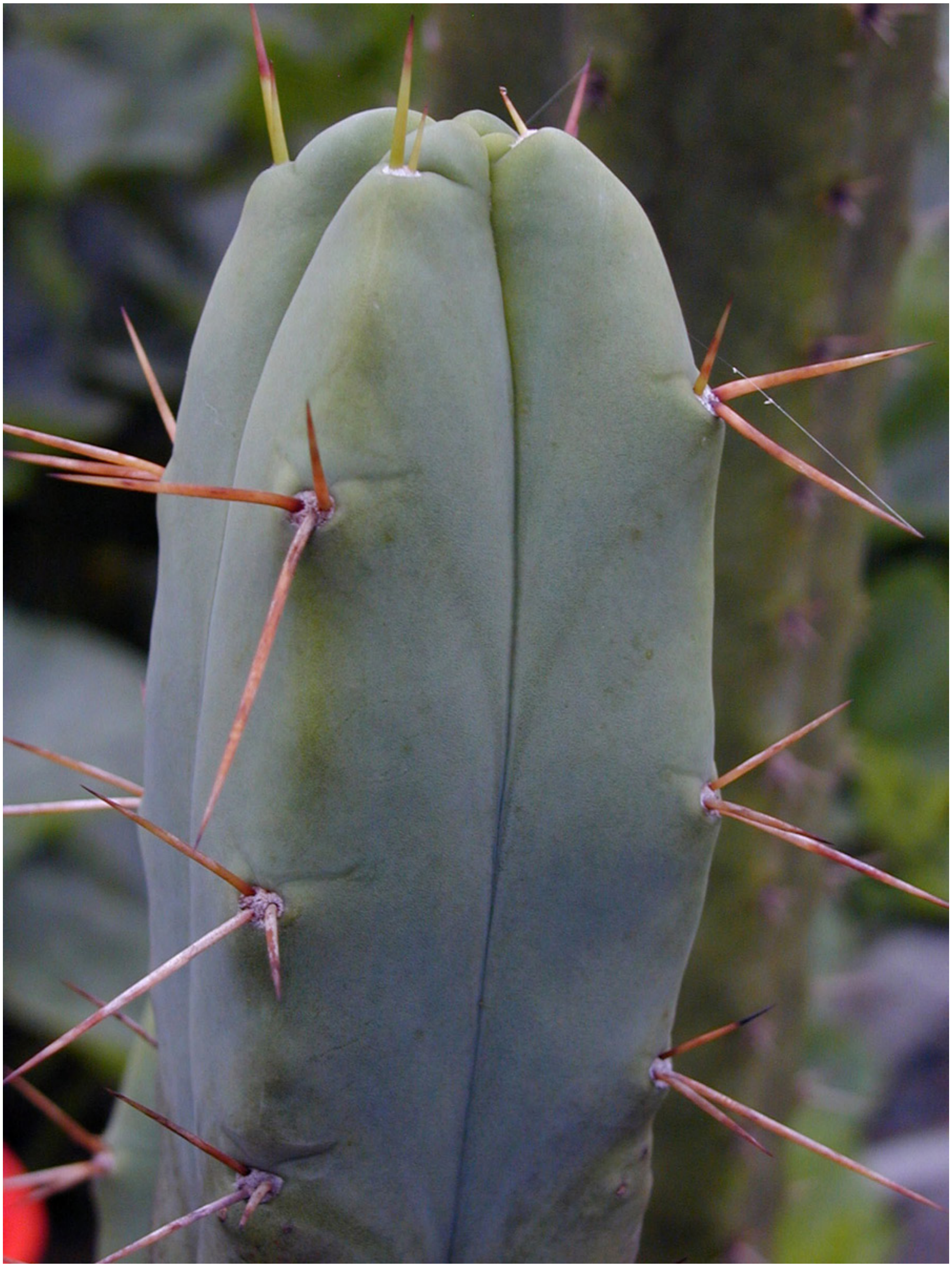
monstrose *Trichocereus bridgesii* (Germany)
(labeled *Trichocereus bridgesii* var. *inermis*)
Photo above by Patrick Noll

unlabeled *Trichocereus bridgesii* cutting from Knize
upper left

pachanoid-peruvianoids
lot of cuttings fresh from Knize
notice the percentage that have labels

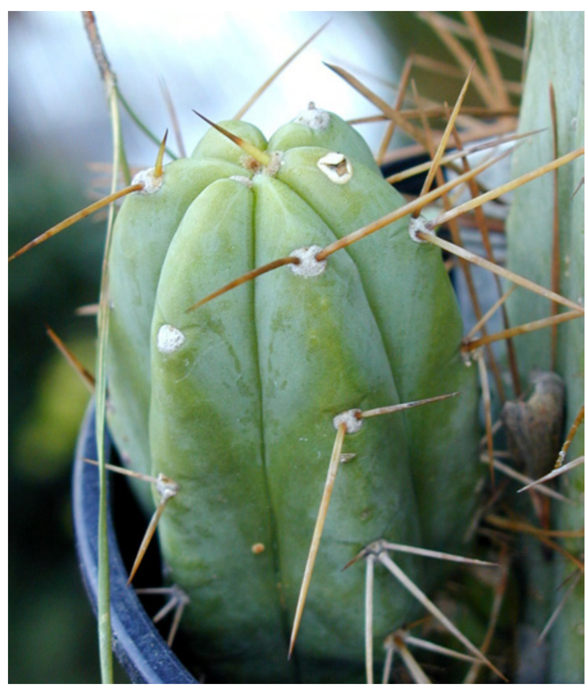
Trichocereus bridgesii **KK919**
Grown from Knize seed

Trichocereus bridgesii **KK919**
Grown from Knize seed
Lower on the same plant shown on the previous page



Trichocereus bridgesii **(Oz)**

Trichocereus bridgesii **Bolivia 53.0162**
above



bridgesioid **sp. SS02**
lower left

Trichocereus bridgesii **RS0005**
lower right

Trichocereus bridgesii
Bolivia 53.0162

Trichocereus bridgesii
monstrose
(FK)

Trichocereus bridgesii **cv. Magnus**
above & left

T. pachanoi **X** ***Echinopsis eyriesii***
Photo by Murple
lower right

Trichocereus bridgesii
2 forms that Murple
wild collected in Bolivia
Parque de la coca, La Paz
upper left & 2 cuttings in the front on the lower right

***Trichocereus* sp.**
BBG 64.0762
Back column

***Trichocereus macrogonus* cv. RSfat4**

Top & right photos are by Murple and were taken from www murple net. Reproduced with permission

cristate *Trichocereus bridgesii*
Photo by Murple

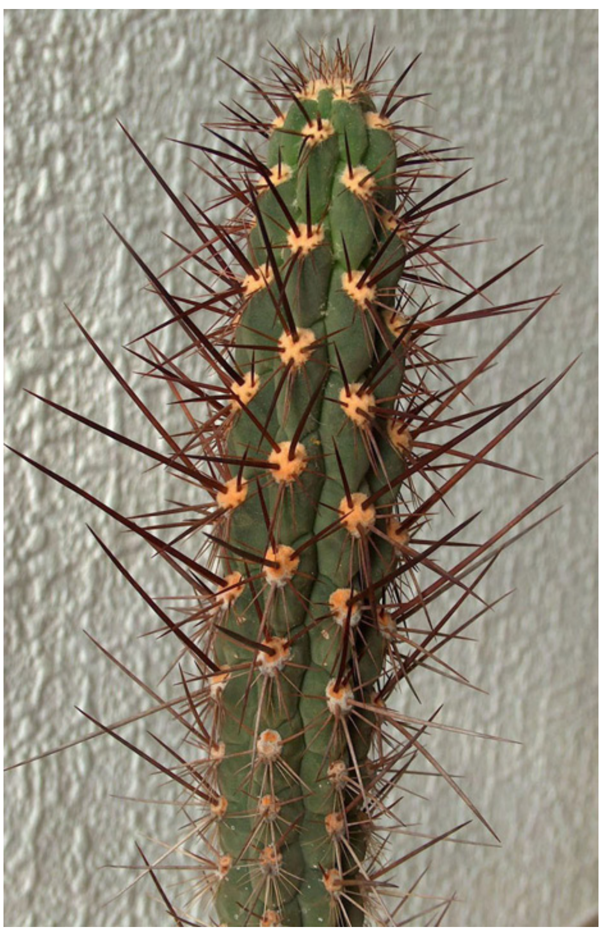
***Trichocereus werdermannianus* Bolivia 50.1998**

Trichocereus pachanoi* sold as *Trichocereus peruvianus
A Kaiserwerth clone collected in Peru
In cultivation in Germany
Photo by Patrick Noll

Trichocereus bridgesii
monstrose form; pup showing tiny leaves

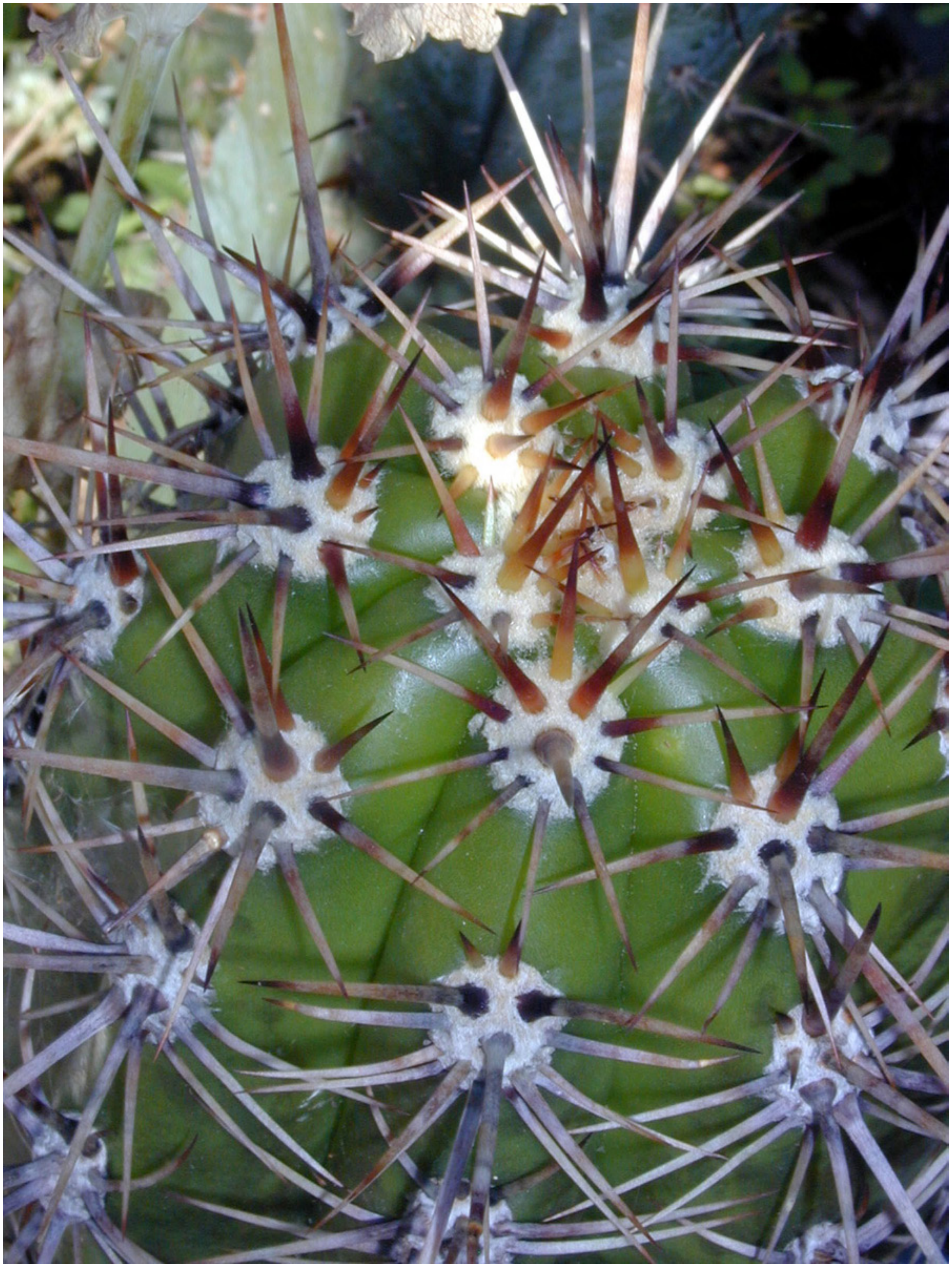
Trichocereus cuzcoensis

Trichocereus cuzcoensis
(BBG)



Trichocereus deserticolus
(Germany)
Photos by Patrick Noll

Trichocereus deserticolus **GC 299.04**
at 600m above Paposo, Chile
Photo by Graham Charles



Trichocereus escayacensis **(SS)**

Jim Daniel with
***Trichocereus* cv. Juul's Giant**
Photo courtesy of Jim Daniel

***Trichocereus escayacensis* (SS)**

***Trichocereus fulvilanus* (Huntington)**

Trichocereus huanucoensis **HBG 18562**
Collected in Peru by Harry S. Johnson, Sr. during the 1950s.
From the same lot of seeds as Peru 56.1153.

An intermediate thought to be *Trichocereus bridgesiiXhuanucoensis*

Potentially another monstrose *bridgesii* clone.
(Seedling arising from a lot of KK *bridgesii* seeds in Oz)

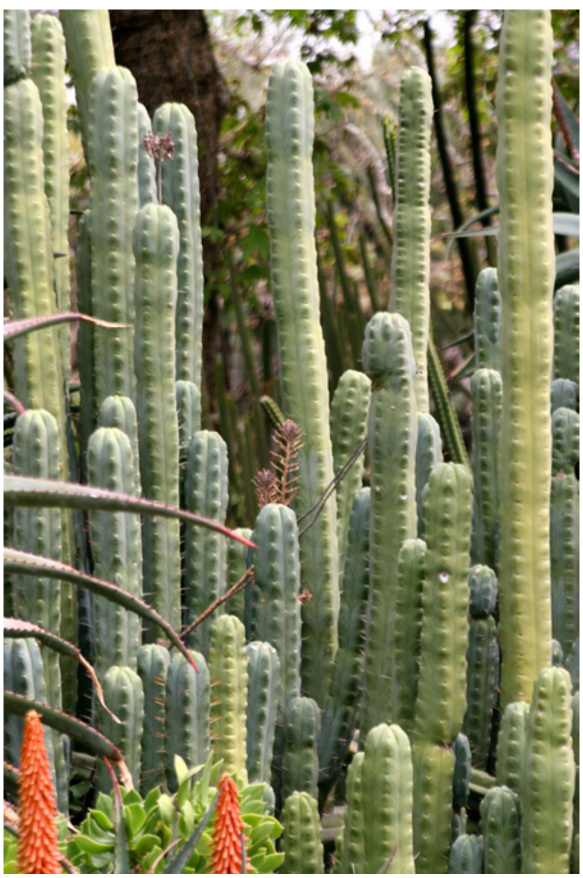
Trichocereus macrogonus
(Huntingon)
above & lower right

Spontaneous mutants like the one on the left are often slow growing and rot prone when they are first getting established.

It is a common practice for them to be grafted in order to get them over the hump of their first several years of life.

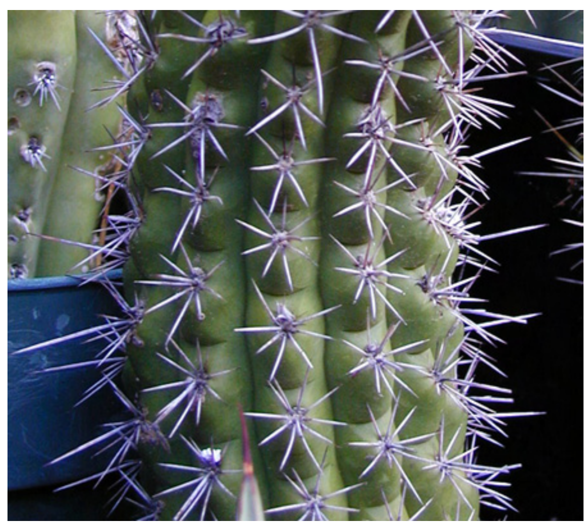
Trichocereus macrogonus
grown from European seed
Photo by Patrick Noll

Trichocereus macrogonus **grown from European seed**



Trichocereus **aff.** ***bridgesii***
(Huntington)

Trichocereus bridgesii **Bolivia 53.0162**



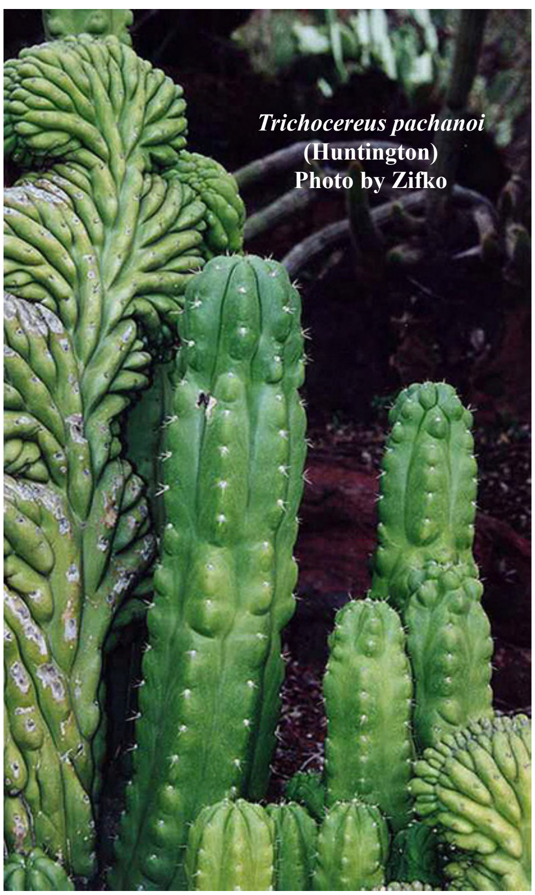
sold mislabeled as *Trichocereus macrogonus*
(Gillette)

Trichocereus pachanoi **(SS)**

Trichocereus pachanoi **(SS)**

Another *Trichocereus pachanoi* from Ecuador
(Huntington)

cristate *Trichocereus pachanoi*
Photo by Murple



Trichocereus pachanoi
(Huntington)
Photo by Zifko

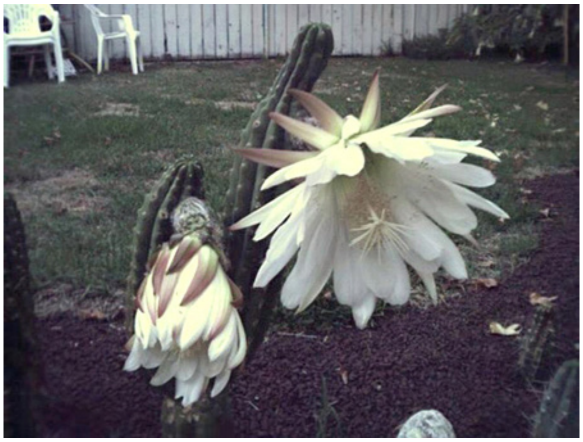
Trichocereus pachanoid
(Australia)
Photo by Zariat
lower right

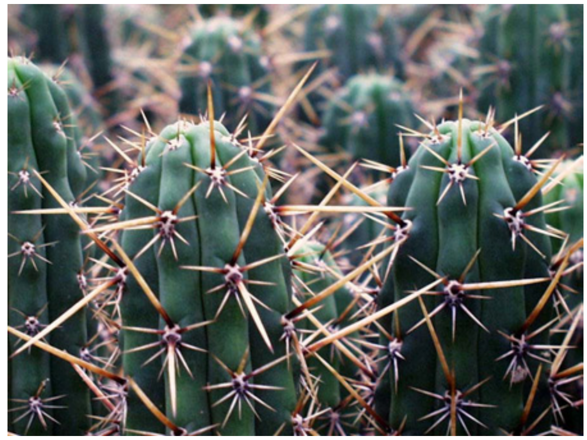
Trichocereus pachanoi **flowering in a Peruvian shaman's garden**
Photos copyright 2006 by Geneva photography
Reproduced with permission

Trichocereus pachanoi **flowering in a Peruvian shaman's garden**
Photos copyright 2006 by Geneva photography
Reproduced with permission

Trichocereus pachanoi **(Australia)**
Photo by Zariat

Trichocereus peruvianus **(GF)**





Trichocereus pachanoi
Photo by Zifko

Trichocereus peruvianus
Photo on upper right provided by Basement Shaman

Trichocereus pachanoi **KK339**
new growth
center right

Trichocereus cv. **SS02**
bottom right
notice the tiny leaf

Trichocereus pachanoi **cv. 'Contorta'**
Photo above by Eel

Trichocereus peruvianus **(Huntington)**

Trichocereus pachanoi
Collected in Ecuador in the late 1930's; now growing in Oz

Trichocereus pachanoi **from Ecuador**
(Australia)

spiny *Trichocereus pachanoid* flowering in Oz

Photo by Anonymous

Photo by Anonymous

Trichocereus pachanoi from Matucana, Peru

Trichocereus pachanoi from Ecuador (Oz)

spiny *Trichocereus pachanoid* in Oz flowering

Trichocereus pachanoi
HBG 53196
Collected in Bolivia by M. Kimnach

cultivated under the name *Trichocereus pachanoi* spiny wild type North Peru
(Knize seed distributed by JLH & grown by SS)

cultivated under the name *Trichocereus pachanoi* spiny wild type North Peru (Knize seed distributed by JLH & grown by SS)

Trichocereus pallarensis (BBG)

Trichocereus pachanoi (HBG)

***Trichocereus pallarensis* (BBG)**
from Ritter's seed

Trichocereus pallarensis **(BBG)**
from Ritter's seed

***Trichocereus peruvianus* KK242**

Photos above by Anonymous. Details of plant shown on page 337; see comments on pages 169-173

***Trichocereus peruvianus* (BH) (below)**
~24 months after photo on page 156

Trichocereus peruvianus **Peru 48.1540**
(BBG)


Trichocereus peruvianus
(HBG)
erect form

Trichocereus peruvianus
(HBG)
semierect/decumbent form

Trichocereus peruvianus **KK242 Photo by Anonymous**
Plant obtained from Knize as cutting approximately 10 years prior to this photo.

Trichocereus peruvianus
in habitat: Omas valley, near Pedro de Pilas, Peru, 2000m
Photo by Graham Charles

Trichocereus peruvianus
grown from seed in Oz

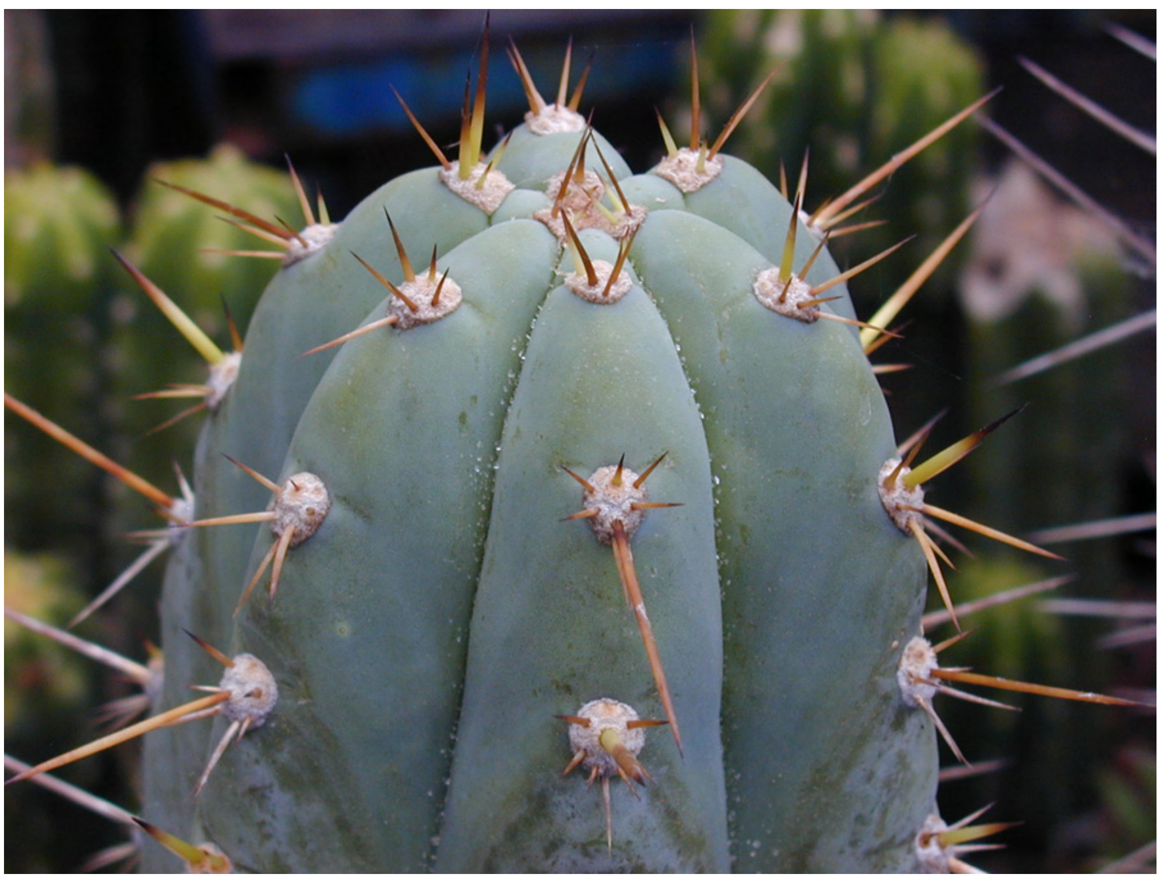
Trichocereus peruvianus
grown from seed in Oz

***Trichocereus peruvianus* (GF)**

Trichocereus peruvianus
(GF)

Trichocereus peruvianus
seed grown in Oz

Trichocereus peruvianus **(Eltzner)**



Grown from Knize-seed labeled *Trichocereus pachanoi.*

Trichocereus puquiensis **Peru 60.1135**
(BBG)

Trichocereus riomizquiensis
(NMCR)
grown from Ritter seed

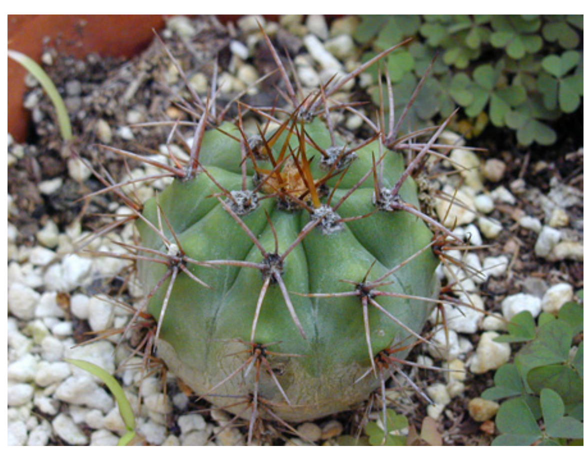
Trichocereus santaensis
(Huntington)

Trichocereus santaensis **OST 92701**
(SS via MG)

Trichocereus santaensis **H76747**
(Huntington)
above

Trichocereus terscheckii
(Germany)
Photo by Patrick Noll
seedling below left

Trichocereus terscheckii **DF**
Quebrada del Toro
(Mesa Garden)
seedling below right



Unidentified *Trichocereus* species
Possibly a form of *santaensis* or hybrid?
(FK)

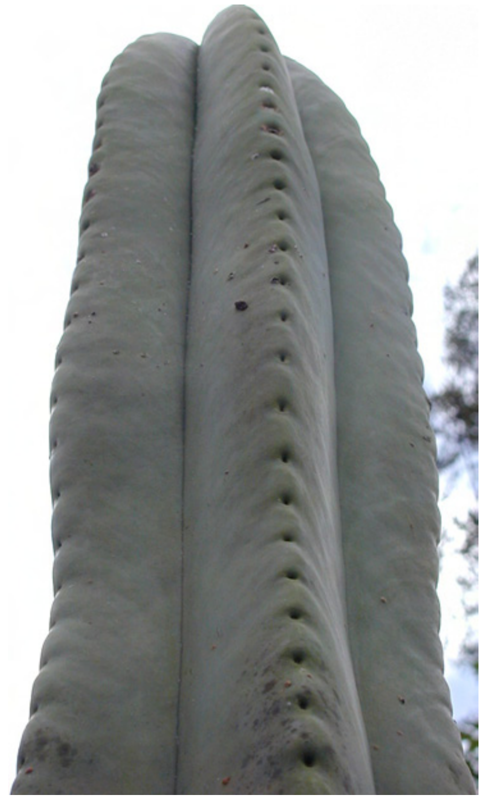
Everything on this page is one plant.

Photo above by Anonymous

Compared to *T. pachanoi*; *T. scopulicola* is the tall column second from the left

***Trichocereus scopulicola* entire page**

Trichocereus **sp. Hutchison *et al*. 6212**
[Peru 64.0762]
Huamachuco Prov., La Libertad Dept., Peru

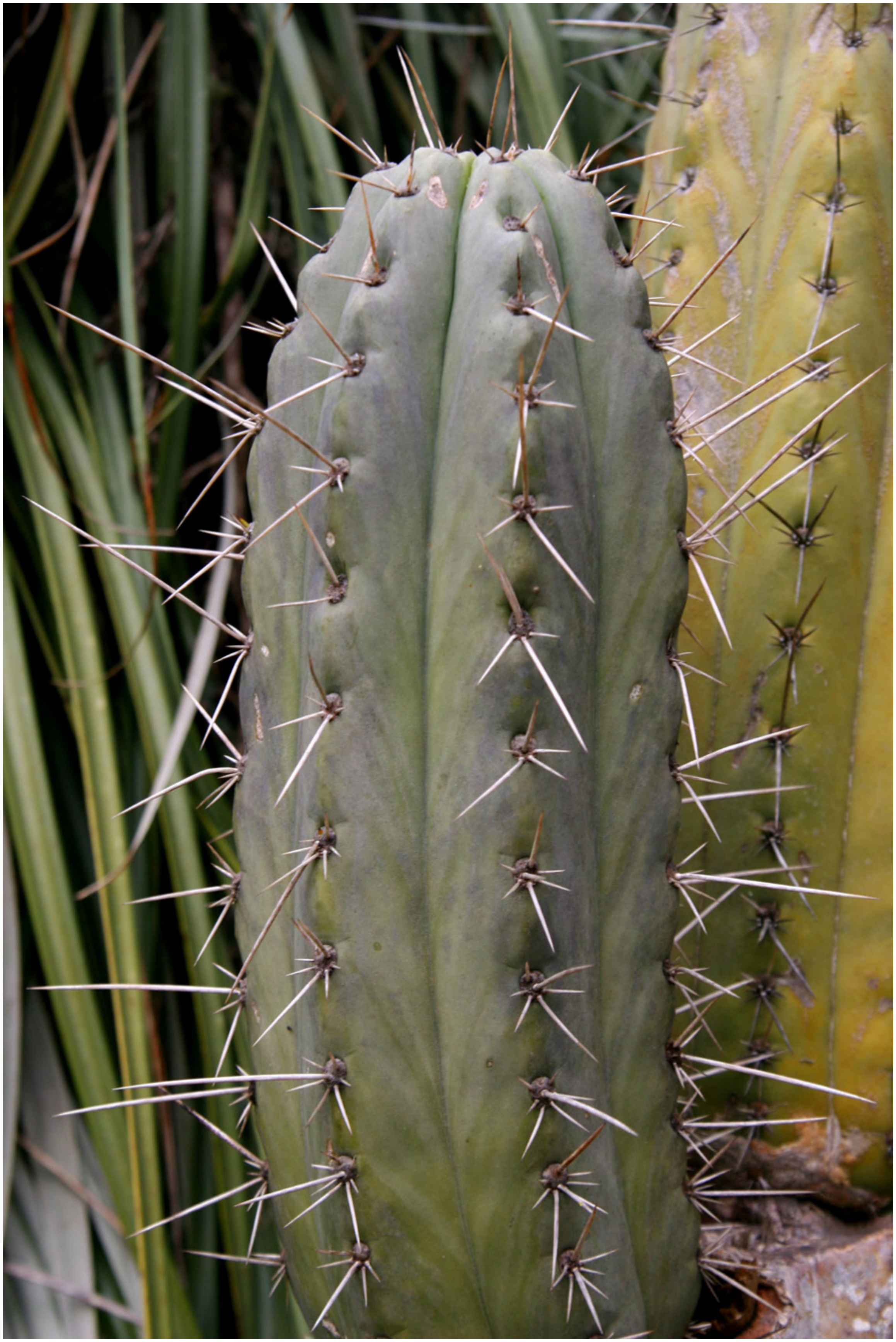


Trichocereus scopulicola **(Oz)**
above

Trichocereus **sp. Hutchison & Wright 3427**
[AKA Peru 65.0715]
below right
Photo by Geoffrey

Trichocereus **sp. Hutchison** ***et al*****. 6212**
[Peru 64.0762]
Huamachuco Prov., La Libertad Dept., Peru

Opuntia cylindrica **(Strybig)**



***Trichocereus* sp. Hutchison & Wright 3427 [AKA Peru 65.0715]**
Known locally as "*San Pedro*" (Collected 15 km E of Olmos, Lambayeque Prov., Peru)

***Trichocereus* sp. SS01**

***Trichocereus bridgesioid* cv. SS02**

***Trichocereus bridgesioid* cv. SS02**
can also be spiny, even on the same column.

Trichocereus cv. **Tom Juul's GiantX*peruvianus* (otj)**

Trichocereus cv. **Tom Juul's GiantX*peruvianus* (otj)**
Two variants from the same lot of F1 seeds
Three photos above and left by Anonymous

Trichocereus peruvianus **fruit**
lower right

***Trichocereus* sp. SS03**

Trichocereus terscheckii (DTT)

Trichocereus sp. Peru 64.0762
See comments on page 231

Trichocereus cv Juul's Giant (A)
See pages 220-223 & elsewhere herein

Trichocereus cv Juul's Giant (A)
See pages 220-223 & elsewhere herein

Juul's Giant

Tom Juul's Giant
Left hand column is of clones in Juul's garden.
Dense grouping is the original mother plant.
Cutting was pirated from the above.

Photos above and on lower left were by Anynoymous

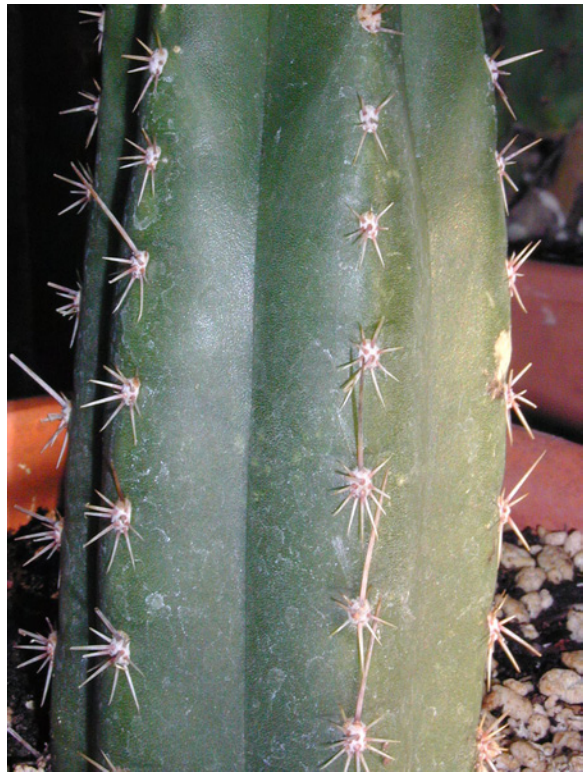
Image below was cuttings that were purchased as "*San Pedro*" in the Arequipa market.
Photo by Anonymous

Trichocereus **cv Juul's Giant X *peruvianus* (SS)**

Trichocereus **cv Juul's Giant X *peruvianus* (SS)**

Trichocereus* cv Juul's Giant X *peruvianus
(SS)

Trichocereus* cv Juul's Giant X *peruvianus
(SS)



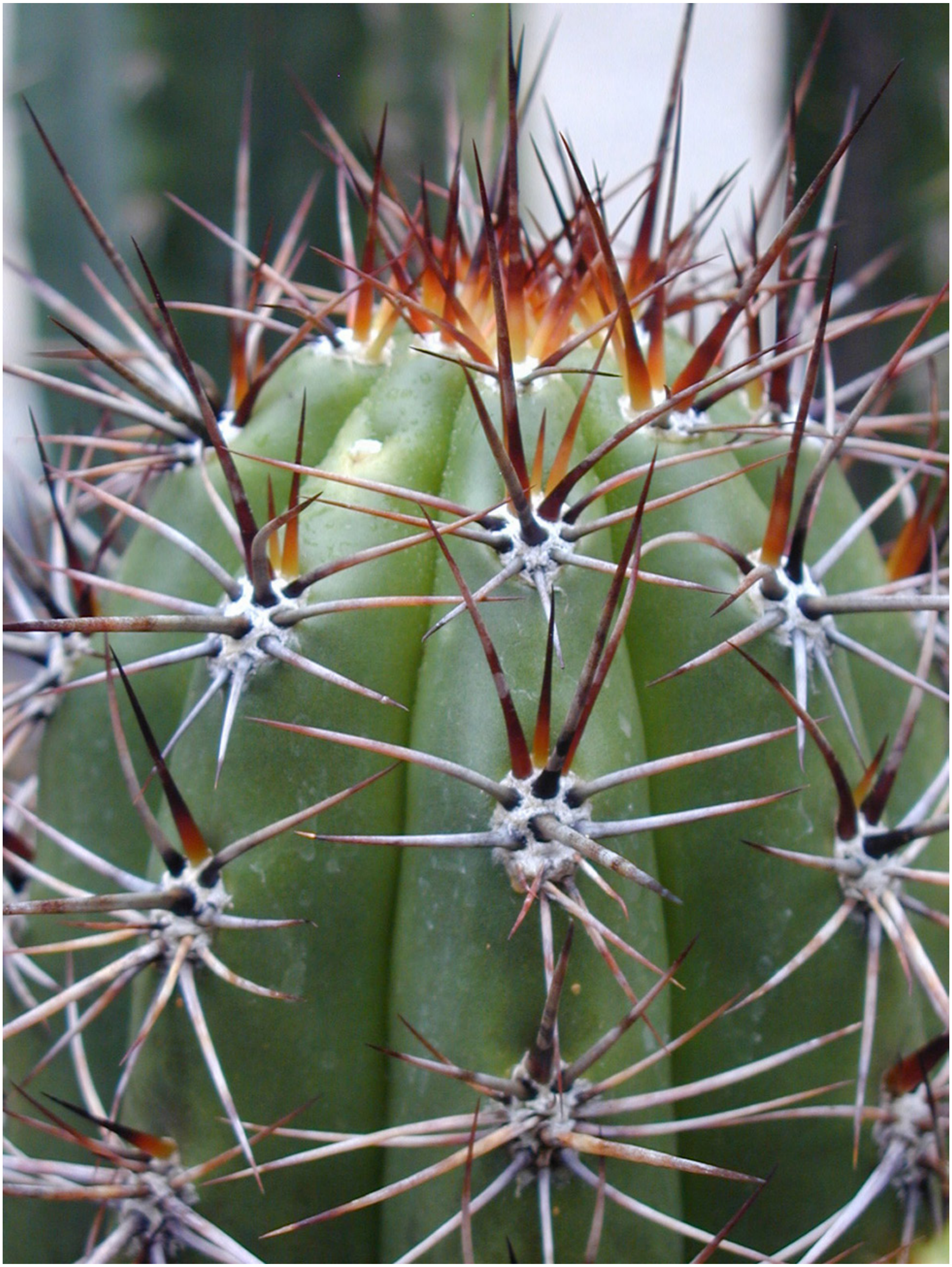
Trichocereus **sp. Torres & Torres N. Chile**
above

cristate *Trichocereus*
sp. Juul's Giant X *Trichocereus peruvianus*
(SS)

***Trichocereus tacaquirense* Bolivia 65.0839**

Trichocereus tacaquirense **Bolivia 65.0839**

Trichocereus taquimbalensis **collected by Roberto Kieseling (as *sn*)**
HBG 68146 (ISI 98.21)



Trichocereus taquimbalensis **collected by Roberto Kieseling (as *sn*)**
HBG 68146 (ISI 98.21)

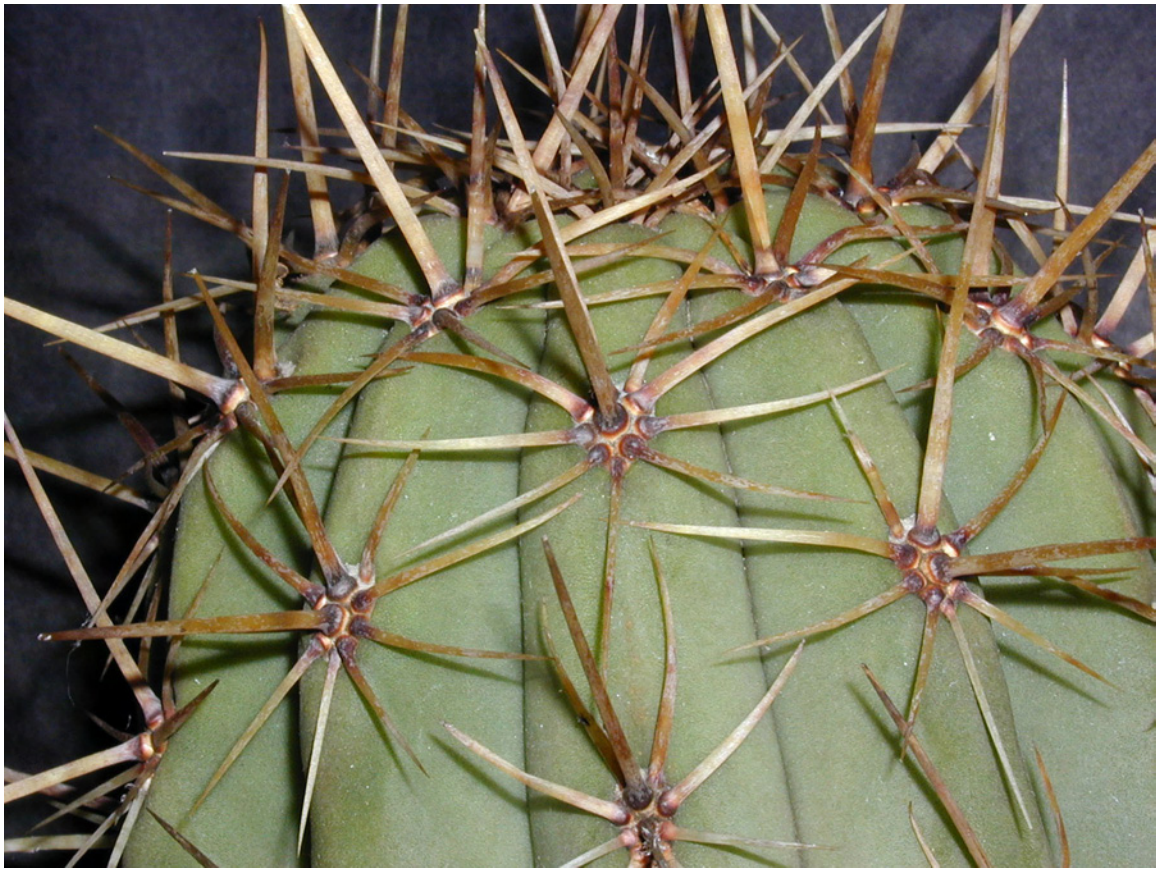
Trichocereus tarmaensis **P.C.Hutchison 1046 [Peru 57.0600]**
(see p. 187 in ***San Pedro*** for more details & images; also page 200 herein)

Trichocereus terscheckii

a *pachanoid Trichocereus*
(Australia)
pre- & post-flower

Trichocereus terscheckii **Argentina 56.0229**
(BBG)

Trichocereus terscheckii **Argentina 56.0229**
(BBG)



Trichocereus werdermannianus **(RS)**

Trichocereus terscheckii **(Paul's Desert)**

Trichocereus uyupampensis Peru 60.0450
Clone propagated from Backeberg-sourced material growing in the Jardin Exotique, Monaco [#3487]
See more images herein

Trichocereus validus
(SS)

Unlabeled fat *pachanoid*

fat *pachanoid*

This is another image of the same plant shown on the previous page.

This plant is unidentified but its location being in between established *T. terscheckii* and *T. pachanoi* causes us to suspect it may be a hybrid. This is also suggested by the height of branching and elements of the spines/areoles.

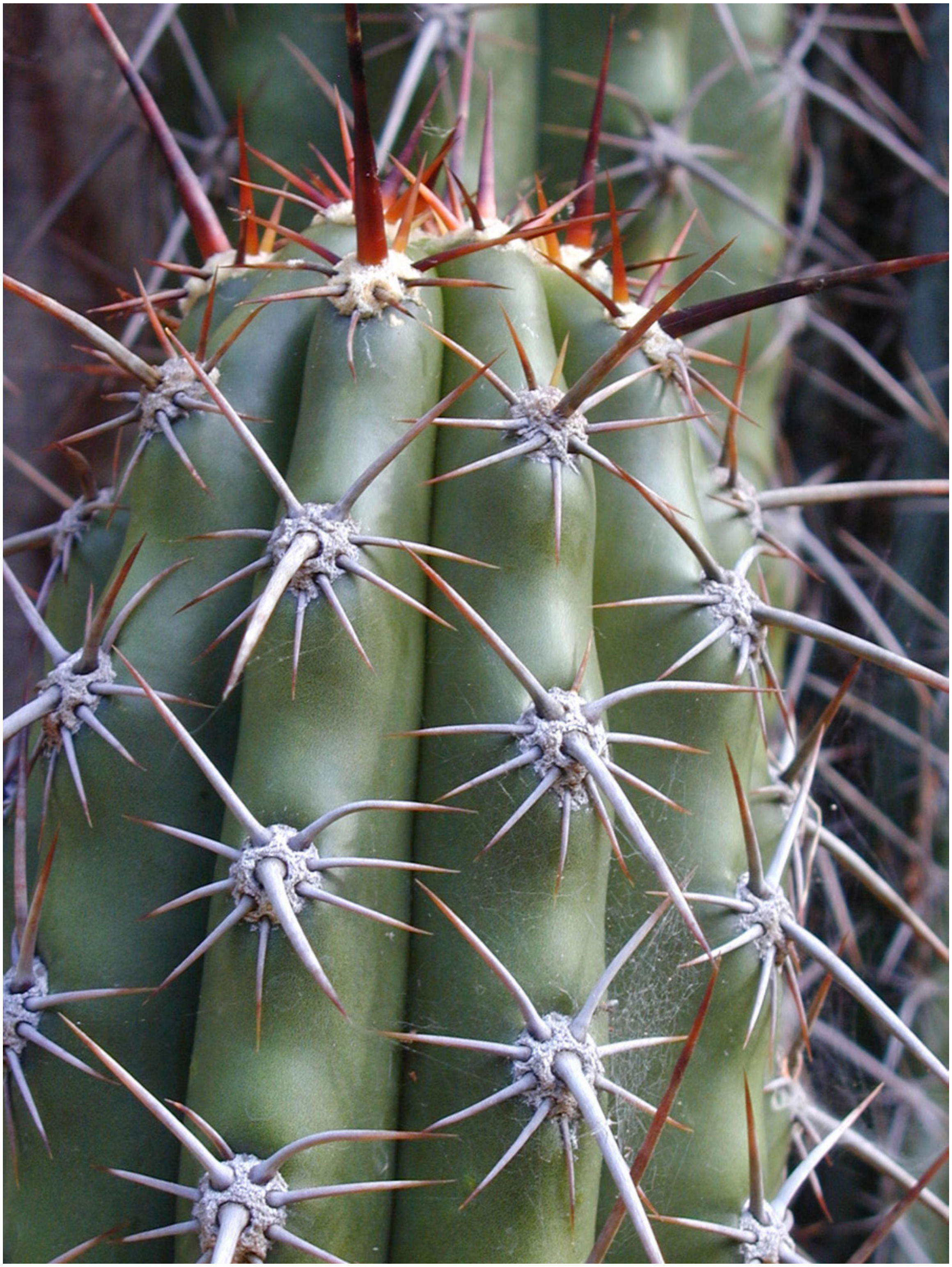
The joint above looks damaged (cold/wet/ice?) but well healed.

***Trichocereus scopulicola* (Oz)**

***Trichocereus* sp. Urubamba**
right-hand column

***Trichocereus* sp. Urubamba**

The next seedlings are a *Trichocereus* grown from seeds collected from a plant growing near Urubamba, Peru. It appeared to be the same material that was encountered for sale, despined, in the Cuzco marketplace.



Trichocereus werdermannianus
(SS)

Trichocereus werdermannianus **Bolivia 50.1998**

Trichocereus werdermannianus **Bolivia 71.0083**

Two forms of *werdermannianus* at Berkeley

***Trichocereus werdermannianus* Bolivia 50.1998**

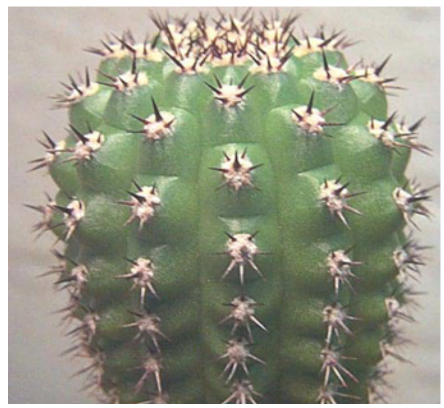
***Trichocereus werdermannianus* Bolivia 71.0083**

***Trichocereus* sp. Urubamba**

***Trichocereus werdermannianus* Bolivia 71.0083**

There is also an interesting ***Lobivia* sp. X *Trichocereus pachanoi***
Its chemistry is unknown but its resemblance to horticultural offerings labeled
***Trichocereus harrissima* (Sticky Situations)**
and to
***Trichocereus brevispinulosus* (NMCR)**
suggests that those too may be hybrids.
Bothof those names are, at best, *nomen nudum*.

Trichocereus brevispinulosus HORT. apparently lacks a description. Suspicions exist that this was a Knize introduction marketed through NMCR but it has also been suggested that this may be a hybrid. It appears to very likely be synonymous with *Trichocereus harrissima* which also lacks any description.



Photos upper & center right by MS Smith

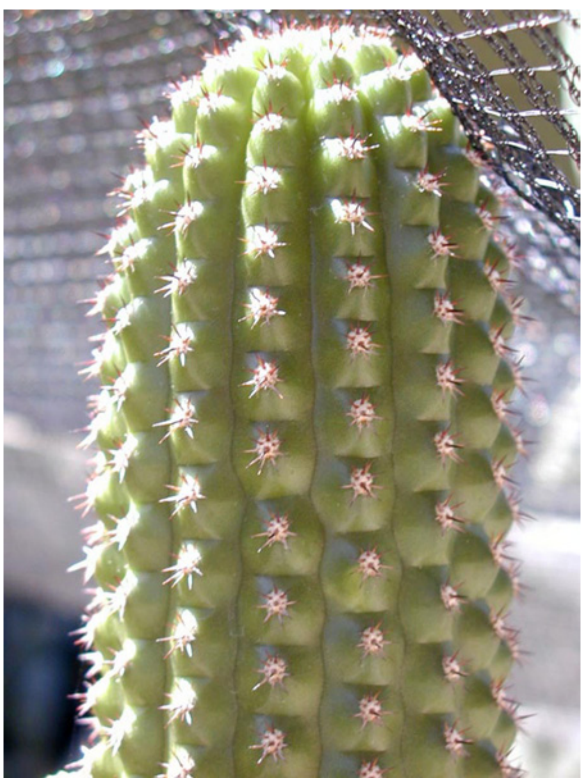
Lobivia* sp. X *Trichocereus pachanoi
(SS)

Trichocereus brevispinulosus
(NMCR via MSSmith)

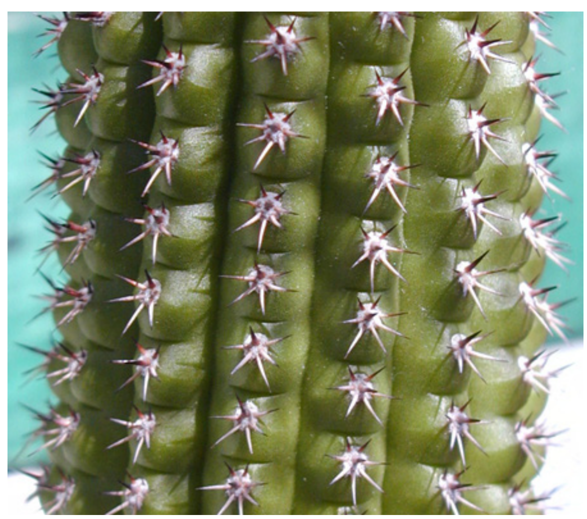
Trichocereus brevispinulosus
(NMCR via Oasis)
bottom right

All lack an analysis.

Trichocereus brevispinulosus
(NMCR via RS)



Trichocereus brevispinulosus
(NMCR via Oasis)



Trichocereus harrissima
(Sticky Situation)
left hand column

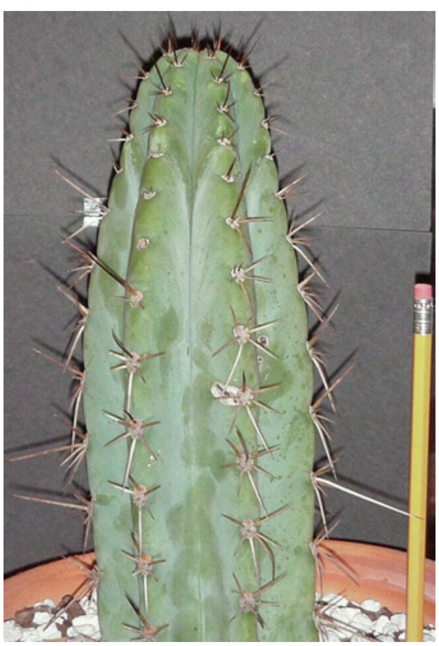
Echinopsis subdenudata
(Germany)
top left
Photo by Patrick Noll

The following is believed to be ***Trichocereus scopulicola*** X ***Echinopsis subdenudata***.

center & top 3 on right

Photos by Snu Voogelbreinder

Analysis is needed.



Echinopsis subdenudata
(Oz)
center left

Trichocereus peruvianus
(Bob Smoley)
M.S. Smith

lower right image see next page

The images on this page are of two columns grown from some seeds labeled as some type of *peruvianus*.

These seeds were sent to Oz, as part of a large assortment of named *peruvianus* forms. Their tags were not retained but the resulting seedlings produced these two beautiful specimens that appear to be of the same form. (The top and bottom images are paired.)

Both of these are basally offshooting withsimilarly fiercely spiny new growth.

Among those seeds were *peruvianus* forma *tarmaensis* and multiple other *peruvianus* collections, forms & varieties available in horticulture.

The plant shown on the lower right corner of the preceeding page is from the same planting.

Unidentified *Trichocereus*
(RS)

Readers may also be interested in ***Sacred Cacti* 3rd Edition Part A**.
That work includes all material from the original *Sacred Cacti* that was not within the pages of Part B

THANKS!

I would like to acknowledge the invaluable input of Roman Štarha, Giorgio Samorini, Maurizio Bini, Carlos Ostolaza, Martin Terry, Roy Mottram & the ILS and thank them for their assistance in obtaining some otherwise-difficult to find papers and for sharing their thoughts.

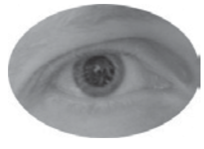
My thanks also go to (in no particular order) Joylene Sutherland, Graham Charles, Snu Voogelbreinder, Jon R. Hanna, Myron Kimnach, Jim Daniel, RS, Kamm, M.S. Smith, Karel Knize, Maurizio Bini, Bobby Brown, Manuel Torres, Sasha, Tania, George, Jane, Sam Pedro, Entheos, IcarosDNA, Geoffrey, Logan Boskey, R.Kundalini, Phillip, Dutchie, Dutchess, Eel, Nat, Zenat, Zariat, Eric Carso, Patrick Noll, Murple, Floyd, Roberto, Zifko, SS, JB, Albert, NS, JS, DP, A, JM, RM, Rob, MC, Yarrow, the staff at the Huntington and at Berkeley and anyone who preferred anonymity for sharing their photos and/or thoughts and/or observations with us. Thanks especially to Manfred for bringing Caycho Jimenez's odd claims to our attention.

Thanks especially to all of the private and/or commercial cactus growers who shared their wealth of knowledge with us and permitted us to photograph their collections. And also to all of my friends in Oz for sharing much so much of their wisdom and time.

I would also like to thank Don Ford for his wealth of supportive efforts enabling me to obtain the myriad of Bay Area images readers can enjoy within this work. Without that input this would have been a very different work.

A warm thank you also to my friends Neil Pike, for his graphics gracing our cover, and Mango Frangipanni for her beautiful renderings of ancient Peruvian imagery.

Thanks also to Mark, Robbie & anyone else involved in the creation of Moksha for enabling this to find physical reality as a printed work.



MydriaticProductions

"More than you need to know."

San Pedro includes the cacti known as San Pedro and related Trichocereus spp. Its wealth of photos can assist readers in gaining familiarity and some understanding of this often misunderstood and bewildering grouping of species and hybrids.

These large, fast growing, columnar species have been reported to contain mescaline. Several have long sacramental histories; recorded in the assorted chronicles left by the invaders of the "New World" and in ancient Peruvian art spanning millenia of their vibrant and beneficial relationship with humans. This relationship persists even into modern times.

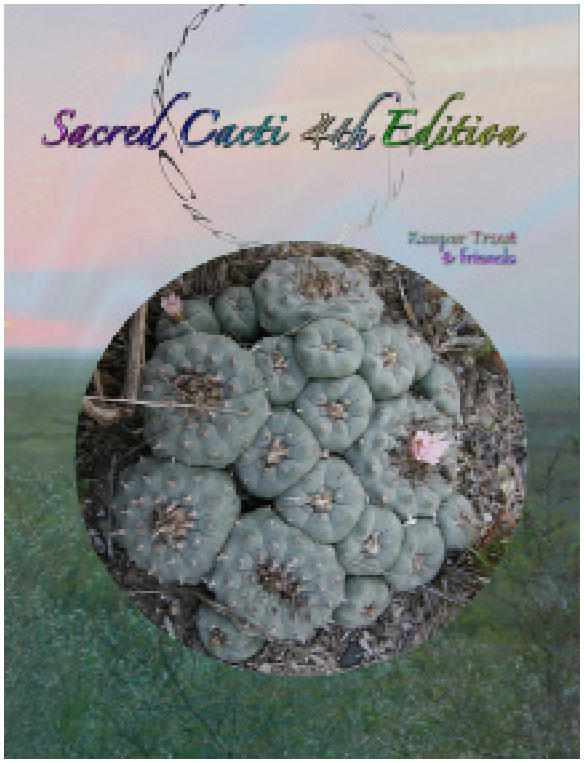
Originally released as the Trichocereus chapter of Sacred Cacti, the text of this edition has been expanded to include corrections and updates along with hundreds of additional photos!

San Pedro provides an informative examination of the botanical characteristics, horticultural offerings & points of confusion, sacramental histories if known, published chemical analysis, if any, and reported pharmaconautical applications.

It is intended to help both researchers and the reader who is already employing these sacred beings as sacraments & spiritual teachers to better recognize, and understand these ancient allies.

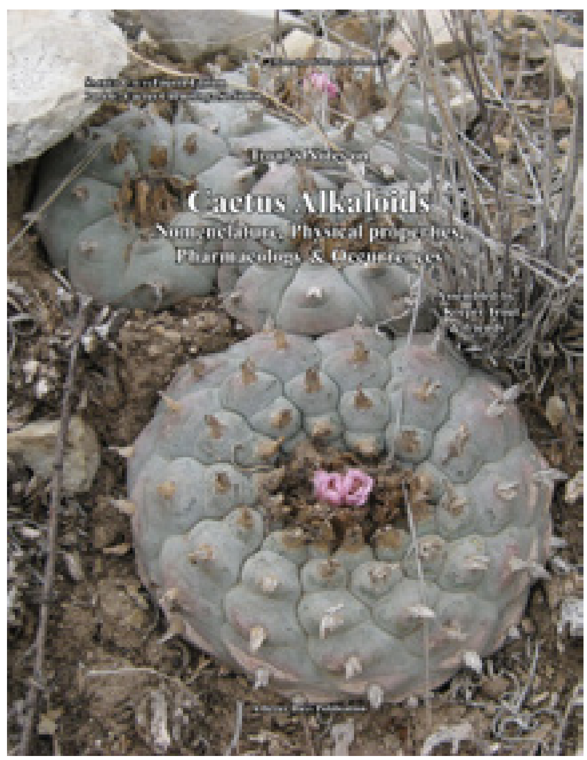
A Better Days Publication
Mydriatic Productions

Want some more Trout?



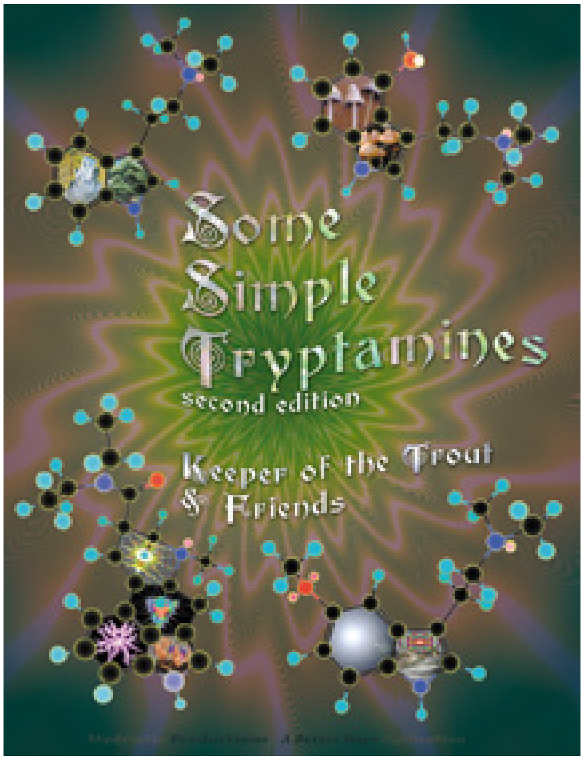
The return of *Sacred Cacti* is at:
http://sacredcacti.com

Cactus Chemistry By Species 2014
Available as a lavishly illustrated and as a "light" text version



The Cactus Alkaloids

Want some more Trout?



Some Simple Tryptamines

Some Other Succulents

Except for the ayahuasca book, these titles are available as free pdf downloads at http://troutsnotes.com/

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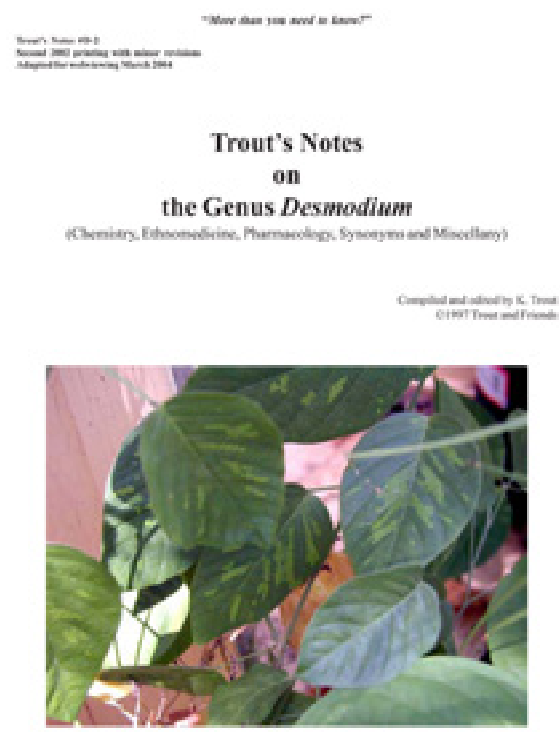

The Genus *Desmodium*

Pachanoi or pachanot ?

An illustrated commentary by Keeper Trout

The subject of our conversation

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http://troutsnotes.com which has additional photographs.

Older versions of this file containing links to our former website "Largely Accurate Information Media" should be discarded as that site is now owned by someone else and appears to contain malware.

This could be a fairly complex discussion but its best to start simple and try to keep it that way. At one point I started referring to this as **Trichocereus pachanoi PC** but have some questions so far as regarding this as a bona fide **pachanoi** so I will tongue-in-cheek begin referring to our beloved horticultural "San Pedro" as **Trichocereus pachanot**.

I'm not trying to suggest that this either is or should become its name, it is simply what I will use during this look into a fun bit of cactus identification trivia. My other option would be a more subtle pacha**no** but, as **Pachano** was the proper name of an amazing scientist who was San Pedro's namesake [weblink], **pachanot** it is. (I did not coin any of these names.)

I also should emphasize that those companies who are selling this plant as **pachanoi** are not doing anything wrong or being deceptive. This is now the primary horticultural form that is widely known and recognized as **pachanoi** in the USA. Many people are unfamiliar with anything else and it takes most people some effort simply to find any other forms. It is not clear exactly what percentage of the available horticultural pachanoi in the USA is presently comprised of the **pachanot** but it is certainly well in excess of 90% and possibly may even be in excess of 99%. In most retail plant outlets it is 100%.

I also intend no slight to this gorgeous plant as it is one of my favorite flowering cacti.

The questions being posed here are still valid.

The topic revolves around an observation made by Michael S. Smith:

What is most commonly recognized as **Trichocereus pachanoi** in the USA differs from the published description for **Trichocereus pachanoi**.

His primary point of contention as concerns the **pachanot** is based on the following rather simple comment from Britton & Rose 1920:

"...ovary covered with black curled hairs; axils of scales on flower-tube and fruit bearing long black hairs."

page 134 in The Cactaceae

Its good to remember that Britton & Rose had initially reported **pachanoi** from Ecuador [bookmark] [weblink] and Backeberg expanded its reported range into Peru in the 1930s. Backeberg encountered it at Huancabamba [bookmark] [weblink] being called San Pedro. Many wild collections and herbarium vouchers have been made.

To lessen some unavoidable confusion, its important to be aware that bona fide **pachanoi** commonly exists with long spines and with very short spines [bookmark] [weblink]. Sometimes both can be present on a single plant. Or its spination can be somewhere in between the two extremes.

The crazy range of variability for **pachanoi** itself makes it tempting to dismiss Smith's questions offhand without taking time for a close look.

Just for fun, let's take that closer look.

The reason that comment of Britton & Rose provoked some conflict with the **pachanot** is the latter typically shows white, light brown or grey woolly hair on the ovary, tube and fruit.

Hair color seems like a really trivial feature to make very much of anything out of, especially considering how most other features on these cacti can be so extremely variable. This is yet another reason that it's easy to dismiss this subject without giving it much thought.

If it had just been Britton & Rose's description it could have ended there.

Fortunately we are lucky enough to have more descriptive comments available to us (and we also have some nice views of what still exists in South America today -- for sake of comparison) [bookmark] [weblink].

If it was just the hair color that was different this conversation would never have begun. It was this small observation however that led us onto what has proven to be an unusually illuminating, thought provoking and valuable pathway of questioning.

Curt Backeberg modified his description of **pachanoi** hair to brown which nicely fits some of the plants still growing where he collected in Peru [weblink].

In the 1931 description that Curt Backeberg wrote for **Cereus pachanoi** Werdermann was the comment:

"Fruchtknoten und Röhre [...] mit langen, braunen Wollhaaren."

page 79 in Neue Kakteen

John Borg made a similar statement in 1937.

"...with ovary and tube covered with long brown hairs."

page 183 in Cacti

However by 1959 the description coming from Backeberg's hand had grown more towards Britton & Rose's black:

"Ov. und Röhre mit schwärzlichen Haaren besetz."

page 1118 in Die Cactaceae

Friedrich Ritter similarly referred to blackish-brown and black in his description of **pachanoi** in 1981:

"Fruchtknoten [...] mit reichlichen schwarzbraunen Wollhaaren"

&

"Blütenröhre [...] langen graugrünen Schuppen und schwarzen, 15–25 mm langen Wollbüscheln"

page 1324 in Kakteen in Südamerika.

In 1984 Carlos Ostolaza wrote another description of **pachanoi** with detailed floristic comments:

"Pericarpel [...] is covered with scales with brownish hairs 15 mm (.6") long on the axils [....] floral tube [...] has fewer scales [...] with more hair on axils."

&

"The fruit [...] covered with scales and black hairs."

page 102 in the Cactus & Succulent Journal (US) 56.

(**pericarpel** = **ovary**)

Another description came from Jens Madsen in 1981:

"[areoles of the floral bracts]...bearing clusters of brownish black, 1-22 mm long, curled and twisted hairs."

page 28 in Flora of Ecuador.

Edward Anderson's 2001 The Cactus Family:

"pericarpels and floral tubes with black hairs"

page 276.

The 2006 New Cactus Lexicon of David Hunt:

"**pc** [pericarpel] and **hyp** [hypanthium] with black hairs"

page 98.

(**hypanthium** = **tube**)

Hmmm.

There seems to be something amiss with our 'San Pedro' [bookmark] [weblink].

While I may be accused of splitting hairs, the next three photos should raise some questions.

"...ovary covered with black curled hairs;
axils of scales on flower-tube [...] bearing long black hairs."?

"...fruit bearing long black hairs."?

This fruit has seen its surface features fortuitously exposed by rain.
This example is the "blackest" hair we have encountered on a pachanot fruit.

Several questions spring to mind but I have no real answer for any of them:

What happened here?

&

How, where & when did this come to be the predominate **pachanoi** in US horticulture?

No matter what the answers turn out to be, there are two topics that exist as a result of this observation:

Topic 1: 'Backeberg's clone' is a misnomer – as the pachanot did not come from Backeberg. See views of the so-called "Backeberg's clone" compared to what Backeberg actually knew as pachanoi [bookmark] [weblink] on the following pages.

Topic 2: The pachanot and pachanoi may look similar but they have predictable differences if their flowers and/or fruit can be examined. Compare South American Trichocereus pachanoi to the "pachanot" in the USA [bookmark] [weblink].

Take a look at a pachanoi in Ecuador today.

More images of pachanoi in Ecuador and Peru will be found farther below.

Topic 1: **Backeberg's clone & why it appears to be mythology**

I unfortunately helped to widely propagate this mistaken identification (now urban legend) in print by including it in my books **Sacred Cacti** and **San Pedro**.

What most people refer to as Backeberg's clone is the predominate cactus sold as **Trichocereus pachanoi** in US horticulture. For many years most of us in Western horticulture knew only this plant as the San Pedro cactus.

You have all no doubt seen many thousands of feet of it growing in countless people's gardens in multiple states.

It is even featured in the center of the cover of my San Pedro book which has an entire section of photographs more or less devoted to it.

While the search is still ongoing and far from complete, thusfar I can find no proof that this plant is known from the wild. The search is still ongoing so stayed tuned.

Just to be sure that our subject is clear, here is an example or three of the pachanot (all of these three are growing in California):

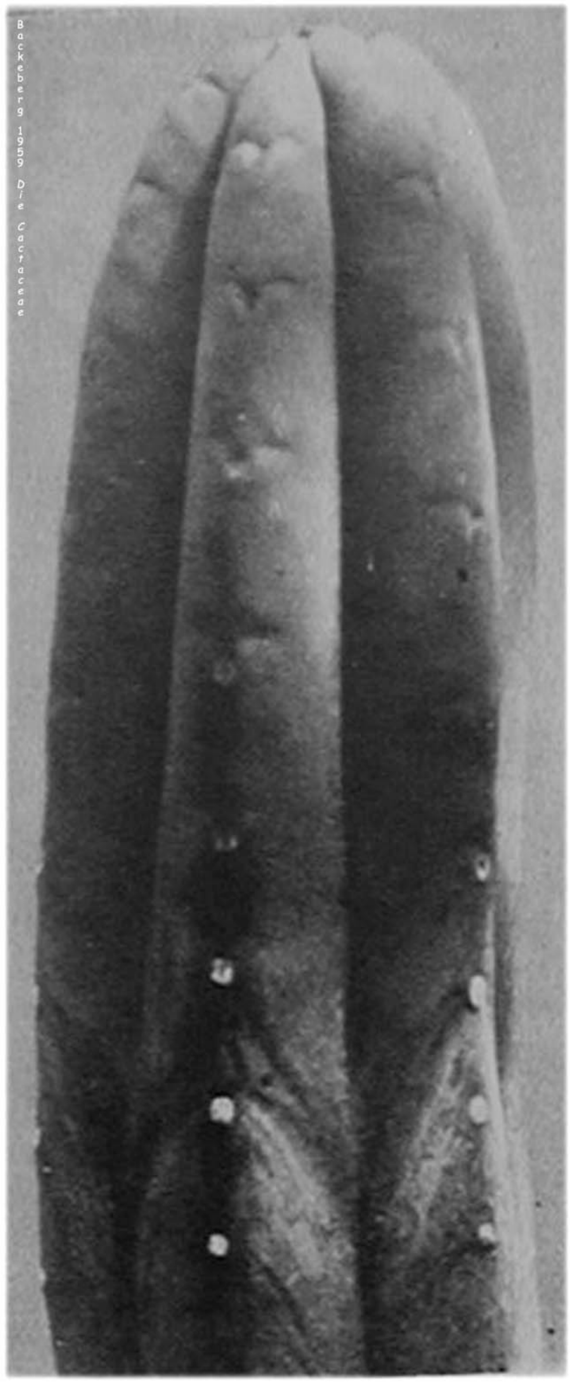

Copyright by Keeper Trout

And a close-up of a fairly typical tip.

And of a fairly typical areole.

And another picture showing a flowering plant in Oakland.

Below, on the other hand, is Backeberg's photo of a bona fide **Trichocereus pachanoi** from Huancabamba Peru. This image was taken from his 1959 **Die Cactaceae**:



The differences are both subtle and not so subtle. It is extremely valuable to pay attention and learn to differentiate them from each other.

Whatever the pachanot turns out to be it is clearly not the same creature that Backeberg shows above. For those who are not yet convinced, please bear with me and check out some more images of **bona fide** pachanoi.

This next image is a bona fide **pachanoi** growing in shaman's garden near Cuzco, Peru (Photo copyright Geneva Photography)
Notice how nicely this matches Backeberg's photo and how different it is from the predominate cultivar in the USA?

This image will reappear with more comments elsewhere here but we wanted to have a copy here for an easy comparison with the other images being shown.

This is a close-up of a tip of a Peruvian **pachanoi** (the shininess is due to this tip cutting having been handled excessively).

More of the same from Peru (these tips were harvested at Matucana)
but these were obtained through an unrelated source.

These two cuttings spent some months in the postal system

Some pachanoi from Knize in Lima, Peru (4 images)

Another view of another bona fide **Trichocereus pachanoi** in Peru.

Photograph above is copyright Grizzly.

Just to be sure that no one forgets bona fide pachanoi can be variably spiny.
[weblink]

Quito, Ecuador
Copyright by Hubbie Smidlak 2008

pachanoi
at Quito, Ecuador


Copyright Hubbie Smidlak 2008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Copyright Hubbie Smidlak 2008


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Copyright HubbleSmidrak 200


Copyright Hubbie Smidlak 2008

pachanoi
at Vilcabamba, Ecuador.


Copyright Hubbie Smidlak 2008


Copyright Hubbie Smidlak 2008


Copyright Hebbie Smudlak 2008

This last image is a closer view of the preceding photograph.

Ecuadorian pachanoi copyright by Hubbie Smidlak 2008

pachanoi in Peru

pachanoi in Peru
Photographs copyrighted by Grizzly


Copyright by Grizzley 2008

We will explore this subject in more detail but even at this point we could already summarize the end point by saying that the plant now mistakenly called Backeberg's clone (namely our pachanot) is not the same plant Backeberg recognized as **pachanoi** at Huancabamba and purported to have brought into horticulture in Germany in 1931.

We have some questions about this latter claim as well since it appears that pachanoi may already have been in horticulture in the US either by or before 1930 and we have not yet been able to determine that anyone preserved knowledge of which European pachanoi might have come from Backeberg.

Before addressing topic 2, the following is a look at some of the pachanoi offerings that are presently under cultivation in Europe.

Some of the assorted horticultural pachanoi presently in Germany

The first image is of a cultivar originally collected in Peru by a German collector named Kaiserwerth. This is sold under the name Trichocereus peruvianus

This is distributed by a cactus vendor in Spain.

Other pachanoi in German horticulture; these next 7 lack further information.


Copyright by Evil Genius


Copyright by Evil Genius


Copyright Evil Genius 2008

This is the oldest representative of a cactus line sold commercially as a pachanoi that Evil Genius can presently locate in Germany. He has some questions concerning its identity and is working on learning more information.

Topic 2: **South American Trichocereus pachanoi compared to the predominate "pachanot" cultivated in the USA.**

As mentioned I have been referring to this as **pachanoi PC** for 'predominate cultivar' or perhaps the predominate clone since it does seem to be produced entirely vegetatively despite it freely flowering & readily hybridizing — or maybe it should stand for politically correct, I don't know.

Due to questions raised about the culturecentrism of this view as a basis for its designation, as it is not necessarily the predominate cultivar elsewhere in the world, this needs abandonment and replacement.

As a result in this discussion it is jokingly referred to as **Trichocereus pachanot**

This is the primary Western cultivar sold in the US under the names **Trichocereus pachanoi**, San Pedro and sometimes as **Echinopsis peruviana** in southern California.

Let's start this with a look at a San Pedro in South America

This is that same bona fide pachanoi growing in a shaman's garden near Cuzco.

Copyright © by Geneva Photography

Notice the details of the flowers and how smooth edged this plant is? Also how indented/sunken the areoles are and the planar relationship they have to the median of the rib? Take a closer look here [bookmark] [weblink] or farther below. Now go back to Backeberg's **pachanoi** photo [bookmark] [weblink] and compare this and then compare both to the **pachanot** [bookmark] [weblink].

Spines here and in Backeberg's photo are shorter than on the **pachanot** but spine length is something that can almost be disregarded (within reason) for being a variable characteristic [bookmark] [weblink]. When they have short spines, it is a common thing for the short expressions of the spination on **pachanoi** to be consistently much shorter than the already short spines of the **pachanot** [bookmark] [weblink].

Many of the trichs show ranges of characteristics rather than set characteristics so it is easy to become diverted from some important points concerning the predominate cultivar.

a) It does not match the description of **pachanoi** as given by Rose & others in perhaps minor but very consistent ways.

b) It is readily differentiable from the **pachanoi** that seems to be most common in Ecuador and Peru.

c) Thus far it has NOT been encountered in the wild or in use among Peruvian shamans.

d) It shows characteristics of flower and fruit, as well as intensely vigorous growth, that are suggestive of it being a selection derived from a hybrid [weblink].

While a **pachanoiXbridgesii** hybrid is at least plausible (compare pachanot and bridgesii [bookmark] [weblink]), there are other possibilities.

We may never know the answer with any degree of certainty – perhaps not even with a lot of work that is yet to be done.

Below we will examine a series of typical **pachanoi** from South America compared to the **pachanot** that we most commonly have growing in the US.

The first images below were shared by MS Smith. All of these images are said to be of Ecuadorian pachanoi.

The one on the left is said to be a photo of a voucher collected in Ecuador by Timothy Plowman. The ones on the right were said to be taken in Ecuador as well.

We do not know their photographers.

Trichocereus pachanoi in Ecuador
Photographers are unknown but lefthand image is said to be vouchers of Timothy Plowman.

Two Ecuadorian pachanoi sold by Karel Knize in Lima, Peru and shipped to Texas.

Two Ecuadorian collections of *Trichocereus pachanoi* from Karel Knize

Now this is going to start to get interesting or perhaps just boringly repetitive. Feel free to skip ahead whenever that happens.

On the left below is a **pachanoi** in Peru and on the right is a US horticultural **pachanot**.

Pay particular attention to spination, areoles, flower buds, flowers, pericarpels, tubes, fruit and the contour of the ribs.

Trichocereus pachanoi
in a shaman's garden in Peru
Photo copyright by Geneva Photography

Trichocereus pachanot
cultivated in California
Photo copyright by Momma Kitty

Ecuadorian **pachanoi** from Knize (KK339) on the left and on the right **pachanot**

Above: *Trichocereus pachanoi* KK339
from Ecuador via Karel Knize

Right: *Trichocereus pachanot* in California

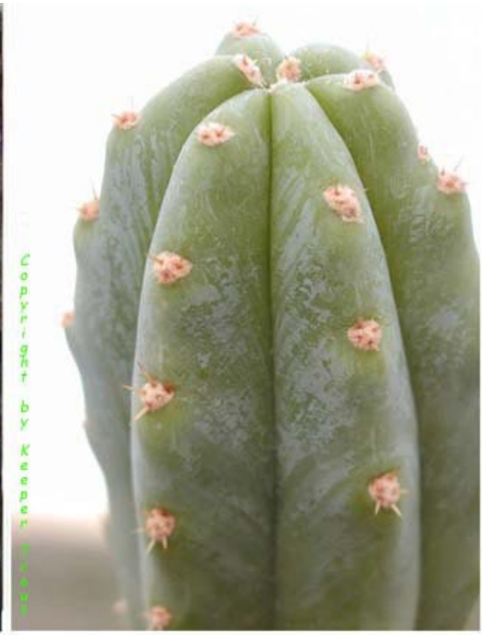
Ecuadorian **pachanoi** from Knize (KK339) on the left and on the right **pachanot**

Trichocereus pachanoi KK339
from Ecuador via Karel Knize

Trichocereus pachanot in California

bona fide **pachanoi** can sometimes be encountered in the US as is shown on the left (Photo by Anonymous) and on the right is our **pachanot** again.

Bona fide *Trichocereus pachanoi* in California
Photo by Anonymous



Trichocereus pachanot in California

Peruvian **pachanoi** on the left (photograph by Grizzly) and on the right **pachanot**.

Trichocereus pachanoi in Peru
Photo by Grizzly

Trichocereus pachanot in California

Peruvian **pachanoi** from Matucana (photo from Kitzu) -- left; right -- **pachanot**.

Trichocereus pachanoi in Peru
Photo copyright by Kitzu

Trichocereus pachanot in California

Ecuadorian **pachanoi** from Knize on the left and on the right **pachanot**.

Trichocereus pachanoi KK339
from Ecuador via Karel Knize

Trichocereus pachanot in California

Ecuadorian **pachanoi** from Knize on the left and on the right **pachanot**.

Trichocereus pachanoi KK339
from Ecuador via Karel Knize

Trichocereus pachanot in California

Ecuadorian **pachanoi** from Knize on the left and on the right **pachanot**.

Trichocereus pachanoi KK339
from Ecuador via Karel Knize

Trichocereus pachanot in California

Flower buds

Upper left image is from Peru: Photographer is unknown to us.

The bottom left and the entire right column are **pachanot** in California.

Flower buds

In Peru on left (Geneva Photography)/ On right is the **pachanot**

Trichocereus pachanoi in Peru
Photo copyright by Geneva Photography

Trichocereus pachanot in California
Photo copyright by Trout

A closer look

In Peru on left (Geneva Photography)/ On right is the **pachanot**

Trichocereus pachanoi in Peru
Photo copyright by Geneva Photography

Trichocereus pachanot in California

In Peru on left (Photographer?)/ On right is the **pachanot**

Left: Trichocereus pachanoi in Peru
(Photographer unknown)
Above: Trichocereus pachanot in California

Ovary & tube
In Peru on left (Geneva Photography)/ On right is the **pachanot**

Trichocereus pachanoi in Peru
Photo copyright by Geneva Photography

Trichocereus pachanot in California
Photograph copyright by Keeper Trout

Flower tube

Bona fide **pachanoi** growing in Oz is on left (photo by Zariat) and on right is typical US **pachanot** cultivar.

bona fide *pachanoi* growing in Oz (below)
Photo copyright by Zariat

pachanot growing in Oakland (right)
Photo copyright by Keeper Trout

Flowers

pachanoi near Cuzco, Peru on left (Geneva photography) and **pachanot** in Oakland, California on right

Trichocereus pachanoi in Peru
Photo copyright by Geneva Photography

Trichocereus pachanot in California

Flowers & fruit (upper left is the pachanoi encountered in Peru by Ritter):
Peruvian **pachanoi** on left. The **pachanot** on right were all taken in California.

Trichocereus pachanot in California (above right)

Lefthand column
Trichocereus pachanoi in Peru

Images copyrighted by their photographers

The next image is all the US **pachanot** cv.

For **pachanoi** the ovaries were described as being covered with black wool.

While these typically do show very short black or dark brown hairs along the axils of the scales on the tube and similarly on the ovary/fruit they are generally obscured by white and/or light brown and/or greyish wool and can be absent. Compare these next five images with the examples of similar locations on the floral tube, ovary and fruit on the Peruvian **pachanoi** shown above.

Trichocereus pachanot in California


Photo by Trout

Fruit:

Peruvian **pachanoi** on left. **pachanot** on right.

Left-hand column: Trichocereus pachanoi in Peru

Above: Trichocereus pachanot in California

Photos are copyrighted by their photographers

If anyone wonders WHY this cultivar predominates the US market almost to uniformity consider that it shows intense vigor permitting commercial operations such as can be seen below.

Those show but a small part of a single professional propagator's mother plants in southern California (All three photos by correspondent requesting anonymity).

The **pachanot** is much faster growing, more cold tolerant, more rot resistant and more water tolerant than a bona fide **Trichocereus pachanoi**. The simple mechanics of its vegetative propagation combined with its popularity as an ornamental obviously would favor it becoming the predominate horticultural offering over a fairly short period of time (in this case possibly a relatively few decades – <5?).

We are still searching for confirmation that this is what actually occurred. It is clear there were at least several points of introduction.

It is now so prevalent in US horticulture from California to Florida that it is presently fairly rare to encounter anything else being produced commercially.

Several possibilities exist.

It is at least plausible that a collector such as Paul C. Hutchison or Harry Johnson jr might have collected a naturally occurring pachanoiXbridgesii hybrid from Bolivia and the parent plant was later extirpated from the wild during the government's efforts to reduce their enormous stands of mescaline-containing cacti near urban areas during the 1970s (in response to what they regarded to be a "hippy invasion").

Either one of those people might even have produced such a hybrid and sold it through their commercial cactus operations.

However, a simpler answer is also quite plausible (and leads the pack). If the material that Robert Field's father received from Harry Blossfeld in 1935 turns out to be synonymous with the pachanot, that would go far to explain why it appears to be so abundantly present in the USA, Europe AND Oz.

According to Robert Field, Blossfeld sold a total of 12 shares in his massive collecting expedition in order to finance his costs. Those supporting his efforts , including Field, received a massive volume of live cactus including something that certainly at least looks like our pachanot. Someday DNA analysis will confirm or reject that possibility and this note will be updated accordingly

See images of Field's plants at troutsnotes.com [weblink].

If anyone has more information concerning this plant's origin, especially if you have facts to the contrary and/or if you can tell us its precise point of entry into US horticulture, please contact us at:

keepertrout
@
gmail.com

Pachanot & Bridgesii compared

bridgesii (above) ; *pachanot* (below)

bridgesii **(above) ;** ***pachanot*** **(below)**

This last example shows the most & blackest hair we have thusfar encountered on a pachanot flower.

Some forms of Trichocereus bridgesii

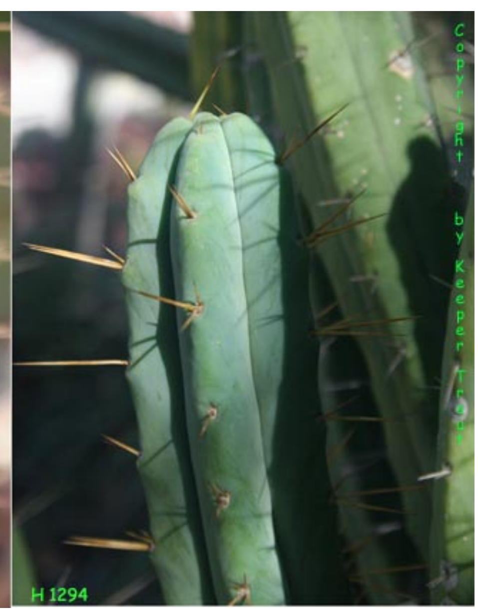
Cuttings above left are from Huanuco, Peru. Photograph copyright by Kitzu

We were told that its spines fell off during transportation.

Image above right & next pair below are H 1294 at the Huntington.

These were obtained as 8 seedlings from Curt Backeberg, which they received the 9th of February 1932.

Photographs copyright by Trout.



Both tips above are of aff. bridgesii
(H 79960 at the Huntington)

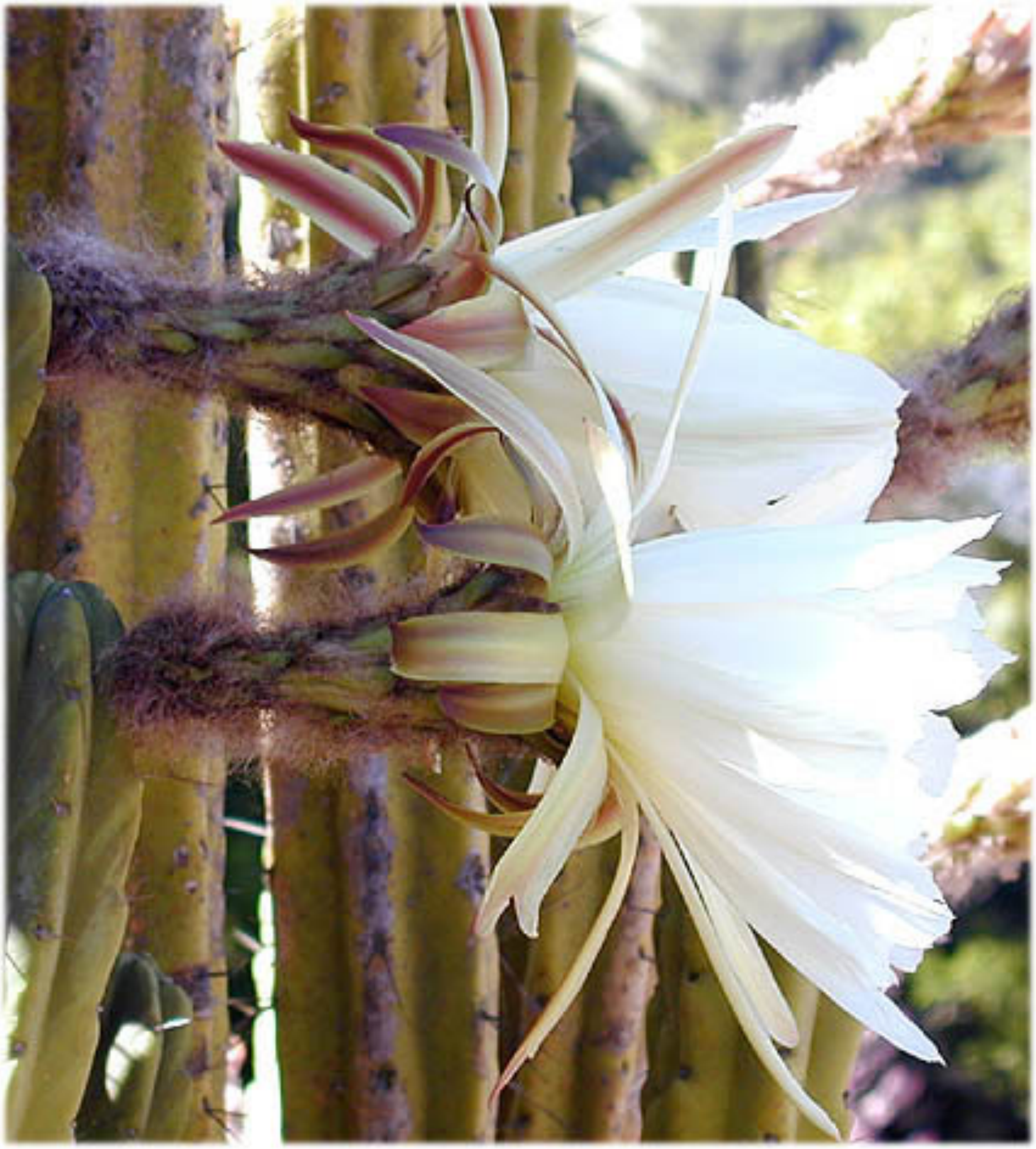
Although most of these are now in cultivation everything depicted above was obtained originally from wild collections.

Some views of bridgesii in Bolivia

Photographs below: copyright by Grizzly

Offerings in the witches markets in Bolivia appear to be for tourists. While some of the tips shown are thus far the closest cacti we have yet seen as concerns the pachanot, they tend to show the presence of some much longer spines which on these cuttings have been removed .

A bridgesii grown from Ritter's seeds that were obtained in 1953.



A couple of oddly stout bridgesii in horticulture.