Trout’s Notes on Cactus Chemistry By Species

“More than YOU need to know?”

Assembled by Keeper Trout & friends

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9 Jan. 2018
C10-2013 with Bad Links replaced 9 January 2018 (with minor edits)

Trouts Notes on Cactus Chemistry

Cactus Chemistry
By Species

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Previously published entitled
Distribution of the Alkaloids & Triterpenoids Reported in Cactaceae; By Species (1997) and as
Trout’s Notes #C-10 Cactus Chemistry Summary: By Species (1999 and later).
This intensely illustrated version merges, updates, corrects and replaces all previous versions.

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This is a work-in-progress that is presently still undergoing editing, proofing and active assembly.
Acquiring & processing the references needed for a comprehensive treatment has postponed the
planned release date so dramatically that I decided to make the in-proofing version available while the
final version takes shape. Please let me know if you spot errors or if you have suggestions to offer about
how to make this a better work. I also welcome any contributions of images; especially in habitat.
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information contained within these pages so long as proper acknowledgment of authorships are
maintained. This is not permission to reproduce this work but it is an encouragement to educate.
No one owns facts or factual data.
“It is pertinent to mention that all of the Trichocereus species, which have been reported to contain alkaloids, grow in a rather limited geographical area confined to Argentina.”

Djerassi et al. 1956 JACS 78: 2312-2315.
Coryphantha echinus
(Terrell County, Texas)
Table of Contents

Distribution of Compounds Reported in the CACTACEAE 7
Cactus taxonomy, images & comments 8
The Cactus Species 11-520
Activity (& Mythology) Notes 521-598
Traditional ethanol-sources 599
LEGUMINOSAE 600-601
References 602-627
Index 628-668
Cactus Phenethylamines: A Tabular Key to their Structural Formulas 669-672
Cactus Isoquinolines: A Tabular Key to their Structural Formulas 673-676
Structural table Isoquinolines in alphabetical order 677
Mescaline Krebs acid conjugates & other compounds 678
Some Cactus Triterpenoids, Sterols & Similar Molecules 679-683
Some other nonalkaloidal molecules 684-685
Biominerals 687-688
What is Cactus Slime? 689
Spines 690
Acknowledgements 692

Opuntia spinosior
(Cactus Country)
More than you need to know?

_Echinocereus coccineus_  
_var. paucispinus_  
(Val Verde County, Texas)
Cactus Chemistry: By Species

Distribution of Alkaloids, Triterpenoids & other Compounds Reported in the Cactaceae

Assembled & edited by Keeper Trout

It is important to understand that all alkaloid concentrations can be highly variable. This can be the result of many factors. Genetics, environment, age, part sampled, weather, health, time of year or time of day, and whether the plants were wild or cultivated, have all been noted as factors potentially capable of influencing the alkaloid content and/or composition in plants. Substantial variations can be encountered based on the variety, local form, age, growth stage and other factors.

An obvious but frequently overlooked fact is that analysis of a cactus can really only tell us about the actual material in hand undergoing analysis and can serve as no more than a probable guideline for what MIGHT be the case with another specimen within the same species. Differences might simply be quantitative but are frequently found to be qualitative as well should enough samplings be performed.

The trend in the literature is a look at one sampling, most often using batched materials, and then move on to the next species. Those which have had in-depth workups performed for different collections and at different times of years suggest this should be undertaken for any species that has only one published analysis.

What should always be kept in mind when encountering any species where a single given alkaloid composition and concentration is stated this indicates that said species has only been analyzed that one single time.

Analysis involving different tissues within a single plant have consistently produced divergent results suggesting that distribution within a given specimen is also an avenue worthy of greater in-depth exploration. Mescaline users already utilize this unequal distribution by removing and ingesting only the outer portions of green tissue from the cactus Trichocereus pachanoi as, while wasteful of much of its contained alkaloid, it generates material that contains a greater percentage of mescaline by weight than would the intact plant. Sadly much of this work is not published and due to the current illegality of such practices (whether sacramental or recreational) will probably never be published in detail.

In many cases not enough variables are noted to understand the reported differences. We would suggest that detailed information about the actual source, the specific part or parts investigated (young or old tissues can produce quite different results as can different internal structures), the date and time of day they were collected and details about how they were processed PRIOR to investigation become regarded as vital information to include along with the normal procedural workup. The word “dried”, as an example, can mean a number of things. For instance, freeze-dried material appears to give lower yields than does careful drying and standard extractions but whether this is the NORM remains to be evaluated.

Extraction approach can also generate differing results. Lengthy heating during Soxhlet extraction can cause changes compared to a room temperature soak being used. Similarly the use of acids during extraction, while valuable, can readily hydrolyze or otherwise alter some components.

The concentrations given are as they were reported in the literature. Many were calculated as the final yield of highly purified and repeatedly recrystallized alkaloids and will therefore be low values. Identification criteria can be found in the occurrence lists under individual alkaloid entries in C13 The Cactus Alkaloids. (Previously released in an abridged form as C-9 Appendix A)

This supplemental listing is primarily of the alkaloids & triterpenoids reported from cacti although we have taken the liberty of including some additional compounds and reports indicating either that alkaloids were present but not identified or else that alkaloids seemed to be absent. Many fruit or flower pigments, carbohydrate, mucilage & polyphenolic studies were omitted.

In every case possible, the original research reports were used for the entries below but in a few instances we relied on second-hand listings when the primary source paper was unavailable. (Instances are indicated in the text.) (%) indicates both that the entry was from a second-hand listing and did not include a percentage.

Also included are notes of some errors appearing in the literature (an incomplete list). These are included simply to help the reader evaluate and resolve the conflicts they may find between this list and others. While making no note as to the source for any of these erroneous entries, they (and the reference that was cited) were included in hopes of reducing the number of errors being perpetuated in the future. We do not suggest people simply take us at our word over highly respected authorities and official databases; we do suggest that in these instances they look at the primary references given and determine the truth for themselves.

One point we would like to make concerning some of the disparities between various researchers is that Agurell & coworkers specifically did not look for any quaternary amines and therefore would not have detected any even if present in their material.

It is also important to note that some workers used young cultivated material grown from seed while others used adult field collected specimens. The claim has been presented, without any indication of its basis, that analytical results are identical between these sets of samples but the available work as will be detailed within does not support that assertion beyond a rough qualitative generalization. Both have value for understanding the chemistry of the plants but in no case can the analysis of a given species or specimen be reliably extrapolated to indicate what will be found in anything other than what was analyzed on the day that it was analyzed.

Cacti can sometimes be highly variable in appearances. This work attempts to present multiple images of single species in habitat and grown under different situations or in multiple hands whenever possible. One clear advantage to this being a PDF is the elimination of concerns about minimizing cost through limiting the number of color photos that are included.
Cactus taxonomy and names in this work

Many species have been renamed multiple times; a partial list of synonyms or points of potential confusion is included. Please see Backeberg, Bravo, Britton & Rose, Anderson, Hunt or the specific botanical authority listed for more nomenclatural or taxonomic details.

Some names have been changed so many times over the course of their analytical history that it can be difficult to locate comprehensive information about what has been published. The obscuring of analytical accounts by the proliferation of synonyms precluding effective indexing is an under appreciated problem. This is not limited to plants. In a sweeping revision of Amphibia Bufo alvarius had its name changed to Cranopsis alvaria in 2006. Later in 2006 the name was changed again, by implication, to Ollotis alvaria. In 2008 it became Incilius alvarius. Incredibly the only one of its historical synonyms not resurrected in that process was Phrynoidis alvarius. Few indexing services of publications can successfully manage to include all known synonyms of either plants or animals causing a fragmented access to the contents of scientific papers.

In many cases chemical work does not reflect the current name en vogue. We have often left names as encountered with efforts made only to reduce confusion. In this process we have employed what many may object to as outdated names. This work is a compendium of published analytical accounts involving cacti rather than being a taxonomic treatment of cacti. Its just as likely that the following are presented however they were analyzed than with what is now their present accepted name.

Please be aware therefore that our use of one specific name over another does not necessarily indicate any agreement with or advocacy of that placement.

In a number of cases older “splitter” synonyms were deliberately preserved in order to prevent lumping from obscuring some interesting analytical results.

A listing of synonyms is also incorporated so this should not cause any problems. Feedback is welcomed.

Comments on color

Every attempt has been made to preserve accurate & realistic color portrayals but caution is needed.

Color images can be highly variable for many reasons including whether the image was shot with 35mm, Polaroid or another film format or if was 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 artificial 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).

There was no control over the quality of some of the contained images (other than their potential rejection) and it was 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.

Trichocereus rosei #1 (T. peruvianus)
left column

Trichocereus rosei #2 (T. peruvianus)
right column
(Chessman)
cristate *Lophophora* "echinata" (above)

new growth on *Cereus peruvianus* (HBG) below
Trouts Notes on Cactus Chemistry

Aviso concerning the results of Djerassi

It should emphasized that most, if not all, of the triterpenoids investigated by Djerassi (and other workers) were primarily artifacts of their isolation and analytical procedure. With only very few exceptions, it is not made clear if any of them actually exist in the plants and, if so, how much is there. In those few cases where it does appear that they actually may exist in the plant, it is as only a very small portion of the total triterpenoids recovered (The usual source for these triterpenoids & sterols was via acid hydrolysis of the corresponding glycosates.)

While it might therefore be debated as to whether these aglycones are really properly listed as cactus components, since they are products arising from the hydrolysis of the mixed saponin fraction, it was deemed important to include them as they appear to have valuable chemotaxonomic significance.

Lopophora williamsii
nestling with Coryphantha ramillosa

Another point concerns Djerassi’s alkaloid investigations. Many species they reported as being devoid of alkaloids were later shown to contain alkaloids (sometimes in appreciable amounts). While not dismissing the possibility of individual variation between samples, we suspect their alkaloid screening technique played a significant role in at least some of the disparate results.

It was specifically flawed with regards to detecting mescaline, substances with similar solubilities or any neutral alkaloids.

Djerassi’s primary criteria for detecting alkaloids:
1) The residue remaining from an initial ethanolic extract would form an alkaline solution when extracted with ether. [Ed.: Not all alkaloids are soluble in ether & not all alkaloids form alkaline solutions.]
2) Alkaloids could be isolated and obtained as crystalline material.
3) Positive Mayer test. (Apparently not used in many cases)

Djerassi sometimes noted the presence of unidentified materials but in many cases there was obviously material present they did not elaborate on or investigate further.

Djerassi repeatedly made the claim that alkaloids and triterpenoid glycosides are not found in the same plant. While this is obviously incorrect if made as a blanket statement when considering trace or low amounts, it might prove true that the presence of substantial amounts of either may preclude large amounts of the other simultaneously being present. A systematic overview and evaluation is needed before drawing any firm conclusions.

Many entries based on bioassays of varieties of known active species were omitted from this work.

More details on those and many of the other species that are included can be found in Sacred Cacti Part A and/or Part B

Some useful trivia

0.00X% indicates X milligrams per 100 grams. (i.e. 0.1% indicates 100 milligrams per 100 grams.)
0.01% by dry wt. is ~4.5 grams of alkaloid per 100 pounds dry wt. [i.e. 10 mg per 100 gm]
"5 to 25+ mg. per 100 grams of fresh” indicates approximately from ~0.01% to over 0.03% by wet wt.

Reported water content in some cacti has ranged from 62 to 95%. Around 90% water by weight is common.

Djerassi et al., [1954 JACS 76: 4089-4091], reported the successful use of a blow torch to deal with spines that caused handling difficulties even with heavy gloves. The qualitative and quantitative analytical results from cacti they despined this way showed no difference from controls. Obviously some care is needed to avoid cooking the flesh.

Wire clippers, needlenose pliers & safety glasses also work.
Cactus Chemistry: By Species

The Cactus Species

Assembled by Keeper Trout & friends

Acanthocereus pentagonus (L.) Britton & Rose
(Now Acanthocereus tetragonus (L.) Hummelinck)
“organo”, “pitahaya”, “pitahaya morada”,
“pitahaya naranjadas”, “night-blooming cereus”,
“barb-wire cactus” Powell & Weedin 2004 & Standley 1924
See comments in Activity Notes

Anhalonium elongata See as Ariocarpus trigonus

Anhalonium jourdanianum Lewin was determined to contain an
unidentified but pharmacologically active alkaloid; Lewin 1894b. It
cannot be demonstrably linked to Lophophora jourdaniana
Habermann. [See comment under] Anderson 1980

Anhalonium lewinii Hennings See as Lophophora williamsii
Anhalonium prismaticum Lemaire See as Ariocarpus retusus
Anhalonium williamsii Rümpler See as Lophophora diffusa
Anhalonium williamsii (Lemaire) Lemaire See as Lophophora
diffusa [See Bruhn & Holmstedt 1974 for details]

Anisocereus foetidus (MacDougall & Miranda) Marshall
See as Pterocereus foetidus
Anisocereus gaumeri (Britton & Rose) Backeberg
See as Pterocereus (?) gaumeri

Aporocactus flagelliformis (L.) Lemaire
“flor del cuerno”, “floricuerno”, “flor del lárgo”, “hierba de la
alfercia”, “junco”, “junquillo”, “cuerno”, “rat-tail cactus”
Standley 1924: 917
Flowers contained Betanin (35.4% of total), Phyllocactin
(59.8% of total) & an unidentified Betacyanin.
Piattelli & Imperato 1969
See comments in Activity Notes

Ariocarpus agavoides (Castañeda) E.F. Anderson
3,4-Dimethoxy-N-methylphenethylamine (trace)
N,N-Dimethyl-3-methoxytryramine (trace)
Hordenine (Over 50% of 1-10 mg of total alkaloids/ 100
gm. fresh.) Bruhn & Bruhn 1973

Ariocarpus bravoanus Hernandez & Anderson
Lacks published analysis.
See comments in Activity Notes.

Ariocarpus disciformis (DeCandolle) Marshall
See as Strombocactus disciformis
Ariocarpus agavoides
(HBG)

Ariocarpus fissuratus var. lloydii
(HBG)
Ariocarpus bravoanus ssp. hintonii

(Ariocarpus fissuratus) (Engelmann) K. Schumann
“chaute”, “chautle”, “peyote cimarrón”, “peyote” (said to be erroneous) Standley 1924: 933
Hordenine (20 mg of sulfate from 1 kg dry) Heffter 1894b
N-Methyltyramine (%?) Diaz et al. 1977

See comments in the Activity Notes.

Ariocarpus fissuratus var. fissuratus

(Rose) Marshall
3,4-Dimethoxy-N-methylphenethylamine (Major alkaloid. 0.004% dry wt.) Norquist & McLaughlin 1970
Hordenine (0.006% by dry weight.) McLaughlin 1969
N-Methyltyramine (visual estimate of 10 mg from 1.92 kg dry) McLaughlin 1969

Ariocarpus fissuratus (Top right & lower left)

fissuratus intermedius (Photo above by Kamm)
Ariocarpus fissuratus
(Presidio County, Texas)
Ariocarpus fissuratus
(Presidio County, Texas)
Ariocarpus fissuratus

Ariocarpus fissuratus intermedius
Ariocarpus fissuratus var. lloydii (Engelmann)
Schumann
Hordenine (no quantification) McLaughlin 1969
N-Methyltyramine (no quantification) McLaughlin 1969

Ariocarpus fissuratus var. lloydii

Ariocarpus furfuraceous see Ariocarpus retusus (most regard as retusus var. furfuraceous; lacks published analysis)

Ariocarpus hintonii see as Ariocarpus bravoanus ssp. hintonii

Ariocarpus kotschoubeyanus (Lemaire) Schumann
“pezula de venado” (Nuevo León) Standley 1924: 933
78% water by weight
Hordenine (0.059% dry wt.) Neal et al. 1971b
N-Methyltyramine (0.015% dry wt.) Neal et al. 1971b
Reported to contain Betalains as pigments.
Wohlpart & Maarry 1968 cited Dreding 1961

See Activity Notes for additional comments.

Ariocarpus retusus Scheidweiller
“chaute”, “chautle”, “peyote” (said to be an erroneous name)
Standley 1924: 933
86% water by weight. Braga & McLaughlin 1969
3,4-Dimethoxy-N-methylphenethylamine (0.00047% dry wt.)
Neal & McLaughlin 1970
Hordenine (0.02% dry wt.: 214 mg from 1.19 kg dry) Braga & McLaughlin 1969
N-Methyl-4-methoxyphenethylamine (0.00045% by dry weight.) Neal & McLaughlin 1970
N-Methylytryamine (0.0016% by dry weight, i.e. 18.5 mg from 1.19 kg) Braga & McLaughlin 1969
[Neal & McLaughlin 1970, did not report the latter compound.]
Retusin (A flavonoid) & β-Sitosterol were recovered by Domínguez et al. 1968. This was the first isolation of retusin (tetramethylated quercetrine); formerly known as a synthetic compound (Gomm & Nierenstein 1931).

See Activity Notes for additional comments.

Ariocarpus kotschoubeyanus
Ariocarpus fissuratus var. lloydii (fat form)

Ariocarpus fissuratus var. lloydii

Ariocarpus kotschoubeyanus var. elephantidens
Both images above; center photo by Kamm

Ariocarpus kotschoubeyanus var. elephantidens
Lower right

Ariocarpus kotschoubyanus var. macdowellii
Lower right
Ariocarpus kotschoubeyanus
var. elephantidens

Ariocarpus retusus
Ariocarpus retusus monstrosus

Photo by Kamm

Ariocarpus retusus

Entire page
Cactus Chemistry: By Species

Ariocarpus retusus
Ariocarpus scaphirostris Boedeker
(Originally misspelled Ariocarpus scapharostrus)
Hordenine (Major alkaloid of 4 in 0.012% total alkaloids)
N-Methyltyramine (no quantification)
3,4-Dimethoxy-N,N-dimethylphenethylamine (no quant.)
3,4-Dimethoxy-N-methylphenethylamine (no quant.)
Bruhn 1975b (Cultivated: California)
**Ariocarpus trigonus** (Weber) Schumann

3,4-Dimethoxy-N-methylphenethylamine (0.007% dry)
Hordenine (Major alkaloid. 0.013% dry weight.)
N-Methyltyramine (trace)

Speer et al. 1970

[Tyramine has been listed in error; the reference cited, Speer et al. 1970, did not report it from this species.]

*Ariocarpus williamsii* (Lemaire) Voss See as *Lophophora williamsii*

*Ariocarpus trigonus*
short-leafed form top left; long leaf form top right

Crested photo by Johnny B. Goode

*Astrophytum asterias* (Starr County, Texas)
Astrophytum myriostigma

*Lemaire*

“mitra” (San Luis Potosí), “birreia de obispo” (Coahuila)
“bonete”, “peyote cimarrón” (Durango) STANDLEY 1924: 955

Appears listed as containing unidentified alkaloid(s) but
either the entry included no reference (ex. SOULIERE 1947)
or else the reference that was cited (BROWN et al. 1968) did
not mention the species.

See comments on the *Astrophytum* species in the *Activity Notes.*
Astrophytum myriostigma
(BTA)
Astrophytum cv. Superkabuto hybrids
Astrophytum myriostigma cv. Onzuka
Austrocylindropuntia cylindrica Lamarck


Der Marderosian 1966 indicated that “correspondence with the original author” verified that their material had indeed been misidentified. While it was not specifically stated; Turner & Heyman were implied.

All of the above were apparently based on misidentified plants. (Actual identity was almost certainly Trichocereus pachanoi. in all instances. It is demonstrably the case in Cruz Sánchez 1948 where an unmistakable T. pachanoi photograph was included. This is also discussed in more detail in Part B; San Pedro) More recently Opuntia cylindrica reverted to an older synonym Austrocylindropuntia cylindrica.

Authenticated Opuntia cylindrica was determined to contain no measurable alkaloid in Agurell 1969b [Obtained via European commercial sources].

“Opuntia cylindrica” (Trichocereus pachanoi) from the 1948 thesis of Guillermo Cruz Sanchez (image above is a scan of a photocopy of the original)
Austrocylindropuntia cylindrica

(hothouse: above; outdoor bed: center right)

Austrocylindropuntia cylindrica (UC)

(C) Strybig Botanical Gardens

Austrocylindropuntia cylindrica (Kimura)
Austrocylindropuntia cylindrica

Austrocylindropuntia exaltata Berger

[Considered varietal to Opuntia subulata in Hunt 2006]
3,4-Dimethoxyphenethylamine (less than 0.01% dry wt.)
4-Hydroxy-3,5-dimethoxyphenethylamine (Less than 0.01% dry wt.) Ma et al. 1986 (Ostolaza #84284)
Austrocylindropuntia cylindrica
(Strobig)
Austrocylindropuntia pachypus  K.Schumann
[sic as Opuntia pachypus]

The claim for the presence of Mescaline was made by Caycho Jimenez 1977 (page 91) but no reference was cited and nothing was included to support his assertion.

Austrocylindropuntia pachypus
(California Cactus Center)
**Austrocylindropuntia subulata (Mühlenpfordt)**

**Engelmann**

3-Methoxytyramine (no quantification)

An unidentified alkaloid was also present.

Meyer et al. 1980

88% of the daily CO2 uptake occurred through the leaves during the daytime but some occurred at night (under well watered conditions)

Nobel & Hartsock 1986
*Austrocylindropuntia subulata*

(Los Angeles County Arboretum)
Aztekium ritteri (Bödeker) Bödeker
(Plants greenhouse grown in Czechoslovakia.)
N-Methyltyramine (0.0031%)
3-Methoxytyramine (Less than 0.0001%)
Hordenine (Less than 0.0001%)
N,N-Dimethyl-3,4-dimethoxyphenethylamine (0.0036%)
Mescaline (0.0009%) (9 mg per kg of dry wt.)
Anhalidine (0.0008%)
Pellotine (0.0026%
ŠTARHA 1994 (All % above are by fresh wt.)

In the wild this plant typically remains solitary for its entire life. Treatment with fungicides and pesticides in cultivation, and also grafting, commonly produce these multiheaded individuals.
Backebergia militaris (Andot.) Bravo ex Sanchez Mejorada

3-Methoxytyramine (0.02% dry wt.) Pumangura & McLaughlin 1981a [Collected in Michoacan, Mexico] [Also in Pumangura et al. 1981b]; (Not identified by Ferrigni et al. 1984.)

3,4-Dimethoxyphenethylamine (0.025% dry wt. [as HCl]) Mata & McLaughlin 1980b; (Not identified Ferrigni et al. 1984.)

3,4-Dimethoxy-N-methylphenethylamine (Detected: No quantification) Ferrigni et al. 1984.

3,4-Dimethoxy-N,N-dimethylphenethylamine (0.0588% dry wt.) Pumangura & McLaughlin 1981a; (Trace: Ferrigni et al. 1984.)

[3-Methoxyphenethylamine (Error. Based on typo in Ferrigni et al. 1984.)

[Phenethylamine (Error. Based on misreading of typo in Ferrigni et al. 1984.)

Also contains some isoquinolines [See Note]; (tetrahydro, dihydro and fully aromatic):

Heliamine (0.75% dry wt. [as HCl]) Mata & McLaughlin 1980b; 1.02% by dry wt. [as HCl]) Pumangura & McLaughlin 1981a; (Identified by ms/ms; but not mentioned in experimental account of isolations: Ferrigni et al. 1984)

Lemaireocereine (0.034% by dry wt. isolated) Pumangura & McLaughlin 1981a; [Also by Pumangura et al. 1981b]; (Not identified in ms/ms by Ferrigni et al. 1984)

N-Methylheliamine (Identified by ms/ms; Detected in an impure residue) Ferrigni et al. 1984

Dehydroheliamine (Identified by ms/ms; 0.07% by dry wt. isolated) Ferrigni et al. 1984

Dehydrolemaireocereine (Identified by ms/ms; 0.006% by dry wt. isolated) Ferrigni et al. 1984

Backebergine (Identified by ms/ms; 0.0126% by dry wt. isolated) Ferrigni et al. 1984

Isobackebergine (Identified by ms/ms; 0.022% by dry wt. isolated) Ferrigni et al. 1984

N-Methyllemaireocereine (possible presence; neither proven nor dismissed) Ferrigni et al. 1984

[7,8-Dimethoxy-3,4-dihydroisoquinoline is a typographical error intending 7,8-Dimethoxy-3,4-dihydroisoquinoline (i.e. Dehydrolemaireocereine) Ferrigni et al. 1984 was cited as the reference]

Unser et al. 1980 evaluated this species using MIKES and reported detecting 3 alkaloids but it is unclear exactly which isomers they observed. One appeared to be N-Methylheliamine.

tlc examination showed the presence of alkaloids and the absence of triterpene glycosides: Kircher 1982

Kircher reported the same sterols as they had encountered in L. schottii and also what they thought was Lauric acid. Lipid content determined to be 7% by dry weight: Kircher 1982

Backebergia Note: One other partially saturated THIQ was depicted in Ferrigni’s line diagram key but appears to have been used as a synthetic intermediary and not isolated from the plant. It should be noted that besides having at least one typo in their key, the first two generic line diagrams are switched. [PEA ↔ THIQ]
Borzicactus sepium (HBK) Britton & Rose
Flower contains Betanin, Phyllocactin, Isophyllocactin and traces of Isobetanin Piattielli & Imperato 1969

Cactus grandiflora Linnaeus See as Selenicereus grandiflorus

Carnegiea euphorbioides (Haw.) Backeberg
See as Neobuxbaumia euphorbioides

Brasiliopuntia brasiliensis (Willdenow) Berger
Positively identified in Stuart 2003 as “ichai”. Mucilage comprised of Arabinose (26.2%), Galactose (49.8%), Galacturonic acid (6.1%), Rhamnose (9.4%) & Xylose (8.6%). Moyna & Di Fabio 1978 (MAM 1308)

Purportedly used as an ayahuasca admixture and alone as a hallucinogenic. Following that earlier report, Bianchi & Samorini 1993: 38 included an image of the leaves. The claims were more recently discredited by Stuart 2003.

See more detailed comments in Activity Notes.
Some of the *Browningia* species

- *B. nobilis*
- *B. pilifera*
- *B. sp.*
- *B. hertlingianus*
- *B. utcubambensis*
**Cactus Chemistry: By Species**

*Browningia candelaris (Meyen) Br. & R.*

In dried aerial parts:
- 0.0058% N-Acetyl-3,4-dimethoxyphenethylamine
- 0.0245% N,N-Dimethyl-3,4-dimethoxyphenethylamine
- 0.0327% N,N-Dimethyl-4-methoxyphenethylamine
- 0.0330% 4-Methoxyamphetamine

**Echevrría & Neimeyer 2012**

Identification was based on a published spectral compendium. 4-Methoxyamphetamine seems most likely to be a gcms misidentification of N-Methyl-4-methoxyphenethylamine.

Also see the interesting conjecture in **Ostolaza 1987**

The entire genus *Browningia* needs analysis.

*Cardonia gigantea (Engelm) Britton & Rose*  
AKA “saguaro”, “sahuarö”, “suwarrow”, “suwarro”, “suaharo”, “suguarö” **Standley 1924: 909**

87-88% water by weight **Kircher 1982**

3,4-Dimethoxyphenethylamine (“less than” 0.00145%) **Bruhn & Lundström 1976b** (See Note A) & (trace) **Bruhn et al. 1970**

3-Methoxytyramine (trace) **Bruhn et al. 1970** & (small amounts) **Bruhn & Lundström 1976b**
Dopamine (0.26%, as HCl, reported from young cultivated plants [Raised in the Netherlands]; not observed in their analysis of wild-collected material [Collected in Arizona])
Bruhn & Lundström 1976b. [Reported in cortical tissue (pulp) at 1%; Callus tissue and adjacent areas had higher dopamine concentrations than healthy tissue (See Note B);
Steelink et al. 1967 [Collected in Arizona]
[Tyramine, 3,4-DiMeO-5-OH-PEA and 3,5-DiMeO-4-OH-PEA have also been erroneously listed for this species but the claims are not supported by Agurell 1969b (the reference that was cited).]
[Mescaline has been erroneously listed for this species. The claim is not supported by any of the references that were given. [i.e. Agurell 1969b, Kapadia & Faye 1970 [See Note C] and Mata & McLaughlin 1976.]

Carnegie Isolated (0.7% dry wt.) & named by Heyl 1928.
(0.575% yield by dry weight (As HCl) in Ordenz et al. 1983.)
Identified in Brown et al. 1968;
Reported present in decent amounts (70% of total alkaloid content.) in Brown et al. 1972b. [Presence also noted in Hodgkins et al. 1967]
Also by Bruhn et al. 1970, who, unlike Brown, suggested presence in young plants but not in larger specimens. I am unable to determine details due to procedural differences. Also: 0.019% by fresh weight (2.9 grams of base from 15 kg fresh) Bruhn & Lundström 1976b
[Agurell et al. 1971a is also cited but is not presently available.] Also isolated in Spath 1929.

Gigantine (5-Hydroxycarnegine) (Identified) Brown et al. 1968
[See Note D]; Only reported in substantial amounts during analysis of wild collected adult cacti and found to be higher in growing tips (see also Brown et al. 1972b who found it composed 25-30% of the total alkaloid content in the whole plant but 50% in the growing tip). [Said to comprise 30% of total alkaloid content in Hodgkins et al. 1967] Bruhn & Lundström 1976b reported 0.0016% by fresh wt. (281.6 mg base from 15 kilos of fresh material) Not reported in greenhouse grown plants (Bruhn & Lundström 1976b); nor in young plants grown outdoors in Arizona (Bruhn et al. 1970).

Salsolidine (Norcarneagine) Bruhn et al. 1970 & Bruhn & Lundström 1976b reported salsolidine to be the major alkaloid (0.02% fresh wt.; 3.2 grams of base from 15 kg fresh), whereas Brown et al. 1972b did not find salsolidine in any samples they tested. 0.47% yield by dry weight (As HCl) was reported in Ordenz et al. 1983. [See also Agurell et al. 1971a; See note above]

Arizzone (0.0036% by fresh wt.; 1.1 grams of base from 15 kg fresh) Bruhn & Lundström 1976b [See also Agurell et al. 1971a; See note above]


Helianine (?) Lundström 1983 cited Pummanura et al. 1983. [See also Agurell et al. 1971a; See note above]

Dehydrohelianine [0.0008% yield by dry weight (As HCl) was reported in Ordez et al. 1983.]

Unger et al. 1980 evaluated this species using MIKES and reported detecting 4 (or 5?) quinolines. One was reported to be Salsolidine; another was either Carnegie or else isomeric with it. The exact isomeric identities of the rest was not clear to us. Two appeared to be trimethoxylated.

1-1.7% alkaloid (Carnegie and Gigante) Kircher 1982

Glucaric acid (tlc by Kringstad & Nordin 1975)
Isocitric acid (tlc & glc by Kringstad & Nordin 1975)
Quinic acid (tlc & glc by Kringstad & Nordin 1975)

Vanillin, Syringaldehyde & p-Hydroxybenzaldehyde were found to be higher in healthy tissue than in callus tissue. A glycoside of 4-Hydroxybenzoic acid and Ferulic acid were reported as minor & trace components respectively.

3,4-Dihydroxybenzoic acid, Vanillic acid & p-Hydroxybenzoic acid found in callus tissue along with trace amounts of p-Coumaric acid & Ferulic acid. Quercetin was also observed at 0.1% of the total callus but was absent from the ribs themselves.

Steelink et al. 1967 tlc examination showed the presence of alkaloids and the absence of triterpene glycosides: Kircher 1982

Lipid content determined to be 2.5% by dry weight.
0.1% sterols: Campesterol, Sitosterol and 1 unknown sterol.
Unable to detect any sterol or triterpene glycosides. Kircher 1982

Carbohydrates in healthy cortical tissue were reported to be composed of Glucose, Galactose (31% of all saccharide constituents), Xylose & Arabinose.
Galactose was lacking from the wound tissue. Steelink et al. 1968

Carnegiea gigantea
Center

40
Carnegiea Notes:

A: Concerning my math-work for Brühn & Lundström 1976b:
15 kg of fresh cactus yielded 32 grams of alkaloids. 80% was nonphenolic and 20% was phenolic. When purifying these fractions they only used 1 gram of the nonphenolic and 0.5 grams of the phenolic fractions. The amounts listed in their account is what was obtained from these aliquots rather than totals.
For all compounds except dopamine the yields were calculated, by $kt$, as if they had used all of their product and then recalculated them in terms of their free bases (Alkaloids were obtained as the hydrochloride salts in all cases except for Arizonine)
B: Dopamine concentrations were reported to increase with exposure to air or to ascorbic acid solutions.
In one case; a sample with 1.4% dopamine was taken. After 1 hour, a second sample, that was taken immediately next to the site of the first, showed 2.1%.
They also noted a a high dopamine content in samples taken near the base (which always has a heavy callus layer).
C: It should be noted that while listing Kapaëa & Faye 1970, they used the volume, and a page number, in Kapaëa et al. 1969.
D: The unusual substitution at the 5 position has also been observed in several other alkaloids found in Pachycereus pringlei, and Pachycereus weberi, as well as in Pachycereus tehuantepecans.
(Gigantine is also found in Pachycereus pecten-aboriginum.)
The question of whether any of the Pachycereus alkaloids are active as visionary compounds is an area overdue for evaluation. Preliminary evaluations depict them as rough and with a heavy body load yet some few people appear to like them. More study is clearly needed.

See also comments in the Activity Notes.

Cephalocereus chrysacanthus (Weber) Britton & Rose.
See as Pilocereus chrysacanthus
Cephalocereus columna-trajani (Karw.) K.Schumann
See as Cephalocereus hoppenstedtii
Cephalocereus euphorbioides (Haw.) Br & R.
See as Neobuxbaumia euphorbioides
Cephalocereus gaumeri Britton & Rose is NOT synonymous with Pterocereus (?) gaumeri
Cactus Chemistry: By Species

*Cephalocereus glaucescens* (Labouret.) Borg
This species was reported to show no detectable alkaloids in the alkaloid screenings of Smolenski *et al.* 1973.
Fruit contains Betanin (major), Phyllocactin and traces of Isophyllocactin & Isobetanin. Piattelli & Imperato 1969

*Cephalocereus guerronis* (Back.) Buxb. See as *Pilocereus guerreronis*

*Cephalocereus hoppenstedtii* (A.Web.) K.Schumann
No detectable alkaloids.
Chalet 1980a cited Dominguez *et al.* 1969

*Cephalocereus leucocephalus* (Poselger) Britton & Rose
“napisora” (Pennington 1963: 155)
Fruit contains Betanin (major), Phyllocactin, Betanidin and traces of Isophyllocactin & Isobetanin.
Piattelli & Imperato 1969
See comments in Activity Notes.

*Cephalocereus maxonii* Rose See as *Pilocereus maxonii*

*Cephalocereus melanostele* Vaupel
*Cephalocereus sp.* (?) Pfeiffer
Claim purporting the presence of Mescaline is made by Caycho Jimenez 1977 (page 91) but he cites no reference and does not include anything that support the assertion.

*Cephalocereus nobilis* (Haworth) Britton & Rose
Fruit contains Betanin (major), Phyllocactin and traces of Isophyllocactin & Isobetanin. Piattelli & Imperato 1969

*Cephalocereus senilis* (Haworth) Pfeiffer
Traces of unidentified triterpene(s) Djerassi 1957 cited unpublished observations by Djerassi & Marfey

*Cephalocereus tetetzo* (A.Web.) Vaupel
See as *Neobuxbaumia tetetzo*

*Cereus acranthus* (K.Schumann) Vaupel
See as *Huageocereus (Weberbauercereus) acranthus*
Cephalocereus senilis
(HBG)
Cactus Chemistry: By Species

*Cereus aethiops* HAWORTH
Candicine (%?) Ruiz et al. 1973
Hordenine (%?) Ruiz et al. 1973
Tyramine (%?) Ruiz et al. 1973

*Cereus aethiops*

*Cereus alacriportanus* PFEIFFER
Hordenine. (Sole alkaloid 1-10 mg/100 gm of fresh plant.)
Agurell 1969b [European commercial source]

*Cereus azureus* PARMENTIER
No detectable alkaloids. Agurell 1969b
[European commercial source]

*Cereus caespitosus* ENGELMANN & A. GRAY
= *Echinocereus reichenbachii* subs. caespitosus
See comments under *Echinocereus reichenbachii* in Activity Notes.

*Cereus comarapanus* CARDENAS
Flower contains Isophyllocactin, Betanin, Phyllocactin & Isobetanin. Piattelli & Imperato 1969

*Cereus coryne*. See as *Stetsonia coryne*

*Cereus divaricatus* LAM. non KUNTZE = *Cereus divaricatus* (LAM.) DE CAND. See as *Harrisia divaricata*.
See comment in Activity Notes.

*Cereus fimbriatus*. See as *Lemaireocereus hystrix*
See comment in Activity Notes.

*Cereus gummosus* See as *Machaerocereus gummosus*

*Cactus flagelliformis* L. = *Cereus flagelliformis* (L.) MILL. See as *Aporocactus flagelliformis*
Please note that, in the past, *Trichocereus pachanoi* has been sold (improperly) under the name *Cereus giganteus* and there is also a Karel Knize nomen nudum designated *Trichocereus giganteus* Knize n.n. There is also material in cultivation designated as *Trichocereus peruvianus* var. *giganteus* that is the same Knize nomen nudum.

*Cereus glaucus* Salm-Dyck
Hordenine (1-10% of 1-10 mg total alkaloids/100 gm of fresh plant) *Agurell* 1969b [European commercial sources]
Tyramine (Over 50% of 1-10 mg total alkaloids/100 gm of fresh) *Agurell* 1969b

*Cereus grandiflorus* Mill. See as *Selenicereus grandiflorus*

*Cereus forbesii* var. *mairanensis* (Huntington)

*Cereus forbesii* O.
Tyramine (Over 50 mg/100 gm of fresh) *Agurell* 1969b [European commercial source]

*Cereus giganteus* Engelmann. See as *Carnegiea gigantea*
*Cereus giganteus* Engelmann See as *Carnegiea gigantea*

The name cactin was assigned to a methionine rich albumin isolated from the seeds of *Cereus jamacaru*. It was found to resemble a protein found in Brazil nuts. *Aragão et al.* 2000

(Sultan earlier used the name cactine for an uncharacterized alkaloid from *Selenicereus grandiflorus*.)

*Cereus macrostibas* (K. Schumann) Berger
See as *Neoraimondia macrostibas*
Adult *Cereus jamaracu*
(Fruit Spirit Botanical Gardens)
Trouts Notes on Cactus Chemistry

Cereus jamacaru De Candolle

“mandacaru”
Tyrmine (total 0.2% crude but only 0.02% was recovered as the HCl) Bruhn & Lindgren 1976 [Obtained via the Kew]. (second to most abundant for Davet 2005)
N-Methylyrmine Davet 2005 (major alkaloid in Davet 2005)
Tyrosine Davet 2005
Hordenine Davet 2005
beta-Sitosterol Davet 2005
[Caffeine (0.08-0.11%) was reported in the seeds by Freise 1935 (1936?), and this was iterated in Willaman & Schubert 1961, but Bruhn & Lindgren 1976, reported that they could detect NO caffeine in either the seeds or stems of this plant. Freise apparently reported it in only some samples of seeds but neglected to note how he identified it. No xanthine derivative has ever been demonstrably isolated from any cacti despite his claim. Bruhn & Lindgren 1976 reported no alkaloidal material in the seeds.]
[Hordenine appeared listed in error but more recently was reported. The reference cited initially, Agurell 1969b, did not investigate this species. Davet 2005 did.]
\[beta-Sitosterol Djerassi 1957 cited unpublished observations by Djerassi & Kan. The list of endophytes in Bezerra et al. 2013 suggests that the potential for bioactivity is worth study.\]

Alkaloid production of callous tissue culture was studied by de Oliveira & Machado 2003
Reported to contain Betalains as pigments.
Wohlpart & Mabry 1968 cited Dreiding 1961
Cactus Chemistry: By Species

*Cereus peruvianus* (Linnaeus) Miller

[See note on the next page.]

Hordenine (??) DeVries et al. 1971

Tyrmine (trace) Agurell 1969b [Obtained via European commercial sources]

Reported to contain Betalains as pigments.

Wohlpert & Mabry 1968 cited Dreiding 1961

**Erroneously** listed both as a mescaline containing plant and as a hallucinogen.

See comments in *Activity Notes*.

Mucilage polysaccharide - 1.6% of total weight of fresh plant.

Uronic acid content of polysaccharide: 44%

Rhamnose: arabinose, galactose (1:1:2)

Mindt et al. 1975

*unlabeled Cereus peruvianus*
Cereus peruvianus is under intensive development for fruit production. The fruit is called koubo in Israel. It can produce fruits 3-4 years after planting from seeds and 2-3 years after planting from cuttings. A 7-year-old plant can bear 60-80 kg of fruits annually.\textsuperscript{1} Ninio \textit{et al.} 2003

The color of the peel changes from green to violet in the early stages of ripening and then from violet to red at the end of the process. The first appearance of color begins near the perianth scar becoming complete violet color about a week later. As ripening continues, the color of the peel changes to red, which is usually followed by the cracking of the fruit.

\begin{table}[h]
\begin{tabular}{|c|c|c|c|}
\hline
 & Green & Purple & Red \\
\hline
Ethanol-insoluble polysaccharides & 14 mg/g & 4 mg/g & 4 mg/g \\
\hline
Ethanol-soluble sugars & 20 mg/g & 75 mg/g & 110 mg/g \\
\hline
\end{tabular}
\end{table}

The main sugars that accumulated in the fruit pulp were Fructose and Glucose in a 1:1 ratio. Each one increased from 25 to 275 μmol/g fw during ripening.

Sucrose was present in low concentration (0-10 μmol/g fw) which did not change significantly during ripening.

The decrease in polysaccharide content is too low to account for the increases in soluble sugars so Ninio felt “it is likely that the observed accumulation of fructose and glucose during ripening is dependent on assimilated transport from the mother plant.”

Ninio also found that fruits which were harvested at the green stage contained lower levels of soluble sugars than red fruits. Their conclusion:

“To obtain fruits of high quality with high sugar concentration, it is recommended to postpone fruit harvest as much as possible (before fruit cracks).”

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{fruit}
\caption{Cereus peruvianus (Austin, Texas) above (HBG) right -- showing splitting ripe fruit}
\end{figure}

Malic acid constituted 90% of the fruit’s organic acids. When the mature green fruit turned purple the content of malic acid decreased by half (from 50 to 25 μmol/g fresh weight) and remained constant for the rest of the ripening process.

Concentrations of citric, succinic, and oxalic acids were all lower than 4 μmol/g fw.

During ripening, the composition of the volatile components changed from being comprised of 2-Heptenal, (E,E)-2,4-Decadienal, (E,Z)-2,4-Decadienal, 2-Decenal & Benzoic acid at the mature green stage to being largely Linalool with smaller amounts of Epoxy linalool and 3,7-Dimethyl-1,5-octadiene-3,7-diol when violet, increasing dramatically when completely red. Those three compounds comprise 99% of the total volatiles in the ripe fruit.

Linalool reaches concentrations of 1.5-3.5 μg/g fresh weight in mature red fruits.\textsuperscript{1} Ninio \textit{et al.} 2003

The aroma of the fruit is the product of (S)-linalool and linalool derivatives.

The initial detection of linalool coincides with the development of the purple color and increases during ripening into a cracked red fruit. The highest values were found in fruit ripening in storage. These findings are in line with the reports that higher linalool levels accumulate in fruit ripening in storage compared to fruit ripening on the tree.\textsuperscript{1} Sitrit \textit{et al.} 2004 cited Ninio \textit{et al.} 2003 & 2004.

S-(+)-Linalool was found to be the main volatile accumulating in the ripening fruit and was determined to occur in a remarkably high optical purity of 98%.\textsuperscript{1} Sitrit \textit{et al.} 2004
Cactus Chemistry: By Species

*Cereus peruvianus* var. (H 5262)
Trichocereus macrogonus form mislabelled as a Cereus sp.

Note

*Trichocereus macrogonus, T. pachanoi, T. peruvianus, T. sp. TJG & some material resembling what is known as Trichocereus argentinensis have all been improperly sold or published as photos in cactus books under this name. (As are other Cereus species)*

Similarly “Cereus” sp. Peru 68.0235 at the Berkeley Botanical Gardens and the fat blue “Cereus” encountered mislabelled are both *Trichocereus.*

It appears probable that *Cereus arequipensis, SOME of the material marked Cereus argentinensis (But NOT true Cereus argentinensis), Cereus bolivianus (No. 6231 in the NY Bot. Garden), some Cereus colossus (But NOT true Cereus coloseus), Cereus hempelianus Bauer, & Cereus tephraanthus bolivianus Weber, may prove to be active Trichocereus species once analyzed.*
Cereus peruvianus formae monstrosus De Candolle
Tyramine (over 50% of 10-50mg total alkaloids/100 gm of fresh plant.) Agurell 1969b [From European commercial source]

Cereus pilocereus is somehow a mistaken rendering referring to Pilocereus Sargentiatus (i.e. Lophocereus schottii) that appears in some early medical literature (ex.: Remington et al. 1918)

Cereus rosei Werdermann See as Trichocereus peruvianus

Cereus sp. Miller
Claim for the presence of Mescaline is made by Caycho Jimenez 1977 (page 91) but no reference was cited and he does not include anything to support his assertion.

Cereus sp. (unidentified; Mexico) was reported to show detectable alkaloids in Smolenski et al. 1973.
Chamaecereus silvestrii
Chamaecereus silvestrii
Cereus speciosus K.Schumann
Reported to contain Betalains as pigments.
WOHLPART & MABRY 1968 cited DREIDING 1961

Cereus stenogonus K.Schumann
Flower contains Betanin, Phyllocactin (30.4% of total), Iso-
phyllocactin & Isobetanin. PIATTELLI & IMPERATO 1969

Cereus stenogonus K.Schumann X Heliaporus smithii (Pfeiff.) Row.:
Flower contains Betanin, Phyllocactin (60.9% of total), Iso-
phyllocactin & Isobetanin. PIATTELLI & IMPERATO 1969

Cereus thouarsii Weber
Reported to contain Betalains as pigments.
WOHLPART & MABRY 1968 cited DREIDING 1961

Cereus validus Haworth
92.6% water by weight in March (fruiting)/ 88.1% in October
(no fruit.). (Argentina)
3-Nitrotyramine (0.19% dry wt.) NEME et al. 1977 & (0.19%
dry wt. in branches) NIETO et al. 1982
Tyramine (0.023%: branches; 0.377%: green fruit; 0.382%:
ripe fruit; All by dry wt.) NIETO et al. 1982
[2 unidentified bases reported in all samples; NIETO et al. 1982]
Choline (0.012%: branches; 0.029%: green fruit; 0.022%:
ripe fruit; All by dry wt.) NIETO et al. 1982

Chamaecereus silvestrii (Speg.) Br. & R.
Reported to contain Betalains as pigments.
WOHLPART & MABRY 1968 cited DREIDING 1961
Weddellite was identified as druses.
Monje & Baran 2002

Cleistocactus baumannii (Lemaire) Lemaire
Weddellite was identified as druses and crystal sand.
Monje & Baran 2002

Cleistocactus jujuyensis (Backeb.) Backeberg
Flowers contains Betanin (major) & Phyllocactin PIATTELLI
& IMPERATO 1969
Reported to contain Betalains as pigments.
WOHLPART & MABRY 1968 cited DREIDING 1961

Cleistocactus parviflorus (K.Schumann) Gosselin
Flower contains Betanin (major), Isophyllocactin, Betanidin
& traces of Phyllocactin
PIATTELLI & IMPERATO 1969

Cleistocactus smaragdiflorus (Weber) Britton & Rose
Flowers contains Betanin (minor) & Phyllocactin (major)
PIATTELLI & IMPERATO 1969

Cleistocactus strausii (Heese) Backeberg
Flower contains Phyllocactin, Isophyllocactin, Betanin &
Isobetanin. PIATTELLI & IMPERATO 1969

The genus Copiapoa seemingly lacks analysis
Cleistocactus baumannii v. flavispinus  H6816
“southern South America” E. Werdermann

Cleistocactus jujuyensis
Argentina 66.0662
(HBG)

Cleistocactus baumannii  J.N. Rose 20063
H317 Argentina
(HBG)
Cleistocactus straussii
(HBG)
Corynopuntia clavata (Engelmann) Knuth
N-Methyltyramine (Major base; 0.51%) Vanderveen et al. 1974 [collected near Albuquerque, NM. 3 collections made]. Also isolated in Keller 1980
Tyramine (trace) Vanderveen et al. 1974
Hordenine (trace) Vanderveen et al. 1974.

Corynopuntia emoryi (Engelmann) Griffith
(Analyzed as Opuntia standlyi v. standlyi)
N-Methyltyramine (no quantification) Meyer et al. 1980
Tyramine (no quantification) Meyer et al. 1980

Corynopuntia emoryi
(SRSU) above

Corynopuntia invicta
(HBG)
*Corynopuntia invicta* Brandegee

Hordenine (%?)

N-Methyltyramine (no quantification)

Tyramine (no quantification)

* Meyer *et al.* 1980
Corynopuntia kunzei (Rose) Griffith
(Analyzed as Opuntia stanlyi v. kunzei)
N-Methyltyramine (0.05%) MEYER et al. 1980
Tyramine (no quantification) MEYER et al. 1980
Corynopuntia schottii ENGELMANN
Hordenine (0.049% dry wt)
N-Methyltyramine (0.018%)
Tyramine (no quantification)
Meyer et al. 1980

[Brown et al. 1968 found no detectable alkaloid in their sample of this species.]
Corynopuntia schottii
(Val Verde County, Texas)

Corynopuntia schottii
(Terrell County, Texas)
Coryphantha bumamma (Ehrenberg) Britton & Rose

3,4-Dimethoxy-N-methylphenethylamine (trace)
Hordenine (Over 50% of 10-50 mg of total alkaloids/100 grams of fresh plant.)
N-Methyl-4-methoxyphenethylamine (trace)

Bruhn et al. 1975b [Wild collected; Guerrero, Mexico]

Coryphantha bumamma (HBG)
Coryphantha cornifera

E.F.A. 4950 Mexico
H56976 A)
Coryphantha calipensis H. BRAVO
β-Methoxy-3,4-dimethoxy-N,N-dimethylphenethylamine (40 mg from 2.56 kg fresh) BRUHN & AGURELL 1974; (10-50% of over 50 mg of total alkaloids/100 grams fresh)
BRUHN et al. 1975b [Wild collected; Puebla, Mexico].
β-Methoxy-3,4-dimethoxy-N-methylphenethylamine [Cali- pamine] (210 mg from 2.56 kg fresh.) BRUHN & AGURELL 1974; (10-50% of over 50 mg of total alkaloids/100 grams fresh) BRUHN et al. 1975b
3,4-Dimethoxy-N-methylphenethylamine (trace) BRUHN & AGURELL 1974 & BRUHN et al. 1975b
Hordenine (trace) BRUHN et al. 1975b
N-Methyltyramine (trace) BRUHN et al. 1975b
Normacromerine (0.005% dry wt.) BRUHN & AGURELL 1974.
[N,N-DiMe-3,4-diMeO-PEA has also been listed in an alkaloid summary. One of the references given, BRUHN & AGURELL 1974, did not report this alkaloid. The other, BRUHN 1975a, is presently unavailable to us.]
[Macromerine has also been listed. The reference given, BRUHN 1975a, is presently unavailable to us.]
Isocitric acid (tlc, gc & gc-ms by KRINGSTAD & NORDAL 1975)

Coryphantha cornifera

Coryphantha cornifera var. echinus (ENGELMANN) L. BENSON
β-O-Methylsympinephrine (no quantification)
3,4-Dimethoxy-N-methylphenethylamine (no quantification)
4-Methoxyphenethylamine (no quantification)
Hordenine (no quantification)
N-Methyltyramine (no quantification)
Sympinephrine (no quantification)
HORNEMAN et al. 1972
[Macromerine has been listed in error. The reference cited, HORNEMAN et al. 1972, did not report this alkaloid.]

Coryphantha compacta (ENGELMANN) BRITTON & ROSE
Needs an analysis. See Activity Notes
*Coryphantha compacta*
(Cactus Country)
**Coryphantha durangensis (RUNGE) BRITTON & ROSE**
3,4-Dimethoxy-N-methylphenethylamine (no quantification)
Hordenine (no quantification)
N-Methyltyramine (no quantification)
Synephrine (no quantification)
Hornemann et al. 1972

**Coryphantha elephantidens LEMAIRE**
Macromerine (no quantification)
β-O-Methylsynephrine (no quantification)
3,4-Dimethoxy-N-methylphenethylamine (no quantification)
Hordenine (no quantification)
N-Methyltyramine (no quantification)
Synephrine (no quantification)
Hornemann et al. 1972

[N-Me-4-MeO-PEA has been reported in error; the reference cited, Hornemann et al. 1972, did not report this alkaloid]

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**Coryphantha greenwoodii H.BRAVO**
β-Methoxy-3,4-dimethoxy-N,N-dimethyl-phenethylamine (10-50% of over 50 mg of total alkaloids/100 grams fresh) Bruhn et al. 1975b
β-Methoxy-3,4-dimethoxy-N-methylphenethylamine (Calipamine) (10-50% of over 50 mg of total alkaloids/100 grams fresh) Bruhn et al. 1975b; (As (-)-form: 0.034% dry wt.) Ranieri et al. 1976
β-O-Methylsynephrine (trace) Bruhn et al. 1975b and Ranieri et al. 1976
3,4-Dimethoxy-N,N-dimethylphenethylamine (trace) Bruhn et al. 1975
3,4-Dimethoxy-N-methylphenethylamine. (1-10% of over 50 mg of total alkaloids/100 grams fresh) Bruhn et al. 1975; (0.0095% by dry weight) Ranieri et al. 1976
3,4-Dimethoxy-N-formyl-β-hydroxy-N-methylphenethylamine Shulgin & Shulgin 1997
Coryphanthine (0.022%) Meyer et al. 1983 Also observed by Davis et al. 1983
Hordenine (trace) Bruhn et al. 1975
Normacromerine (0.043% dry wt.) Ranieri et al. 1976
O-Methylcandicine (no quantification) Meyer et al. 1983
Synephrine (trace) Ranieri et al. 1976

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**Coryphantha durangensis**

*Coryphantha echinus*
See as *Coryphantha cornifera var. echinus*
Coryphantha macromeris (Engelmann) Lemarie

“Doña ana” “Big nipple cactus”

Macromerine (0.16% dry wt.) Brown et al. 1972a [Also observed as the major alkaloid in Brown et al. 1968] Hodgekins et al. 1967 reported it to be the “main alkaloid”. Unidentified alkaloids were observed in Brown et al. 1968

[All of the many listings, or mention, of other alkaloids reported from this species (Including normacromerine) are apparently in error as they all cited references, (such as Keller), that actually analyzed Coryphantha macromeris var. runyonii (C. runyonii).

The equating of analytical reports for different varieties and the assumption that they could be viewed as generalized alkaloid profiles for the entire species, has lead to not a few unfortunate errors in the chemical literature; both in discussions and in tabular summaries.

Normacromerine would not be surprising but someone needs to report it based on an actual analysis.

Mescaline is an erroneous listing. Barceloux 2008 confusedly includes Coryphantha macromeris along with “several South American cactus species [that] contain mescaline”]

Coryphantha macromeris var. runyonii L.Benson

3,4-Dimethoxy-N-methylphenethylamine (trace) Agurell 1969b [Obtained via European commercial sources]; (0.0006% fresh) Keller et al. 1973.

Epinephrine (14.22 µg/gm fresh), Keller 1978.

Hordenine (trace) Agurell 1969b; (0.0004%) fresh) Keller et al. 1973.

Macromerine (Major alkaloid. 0.07% dry wt.) Below et al. 1968; (major alkaloid- over 50% of over 50 mg total alkaloids/ 100 gm fresh) Agurell 1969b; (0.0021% fresh) Keller et al. 1973.

Metanephrine (0.0002% fresh) Keller et al. 1973.

N-Formylnormacromerine [0.0077% fresh] Keller et al. 1973; (0.19% dry wt.) Keller et al. 1973.

N-Methyl-4-methoxyphenethylamine (0.0005% fresh) Keller et al. 1973.

[N-Me-4-OH-tyramine appears in the literature erroneously. It is probably a typo meaning N-Me-4-MeO-PEA or N-Me-4-OH-PEA. (Tyramine IS 4-OH-PEA)]
Coryphantha macromeris var. runyonii

variant form (Starr Co, Texas)
Plants on this and the previous page are wild plants that were relocated into a cactus bed.
**Coryphantha missouriensis** (Sweet.) Britton & Rose
3,4-Dimethoxy-N-methylphenethylamine (trace)
Hordenine (0.39% dry wt.)
N-Methyltyramine (0.013% dry wt.)
Tyramine (trace)
_Pumangura et al._ 1981

**Coryphantha ottonis** (Pfeiffer) Lemaire
4-Methoxyphenethylamine (no quantification)
Hordenine (no quantification).
N-Methyltyramine (no quantification)
Synephrine (no quantification)
_Horneman et al._ 1972

**Coryphantha palmeri** Britton & Rose
β-Sitosterol (0.003% dry wt.)
Dotriacontane
Eicosanol
Galactose
Saccharose
Small amounts of an unsaturated triterpenol (A tetracyclic triterpenoid).
Small amounts of an unidentified alkaloid.
_Dominguez et al._ 1970
No detectable alkaloid. _Chalet_ 1980a cited _Dominguez et al._ 1969
[Traces of Mescaline are seemingly implied to have been detected in this species but the account is unclear and does not specifically state it. _Gennaro et al._ 1996]
Needs additional analysis.
See comment & image in Activity Notes

**Coryphantha pectinata** (Engelmann) Britton & Rose
β-O-Methylsynephrine
3,4-Dimethoxy-N-methylphenethylamine
4-Methoxy-β-hydroxyphenethylamine
Hordenine
Macromerine
N-Methyl-4-methoxyphenethylamine
N-Methyltyramine
Synephrine
_Horneman et al._ 1972 (no quantification)

**Coryphantha poselgeriana** (Dietrich) Britton & Rose
4-Methoxyphenethylamine
Hordenine
N-Methyltyramine
Synephrine
_Horneman et al._ 1972 (no quantification)

**Coryphantha radians** (De Candolle) Britton & Rose
Hordenine (1-10% of over 1-10 mg of total alkaloids/ 100 grams fresh.) _Bruhn et al._ 1975 [Wild collected: Querétaro, Mexico].
N-Methyltyramine (Over 50% of 1-10 mg of total alkaloids/ 100 grams fresh) _Bruhn et al._ 1975
[Traces of Mescaline are seemingly implied to have been detected in this species but the account is unclear and does not specifically state it. _Gennaro et al._ 1996]

**Coryphantha ramillosa** C. CUTAK
β-O-Methylsynephrine (0.0015% dry wt. 1.9% of total alkaloid.) _Sato et al._ 1973.
Hordenine (0.73% in dry. 91.8% of total alkaloid.) _Sato et al._ 1973.
N-Methyl-4-methoxyphenethylamine (0.00092% dry wt.: 0.1% of total alkaloid.) _Sato et al._ 1973.
N-Methyltyramine (0.043% by dry weight. 5.5% of total alkaloid) _Sato et al._ 1973
Synephrine (0.0057% dry wt.) _Sato et al._ 1973.

_Coryphantha runyonii_ Britton & Rose See as Coryphantha macro-meris var runyonii

**Coryphantha radians** 96.0797 Mexico
Trouts Notes on Cactus Chemistry

*Coryphantha poselgeriana*
Normal seedling (top)
Odd seedling (center)
Photo from Kreuzinger catalog (lower image)

*Coryphantha ramillosa*
(Terrell County, Texas)
Coryphantha ramillosa
Terrell County, Texas
Coryphantha ramillosa
(BTA)
**Coryphantha tuberculosa**

As *Escobaria tuberculosa* Britton & Rose

Reported to contain druses of Weddellite.

Rivera & Smith 1979
(collected in the Marathon Basin, West Texas)

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**Coryphantha vivipara (Nuttall) Engelmann**

Hordenine (Sole alkaloid present. 10-50 mg/100 grams of fresh plant.) Bruhn et al. 1975 [Cultivated: Switzerland]

CO₂ uptake occurred entirely at night through the stems (under well watered conditions).

Nobel & Hartsock 1986
Trouts Notes on Cactus Chemistry

*Coryphantha vivipara*
(cultivated: New Mexico)
Coryphantha scolymoides (Scheidweiler) A. Berger [excluded]
Traces of Mescaline reported (between 4-12 µg/gm fresh) Gennaro et al. 1996

Coryphantha vivipara (Nuttall) Britton & Rose
var. arizonica (Engelmann) W.T. Marshall
Hordenine (0.017% by dry weight.) Howe et al. 1977b
An unidentified quaternary alkaloid was reported by Brown et al. 1968
Cylindropuntia acanthocarpa Engelmann & Bigelow

3,4-Dimethoxyphenethylamine (around 0.01% dry wt.)
4-Hydroxy-3,5-dimethoxyphenethylamine (Less than 0.01% dry wt.)
Mescaline (0.01% dry wt. [ie 10 mg/ 100 gm dry wt])
Ma et al. 1986 (Analyzed F. ZeylmaKer #8320)
[Hordenine has also been listed in error, this species is not included by TA Smith 1977; the reference cited.]
[Meyer et al. 1980: traces of unidentified alkaloids]
Quercetin-3-rutinoside, Quercetin-3-glucoside and Kaempferol-3-glucoside (flavonoids) were reported in the flowers.
Clark et al. 1980 [Collected east of Florence, AZ]
*Cylindropuntia acanthocarpa*

(NMCR)
Cylindropuntia acanthocarpa
var. thornberi
(BTA)
**Cylindropuntia echinocarpa** Engelmann & Bigelow

“silver cholla”

3,4-Dimethoxyphenethylamine (Around 0.01% dry wt.)

4-Hydroxy-3,5-dimethoxyphenethylamine (Around 0.01% dry wt.)

Mescaline (Around or less than 0.01% dry wt.)

Ma et al. 1986 (F. Zeylmaker #8327 & 8328)

See comments in Activity Notes.

**Cylindropuntia fulgida** Engelmann

Unidentified alkaloids reported by Meyer et al. 1980

Quercetin-3-rutinoside, Quercetin-3-glucoside and Kaempferol-3-glucoside (flavonoids) were reported in the flowers.

Clark et al. 1980 [Collected east of Florence, Arizona]

Cholla gum was determined to contain Arabinose (51.6%), Galactose (31.7%), Galacturonic acid (11.2%), Rhamnose (2 or 3%) & Xylose (15.0%). (Gum degradation products were studied) Parkhi & Jones 1966. [Sands & Klass 1929 found: Arabinose (53.2%), Galactose (8.4%), Galacturonic acid (11.5%) & Rhamnose (5.5%) They did not detect Xylose; Brown et al. 1949 reported L-Arabinose (6 parts), D-Galactose (3 parts), D-Galacturonic acid (1 part), L-Rhamnose (traces) & D-Xylose (2 parts)] See also Anderson et al. 1925
Cylindropuntia aff. echinocarpa
Trouts Notes on Cactus Chemistry

*Cylindropuntia imbricata* Haworth

- 3-Methoxytyramine (no quantification)
- 3,4-Dimethoxyphenethylamine (no quantification)
- Mescaline (Not quantified)
- Tyramine (no quantification)

Unidentified alkaloid also present.

Meyer *et al.* 1980

Reported to contain druses of Whewellite.

Rivera & Smith 1979

(collected on the campus of the University of Texas at Austin)
Cylindropuntia kleiniae
(SRSU) lower left & right column

Cylindropuntia imbricata
(Cactus Country) top left
(Travis County, Texas) center left
Trouts Notes on Cactus Chemistry

**Cylindropuntia kleiniae DeCandolle**
N-Methyltyramine (no quantification)
Tyramine (no quantification)
Meyer et al. 1980

**Cylindropuntia leptocaulis DC**
(aka “tasajillo”)
Most often appearing in the literature as Opuntia leptocaulis.
Reported by Meyer et al. 1980 to contain traces of unidentified alkaloids.
It was reported to show no detectable alkaloids in the screenings of Smolenski et al. 1973.
Betacyanins reported as pigments.
Mabry et al. 1963

A number of compounds were isolated from Chaetomium globosum. This fungus was found inhabiting the rhizosphere of Opuntia leptocaulis.
- Globosuxanthone A (a new dihydroxanthone)
- Globosuxanthone B (a new tetrahydroxanthone)
- Globosuxanthone C (a new xanthone)
- Globosuxanthone D (a new xanthone)
- 2-Hydroxyvertixanthone
- Chrysazin (anthraquinone)
- 1,3,6,8-Tetrahydroantraquinone
WiJERATNE et al. 2006a

Five new isocoumarins were isolated from cultures of Para-phaeosphaeria quadriseptata, a fungal strain living in association with Opuntia leptocaulis.
- Paraphaeosphaerin A, B & C
  and
- Chaetochiversins A and B
Along with a new chroman-4-one, Aposphaerin C.
WiJERATNE et al. 2006b

See comments in Activity Notes.
Cylindropuntia ramosissima (Engelmann) F.M. Knuth
3,4-Dimethoxyphenethylamine (less than 0.01% dry wt.)
Ma et al. 1986 (F. Zeylmaeker #8501)
Cylindropuntia spinosior
(Cactus Country)
Cylindropuntia spinosior
(SRSU) above
(Cactus Country) below
Cylindropuntia spinosior-imbricata intermediate
(Silver City, New Mexico, USA)
**Cylindropuntia spinosior (Engelmann) Toumey**

Tyramine (0.0018% dry wt.)
3-Methoxytyramine (0.001% dry wt.)
3,4-Dimethoxyphenylethylamine. (trace)
Mescaline (0.00004% dry wt.) [Initially detected by Krüger et al. 1977] This is 40 μg per 100 grams of dried material.

Pardanani et al. 1978
Quercetin-3-rutinoside, Quercetin-3-glucoside and Kaempferol-3-glucoside (flavonoids) were reported in the flowers.

Clark et al. 1980 [Collected east of Florence, Arizona]

**Cylindropuntia versicolor (Engelmann ex J.M. Coulter) F.M. Knuth**

Hordenine (no quantification)
N-Methylyramine (no quantification)
Tyramine (no quantification)
Unidentified alkaloids were also present.

Meyer et al. 1980

Chemical studies have been performed on *Aspergillus terreus*. This fungus was found inhabiting the rhizosphere of *Opuntia versicolor*.

Asterredione (a novel cyclopentenedione)
(+)-5(6)-Dihydro-6-methoxyterrecyclic acid A (a new terrecyclic acid A derivative)
(+)-5(6)-Dihydro-6-hydroxyterrecyclic acid A (a new terrecyclic acid A derivative)
(+)-Terrecyclic acid A
(−)-Quadrone
Betulinan A
Asterriquinone D
and
Asterriquinone C

Wijeratne et al. 2003
See comments in Activity Notes.


**Trouts Notes on Cactus Chemistry**

*Cylindropuntia whipplei* (Engelmann & Bigelow)
F.M. Knuth
3,4-Dimethoxyphenethylamine (no quantification)
Unidentified alkaloids were also present.
Meyer et al. 1986

*Cylindropuntia versicolor* (Saguaro National Park)
Denmoza rhodacantha (Salm-Dyck) Britton & Rose
Candicine (%?) Nieto 1987

*Cylindropuntia stanlyi* Engelmann var. kunzei (Rose) L.Benson
See as Corynopuntia kunzei
*Cylindropuntia stanlyi* var. stanlyi Engelmann
See as Corynopuntia emoryi

*Denmoza rhodacantha* (UC) 72.0479

*Dolichothele baumii* (Boedecker) Werdermann & Buxbaum
Dolichotheline (An imidazole)
6 unidentified alkaloids (tentatively)
Dingerdissen & McLaughlin 1973b
Dehydrogeosmin - Minor volatile in the floral scent.
Sesquiterpene alcohol 1 - Trace volatile in the floral scent.
Sesquiterpene alcohol 2 - Minor volatile in the floral scent.
Schlumberger et al. 2004 (In tepals; gc-ms)
Denmoza rhodantha
(UC)

Dolichothele longimamma
(UC)
Dolichothele longimamma longimamma
(BTA) 88.409
Dolichothele longimamma
(Cactus Country)

Dolichothele melaleuca
(California)
Trouts Notes on Cactus Chemistry

**Dolichothele longimamma** (De Candolle) Britton & Rose

N-Methyl-4-methoxy-β-hydroxyphenethylamine (Longimamine: O-Methylsyneprine) (0.00037% dry wt.) *Ranieri & McLoughlin 1976.* [Reported in *Ranieri & McLoughlin 1975b*]

Normacromerine (0.012% dry wt.) *Ranieri & McLoughlin 1976.* [Reported in *Ranieri & McLoughlin 1975b*]

Syneprine (0.43% dry wt.) *Ranieri & McLoughlin 1976.* [Reported in *Ranieri & McLoughlin 1975b*]

Also contains a few tetrahydroisoquinolines (If you ever doubted there are chemists with a twisted sense of humor…)

Longimammosine [6-Hydroxy-2-methyl-THIQ] (0.0019% dry wt.) *Ranieri & McLoughlin 1976.* [Reported in *Ranieri & McLoughlin 1975b*]

Longimammidine [8-Hydroxy-2-methyl-THIQ] (0.0019% dry wt.) *Ranieri & McLoughlin 1976.* [Reported in *Ranieri & McLoughlin 1975b*]

Longimammatine [6-Methoxy-THIQ] (0.0028% dry wt.) *Ranieri & McLoughlin 1976.* [Reported in *Ranieri & McLoughlin 1975b*]

Longimammamine [4,8-Dihydroxy-2-methyl-THIQ] (0.0008% dry wt.) *Ranieri & McLoughlin 1976.* [Reported in *Ranieri & McLoughlin 1975b*]

Note: Do not confuse with Longimammine which is a phenethylamine.

Ubine (no quantification) *Kruger et al. 1977,* NOT reported in *Ranieri & McLoughlin 1976*

And Dolichothele (An imidazole) (Identified) Dingderissen & McLoughlin 1973b (Also noted “…large number of unusual compounds that were unidentified…”)

Natural occurrence in the plant of lauric, myristic and other fatty acids esterified to the C-3 hydroxyl groups of assorted 12-Oleanene series triterpenes, including: β-Amyrin, Erythrodiol, Longispinogenin, Methyl oleanolate, Mamiladiol, Oleanone, Oleanolic aldehyde.

Spencer *et al. 1983*


**Dolichothele longimamma** (HBG)

**Dolichothele melaleuca** (Dietrich) Britton & Rose

Dolichothele (An imidazole) (Tentatively) 6 unidentified alkaloids Dingderissen & McLoughlin 1973b

**Dolichothele sphaerica** (Dietr.) Britton & Rose

Phenethylamine (traces) Keller 1982

β-O-Ethylsyneprine (0.0038% dry wt.) Dingderissen & McLoughlin 1973a. Recovered via preparative tlc but said to have been shown to be an extraction artifact of Syneprine. Dingderissen & McLoughlin 1973c

β-O-Methylsyneprine (0.0060% dry wt.) Dingderissen & McLoughlin 1973a. Recovered via preparative tlc: Dingderissen & McLoughlin 1973c

N-Methylphenethylamine (0.0411% by dry weight) Dingderissen & McLoughlin 1973a. Recovered via preparative tlc: Dingderissen & McLoughlin 1973c


Syneprine (0.0033% dry wt.) Dingderissen & McLoughlin 1973a. Recovered via preparative tlc: Dingderissen & McLoughlin 1973c

Dolichothele (N-Isovalerylhistamine) 0.7% by dry wt: (no mention of other alkaloids) Rosenberg & Paul 1969 & 1970; (0.65% major alkaloid) Dingderissen & McLoughlin 1973b (reported presence of other, mainly trace, alkaloids). 0.65% also reported in Dingderissen & McLoughlin 1973a [Also said to be reported in Habermann 1974a (from Štárha nd)] Detected in tlc in Dingderissen & McLoughlin 1973c.
Dolichothele sphaerica in habitat (Jim Hogg County, Texas)
Dolichothele surculosa
(HBG)

Dolichothele sphaerica
(Jim Hogg County, Texas)
**Dolichothele surculosa** *(Boedeker) F. Buxbaum*

Hordenine (0.178% dry wt.)
N-Methyltyramine (0.134% dry wt.)
N-Methylphenethylamine (0.25% by dry weight.)
Syneprine (0.017% dry wt.)
The imidazole, Dolichotheline was also identified.
[An unidentified imidazole was also reported]

Dingerdissen & McLauughlin 1973b

[Also cited as a reference but they DID NOT analyze this species]

Reported to contain Betalains as pigments (As *Mammillaria surculosa*).

Wohlpart & Mabry 1968 cited Dreiding 1961

Volatile components of the floral scent have been studied.

Dehydrogeosmin - Minor volatile in floral scent.

Sesquiterpene alcohol 1 - Trace volatile in floral scent.

Sesquiterpene alcohol 2 - Minor volatile in floral scent.

Schlumberger *et al.* 2004 (In tepals; gc-ms)

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**Dolichothele surculosa**

**Dolichothele uberiformis** *(Zuccarini) Britton & Rose*

3,4-Dimethoxy-N-methylphenethylamine (0.007% dry wt.)
Hordenine (trace) [Also in Kruger *et al.* 1977]
N-Methyl-4-methoxyphenethylamine (0.004% dry wt.)
N-Methyltyramine (trace) [Also in Kruger *et al.* 1977]
Normacromerine (0.068% dry wt.)
Syneprine (0.12% dry wt.)
Ubine (N,N-diMe-β-OH-PEA) (Major alkaloid. 0.24% dry wt.)
(-)-Longimaminine (0.016% dry wt.)
Longimmaminine (trace)
Uberine (5-MeO-7-OH-2-Me-THIQ) (0.002% dry wt.) [Also in Kruger *et al.* 1977]
Dolietheline (An imidazole) Dingerdissen & McLauughlin 1973b (Also noting a “...large number of unusual compounds that were unidentified...”)

[Agurell 1969b is cited as a reference by DID NOT analyze this species. Wheaton & Stewart 1970 also appears cited as a reference but DOES NOT mention this species.]

Dongianimaminine was reported in error. Ranieri & McLauughlin 1977 did NOT observe this alkaloid.

See comments in Activity Notes.

Echinocactus arechavaletai Schumann.

See as Wiggensia arechavaletai

Echinocactus caespitosus was reported to contain an unidentified alkaloid by Brown *et al.* 1968

Echinocactus concinus Monville. See as Notocactus concinus

Echinocactus grandis Rose

β-Sitosterol (0.005% by dry wt.)
Galactose, Rhamnose, traces of an aliphatic saturated tetrol & small amounts of a polyhydroxylated steroid.

Dominguez *et al.* 1970

Reported to contain no detectable alkaloid. Chalet 1980a cited Dominguez *et al.* 1969


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**Dolichothele uberiformis**

(HBG) top left
(California Cactus Center) bottom left
Echinocactus horizonthalonius
Presidio County, Texas

Echinocactus horizonthalonius
in Hudspeth County, Texas
Echinocactus horizonthalonius
in Terrell County, Texas

Echinocactus horizonthalonius
in Hudspeth County, Texas
Echinocactus ingens
Echinocactus visnaga above

Echinocactus visnaga, Echinocactus ingens and Echinocactus grandis are all considered to be synonyms of Echinocactus platyacanthus.

Echinocactus ingens juvenile form below
Echinocactus texensis Horv
AKA the “Horse Crippler” or “Devil’s Head” or “Viznaga”

Reported to contain unidentified quaternary alkaloid(s) by Brown et al. 1968.
Echinocactus (Homalocephala) texensis in Texas: Terrell County (above) & Starr County (below)
**Cactus Chemistry: By Species**

**Echinocactus horizonthalonius Lemaire**
No detectable alkaloid. Brown et al. 1968
Reported to contain druses of Weddellite. Rivera & Smith 1979. See comments on the Biominerals page.

**Echinocactus hystrix Haw.**
See as Lemaireocereus hystrix
Echinocactus ingensis Pfeiffer
See as Echinocactus platycanthus
Echinocactus lewini K.Schumann
See as Lophophora williamsii

**Echinocactus platycanthus** was reported to contain unidentified alkaloids. (from Soulaire 1947)

**Echinocactus polycephalus Engelmann & Bigelow** Mescaline was NOT observed at the levels they were capable of detecting. Genaro et al. 1996

**Echinocactus polycephalus var. xeranthoides Coulter**
Brown et al. 1968 reported to contain unidentified alkaloid.

**Echinocactus pruinosus O.**
See as Lemaireocereus pruinosus
Echinocactus ritteri Bod.
See as Aztekium ritteri
Echinocactus texensis Hofffer
See as Homalocepha texensis

**Echinocactus visnaga Hooker**

**Echinocactus williamsii Lemaire ex Salm-Dyck**
See as Lophophora williamsii

**Echinocereus acifer (Otto) Lemaire**
Domínguez et al. 1969 reported an unidentified alkaloid.

**Echinocereus blanckii Posegner ex Rümpler**
Has 94% water by weight
N,N-Dimethylhistamine (0.016% by fresh wt/ 0.285% by dry wt. (As 2HCl) )
3,4-Dimethoxyphenethylamine (0.0065 % by fresh wt/ 0.114% by dry wt. (As HCl) Wagner & Grevel 1982b
[N-Me-3,4-DMeO-PEA has been listed in error. The reference, Wagner & Grevel 1982b, did not report this compound.]
Citrine (7.6% in stem juice) Hegnauer 1964 cited Bergström 1934

**Echinocereus polypephalus** Mescaline NOT observable at the levels they were capable of detecting. Genaro et al. 1996

**Echinocereus chloranthus Engelmann**
Brown et al. 1968 reported to contain unidentified alkaloid.

**Echinocereus cinerascens (DeCandolle) Rümpler**
3,4-Dimethoxy-N,N-dimethylphenethylamine (0.01% fresh)
Bruhn & Sánchez-Mejorada 1977 [Wild collected: Hidalgo, Mexico].
3,4-Dimethoxy-N-methylphenethylamine (0.0002%; 1.95x10^{-4} % fresh) Bruhn & Sánchez-Mejorada 1977
Glucaric acid (tlc by Kringstad & Nordal 1975)
*Echinocereus enneacanthus* var. *enneacanthus* (Cactus Country) “strawberry cactus” STANLEY 1924
Cactus Chemistry: By Species

**Echinocereus enneacanthus var. stramineus** (Engelmann)

L. Benson

"pitahaya" Standley 1924

Brown et al. 1968 reported to contain unidentified alkaloids. Contains large amounts of some form of Calcium oxalate.

See a photo on the biomineral page in this work.

**Echinocereus merkerii** Hildm.

3,4-Dimethoxy-N,N-dimethylphenethylamine (no quantification) Agurell et al. 1969

3,4-Dimethoxy-N-methylphenethylamine (no quantification) Agurell et al. 1969

3,4-Dimethoxyphenethylamine (no quantification) Agurell et al. 1969 and McFarlane & Slaytor 1972

3-Methoxytyramine (no quantification) Agurell et al. 1969

Tyramine (no quantification) McFarlane & Slaytor 1972b

Hordenine (no quantification) Agurell et al. 1969 and McFarlane & Slaytor 1972b

Candicine (no details) Shulgin & Shulgin 1997

Salsoline (no quantification) Agurell et al. 1969; (no details) Shulgin & Shulgin 1997

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*Echinocereus enneacanthus var. stramineus*

Upper two images

*Echinocereus merkerii*

Echinocereus merkerii

Echinocereus merkerii
Echinocereus pectinatus (Scheidweiler) Engelmann has been listed in error as containing hordenine. Agurell 1969b, the reference cited for the claim, did not examine this species.

Echinocereus triglochidiatus Engelmann
var. gurneyi Benson
Dihydroquercetin
Dihydroquercetin 7-O-glucoside
Dihydrokaempferol
Dihydrokaempferol 7-O-glucoside
Dihydromyricetin
Dihydromyricetin 7-O-glucoside
Quercetin 7-O-glucoside
Quercetin 3-O-glucoside
Quercetin 3-O-rhamnosylglucoside
Kaempferol 3-O-glucoside
Kaempferol 3-O-rhamnosylglucoside
Present in perianth parts; in particular the tepals. Epidermis & spines contained traces only. Absent from the cortex. Miller & Bohm 1982. (Wild collected: Marathon, Texas)

Echinocereus triglochidiatus var. paucispinus Engelmann
N,N-Dimethylhistamine (no quantification) Mata & McLaughlin 1982 citing Ferrigni & McLaughlin 1981: unpublished results; (0.11% dry wt; isolation, tlc, mp, mmp, pmr) Ferrigni et al. 1982.

Echinocereus triglochidiatus var. paucispinus
(Val Verde, Texas)

Echinocereus triglochidiatus has been listed as containing 5-MeO-DMT but there is no basis for that assertion. (This compound was nowhere mentioned in the reference cited: i.e. Bye 1979. It does not appear to have ever been reported in nature.)

This species has also had a report of 5-Methoxy-N,N-dimethyltryptamine or what was suspected to be 5-MeO-DMT (first mentioned as a possibility in Bye 1979, citing personal communication with JL McLaughlin, and later repeated as fact many other places.) Schultes & Hofmann 1979 & 1980 also mentioned the possibility that a tryptamine derivative may have been observed.

In some retellings the identity was inexplicably recreated as DMT. This was never proven. More importantly, Ferrigni et al. made a comment that whatever indole(s) they observed was present in trace amounts and was unstable in their extraction procedure. Unknown(s) were suspected of being indolic due to reacting with Ehrlichs reagent and forming a blue chromophore in TLC.

Had unknown been DMT or 5-MeO-DMT, they would have been both stable and easily been recovered using their approach so, whatever the identity of their unidentified compound(s) turns out to be, it was decidedly NEITHER 5-MeO-DMT NOR DMT. They determined the main alkaloid present was dimethylhistamine.

Some imidazoles are reactive with Ehrlichs reagent but Dimethylhistamine is not, suggesting that more investigation might be warranted.

To risk adding more confusion to the issue the plants being discussed are actually E. coccineus (tetraploid), var. paucispinus & var. gurneyi, and not E. triglochidiatus (which is diploid) This is also true for part of neomexicanus, but I do not know which Ferrigni used. See Powell & Weedon 2004. Every image on THIS page is Echinocereus coccineus. The name “triglochidiatus” is preserved on this page only to aid keyword efficacy.

See comments in the Activity Notes.

Echinocereus viridiflorus Engelmann var. chloranthus Backeberg
See as Echinocereus chloranthus

Echinofossulocactus multicostatus (Hildm.) Br. & R.
No detectable alkaloid.

Chalet 1980a cited Dominguez et al. 1969
Echinocereus coccineus
var. gurneyi

Echinocereus triglochidiatus
var. neomexicanus

Echinocereus coccineus inermis
counterclockwise from top

*Echinocereus coccineus* var. *gurneyii* (Sul Ross)

*Echinocereus coccineus* var. *coccineus* (Sul Ross)

*Echinocereus coccineus* var. *paucispina*

(Judge Roy Bean Visitors Center)

*Echinocereus coccineus* var. *inermis* (SS)
Echinopsis ancistrophora

(s) Abra Santa Laura, Jujuy, Argentina

(% given is percentage of the total scent fraction)
limonene 0.43
linalool 0.07
(E,E)-2,6-dimethyl-3,5,7-octatriene-2-ol 2.33
all monoterpenoids 2.82
β-copaene 0.11
β-elemene 0.66
germacrene D 13.14
bicyclogermacrene 0.28
(Z,E)-α-farnesene 0.22
(E)-nerolidol 71.3
unknown sesquiterpenoids 3.13
all sesquiterpenoids 88.96
nonanal 3.49
hexadecane 1.38
unknown fatty acid derivatives 0.48
all fatty acid derivatives 5.35
benzaldehyde 0.13
unknown aromatics 0.24
all aromatics 0.37
methyl-anthranilate 0.12
indole 2.37
all nitrogenous compounds 2.49

Schlumpberger & Raguso 2008

Echinopsis ancistrophora

(s) Calderilla, Salta, Argentina

(% given is percentage of the total scent fraction)
limonene 0.02
1,8-cineole 0.06
6-methyl-5-heptene-2-one 0.05
(E,E)-2,6-dimethyl-1,3,5,7-octatetraene 0.74
geranial 0.06
(E,Z)-2,6-dimethyl-3,5,7-octatriene-2-ol 0.35
(E,E)-2,6-dimethyl-3,5,7-octatriene-2-ol 3.13
geranial 0.61
geranyl acetate 0.07
unknown monoterpenoids 0.1
all monoterpenoids 5.18
α-copaene 1.37
β-copaene 0.62
β-elemene 0.09
(E)-caryophyllene 0.57
germacrene D 32.58
bicyclogermacrene 0.07
(Z,E)-α-farnesene 0.31
δ-cadinene 0.06
(E)-nerolidol 47.64
(E,E)-farnesyl acetate 3.33

Schlumpberger & Raguso 2008

Echinopsis ancistrophora

(s) Cuesta del Cebilar, Salta, Argentina

(% given is percentage of the total scent fraction)
6-methyl-5-heptene-2-one 0.12
geranyl acetate 0.07
unknown monoterpenoids 0.12
all monoterpenoids 0.39
α-copaene 1.12
β-bourbonene 0.48
β-copaene 0.16
β-elemene 0.04
(E)-caryophyllene 0.13
humulene 0.03
germacrene D 5.52
bicyclogermacrene 0.06
(Z,E)-α-farnesene 0.07
(Z)-nerolidol 0.83
(E)-nerolidol 87.52
unknown sesquiterpenoids 1.84
all sesquiterpenoids 97.8
nonanal 0.07
methylhexadecanoate 1.06
unknown fatty acid derivatives 0.68
all fatty acid derivatives 1.82

Schlumpberger & Raguso 2008

Echinopsis ancistrophora

(s) El Fuerte, Jujuy, Argentina

(% given is percentage of the total scent fraction)
6-methyl-5-heptene-2-one 8.55
all monoterpenoids 8.55
(E,E)-α-farnesene 10.23
(E)-nerolidol 35.6
spathulenol 35.9
unknown sesquiterpenoids 7.97
all sesquiterpenoids 89.7
nonanal 0.33
unknown fatty acid derivatives 0.75
all fatty acid derivatives 1.08
benzaldehyde 0.18
methyl benzoate 0.49
all aromatics 0.67

Schlumpberger & Raguso 2008
### Echinopsis ancistrophora ssp. ancistrophora

La Caldera, Campo Alegre, Salta, Argentina

(% given is percentage of the total scent fraction)

<table>
<thead>
<tr>
<th>Compound</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>limonene</td>
<td>0.14</td>
</tr>
<tr>
<td>1,8-cineole</td>
<td>1.27</td>
</tr>
<tr>
<td>6-methyl-5-heptene-2-one</td>
<td>4.8</td>
</tr>
<tr>
<td>linalool</td>
<td>0.01</td>
</tr>
<tr>
<td>geranyl acetate</td>
<td>2.33</td>
</tr>
<tr>
<td>unknown monoterpenoids</td>
<td>0.39</td>
</tr>
<tr>
<td>all monoterpenoids</td>
<td>8.95</td>
</tr>
<tr>
<td>α-copaene</td>
<td>0.35</td>
</tr>
<tr>
<td>β-copaene</td>
<td>0.07</td>
</tr>
<tr>
<td>α-santalene</td>
<td>0.1</td>
</tr>
<tr>
<td>β-santalene</td>
<td>0.07</td>
</tr>
<tr>
<td>germacrene D</td>
<td>2.32</td>
</tr>
<tr>
<td>(Z,E)-α-farnesene</td>
<td>0.17</td>
</tr>
<tr>
<td>(E,E)-α-farnesene</td>
<td>0.09</td>
</tr>
<tr>
<td>δ-cadinene</td>
<td>0.01</td>
</tr>
<tr>
<td>β-sesquiphellandrene</td>
<td>0.1</td>
</tr>
<tr>
<td>dehydrogeosmin</td>
<td>1.37</td>
</tr>
<tr>
<td>(Z)-nerolidol</td>
<td>0.75</td>
</tr>
<tr>
<td>(E)-nerolidol</td>
<td>73.64</td>
</tr>
<tr>
<td>(E,E)-farnesyl acetate</td>
<td>0.07</td>
</tr>
<tr>
<td>(E,E)-farnesol</td>
<td>2.18</td>
</tr>
<tr>
<td>unknown sesquiterpenoids</td>
<td>3.62</td>
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<tr>
<td>all sesquiterpenoids</td>
<td>84.89</td>
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<tr>
<td>nonanal</td>
<td>0.88</td>
</tr>
<tr>
<td>hexadecane</td>
<td>0.93</td>
</tr>
<tr>
<td>unknown fatty acid derivatives</td>
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<td>all fatty acid derivatives</td>
<td>2.22</td>
</tr>
<tr>
<td>benzaldehyde</td>
<td>1.14</td>
</tr>
<tr>
<td>methyl benzoate</td>
<td>0.04</td>
</tr>
<tr>
<td>benzyl alcohol</td>
<td>1.13</td>
</tr>
<tr>
<td>phenethyl alcohol</td>
<td>0.59</td>
</tr>
<tr>
<td>unknown aromatics</td>
<td>1.04</td>
</tr>
<tr>
<td>all aromatics</td>
<td>3.94</td>
</tr>
</tbody>
</table>

Schlumpberger & Raguso 2008

### Echinopsis ancistrophora ssp. ancistrophora

Quebrada de Escoipe, Escoipe, Salta, Argentina

(% given is percentage of the total scent fraction)

<table>
<thead>
<tr>
<th>Compound</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>limonene</td>
<td>0.51</td>
</tr>
<tr>
<td>1,8-cineole</td>
<td>5.02</td>
</tr>
<tr>
<td>geranyl acetate</td>
<td>0.51</td>
</tr>
<tr>
<td>unknown monoterpenoids</td>
<td>0.02</td>
</tr>
<tr>
<td>all monoterpenoids</td>
<td>6.06</td>
</tr>
<tr>
<td>β-copaene</td>
<td>0.1</td>
</tr>
<tr>
<td>α-santalene</td>
<td>0.38</td>
</tr>
<tr>
<td>β-santalene</td>
<td>0.27</td>
</tr>
<tr>
<td>germacrene D</td>
<td>0.73</td>
</tr>
<tr>
<td>(Z,E)-α-farnesene</td>
<td>0.61</td>
</tr>
<tr>
<td>(E,E)-α-farnesene</td>
<td>0.16</td>
</tr>
<tr>
<td>δ-cadinene</td>
<td>0.02</td>
</tr>
<tr>
<td>β-sesquiphellandrene</td>
<td>0.38</td>
</tr>
<tr>
<td>dehydrogeosmin</td>
<td>0.17</td>
</tr>
<tr>
<td>(Z)-nerolidol</td>
<td>0.09</td>
</tr>
<tr>
<td>(E)-nerolidol</td>
<td>83.75</td>
</tr>
<tr>
<td>(E,E)-farnesyl acetate</td>
<td>0.09</td>
</tr>
<tr>
<td>(E,E)-farnesol</td>
<td>0.56</td>
</tr>
<tr>
<td>unknown sesquiterpenoids</td>
<td>4.19</td>
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<td>all sesquiterpenoids</td>
<td>91.69</td>
</tr>
<tr>
<td>nonanal</td>
<td>0.49</td>
</tr>
<tr>
<td>all fatty acid derivatives</td>
<td>0.49</td>
</tr>
<tr>
<td>benzaldehyde</td>
<td>0.13</td>
</tr>
<tr>
<td>methyl benzoate</td>
<td>0.14</td>
</tr>
<tr>
<td>benzyl alcohol</td>
<td>1.42</td>
</tr>
<tr>
<td>phenethyl alcohol</td>
<td>0.07</td>
</tr>
<tr>
<td>all aromatics</td>
<td>1.76</td>
</tr>
</tbody>
</table>

Schlumpberger & Raguso 2008
### Echinopsis ancistrophora ssp. ancistrophora

Quebrada de Humahuaca, Volcán, Jujuy, Argentina

(% given is percentage of the total scent fraction)

<table>
<thead>
<tr>
<th>Compound</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>limonene</td>
<td>0.11</td>
</tr>
<tr>
<td>1,8-cineole</td>
<td>1.4</td>
</tr>
<tr>
<td>all monoterpenoids</td>
<td>1.51</td>
</tr>
<tr>
<td>α-cubebene</td>
<td>0.28</td>
</tr>
<tr>
<td>α-copaene</td>
<td>3.28</td>
</tr>
<tr>
<td>β-bourbonene</td>
<td>8.03</td>
</tr>
<tr>
<td>β-copaene</td>
<td>2.18</td>
</tr>
<tr>
<td>β-elemene</td>
<td>0.17</td>
</tr>
<tr>
<td>(E)-caryophyllene</td>
<td>1.65</td>
</tr>
<tr>
<td>humulene</td>
<td>0.29</td>
</tr>
<tr>
<td>germacrene D</td>
<td>50.75</td>
</tr>
<tr>
<td>bicyclogermacrene</td>
<td>1.44</td>
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<tr>
<td>(Z,E)-α-farnesene</td>
<td>2.48</td>
</tr>
<tr>
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</tr>
<tr>
<td>dehydrogeosmin</td>
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</tr>
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<td>(E)-nerolidol</td>
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</tr>
<tr>
<td>α-cadinol</td>
<td>0.72</td>
</tr>
</tbody>
</table>

unknown sesquiterpenoids 21.58

all sesquiterpenoids 96.59

nonanal 0.40

all fatty acid derivatives 0.4

benzyl alcohol 0.29

all aromatics 0.29

Schlumpberger & Raguso 2008

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### Echinopsis ancistrophora ssp. ancistrophora

Quebrada de Toro, El Mollar, Salta, Argentina

(% given is percentage of the total scent fraction)

<table>
<thead>
<tr>
<th>Compound</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>limonene</td>
<td>0.04</td>
</tr>
<tr>
<td>6-methyl-5-heptene-2-one</td>
<td>1.71</td>
</tr>
<tr>
<td>geranyl acetate</td>
<td>1.11</td>
</tr>
<tr>
<td>unknown monoterpenoids</td>
<td>1.16</td>
</tr>
<tr>
<td>all monoterpenoids</td>
<td>4.02</td>
</tr>
<tr>
<td>α-cubebene</td>
<td>0.35</td>
</tr>
<tr>
<td>α-copaene</td>
<td>0.81</td>
</tr>
<tr>
<td>β-bourbonene</td>
<td>0.32</td>
</tr>
<tr>
<td>β-copaene</td>
<td>0.19</td>
</tr>
<tr>
<td>(E)-caryophyllene</td>
<td>0.21</td>
</tr>
<tr>
<td>humulene</td>
<td>0.02</td>
</tr>
<tr>
<td>germacrene D</td>
<td>2.8</td>
</tr>
<tr>
<td>bicyclogermacrene</td>
<td>1.16</td>
</tr>
<tr>
<td>(Z,E)-α-farnesene</td>
<td>0.11</td>
</tr>
<tr>
<td>(E,E)-α-farnesene</td>
<td>0.24</td>
</tr>
<tr>
<td>δ-cadinene</td>
<td>0.06</td>
</tr>
<tr>
<td>dehydrogeosmin</td>
<td>0.15</td>
</tr>
<tr>
<td>(Z)-nerolidol</td>
<td>1.31</td>
</tr>
<tr>
<td>(E)-nerolidol</td>
<td>82.43</td>
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<tr>
<td>spathulenol</td>
<td>0.24</td>
</tr>
<tr>
<td>(E,E)-farnesol</td>
<td>0.56</td>
</tr>
<tr>
<td>unknown sesquiterpenoids</td>
<td>4.95</td>
</tr>
<tr>
<td>all sesquiterpenoids</td>
<td>94.9</td>
</tr>
<tr>
<td>nonanal</td>
<td>0.41</td>
</tr>
<tr>
<td>hexadecane</td>
<td>0.17</td>
</tr>
<tr>
<td>Unknown fatty acid derivatives</td>
<td>0.22</td>
</tr>
<tr>
<td>all fatty acid derivatives</td>
<td>0.81</td>
</tr>
<tr>
<td>benzaldehyde</td>
<td>0.03</td>
</tr>
<tr>
<td>benzyl alcohol</td>
<td>0.24</td>
</tr>
<tr>
<td>phenethyl alcohol</td>
<td>0.01</td>
</tr>
<tr>
<td>all aromatics</td>
<td>0.28</td>
</tr>
</tbody>
</table>

Schlumpberger & Raguso 2008

---

### Echinopsis ancistrophora ssp. ancistrophora

Quebrada de Toro, south Puente Toro, Salta, Argentina

(% given is percentage of the total scent fraction)

<table>
<thead>
<tr>
<th>Compound</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>limonene</td>
<td>0.16</td>
</tr>
<tr>
<td>unknown monoterpenoids</td>
<td>0.43</td>
</tr>
<tr>
<td>all monoterpenoids</td>
<td>0.59</td>
</tr>
<tr>
<td>α-copaene</td>
<td>0.04</td>
</tr>
<tr>
<td>β-bourbonene</td>
<td>0.09</td>
</tr>
<tr>
<td>β-copaene</td>
<td>0.04</td>
</tr>
<tr>
<td>(E)-caryophyllene</td>
<td>0.03</td>
</tr>
<tr>
<td>germacrene D</td>
<td>0.14</td>
</tr>
<tr>
<td>(E)-nerolidol</td>
<td>94.28</td>
</tr>
<tr>
<td>spathulenol</td>
<td>0.27</td>
</tr>
<tr>
<td>(E,E)-farnesol</td>
<td>0.49</td>
</tr>
<tr>
<td>unknown sesquiterpenoids</td>
<td>2.45</td>
</tr>
</tbody>
</table>

unknown aromatics 0.02

Methyl-anthrinalate 0.01

Indole 0.8

All nitrogenous compounds 0.81

Schlumpberger & Raguso 2008

---

### Echinopsis ancistrophora ssp. ancistrophora

Quebrada de Toro, south Puente Toro, Salta, Argentina

(% given is percentage of the total scent fraction)

<table>
<thead>
<tr>
<th>Compound</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>limonene</td>
<td>0.16</td>
</tr>
<tr>
<td>unknown monoterpenoids</td>
<td>0.43</td>
</tr>
<tr>
<td>all monoterpenoids</td>
<td>0.59</td>
</tr>
<tr>
<td>α-copaene</td>
<td>0.04</td>
</tr>
<tr>
<td>β-bourbonene</td>
<td>0.09</td>
</tr>
<tr>
<td>β-copaene</td>
<td>0.04</td>
</tr>
<tr>
<td>(E)-caryophyllene</td>
<td>0.03</td>
</tr>
<tr>
<td>germacrene D</td>
<td>0.14</td>
</tr>
<tr>
<td>(E)-nerolidol</td>
<td>94.28</td>
</tr>
<tr>
<td>spathulenol</td>
<td>0.27</td>
</tr>
<tr>
<td>(E,E)-farnesol</td>
<td>0.49</td>
</tr>
<tr>
<td>unknown sesquiterpenoids</td>
<td>2.45</td>
</tr>
</tbody>
</table>

unknown aromatics 0.02

Methyl-anthrinalate 0.01

Indole 0.8

All nitrogenous compounds 0.81

Schlumpberger & Raguso 2008
**Trouts Notes on Cactus Chemistry**

---

**Echinopsis ancistrophora ssp. ancistrophora**
Quebrada de Toro Rio Blanco, Salta, Argentina

(% given is percentage of the total scent fraction)

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>limonene</td>
<td>0.06</td>
</tr>
<tr>
<td>1,8-cineole</td>
<td>0.07</td>
</tr>
<tr>
<td>6-methyl-5-heptene-2-one</td>
<td>0.37</td>
</tr>
<tr>
<td>geranyl acetate</td>
<td>0.1</td>
</tr>
<tr>
<td>unknown monoterpenoids</td>
<td>0</td>
</tr>
<tr>
<td>all monoterpenoids</td>
<td>0.6</td>
</tr>
<tr>
<td>α-cubebene</td>
<td>0.04</td>
</tr>
<tr>
<td>α-copaene</td>
<td>2.84</td>
</tr>
<tr>
<td>β-bourbonene</td>
<td>0.27</td>
</tr>
<tr>
<td>β-copaene</td>
<td>0.89</td>
</tr>
<tr>
<td>β-elemene</td>
<td>0.05</td>
</tr>
<tr>
<td>(E)-caryophyllene</td>
<td>0.29</td>
</tr>
<tr>
<td>humulene</td>
<td>0.20</td>
</tr>
<tr>
<td>germacrene D</td>
<td>19.13</td>
</tr>
<tr>
<td>bicyclogermacrene</td>
<td>0.56</td>
</tr>
<tr>
<td>(Z,E)-α-farnesene</td>
<td>0.18</td>
</tr>
<tr>
<td>(E,E)-α-farnesene</td>
<td>0.17</td>
</tr>
<tr>
<td>δ-cadinene</td>
<td>0.22</td>
</tr>
<tr>
<td>dehydrogeosmin</td>
<td>0.2</td>
</tr>
<tr>
<td>(E)-nerolidol</td>
<td>68.53</td>
</tr>
<tr>
<td>α-cadinol</td>
<td>0.03</td>
</tr>
<tr>
<td>(E,E)-farnesol</td>
<td>0.42</td>
</tr>
<tr>
<td>all sesquiterpenoids</td>
<td>4.47</td>
</tr>
<tr>
<td>nonanal</td>
<td>0.27</td>
</tr>
<tr>
<td>hexadecane</td>
<td>0.05</td>
</tr>
<tr>
<td>all fatty acid derivatives</td>
<td>0.32</td>
</tr>
<tr>
<td>benzaldehyde</td>
<td>0.08</td>
</tr>
<tr>
<td>methyl benzoate</td>
<td>0.06</td>
</tr>
<tr>
<td>benzyl alcohol</td>
<td>0.17</td>
</tr>
<tr>
<td>unknown aromatics</td>
<td>0.01</td>
</tr>
<tr>
<td>all aromatics</td>
<td>0.32</td>
</tr>
</tbody>
</table>

Schlumpberger & Raguso 2008

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**Echinopsis ancistrophora ssp. arachncantha**
Samaipata & Torrecillas & cultivated, Santa Cruz, Bolivia

(% given is percentage of the total scent fraction)

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>limonene</td>
<td>0.25</td>
</tr>
<tr>
<td>1,8-cineole</td>
<td>15.41</td>
</tr>
<tr>
<td>6-methyl-5-heptene-2-one</td>
<td>1.6</td>
</tr>
<tr>
<td>geranyl acetate</td>
<td>1.06</td>
</tr>
<tr>
<td>all monoterpenoids</td>
<td>18.33</td>
</tr>
<tr>
<td>β-bourbonene</td>
<td>0.11</td>
</tr>
<tr>
<td>(E)-caryophyllene</td>
<td>2.00</td>
</tr>
<tr>
<td>(Z,E)-α-farnesene</td>
<td>0.12</td>
</tr>
<tr>
<td>β-sesquiphellandrene</td>
<td>0.03</td>
</tr>
<tr>
<td>(Z)-nerolidol</td>
<td>0.04</td>
</tr>
<tr>
<td>(E)-nerolidol</td>
<td>53.38</td>
</tr>
<tr>
<td>spathulenol</td>
<td>0.04</td>
</tr>
<tr>
<td>unknown sesquiterpenoids</td>
<td>8.3</td>
</tr>
<tr>
<td>all sesquiterpenoids</td>
<td>64.02</td>
</tr>
<tr>
<td>nonanal</td>
<td>4.49</td>
</tr>
<tr>
<td>unknown fatty acid derivatives</td>
<td>10.36</td>
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<tr>
<td>benzaldehyde</td>
<td>0.6</td>
</tr>
<tr>
<td>methyl benzoate</td>
<td>1.9</td>
</tr>
<tr>
<td>unknown aromatics</td>
<td>0.1</td>
</tr>
<tr>
<td>all aromatics</td>
<td>2.6</td>
</tr>
<tr>
<td>indole</td>
<td>0.2</td>
</tr>
<tr>
<td>all nitrogenous compounds</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Schlumpberger & Raguso 2008

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**Echinopsis ancistrophora ssp. cardenasiana**
Cultivated plants, Tarija, Bolivia

(% given is percentage of the total scent fraction)

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>limonene</td>
<td>4.92</td>
</tr>
<tr>
<td>trans-β-ocimene</td>
<td>2.14</td>
</tr>
</tbody>
</table>

Schlumpberger & Raguso 2008

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Echinopsis eyriesii

Both images above
This is a nice example of how the filaments of the inner stamens on an Echinopsis flower are adhered more tightly together in comparison to what can be seen elsewhere here on flowers of Trichocereus.
Echinopsis mamilosa Guerke
See potential analysis under Pseudolobivia kermesina.
Hunt recognizes these as synonyms, but, even if true, it should not be taken for granted that the chemistry of synonyms are the same without some analytical work. Material recognized as Echinopsis mamilosa should be analyzed and compared to that of material identified as Echinopsis kermesina.

Echinopsis multiplex (Pfeiffer) Pfeiffer & Otto
Showed antitumor & antineoplastic activity.
See Activity Notes.
This species presently appears to lack any published analysis.

Echinopsis obrepanda (Salm-Dyck) K. Schumann
Dehydrogeosmin - Trace volatile in floral scent.
trans-Nerolidol - Major volatile in floral scent.
Sesquiterpene alcohol 1 - Trace volatile in floral scent.
Sesquiterpene alcohol 2 - Trace volatile in floral scent.
Schlumberger et al. 2004 (In tepals; gc-ms)

Echinopsis pachanoi (Britton & Rose) Friedrich & Rowley
See as Trichocereus pachanoi

Echinopsis pasacana (Weber) Friedrich & Rowley
See as Trichocereus pasacana

Echinopsis peruvianus (Britton & Rose) Friedrich & Rowley
See as Trichocereus peruvianus

Echinopsis peruviana spp. puquiensis (Rauh & Backeberg) Ostolaza
See as Trichocereus puquiensis

Echinopsis rhodotricha K. Schumann
Hordenine (Major alkaloid in the traces present.)
Tyramine (10-50% of the traces of alkaloid present.)
Agurell et al. 1971b [Commercial source: Netherlands]
[Agurell 1969b reported no detectable alkaloid. European commercial sources]

Echinopsis schickendantzii Weber
See as Trichocereus schickendantzii

Echinopsis scopulicola (Ritter) Mottram
See as Trichocereus scopulicola

Echinopsis spachiana (Lemaire) Friedrich & Rowley
See as Trichocereus spachianus

Echinopsis strigosa (Salm-Dyck) Friedrich & Rowley
See as Trichocereus strigosus

Echinopsis taquimbalensis (Cardenas) Friedrich & Rowley
See as Trichocereus taquimbalensis

Echinopsis terscheckii (Parmentier) Friedrich & Rowley
See as Trichocereus terscheckii

Echinopsis thelegonoides (Spegazzini) Friedrich & Rowley
See as Trichocereus thelegonoides

Echinopsis thelegona (Weber) Friedrich & Rowley
See as Trichocereus thelegonus

Echinopsis triumphans R. Mey was reported to contain
Isocitric acid (tlc & glc by Kringstad & Nordal 1975)

Echinopsis tubiflora (Pfeiffer) Zuccarini
24¢-Methylcholesterol (33.1% of total)
Sitosterol (66.9% of total)
Salt et al. 1987

Echinopsis valida Monv. See as Trichocereus validus but please be aware that 2 or 3 different plants are sometimes called E. valida.
Trouts Notes on Cactus Chemistry

Echinopsis multiplex
above

Echinopsis triumphans
right-hand column

Echinopsis werdermanniana (Backeb. Fiedr. & Rowley) See as Trichocereus werdermannianus [Please note that while the CITES Cactaceae Checklist gave the opinion that this species no longer existed as it had been absorbed by Trichocereus terscheckii, the New Cactus Lexicon once again regards them to be separate species. Apparently the split involved the recognition that their ranges in the wild did not overlap but the cause for the merger is still unclear.]

Epiphyllum anguliger (Lemaire) Britton & Rose
Reported to contain Kaempferol & Quercetin (Flavonols)
Richardson 1978 (based on acid hydrolysis)

Epiphyllum truncatum Haworth See as Schlumbergera truncata
Epiphyllum oxypetalum (DC) Haworth

In leaves:
- Allyldimethyl(prop-1-ynyl)silane
- Cyclohexylmethyl hexyl ester of sulfurous acid
- 2,5-Dihydroxy-4-isopropyl-2,4,6-cycloheptatrien-1-one
- 4,4-dimethyl-cholesta-22,24-dien-5-ol
- 3,7-dimethyl-6-octen-1-ol
- Hentriacontane
- Heptacosane
- 2,3,5,5,8,8-hexamethyl-cycloocta-1,3,6-triene
- 1-(2-hydroxy-5-methylphenyl)-ethanone
- 4-Hydroxy-2-methylacetophenone
- 4-((1E)-3-Hydroxy-1-propenyl)-2-methoxyphenol
- Megastigmatrienone
- 2-methyl-eicosane
- 2-methyl-nonadecane
- 2-methyl-octadecane
- n-Hexadecanoic acid
- Octadecanoic acid
- Phytol
- Spinasterone
- Stigmaster-4-en-3-one
- 4,22-Stigmastadiene-3-one
- 22-Stigmasten-3-one
- Stigmasterol
- Testosterone cypionate
- Tetradecane
- 2,6,10,14-tetramethyl-hexadecane
- Dandekar et al. 2015

See entry in the Activity Notes.

Floral “head-space” molecules:
- trans-Alloctronone
- n-Amyl salicylate
- Benzaldehyde
- Benzyl alcohol
- Benzyl benzoate
- Benzyl isovalerate
- Benzyl salicylate
- Benzyl tiglate
- (E)-iso Citral
- n-Decanal
- Dodecane
- 2,3-Epoxy geraniol
- Ethyl benzoate
- Eugenol
- Farnesol
- 2E,6E-Farnesol
- Geraniol
- Geranyl acetate
- Geranyl acetone
- Geranyl isobutyrate
- n-Hexanal
- Indole
- Isoeugenol
- Limonene
- Melonal
- p-Mentha-1(7),2,8-triene
- Methyl benzoate
- 6-Methyl-5-hepten-2-one
- Methyl salicylate
- Myrcene
- α-Myrcene
- Nerol
- Neral
- Neryl acetate
- Nonadecane
- allo-Ocimene
- cis-β-ocimene
- trans-Ocimene
- 2-Oxo-citronellol
- 2-(1’Pentenyl)-furan
- α-Phellandrene
- Phenol
- Phenylethyl alcohol
- Phenylethyl benzoate
- α-Terpinene
- 1,3,5-Trimethyl benzene
- Terpinolene
- Tetradecane
- Marsili 2002

Essential oil:
- Benzyl salicylate (9.7%)
- Methyl linoleate (21.1%)
- Maia & Andrade 2009 citing Zoghbi 2001

Echinopsis oxypetalum
above

Photograph from Creative Commons. Taken by Elisa Arteaga from Caracas, Venezuela (Epiphyllum oxypetalum) [CC BY-SA 2.0 (https://creativecommons.org/licenses/by-sa/2.0)], via Wikimedia Commons
Epiphyllum phyllanthus (L.) Haworth See Activity Notes.

Echinopsis oxypetalum
both of the above
Epiphyllum phyllanthoides (DC) Sweet
See as Nopaltocochia phyllanthoides

Epiphyllum sp.
Unsubstantiated and referenceless claim for the presence of mescaline is made by Caycho Jimenez 1977 (page 91). He does not include anything supporting his assertion.

Sterols isolated from leaves:
Avenasterol (8.4% of total)
24-¢-Methylcholesterol (9.4% of total)
Stigmasterol (2.5% of total)
Sitosterol (75.5% of total)
24¢-Methylcholestenol (traces)
Sitostanol (4.2% of total)
Salt et al. 1987
Epithelantha bokei
Presidio Co, Texas
habitat is the foreground
Epithelantha micromeris (Engelmann) Weber

Tyramine (Less than 0.001%). Štárha 1995b; (0.0003%). Štárha 1994 [All of Štárha’s Epithelantha specimens were seed grown in Czechoslovakian greenhouses]

N-Methyltyramine (Less than 0.001%). Štárha 1995b; (0.0004%). Štárha 1994

Hordenine (0.003%). Štárha 1995b; (0.0026%). Štárha 1994

3-Methoxytyramine (0.006%). Štárha 1995b; (0.0059%). Štárha 1994

3,4-Dimethoxyphenethylamine (0.44%). Štárha 1995b [Note from Dr. Štárha, rec’d. Jan. 1999 indicates this to be a typo intending 0.004% by fresh weight]; (0.0042%). Štárha 1994

N-Methyl-3,4-dimethoxyphenethylamine (Less than 0.001%). Štárha 1995b; (0.0010%). Štárha 1994 (All values above are % by fresh weight.)

[Both Domínguez et al. 1969 and McLoughlin (unpublished) detected trace amounts of alkaloids.]

It should also be noted that West & McLoughlin 1977 isolated and crystallized the following (As acid hydrolysis products of the corresponding saponins):

Epithelanthic acid (Δ9(11)-12-oxo-oleane) (0.00008% dry wt.)

Methyllepithelanthate (A triterpene) (0.0004% dry wt.)

Methylmachaerinate (A triterpene diol) (0.0003% dry wt.)

(Thought to possibly be an artifact arising from machaeric acid)

Oleanolic acid (A triterpene) (0.58% (crude) dry wt.)

β-Sitosterol (A sterol) (0.001% dry wt.)

An unidentified triterpene lactone (0.0002% dry wt.)

Methyl oleanate (As 5% of oleanolic acid content; thought to possibly be an artifact.)

See Activity Notes.

The several varieties of this plant appear to lack analysis.

Escobaria aguirreana (Glass & Foster) Taylor

See as Gymnocalycium aguirreanum

Escobaria missouriensis (Sweet) Hunt

See as Coryphantha missouriensis

Escobaria roseana (Boedeker) Taylor

See as Gymnocalycium roseanum Buxbaum

Escobaria tuberculosa

See as Coryphantha tuberculosa

Escobaria vivipara (Nuttall) Buxbaum

See as Coryphantha vivipara
Escontria chiotilla
**Eriocereus guelichii (Spez.) Berg.**
Fruit contains Phyllocactin, Betanin, Isobetanin & Iso-
phyllocactin. **PIATTELI & IMPERATO 1969**

**Eriocereus spp.** This genus seriously needs some analysis.

**Escontria chiotilla (Weber) Rose**
86.3% water by weight
4-Hydroxy-3,5-dimethoxyphenethylamine (Around 0.01% dry wt.) **MA et al. 1986**
Longispinogenin [0.29% yield; dry wt.]
Maniladiol [0.1% yield; dry wt.]
**Djerassi et al. 1956a** [Collected at marker km 368 along Mexico City-Oaxaca Hwy, Puebla, Mexico]

**Escontria gaumeri** See as **Pterocereus gaumeri**

**Espostoa huanucensis Ritter**
Hordenine (0.002% dry wt.)
N-Methylyramine (0.002% by dry weight.)
Tyramine (0.004% by dry weight.)
Mata et al. 1976a [Also Mata et al. 1976b]
Unidentified trace alkaloid detected in Mata et al. 1976a.

**Espostoa lanata (HBK) Br. & R.**
Reported to be alkaloid negative (Based on Mayer’s test showing no detectable alkaloid); also reported to lack triterpenes. **Djerassi et al. 1955b** [Wild collected in Peru] [Mata & McLoughlin 1976 also appears listed as a reference but they simply mentioned Djerassi’s work.]

**Espostoa lanata (HBK) Br. & R.**
(UC) upper right

**Ferocactus hamatocanthus flowering**
(SRSU)
Ferocactus hamatocanthis
(near Sanderson, Texas) above
(Sull Ross State University) right
(Presidio Co, Texas) left & below
Ferocactus acanthodes (Lemaire) Britton & Rose
CO₂ uptake occurred entirely at night through the stems
(under well watered conditions)
Nobel & Hartsock 1986

Ferocactus hamatocanthus (Muehlenpfordtii) Britton & Rose
No detectable alkaloids.
Chalet 1980a cited Dominguez et al. 1969

Ferocactus latispinus (Haworth) Britton & Rose
No detectable alkaloids in the screenings of Fong et al. 1972

Ferocactus hamatocanthus
left and above

Ferocactus recurvus (Mill.) Berg.
No detectable alkaloids.
Chalet 1980a cited Dominguez et al. 1969

Ferocactus stainesii (Andot.) Britton & Rose var. pringlei (Coelte) Britton & Rose
Reported to contain unidentified alkaloid(s). Chalet 1980a cited Dominguez et al. 1969

Ferocactus wislizeni (Engelm.) Britton & Rose
Unidentified alkaloids indicated. Brown et al. 1968

Glandulicactus crassihamatus (Weber) Marshall
Reported to contain unidentified alkaloid(s). Chalet 1980a cited Dominguez et al. 1969
Ferocactus recurvus

Ferocactus wislizeni var. herreræ short-spined form
Ferocactus wislizeni (Cactus Country, VIC - top; Tucson Arizona - bottom)
Grusonia bradttiana  
(SRSU)  
above & right

Ferocactus wislizeni  
(Cactus Country)  
below
Grusonia bradtiana (Coulter) Britton & Rose
Reported to contain unidentified alkaloid(s). Chalet 1980a cited Dominguez et al. 1969

Grusonia clavata (Engelmann) H.Robinson
see as Corynopuntia clavata
Grusonia emoryi (Engelmann) Pinkava
see as Corynopuntia stanlyi var. stanlyi

Grusonia invicta (T.Brandegee) E.F.Anderson
see as Corynopuntia invicta
Grusonia kunzei (Rose) Pinkava
see as Corynopuntia stanlyi var. kunzei
Grusonia schottii (Engelmann) H.Robinson
see as Corynopuntia schottii

Grusonia bradtiana (SRSU)
**Gymnocactus aguirreanus** Glass & Foster
Hordenine (2.26% dry wt.)
N-Methylyramine (trace)
N-Methylphenethylamine (trace)
West et al. 1974

**Gymnocactus sp.** (Thought to be a variety of *G. roseanus*)
N-Methylphenethylamine (0.04% dry wt.)
Hordenine (1.89% dry wt.)
West et al. 1974 [Collected from El Chiflon, Mexico.]

**Gymnocactus viereckii** (Werdermann) Backeberg
N-Methylphenethylamine (trace) West et al. 1974

**Gymnocactus beguinii** (Weber) Backeberg
Hordenine (trace)
N-Methylyramine (trace)
N-Methylphenethylamine (trace)
West et al. 1974

**Gymnocactus horripilus** (Lemaire) Backeberg
Hordenine (trace)
N-Methylphenethylamine (0.17% dry weight.)
West et al. 1974

**Gymnocactus knuthianus** (Boedecker) Backeberg
N-Methylphenethylamine (trace) West et al. 1974

**Gymnocactus mandragora** (Fric) Backeberg
N-Methylphenethylamine (trace)
N-Methylyramine (trace)
West et al. 1974.

**Gymnocactus roseanus** (Boedecker) Glass & Foster
Hordenine (2.39% dry wt.)
N-Methylphenethylamine (trace)
N-Methylyramine (trace)
West et al. 1974

**Gymnocalycium achirasense** Till & Schatzl
Tyramine (0.00159% [± 0.00008])
N-Methyltyramine (0.00045% [± 0.00006])
Hordenine (0.00129% [± 0.00006])
Mescaline (0.00007% [± 0.00001])
N-Methylmescaline (0.00013% [± 0.00001])
N,N-Dimethylmescaline (0.00025% [± 0.00002])
Anhalamine (0.00097% [± 0.00001])
Starha et al. 1998 (% by fresh weight.)

Starha used cultivated plants; gc or gcms to identify.
Gymnocalycium asterium

Gymnocalycium asterium

Gymnocalycium asterium

Gymnocalycium asterium

Gymnocalycium asterium

Gymnocalycium asterium

Gymnocalycium asterium

Gymnocalycium asterium

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Gymnocalycium asterium

Gymnocalycium asterium

Gymnocalycium asterium
**Gymnocalycium andreae (Böd.) Backeb. & F.M.Knuth**

Betalains. Wohlfart & Marrey 1968 cited Dreiding 1961
"trans-β-Ocimene - Minor volatile in floral scent, absent in some
Dehydrogeosmin - Minor volatile, major or absent in some;
present in 73%, absent in 15%, questionable in 12%.
Heptadecene - Minor volatile, trace in some.
Bergamotene - Minor volatile.
β-Farnesene - Major volatile, trace or absent in some.
Sesquiterpene alcohol - Trace volatile, absent in some.
Alkane - Trace volatile, absent in some.
Eudesman-3,7-dien? - Minor volatile, absent in some.
trans-Nerolidol - Major volatile, trace or absent in some.
Alkene 1 - Minor volatile, trace in some.
Sesquiterpene alcohol 1 - Minor volatile, trace in some.
Sesquiterpene alcohol 2 - Minor volatile.
Alkene 2 - Minor volatile, absent in some.
Alkene 3 - Minor volatile, trace in some.
Highly variable among cultivated individuals. 19 of 20 showed
floral scent dominated by either β-Farnesene or trans-Nerol-
olod; 1 specimen had Dehydrogeosmin as the largest peak.
Six wild specimens from Argentina had a uniform floral scent
composed almost entirely of β-Farnesene.
Schlumberger et al. 2004 (In tepals; gc-ms)

**Gymnocalycium anisitsii (K.Schumann) Br. & R.**

Tyramine (Less than 0.0001%)
Hordenine (Approximately 0.001%)
N-Methylmescaline (Less than 0.0001%)
Anhalinine (Between 0.0001-0.001%)
Anhalidine (Between 0.0001-0.001%)
Anhalonidine (Less than 0.0001%)
Štárha 1996 (% by fresh weight.)

**Gymnocalycium asterium var. paucispinum**

Tyramine (0.00089% [± 0.00013])
N-Methyltyramine (0.00012% [± 0.00004])
Hordenine (0.00105% [± 0.0001])
Mescaline (0.00013% [± 0.00002])
N-Methylmescaline (0.0031% [± 0.00004])
N,N-Dimethylmescaline (0.0005% [± 0.00004])
O-Methylanhalidine (0.00011% [± 0.00002])
Anhalidine (Trace)
Anhalamine (0.00054% [± 0.00002])
Lophophorine (Trace)
Anhalonine (Trace)
Štárha et al. 1998 (% by fresh weight.)

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**Gymnocalycium albispinum Backeb.**

Tyramine (Between 0.0001-0.001%)
N-Methyltyramine (Less than 0.0001%)
Hordenine (Between 0.0001-0.001%)
Anhalinine (Less than 0.0001%)
O-Methylanhalonidine (Less than 0.0001%)
Anhalonidine (Less than 0.0001%)
Pellotine (Less than 0.0001%)
Anhalonine (Less than 0.0001%)
Lophophorine (Less than 0.0001%)
Štárha et al. 1997 (% by fresh weight.)
Gymnocalycium achirense
(California Cactus)
Gymnocalycium achirasense

Gymnocalycium baldianum
Gymnocalycium baldianum (Great Petaluma Desert)
Gymnocalycium baldianum *(Spegazzini) Spegazzini*

- Tyramine (Less than 0.0001%)
- Hordenine (Approximately 0.001%)

**Mescaline** (Less than 0.0001%)
- Anhalimine (Less than 0.0001%)
- Anhalidine (Less than 0.0001%)
- Anhalamine (Less than 0.0001%)
- Anhalonidine (Less than 0.0001%)
- Pellotine (Less than 0.0001%)
- Anhalonine (Less than 0.0001%)
- Lophophorine (Less than 0.0001%)

ŠtArha 1996 (% by fresh weight.)

Reported to contain Betalains as pigments. Wohlpard & Marry 1968 cited Dreiding 1961

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Gymnocalycium bayrianum Till

- Tyramine (Between 0.0001-0.001%)
- Hordenine (Between 0.0001-0.001%)
- N-Methyltyramine (Less than 0.0001%)
- Anhalimine (Less than 0.0001%)
- Anhalonidine (Less than 0.0001%)
- Pellotine (Less than 0.0001%)
- Anhalonine (Between 0.0001-0.001%)
- Lophophorine (Less than 0.0001%)

ŠtArha 1996 (% by fresh weight.)

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Gymnocalycium bruchii

*(HBG)*
Gymnocalycium bodenbenderianum ssp. intertextum

Dehydrogeosmin - Major volatile in the flower scent.
Sesquiterpene alcohol 1 - Minor volatile in floral scent.
Sesquiterpene alcohol 2 - Major volatile in floral scent.
Scent emission from the apical half of tepal was dominated by Dehydrogeosmin and Sesquiterpene alcohol 1; basal half was dominated by β-Farnesene.

Schlumberger et al. 2004 (in tepals; gc-ms)

Cristate Gymnocalycium bodenbenderianum (HBG) H 72769

Gymnocalycium boszingianum Schütz

Tyramine (Between 0.0001-0.001%.)
Hordenine (Approximately 0.001%.)
Anhalinine (Between 0.0001-0.001%.)
N-Methylmescaline (Less than 0.0001%.)
N-Methyltyramine (Less than 0.0001%.)
Anhalonidine (Less than 0.0001%.)
Pellotine (Less than 0.0001%.)
Anhalonine (Less than 0.0001%.)
Lophophorine (Less than 0.0001%.)
Štárha 1996 (% by fresh weight.)

Gymnocalycium bruchii (Spegazzini) Hosseus

trans-β-Ocimene - Minor volatile in floral scent.
Dehydrogeosmin - Major volatile, minor in some.
trans-Nerolidol - Major volatile, absent in some.
Sesquiterpene alcohol 1 - Minor volatile, trace in some.
Sesquiterpene alcohol 2 - Minor volatile, major in some.

Schlumberger et al. 2004 (In tepals; gc-ms)

Gymnocalycium calochlorum (Boedecker) Y.Ito

Mescaline (Between 0.0001-0.001%.)
Tyramine (Between 0.0001-0.001%.)
N-Methyltyramine (Less than 0.0001%.)
Hordenine (Approximately 0.001%.)
N-Methylmescaline (Less than 0.0001%.)
Anhalanine (Less than 0.0001%.)
Anhalidine (Less than 0.0001%.)
Anhalamine (Less than 0.0001%.)
Anhalonidine (Between 0.0001-0.001%.)
Pellotine (Less than 0.0001%.)
Štárha 1996 (% by fresh weight.)
Gymnocalycium boszingianum  
(Cactus Data)  
top row

Gymnocalycium calochlorum seedling  
(Mesa Garden)

Gymnocalycium boszingianum  
(Cactus Data)  
below
Gymnocalycium calochlorum
**Gymnocalycium cardenasianum** Ritter
Tyramine (Between 0.0001-0.001%)
N-Methyltyramine (Less than 0.0001%)
Hordenine (Between 0.0001-0.001%)
Anhalinine (Less than 0.0001%)
Anhalonidine (Less than 0.0001%)
Pellotine (Less than 0.0001%)
Štárha 1996 (% by fresh weight.)

**Gymnocalycium carminanthum** Borth & Koop
Tyramine (0.00007% ± 0.00003)
N-Methyltyramine (Trace)
Hordenine (0.00016% ± 0.00005)
Mescaline (0.00006% ± 0.00005)
N-Methylmescaline (Trace)
N,N-Dimethylnorleucine (0.00008% ± 0.00002)
O-Methylnorleucine (0.00007% ± 0.00002)
Anhalamine (0.00088% ± 0.00003)
Anhalonidine (Trace)
Štárha et al. 1998 (% by fresh weight.)

**Gymnocalycium chubutense** Spegazzini
Tyramine (Between 0.0001-0.001%)
N-Methyltyramine (Between 0.0001-0.001%)
Hordenine (Approximately 0.001%)
N-Methylmescaline (Between 0.0001-0.001%)
O-Methylnorleucine (Less than 0.0001%)
O-Methylnorleucine (Less than 0.0001%)
Anhalonidine (Less than 0.0001%)
Pellotine (Between 0.0001-0.001%)
Anhalonidine (Trace)
Lophophorine (Between 0.0001-0.001%)
Štárha et al. 1997 (% by fresh weight.)

**Gymnocalycium comarapense** Backeberg
Tyramine (Between 0.001-0.001%)
N-Methyltyramine (Less than 0.0001%)
Hordenine (Less than 0.0001%)
Mescaline (Less than 0.001%)
N-Methylmescaline (Less than 0.001%)
Anhalamine (Less than 0.0001%)
Pellotine (Less than 0.0001%)
Štárha 1995 (% by fresh weight.)

**Gymnocalycium delaeitii** Backeberg
Tyramine (Less than 0.0001%)
N-Methyltyramine (Less than 0.0001%)
Hordenine (Approximately 0.001%)
N-Methylmescaline (Less than 0.0001%)
Anhalamine (Less than 0.001%)
Anhalonidine (Less than 0.0001%)
Pellotine (Less than 0.0001%)
Štárha 1996 (% by fresh weight.)

**Gymnocalycium cardenasianum** seedling

**Gymnocalycium curvispinum** Fríc
Tyramine (Between 0.0001-0.001%)
N-Methylmescaline (Less than 0.0001%)
Hordenine (Less than 0.0001%)
Anhalamine (Between 0.0001-0.001%)
Anhalonidine (Less than 0.0001%)
Pellotine (Less than 0.0001%)
Anhalonidine (Less than 0.0001%)
Štárha 1996 (% by fresh weight.)

**Gymnocalycium eytianum** Cárdenas
Weddellite was identified as druses.
Monje & Baran 2002

**Gymnocalycium denudatum**
Trouts Notes on Cactus Chemistry

Gymnocalycium denudatum (L.&O.) PFEIFF.
Tyramine (0.00066% ± 0.00006)
N-Methylyrtrimine (0.00061% ± 0.00002)
Hordenine (0.00052% ± 0.00005)
Mescaline (Trace)
N-Methylmescaline (0.00008% ± 0.00001)
N,N-Dimethylmescaline (0.00073% ± 0.00005)
O-Methylanhalidine (0.00025% ± 0.00003)
Anhalidine (0.00006% ± 0.00002)
O-Methylmolangitine (0.0001% ± 0.00002)
Anhalamine (Trace)
Anhalonidine (Trace)
ŠTARHA et al. 1998 (% by fresh weight.)

Gymnocalycium fleischerianum BACKEBERG
Tyramine (0.0001-0.001% dry wt.)
N-Methylyrtrimine (0.001% dry wt.)
Hordenine (0.0001-0.001% dry wt.)
Mescaline (0.0001-0.001% dry wt.)
N-Methylmescaline (0.001-0.001% dry wt.)
N,N-Dimethylmescaline (0.001-0.001% dry wt.)
Anhalamine (0.001-0.001% dry wt.)
Anhalonidine (0.00001-0.0001% dry wt.)
ŠTARHA 2001c did not include a citation for his information. (G. fleischerianum is included only in the table on page 91 and not in the by species breakdown)

Gymnocalycium friedrichii Paz.
Tyramine (Between 0.0001-0.001%)
Hordenine (Less than 0.0001%)
ŠTARHA 1996 (% by fresh weight.)

Gymnocalycium gibbosum (Haworth) PFEIFFER
92.1% water by weight (pH of juice: 4.6-5.0) HERRERO-DUCLUX 1930b
Tyramine (Less than 0.0001%)
N-Methylyrtrimine (Approximately 0.001%)
Hordenine (Approximately 0.001%)
Mescaline (unquantified and tentatively identified. Colorless birefringent crystals, n 1.544, mp 160-162° were claimed to show the "reactions of mescaline") HERRERO-DUCLUX 1930b. Not observed by ŠTARHA et al. 1997.
N-Methylyrtrimine (Between 0.0001-0.001%)
N,N-Dimethylmescaline (Less than 0.0001%)
O-Methylanhalidine (Approximately 0.001%)
Anhalidine (Approximately 0.001%)
O-Methylmolangitine (Approximately 0.001%)
Anhalamine (Between 0.0001-0.001%)
Anhalonidine (Between 0.0001-0.001%)
Pellotine (Between 0.0001-0.001%)
Lophophorine (Between 0.0001-0.001%)
Anhalonine (Between 0.0001-0.001%)
No quantification (or accurate identification) attempted; HERRERO-DUCLUX 1930b [Our source was RETT; CA gives this as Anhalonine. We presently lack the primary paper.] (Approximately 0.001%)
Anhalonidine (Less than 0.0001%)
Anhalamine (Between 0.0001-0.001%)
No quantification (or accurate identification) attempted; HERRERO-DUCLUX 1930b (Between 0.0001-0.001%)
[All of ŠTARHA’s values are % by fresh wt]
Gymnocalycium friedrichii
Entire page
### Gymnocalycium horridispinum

**Frank**

- Mescaline (Between 0.0001-0.001%.)
- Tyramine (Approximately 0.001%.)
- N-Methyltyramine (Less than 0.0001%.)
- Hordenine (Approximately 0.001%.)
- Pellotine (Less than 0.0001%.)

*Štárha* 1996 (% by fresh weight.)

### Gymnocalycium leeanum

**Hooker** Br. & R.

- Anhalonine (Unconfirmed) Herrero-Ducloux 1930b
  - Not observed by DeVries et al. 1971
- Hordenine (%?) DeVries et al. 1971
- Lophophorine (Unconfirmed) Herrero-Ducloux 1930b
  - Not observed by DeVries et al. 1971
- Mescaline (Unconfirmed) Herrero-Ducloux 1930b
  - Not observed by DeVries et al. 1971
- N-Methyltryamine (?%) DeVries et al. 1971
- Tyramine (0.00583%) DeVries et al. 1971

### Gymnocalycium leeanum

**Hooker** Br. & R.

- Anhalonine (Unconfirmed) Herrero-Ducloux 1930b
  - Not observed by DeVries et al. 1971
- Hordenine (%?) DeVries et al. 1971
- Lophophorine (Unconfirmed) Herrero-Ducloux 1930b
  - Not observed by DeVries et al. 1971
- Mescaline (Unconfirmed) Herrero-Ducloux 1930b
  - Not observed by DeVries et al. 1971
- N-Methyltryamine (?%) DeVries et al. 1971
- Tyramine (0.00583%) DeVries et al. 1971

### Gymnocalycium mazanense

**Backeberg**

- N-Methyltyramine (Less than 0.0001%.)
- Tyramine (Between 0.0001-0.001%.)
- Hordenine (Approximately 0.001%.)
  - *Štárha* et al. 1997 (% by fresh weight.)
Gymnocalycium marsoneri
(California)

Gymnocalycium gibbosum
(HBG)
Lower right
Gymnocalycium mazanense
**Gymnocalycium megalotheles** (Sencke) Britton & Rose

- Tyramine (Approximately 0.001%)
- Hordenine (Between 0.0001-0.001%)
- N-Methyltyramine (Less than 0.0001%)
- Anhalidine (Less than 0.0001%)
  Štárha 1996 (% by fresh weight.)

**Gymnocalycium mesopotamicum** Kiessling

- Tyramine (Trace)
- N-Methyltyramine (Trace)
- Hordenine (Trace)
- Mescaline (Trace)
- N-Methylmescaline (Trace)
- N,N-Dimethylmescaline (0.00279% ± 0.0005)
- Anhalamine (0.0019% ± 0.00028)
- Anhalonidine (0.00005% ± 0.00003)
  Štárha et al. 1998 (% by fresh weight.)

**Gymnocalycium mihanovichii** (Fric & Gürke) Britton & Rose

- Hordenine (Less than 0.0001%)
- Tyramine (Between 0.0001-0.001%)
  Štárha 1996 (% by fresh weight.)
- Reported to contain Betalains as pigments. Wohlpard & Mabry 1968 cited Dreiding 1961

**Gymnocalycium monvillei** (Lemaire) Britton & Rose

- Tyramine (Between 0.0001-0.001%)
- N-Methyltyramine (Between 0.0001-0.001%)
- Hordenine (Approximately 0.001%)
- Mescaline (Less than 0.0001%)
- N,N-Dimethylmescaline (Less than 0.0001%)
- O-Methylanhalidine (Less than 0.0001%)
  Štárha et al. 1997 (% by fresh weight.)

- Dehydrogeosmin - Major volatile in floral scent, minor or absent in some.
- Sesquiterpene alcohol 1 - Minor volatile, trace in some.
- Sesquiterpene alcohol 2 - Minor volatile.
- Dehydrogeosmin present in 85% of their samples, absent in 5%, questionable in 10%.
  Schlumberger et al. 2004 (In tepals; gc-ms)
Gymnocalycium mihanovichii var. friedrichii
AKA Gymnocalycium friedrichii
This is a “color form” at HBG

Gymnocalycium monvillei
above & below
(Cactus Country)
Gymnocalycium moserianum Schutz
Tyramine (0.00077% ± 0.0001)
N-Methyltyramine (0.0001% ± 0.00003)
Hordenine (0.00011% ± 0.00003)
**Mescaline** (0.00007% ± 0.00001)
N-Methylmescaline (0.00151% ± 0.00015)
N,N-Dimethylmescaline (0.00071% ± 0.00006)
O-Methylanhalidine (0.00007% ± 0.00001)
Anhaline (0.00007% ± 0.00001)
O-Methylanhalonidine (0.00007% ± 0.00001)
Anhalidine (0.00007% ± 0.00001)
Anhalonidine (0.00014% ± 0.00003)
Pellotine (0.00012% ± 0.00003)
Anhalonine (Trace)
Lophophorine (Trace)
Štárha et al. 1998 (% by fresh weight.)

Gymnocalycium multiflorum (Hooker) Br. & R. Herrero-Ducloux 1932a reported the recovery of small quantities of a ‘mescaline-like’ alkaloid but did not identify it. This species is now considered G. monvillei.

Gymnocalycium netrelianum Britton & Rose
Tyramine (Less than 0.001%)
Hordenine (Between 0.0001-0.001%)
**Mescaline** (Between 0.0001-0.001%)
N-Methylmescaline (Less than 0.001%)
Pellotine (Less than 0.001%)
Štárha 1995a (% by fresh weight.)

Gymnocalycium nigriareolatum Backeberg
Tyramine (0.00047% ± 0.00005)
N-Methyltyramine (0.00008% ± 0.00002)
Hordenine (0.0014% ± 0.00006)
**Mescaline** (0.00006% ± 0.00002)
N-Methylmescaline (0.00006% ± 0.0001)
N,N-Dimethylmescaline (0.00009% ± 0.00002)
O-Methylanhalidine (0.00007% ± 0.00001)
Anhalamine (0.00019% ± 0.00004)
Anhalonidine (0.00008% ± 0.00002)
Štárha et al. 1997 (% by fresh weight.)

Gymnocalycium oenanthemum Backeberg
Tyramine (Between 0.0001-0.001%)
N-Methyltyramine (Less than 0.0001%)
Hordenine (Approximately 0.001%)
**Mescaline** (Less than 0.0001%)
N-Methylmescaline (Less than 0.0001%)
N,N-Dimethylmescaline (Less than 0.0001%)
O-Methylanhalidine (Less than 0.0001%)
O-Methylanhalonidine (Less than 0.0001%)
Anhalidine (Less than 0.0001%)
Anhalamine (Less than 0.0001%)
Anhalonidine (Between 0.0001-0.001%)
Pellotine (Between 0.0001-0.001%)
Anhalonine (Less than 0.0001%)
Lophophorine (Less than 0.0001%)
Štárha et al. 1997 (% by fresh weight.)
Cactus Chemistry: By Species

**Gymnocalycium pflanzii (Vaupel) Werdermann**

- Tyramine (Approximately 0.001%)
- Hordenine (Between 0.0001-0.001%)
- N-Methylyramine (Less than 0.0001%)
- N-Methylmesaline (Less than 0.0001%)
- Anhalamine (Less than 0.0001%)
- Anhalonidine (Less than 0.0001%)
- Pellotine (Between 0.0001-0.001%)
- Lophophorine (Between 0.0001-0.001%)
- Štárha 1996 (% by fresh weight.)

**Gymnocalycium pungens Fleischer**

- Hordenine (Approximately 0.001%)
- Tyramine (Between 0.0001-0.001%)
- Štárha 1996 (% by fresh weight.)

**Gymnocalycium quehlianum (Haage) Berg.**

- Tyramine (Between 0.0001-0.001%)
- Hordenine (Between 0.0001-0.001%)
- Mescaline (Less than 0.0001%)
- N-Methylmescaline (Less than 0.0001%)
- N,N-Dimethylmescaline (Less than 0.0001%)
- Anhalinine (Less than 0.0001%)
- O-Methylanhalonidine (Between 0.0001-0.001%)
- Anhalonidine (Less than 0.0001%)
- Pellotine (Less than 0.0001%)
- Anhalonine (Less than 0.0001%)
- Lophophorine (Less than 0.0001%)
- Štárha et al. 1997 (% by fresh weight.)

**Gymnocalycium multiflorum (UC)**

**Gymnocalycium pflanzii var. albopulpa (HBG)**

- Weddellite was identified as druses.
  - Monje & Baran 2002

**Gymnocalycium ragonesii Cast.**

- Tyramine (0.00009% ± 0.00002)
- N-Methylyramine (0.00005% ± 0.00001)
- Hordenine (0.0035% ± 0.00014)
- Mescaline (Trace)
- N-Methylmescaline (Trace)
- O-Methylanhalidine (0.00048% ± 0.00003)
- Anhalinine (0.00109% ± 0.00018)
- O-Methylanhalonidine (0.00007% ± 0.00001)
- Anhalonidine (Trace)
- Pellotine (Trace)
- Štárha et al. 1998 (% by fresh weight.)

**Gymnocalycium lagunillasense Card. (Now just a synonym of Gymnocalycium pflanzii var. pflanzii)**

**Gymnocalycium platense (Spegazzini) Britton & Rose**

- Weddellite was identified as druses.
  - Monje & Baran 2002

**Gymnocalycium unicordatum var. unicordatum (LCR)**

- Weddellite was identified as druses.
  - Monje & Baran 2002
Gymnocalycium pflanzii
(Field)
**Gymnocalycium riojense Frič ex H.Till & W.Till**

- **Tyramine**
  - 0.001% dry wt.
  - ŠtArhA 2001c cited ŠtArhA 2001a
  - Not observed.
  - ŠtArhA 2002
- **N-Methyltyramine**
  - 0.00001-0.0001% dry wt.
  - ŠtArhA 2001c cited ŠtArhA 2001a
  - Less than 0.0001% fresh wt.
  - ŠtArhA 2002
- **Hordenine**
  - 0.001% dry wt.
  - ŠtArhA 2001c cited ŠtArhA 2001a
  - Not observed.
  - ŠtArhA 2002
- **Mescaline**
  - 0.00001-0.0001% dry wt.
  - ŠtArhA 2001c cited ŠtArhA 2001a
  - Less than 0.0001% fresh wt.
  - ŠtArhA 2002
- **N-Methylmescaline**
  - 0.00001-0.0001% dry wt.
  - ŠtArhA 2001c cited ŠtArhA 2001a
  - Less than 0.0001% fresh wt.
  - ŠtArhA 2002
- **Anhalinine**
  - 0.00001-0.0001% dry wt.
  - ŠtArhA 2001c cited ŠtArhA 2001a
  - Less than 0.0001% fresh wt.
  - ŠtArhA 2002
- **O-Methylanhalonidine**
  - 0.00001-0.0001% dry wt.
  - ŠtArhA 2001c cited ŠtArhA 2001a
  - Less than 0.0001% fresh wt.
  - ŠtArhA 2002
- **Pellotine**
  - 0.00001-0.0001% dry wt.
  - ŠtArhA 2001c cited ŠtArhA 2001a
  - Less than 0.0001% fresh wt.
  - ŠtArhA 2002
- **Anhalonidine**
  - 0.00001-0.0001% dry wt.
  - ŠtArhA 2001c cited ŠtArhA 2001a
  - Less than 0.0001% fresh wt.
  - ŠtArhA 2002

According to Hunt 1999, *Gymnocalycium triacanthum* was lumped into *Gymnocalycium riojense* Frič ex H.Till & W.Till. Hunt 2006 mentions that Till & Till recognized four subspecies within *G. riojense* with three varieties within each of three of the four. Hunt 2006 also notes that *G. riojense* has more recently been absorbed into *Gymnocalycium bodenbenderianum* (BGR.) Hill.

See also the synonym list of Ulrich Creutzberg 2010 and Creutzberg’s informational website.
**Gymnocalycium riograndense** Cardenas
Tyramine (Between 0.0001-0.001%)
N-Methyltyramine (Less than 0.001%)
Hordenine (Less than 0.001%)
**Mescaline** (Between 0.0001-0.001%)
N-Methylmescaline (Less than 0.001%)
Anhalinine (Less than 0.001%)
Anhalidine (Less than 0.001%)
Anhalonidine (Less than 0.001%)
Pellotine (Less than 0.001%)
Anhalonine (Less than 0.001%)
Lophophorine (Less than 0.001%)
ŠtAria 1995a (% by fresh weight.)

**Gymnocalycium saglione** (Cels) Britton & Rose
Tyramine (0.027% dry wt.) Nieto et al. 1982.
Also; Less than 0.001% [fresh wt] in ŠtAria 1995a
Hordenine (0.008% dry wt.) Nieto et al. 1982.
Also; Less than 0.001% [fresh wt] in ŠtAria 1995a
Anhalidine (Less than 0.001%) ŠtAria 1995a
Anhalonidine (Between 0.0001-0.001%) ŠtAria 1995a
Pellotine (Less than 0.001%) ŠtAria 1995a
Anhalonine (Less than 0.001%) ŠtAria 1995a
Lophophorine (Less than 0.001%) ŠtAria 1995a
Candicine (0.041% dry wt.) Nieto et al. 1982.
[3 unidentified bases reported; Nieto et al. 1982]

**Gymnocalycium schickendantzii** (Weber) Britton & Rose
Tyramine (Approximately 0.001%)
N-Methyltyramine (Between 0.0001-0.001%)
Hordenine (Approximately 0.001%.) ŠtAria 1996; Also (%?) Ruiz et al. 1973
Anhalinine (Between 0.0001-0.001%)
Anhalidine (Less than 0.0001%)
Anhalamidine (Less than 0.0001%)
Pellotine (Less than 0.0001%)
Anhalonidine (Less than 0.0001%)
Lophophorine (Less than 0.0001%)
All above by ŠtAria 1996 (% by fresh weight.)
Candicine (%?) Ruiz et al. 1973

**Gymnocalycium stellatum** Spegazzini
Tyramine (Between 0.0001-0.001%)
N-Methyltyramine (Less than 0.0001%)
Hordenine (Approximately 0.001%)
**Mescaline** (Less than 0.0001%)
N-Methylmescaline (Between 0.0001-0.001%)
N,N-Dimethylmescaline (Less than 0.0001%)
Anhalinine (Between 0.0001-0.001%)
O-Methylanhalonidine (Less than 0.0001%)
Anhalamine (Less than 0.0001%)
Anhalonidine (Between 0.0001-0.001%)
Pellotine (Between 0.0001-0.001%)
Anhalonine (Between 0.0001-0.001%)
Lophophorine (Less than 0.0001%)
ŠtAria et al. 1997 (% by fresh weight.)
Gymnocalycium stellatum

Gymnocalycium tillianum var. turecek
Trouts Notes on Cactus Chemistry

**Gymnocalycium triacanthum**
Gymnocalycium strigianum Jeggle
Tyramine (Less than 0.001%)
Hordenine (Less than 0.001%)
Mescaline ("readily apparent" at around 0.001%)
N-Methylysergic acid ("readily apparent" at around 0.001%)
Anhalinine (Less than 0.001%)
Anhalidine (Less than 0.001%)
Anhalonidine (Less than 0.001%)
Pellotine ("readily apparent" at around 0.001%)
Anhalonine (Less than 0.001%)
Lophophorine (Less than 0.001%)
Štárha 1995a (% by fresh weight.)

Gymnocalycium tillianum Rausch
Tyramine (Less than 0.001%)
N-Methylysergic acid (Less than 0.001%)
Hordenine (Between 0.0001-0.001%)
Anhalinine (Less than 0.001%)
Anhalidine (Less than 0.001%)
Anhalonidine (Between 0.0001-0.001%)
Pellotine (Between 0.0001-0.001%)
Štárha 1995a (% by fresh weight.)

Gymnocalycium triacanthum Backberg
Tyramine (Trace)
N-Methylysergic acid (0.000005% [± 0.00001])
Hordenine (0.00054% [± 0.00004])
Mescaline (Trace)
N-Methylysergic acid (Trace)
N,N-Dimethylysergic acid (Trace)
O-Methylanhalidine (0.00015% [± 0.00001])
Anhalinine (0.00014% [± 0.00001])
Anhalidine (Trace)
Anhalonidine (0.0006% [± 0.00001])
Štárha et al. 1998 (% by fresh weight.)

Gymnocalycium triacanthum
Tyramine (Trace)
N-Methylysergic acid (Between 0.0001-0.001%)
Hordenine (Between 0.0001-0.001%)
Mescaline (Trace)
N-Methylysergic acid (Trace)
N,N-Dimethylysergic acid (Trace)
O-Methylanhalidine (0.00015% [± 0.00001])
Anhalinine (0.00014% [± 0.00001])
Anhalidine (Trace)
Anhalonidine (0.0006% [± 0.00001])
Štárha et al. 1998 (% by fresh weight.)

Gymnocalycium triacanthum
Tyramine (Trace)
N-Methylysergic acid (Between 0.0001-0.001%)
Hordenine (Between 0.0001-0.001%)
Mescaline (Trace)
N-Methylysergic acid (Trace)
N,N-Dimethylysergic acid (Trace)
O-Methylanhalidine (0.00015% [± 0.00001])
Anhalinine (0.00014% [± 0.00001])
Anhalidine (Trace)
Anhalonidine (0.0006% [± 0.00001])
Štárha et al. 1998 (% by fresh weight.)

Gymnocalycium tillianum
Tyramine (Less than 0.001%)
N-Methylysergic acid (Less than 0.001%)
Hordenine (Between 0.0001-0.001%)
Anhalinine (Less than 0.001%)
Anhalidine (Less than 0.001%)
Anhalonidine (Between 0.0001-0.001%)
Pellotine (Between 0.0001-0.001%)
Štárha 1995a (% by fresh weight.)

Gymnocalycium triacanthum
Tyramine (Trace)
N-Methylysergic acid (Between 0.0001-0.001%)
Hordenine (Between 0.0001-0.001%)
Mescaline (Trace)
N-Methylysergic acid (Trace)
N,N-Dimethylysergic acid (Trace)
O-Methylanhalidine (0.00015% [± 0.00001])
Anhalinine (0.00014% [± 0.00001])
Anhalidine (Trace)
Anhalonidine (0.0006% [± 0.00001])
Štárha et al. 1998 (% by fresh weight.)

Gymnocalycium tripregi
Tyramine (Trace)
N-Methylysergic acid (Between 0.0001-0.001%)
Hordenine (Between 0.0001-0.001%)
Mescaline (Trace)
N-Methylysergic acid (Trace)
N,N-Dimethylysergic acid (Trace)
O-Methylanhalidine (0.00015% [± 0.00001])
Anhalinine (0.00014% [± 0.00001])
Anhalidine (Trace)
Anhalonidine (0.0006% [± 0.00001])
Štárha et al. 1998 (% by fresh weight.)
Gymnocalycium altissima
Looks like it might be interesting to analyze.
Gymnocalycium vatteri Buining
Mescaline (Between 0.0001-0.001%.)
Tyramine (Approximately 0.001%.)
N-Methyltyramine (Between 0.0001-0.001%.)
Hordenine (Approximately 0.001%.)
N-Methylmescaline (Between 0.0001-0.001%.)
Anhalinine (Approximately 0.001%.)
Anhalidine (Less than 0.0001%.)
Anhalonidine (Between 0.0001-0.001%.)
Pellotine (Between 0.0001-0.001%.)
Anhalonine (Less than 0.0001%.)
Lophophorine (Less than 0.0001%.)
ŠtArhA 1996 (% by fresh weight.)

Haageocereus acranthus (Vpl.) Backeb erg
Flower contains Phyllocactin, Isophyllocactin, Betanin & Isobetanin. Piattelli & Imperato 1969
Claim for the presence of mescaline is made by Caycho 1977 (page 91 as Cereus acranthus Vaupel) but no reference was cited and he does not include anything to support his assertion. See comment in Activity Notes.

Hamatocactus hamatocanthus (Mehlenpf.) Borg See as Ferocactus hamatocanthus

Hariota salicornioides DC
Citric acid (5.2% in stem juice)
Hegna uer 1964 cited Bergström 1934
Reported to contain Betalains as pigments. Wohlpart & Mably 1968 cited Dreiding 1961

Harrisia adscendens (Gürke) Br. & R.
“rabo de raposa”
Unconfirmed report of caffeine (0.12-0.2%) in the seeds. Hegna uer 1964 & Mata & McLaughlin 1982 cite Freise 1935.
As was mentioned elsewhere here, Freise’s reports of caffeine from cactus seeds have never been confirmed by anyone.

Harrisia fernowii lacks reported analysis

Haseltonia columna-trajani (Kaew.) Backeb erg
See as Cephalocereus hoppenstedtii

Helianthocereus chende (Gosselin) Backeb erg
See as Polaskia chende

Helianthocereus andalgalensis (Weber) Backeb erg
See as Trichocereus andalgalensis
Helianthocereus atacamensis (Phil.) Backeb erg
See as Trichocereus atacamensis
Helianthocereus huascha (Weber) Backeb erg
See as Trichocereus huascha
Helianthocereus pasacana (Weber) Backeb erg.
See as Trichocereus pasacana
Helianthocereus poco (Backeb erg) Backeb erg
See as Trichocereus poco
Helianthocereus speciosus (Ca van.) Br. & R.
See as Cereus speciosus

Hertrichocereus beneckei (Ehrendberg) Backeb erg
See as Stenocereus beneckei

Homalocephala texensis Britton & Rose
See as Echinocactus texensis
Haageocereus (Weberbauercereus) acranthus  
(Field & Cactus Country)
**Hylocereus costaricensis (Weber) Britton & Rose**

Total betacyanin
Phyllocactin was present at several times the betanin content.
Total 0.39 ± 0.041 mg/g in fruit pulp.
Betanin (17.9 ± 1.4% of total)
Phyllocactin (63.9 ± 4.1% of total)
Hylocerenin (6.4 ± 0.72% of total)
Isobetanin (2.8 ± 0.32% of total)
Isophyllocactin (7.4 ± 0.66% of total)
Isohylocerenin (1.0 ± 0.15% of total)

(% = relative percent of total peak in HPLC)

Wybraniec & Mizrahi 2002

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**Hylocereus costaricensis X purpusii**

Fruit contained:
Betanidin 5-O-β-sophoroside
Betanin & Isobetanin
2’-Apiosyl-betanin & 2’-Apiosyl-isobetanin
Phyllocactin & Isophyllocactin
4’-Malonyl-betanin & 4’-Malonyl-isobetanin
Hylocerenin & Isohylocerenin
2’-Apiosyl-phyllocactin & 2’-Apiosyl-isophyllocactin

Peel contained same and additionally
5’-O-E-Feruloyl-2’-apiosylbetanin
5’-O-E-Feruloyl-2’-apiosylisobetanin
5’-O-E-Sinapoyl-2’-apiosylbetanin
5’-O-E-Sinapoyl-2’-apiosylisobetanin
5’-O-E-Feruloyl-2’-apiosylphyllocactin
5’-O-E-Feruloyl-2’-apiosylisophyllocactin

Wybraniec et al. 2007 (hplc)

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**Hylocereus monacanthus (Lemaire) Britton & Rose** lacks a
analysis. See comments in the Activity & Mythology Notes.

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**Hylocereus hybrid 1 (Hylocereus undatus (whiteflesh) X sp. 487)**

Total 0.28 ± 0.024 mg/g in fruit pulp.
Betanin (76.2 ± 5.7% of total)
Phyllocactin (12.0 ± 1.0% of total)
Hylocerenin (1.3 ± 0.12% of total)
Isobetanin (9.6 ± 0.79% of total)
Isophyllocactin (0.7 ± 0.09% of total)
Isohylocerenin (0.2 ± 0.03% of total)

(% = relative percent of total peak in HPLC)

Wybraniec & Mizrahi 2002

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**Hylocereus Hybrid 35 (Hylocereus sp. 487 X polyrhizus)**

Total 0.33 ± 0.031 mg/g in fruit pulp.
Betanin (60.6 ± 4.2% of total)
Phyllocactin (19.5 ± 1.9% of total)
Hylocerenin (4.1 ± 0.34% of total)
Isobetanin (13.6 ± 1.3% of total)
Isophyllocactin (1.9 ± 0.17% of total)
Isohylocerenin (0.2 ± 0.04% of total)

(% = relative percent of total peak in HPLC)

Wybraniec & Mizrahi 2002

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**Hylocereus Hybrid 95 (Hylocereus polyrhizus X sp. 487)**

Total 0.30 ± 0.023 mg/g in fruit pulp.
Betanin (57.9 ± 3.8% of total)
Phyllocactin (19.7 ± 1.5% of total)
Hylocerenin (3.6 ± 0.44% of total)
Isobetanin (11.3 ± 1.1% of total)
Isophyllocactin (6.4 ± 0.53% of total)
Isohylocerenin (1.0 ± 0.11% of total)

(% = relative percent of total peak in HPLC)

Wybraniec & Mizrahi 2002

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**Hylocereus costaricensis (HBG)**

Except for center, front column
Hylocereus ocamponis (Salm-Dyck) Britton & Rose

Fruit contained:
- Betanidin 5-O-β-sophoroside
- γ-Aminobutyric acid
- Betaxanthin
- Indicaxanthin
- Betanin & Isobetanin
- 2'-Apiosyl-betanin & 2'-Apiosyl-isobetanin
- Phyllocactin & Isophyllocactin
- 4'-Malonyl-betanin & 4'-Malonyl-isobetanin
- Hylocerenin & Isohylocerenin
- 2'-Apiosyl-phyllocactin & 2'-Apiosyl-isophyllocactin

Peel contained the same and additionally
- 5''-O-E-Feruloyl-2'-apiosylbetanin
- 5''-O-E-Feruloyl-2'-apiosylisobetanin
- 5''-O-E-Sinapoyl-2'-apiosylbetanin
- 5''-O-E-Sinapoyl-2'-apiosylisobetanin
- 5''-O-E-Feruloyl-2'-apiosylphyllocactin
- 5''-O-E-Feruloyl-2'-apiosylisophyllocactin

Wybraniec et al. 2007 (hplc)

Hylocereus polyrhizus (Weber) Britton & Rose

(now Hylocereus monacanthus (Lemaire) Britton & Rose)

"pitaya" Commercial fruit in Israel.
Total 0.28 ± 0.019 mg/g in fruit pulp.
Betanin (18.9 ± 1.3% of total)
Phyllocactin (36.1 ± 2.2% of total)
Hylocerenin (11.7 ± 1.1% of total)
Isobetanin (7.2 ± 0.55% of total)
Isophyllocactin (19.2 ± 1.5% of total)
Isohylocerenin (5.8 ± 0.32% of total)
(% = relative percent of total peak in HPLC)
Wybraniec & Mizrahi 2002

Fruit pulp was reported to contain:
- Betanin
- Phyllocactin (= 6'-O-malonylbetanin)
- Betanidin 5-O-[6'-O-(3''-hydroxy-3''-methyl-glutaryl)-β-D-glucopyranoside] (New compound named Hylocerenin.)
- Isobetanidin 5-O-[6'-O-(3''-hydroxy-3''-methyl-glutaryl)-β-D-glucopyranoside] (New compound Isohylocerenin)

Isobetanin
- Isophyllocactin
- Phyllocactin
(electrospray MS/MS, HPLC, and NMR)
Wybraniec et al. 2001

Fruit contained:
- Betanidin 5-O-β-sophoroside
- Betanin & Isobetanin
- 2'-Apiosyl-betanin & 2'-Apiosyl-isobetanin
- Phyllocactin & Isophyllocactin
- 4'-Malonyl-betanin & 4'-Malonyl-isobetanin
- Hylocerenin & Isohylocerenin
- 2'-Apiosyl-phyllocactin & 2'-Apiosyl-isophyllocactin

Peel contained the same and additionally
- 5''-O-E-Feruloyl-2'-apiosylbetanin
- 5''-O-E-Feruloyl-2'-apiosylisobetanin
- 5''-O-E-Sinapoyl-2'-apiosylbetanin
- 5''-O-E-Sinapoyl-2'-apiosylisobetanin
- 5''-O-E-Feruloyl-2'-apiosylphyllocactin
- 5''-O-E-Feruloyl-2'-apiosylisophyllocactin

Wybraniec et al. 2007 (hplc)

Hylocereus purpusii (Weingart) Britton & Rose

Lupeone & Lupeol (In a 4:1 ratio in the surface wax)
[Grown in Germany]
Wollenweber & Dörr 1995

Total 0.23 ± 0.018 mg/g in fruit pulp.
Betanin (66.9 ± 4.1% of total)
Phyllocactin (21.3 ± 1.4% of total)
Hylocerenin (2.0 ± 0.18% of total)
Isobetanin (7.2 ± 0.73% of total)
Isophyllocactin (2.4 ± 0.17% of total)
Isohylocerenin (0.1 ± 0.03% of total)
(% = relative percent of total peak in HPLC)
Wybraniec & Mizrahi 2002

Fruit contained:
- Betanidin 5-O-β-sophoroside
- Betanin & Isobetanin
- 2'-Apiosyl-betanin & 2'-Apiosyl-isobetanin
- Phyllocactin & Isophyllocactin
- 4'-Malonyl-betanin & 4'-Malonyl-isobetanin
- Hylocerenin & Isohylocerenin
- 2'-Apiosyl-phyllocactin & 2'-Apiosyl-isophyllocactin

Peel contained the same and additionally
- 5''-O-E-Feruloyl-2'-apiosylbetanin
- 5''-O-E-Feruloyl-2'-apiosylisobetanin
- 5''-O-E-Sinapoyl-2'-apiosylbetanin
- 5''-O-E-Sinapoyl-2'-apiosylisobetanin
- 5''-O-E-Feruloyl-2'-apiosylphyllocactin
- 5''-O-E-Feruloyl-2'-apiosylisophyllocactin

Wybraniec et al. 2007 (hplc)

Hylocereus sp. 487

Total 0.30 ± 0.023 mg/g in fruit pulp.
Betanin (57.2 ± 4.2% of total)
Phyllocactin (34.2 ± 2.1% of total)
Hylocerenin (1.5 ± 0.11% of total)
Isobetanin (3.4 ± 0.41% of total)
Isophyllocactin (2.0 ± 0.18% of total)
Isohylocerenin (0.2 ± 0.04% of total)
(% = relative percent of total peak in HPLC)
Wybraniec & Mizrahi 2002
Hylocereus undatus (Haworth) Britton & Rose

"pitahaya" (Jalisco, Yucatan, Costa Rica, El Salvador, Puerto Rico), "pitahaya orejona" (Oaxaca), "tusajo" (Durango) "junco", "juco tapatio", "chacoub", "zacoub" (Yucatan) "caliz" (Philippines) Standley 1924: 913

From leaves:
- Cholesterol (traces)
- 24-β-Methylcholesterol (18.5% of total)
- Stigmasterol (8.3% of total)
- Sitosterol (73.2% of total)

Salt et al. 1987

Total 0.29 ± 0.027 mg/g in redfleshed fruit pulp.
- Betain (61.2 ± 4.3% of total)
- Phylloclactin (28.0 ± 2.1% of total)
- Hylocerenin (2.2 ± 0.17% of total)
- Isobetain (6.0 ± 0.51% of total)
- Isophylloclactin (1.9 ± 0.17% of total)
- Isohylocerenin (0.6 ± 0.07% of total)

(% = relative percent of total peak in HPLC)

Wybraniec & Mizrahi 2002

Fruit contained:
- Betanidin 5-O-β-sophoroside
- Betain & Isobetain
- 2'-Aposyl-betain & 2'-Aposyl-isobetain
- Phylloclactin & Isophylloclactin
- 4'-Malonyl-betain & 4'-Malonyl-isobetain
- Hylocerenin & Isohylocerenin
- 2'-Aposyl-phylloclactin & 2'-Aposyl-isophylloclactin

Peel contained the same and additionally
- 5''-O-E-Feruloyl-2'-apiosylbetain
- 5''-O-E-Feruloyl-2'-apiosylisobetain
- 5''-O-E-Sinapoyl-2'-apiosylbetain
- 5''-O-E-Sinapoyl-2'-apiosylisobetain
- 5''-O-E-Feruloyl-2'-apiosylphylloclactin
- 5''-O-E-Feruloyl-2'-apiosylisophylloclactin

Wybraniec et al. 2007 (hplc)

Flowers reported to contain:
- isorhamnetin,
- isorhamnetin 3-O-β-D-glucopyranoside
- isorhamnetin 3-O-α-L-rhamnopyranosyl(1→6)-β-D-galactopyranoside.
- isorhamnetin 3-O-β-D-rutinoside
- kaempferol
- kaempferol 3-O-α-L-arabinofuranoside
- kaempferol 3-O-β-D-galactopyranoside
- kaempferol 3-O-β-D-glucopyranoside
- kaempferol 3-O-α-L-rhamnopyranosyl(1→6)-β-D-galactopyranoside
- kaempferol 3-O-β-D-rutinoside
- querctein
- querctein 3-O-β-D-galactopyranoside
- querctein 3-O-β-D-glucopyranoside

Yi et al. 2011

Wu et al. 2011 added three glycosides they named - Undatusides A-C.

Isla y minor Backeberg (T.)

Phenethyamine (no quantification)
- Tyramine (no quantification)
- N-Methyltyramine (no quantification)
- Hordenine (no quantification)
- 3-Methoxytyramine (no quantification)
- 3,4-Dimethoxyphenethylamine (0.0038% dry wt.)
- Mescaline (0.0017% dry wt.)
- Corypalline (7-Hydroxy-6-methoxy-2-methyl-tetrahydroisoquinoline)
- Pellotine (no quantification)

Doetsch et al. 1980

Isolatocereus dumortieri (Scheidw.) Backeberg

See as Lemaireocereus dumortieri

Lemaireocereus aragonii (Weber) Britton & Rose

This is now Stenocereus aragonii

91.3% water by weight

Thought to contain an Amyrin mixture but never fully investigated due to insufficient material.

No ether soluble alkaloids.

DiRassi et al. 1955b [Wild collected; Costa Rica]

Hylocereus undatus (Haworth) Britton & Rose

"pitahaya" (Jalisco, Yucatan, Costa Rica, El Salvador, Puerto Rico), "pitahaya orejona" (Oaxaca), "tusajo" (Durango) "junco", "juco tapatio", "chacoub", "zacoub" (Yucatan) "caliz" (Philippines) Standley 1924: 913

From leaves:
- Cholesterol (traces)
- 24-β-Methylcholesterol (18.5% of total)
- Stigmasterol (8.3% of total)
- Sitosterol (73.2% of total)

Salt et al. 1987

Total 0.29 ± 0.027 mg/g in redfleshed fruit pulp.
- Betain (61.2 ± 4.3% of total)
- Phylloclactin (28.0 ± 2.1% of total)
- Hylocerenin (2.2 ± 0.17% of total)
- Isobetain (6.0 ± 0.51% of total)
- Isophylloclactin (1.9 ± 0.17% of total)
- Isohylocerenin (0.6 ± 0.07% of total)

(% = relative percent of total peak in HPLC)

Wybraniec & Mizrahi 2002

Fruit contained:
- Betanidin 5-O-β-sophoroside
- Betain & Isobetain
- 2'-Aposyl-betain & 2'-Aposyl-isobetain
- Phylloclactin & Isophylloclactin
- 4'-Malonyl-betain & 4'-Malonyl-isobetain
- Hylocerenin & Isohylocerenin
- 2'-Aposyl-phylloclactin & 2'-Aposyl-isophylloclactin

Peel contained the same and additionally
- 5''-O-E-Feruloyl-2'-apiosylbetain
- 5''-O-E-Feruloyl-2'-apiosylisobetain
- 5''-O-E-Sinapoyl-2'-apiosylbetain
- 5''-O-E-Sinapoyl-2'-apiosylisobetain
- 5''-O-E-Feruloyl-2'-apiosylphylloclactin
- 5''-O-E-Feruloyl-2'-apiosylisophylloclactin

Wybraniec et al. 2007 (hplc)

Flowers reported to contain:
- isorhamnetin,
- isorhamnetin 3-O-β-D-glucopyranoside
- isorhamnetin 3-O-α-L-rhamnopyranosyl(1→6)-β-D-galactopyranoside.
- isorhamnetin 3-O-β-D-rutinoside
- kaempferol
- kaempferol 3-O-α-L-arabinofuranoside
- kaempferol 3-O-β-D-galactopyranoside
- kaempferol 3-O-β-D-glucopyranoside
- kaempferol 3-O-α-L-rhamnopyranosyl(1→6)-β-D-galactopyranoside
- kaempferol 3-O-β-D-rutinoside
- querctein
- querctein 3-O-β-D-galactopyranoside
- querctein 3-O-β-D-glucopyranoside

Yi et al. 2011

Wu et al. 2011 added three glycosides they named - Undatusides A-C.

See comments in Activity Notes.

Lemaireocereus aragonii MK2423

(HBG) H 59651
Trouts Notes on Cactus Chemistry

Lemaireocereus aragonii MK2423 (UC) H 59651

Lemaireocereus chende (Gosselin) Britton & Rose
See as Polaskia chende
Lemaireocereus chichipe (Gosselin) Britton & Rose
See as Polaskia chichipe

Lemaireocereus deficiens (O. & Dietr.) Br. & R.
No saponins or terpenes. Hegnauer 1964
Traces of unidentified terpene(s). Djerassi 1957 cited unpublished observations by Djerassi & Mitscher.

Lemaireocereus beneckei (Ehrenberg) Berger See as Stenocereus beneckei

Lemaireocereus deficiens H 811
Lower photo is new growth
Lemaireocereus deficiens
(HBG) H 811
entire page
**Lemaireocereus dumortieri Britton & Rose**

This is now *Stenocereus dumortieri*.

Dumortierigenin (A triterpene lactone) 0.21% by dry wt.

No detectable alkaloid.

Djerassi et al. 1954b

[Wild collected; Hildago, Mexico]

Two triterpene sapogenins, Dumortierigenin

Pachanol D (New triterpene sapogenin with a new skeletal type. They named it pachanane.)

Kinoshita et al. 1998

Dumortierinoside A (A new triterpenoid saponin) i.e. Dumortierigenin 3-O-α-L-rhamnosyl(1→2)-β-D-glucosylpyranosyl(1→2)-β-D-glucuronopyranoside

Kinoshita et al. 2000

Three new triterpenoid saponins

(As *Isolatocereus dumortieri* Backeb erg)

Dumortierinoside A methyl ester

Pachanoside I1 (Aglycon was pachanol I: new pachanane-type triterpene skeleton.)

Pachanoside D1 (Aglycon was pachanol D)

Kakuta et al. 2012

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*Lemaireocereus dumortieri* (UC) notice the variations

53.1153 Jalisco State, México
Lemaireocereus dumortieri
(UC)
53.1153 Jalisco State, México
Lemaireocereus dumortieri
(UC)
53.1153 Jalisco State, México
Lemaireocereus griseus
65.0387 Colombia
Lemaireocereus griseus (Haworth) Britton & Rose

“Cardon dato”, “Mexican organ pipe”, “dagger cactus”, “pitaya”, “pitayo de mayo”, “yato” (Netherland Antilles)

“No alkaloids”

Erythrodiol (0.58% dry wt.)
Longispinogenin (0.82% dry wt.)
Oleanolic acid (Isolated via acetate methyl ester as 2% dry wt.)
Betulin (Isolated via the acetate methyl ester as 4% dry wt.)
Unidentified lactone 0.12% [Thought identical with material from L. hystrix; i.e “hystrix lactone”]
Djerassi et al. 1956a [Venezuela]
**Lemaireocereus hollianus** (Web.) Britton & Rose
This is now *Pachycereus hollianus*.

“baboso”
86.5% water by weight. Djerassi et al. 1956a
No alkaloids present. Unger et al. 1980

Yielded only small amounts of a nonpolar substance that they believed was “probably similar” to the “aromatic” (?) alcohol they encountered with *T. chiloensis* and *T. cuzcoensis*. No triterpenes detected.

Djerassi et al. 1956a [Collected on Tehuacán-Puebla road 7 km from Zapotitlán, Mexico.]

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**Lemaireocereus humilis** Britton & Rose
This is now *Stenocereus humilis*.

No saponins or terpenes. Hegnauer 1964

Traces of unidentified terpene(s).

Djerassi 1957 cited unpublished observations by Djerassi & Mitscher.
**Lemaireocereus hystrix (Haw.) Britton & Rose**

79.7% water by weight

Unidentified neutral triterpene lactone ("hystrix lactone"; possibly isomeric with thurberogenin) [0.025% by dry wt]

Erythrodiol [0.067% by dry wt]

Oleanolic acid [(crude) 0.95% by dry wt]

Longispinogenin [0.17% by dry wt]

Betulinic acid (0.025% by dry wt) [isolated via its methyl ester]

No detectable alkaloid.

Dierassi & Lipman 1954 [Collected in Mona district, Jamaica]

Noted an almost identical qualitative composition as *L. longispinus*

See **Activity Endnote** for a more recent curiosity.

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**Lemaireocereus laetus**

(UC)

**Lemaireocereus laetus** Britton & Rose

This is now *Armatocereus laetus*

82.3% water by weight

[Concluded it was almost devoid of alkaloids or triterpenes. Unable to resolve and separate. No ether soluble alkaloids. Much unidentified oily material (All neutral).]

Dierassi *et al.* 1955b [Wild collected; Peru].

This species needs an analysis. E. Wade purportedly encountered it being used on a local basis as a *T. pachanoi* substitute.

See **Activity Notes** for more comments.

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**Lemaireocereus hystrix** H 49153

(Puerto Rico) Collected by C. Fleming

(HBG)

This is now *Stenocereus fimbriatus*
Lemaireocereus longispinus Britton & Rose
This is now Stenocereus eichlamii.
81.5% water by weight
Alkaloid devoid.
“Rich source” of triterpenoid glycosides.
Erythrodiol [0.33% by dry wt]
Oleanolic acid [(crude) 2.76% by dry wt]
Longispinogenin [0.4% by dry wt]
Dierassi et al. 1953c [Guatemala; cultivated: Guatemala City]

Lemaireocereus marginatus (DC) Berg.
See as Pachycereus marginatus

Lemaireocereus mixtecensis (Purpus) Britton & Rose See as Polaskia chichipe

Spine on an adult Lemaireocereus matucanense.
Hunt 2006: “doubtfully distinct from Armatocereus laetus”
See additional comments in the Activity Notes.
Lemaireocereus montanus *Britton & Rose*

“pithaya” [sp?]

Oleanolic acid
Queretaroic acid
β-Sitosterol

Djerassi 1957 cited unpublished observations by Djerassi & Kan.

This is now *Stenocereus montanus*.
Lemaireocereus pruinatus (Otto) Britton & Rose

AKA “Pitayo”

89% water by weight. Djerassi et al. 1955b

Reported to show no detectable alkaloids in the screenings of Fong et al. 1972.

Unidentified alkaloids detected by Brown et al. 1968

Oleanolic acid (An acidic triterpene; single component: 0.2% fresh wt/ 1.8% dry.)

Djerassi et al. 1955b [Cultivated: California]

First analyzed by L.H. Liu (unpublished observation from Djerassi’s lab) according to Djerassi & Lipman 1954.

This is now Stenocereus pruinosus.

Lemaireocereus pruinatus

seedling

Lemaireocereus pruinatus

(HBG)

H 72996 México
Lemaireocereus pruinosus
(HBG)
H 72996 México
Lemaireocereus queretaroensis (Weber) Safford
“pitahaya” Standley 1924: 900
Queretaroic acid (A dihydroxy triterpene acid) No isolation details included.
Djerassi et al. 1955a. Also in Djerassi et al. 1956b.
Oleanolic acid Djerassi et al. 1956b
See comments in Activity Notes.
**Lemaireocereus quevedonis G. Ortega**

This is now *Stenocereus quevedonis.*

- 87.2% water by weight
- “*hystric lactone*” (~0.4% yield dry wt)
- Longispinogenin (1.42% yield dry wt.)
- Oleanolic acid
- Betulinic acid

D’HERASISI et al. 1956a [Collected near Aculpulco, Mexico]

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**Sinaloa State, México**

68.0138 on left; 59.1463 on right
**Lemaireocereus thurberi** (Engelmann) Britton & Rose

This is now *Stenocereus thurberi*. "Pitahaya dulce" or "Organ pipe" or "Pitahaya" Standley 1924

84.9% water by weight Djerassi et al. 1953a [Kirscher 1972 reported 85%; Kirscher 1982 reported 77-80%]

No alkaloids- Based on negative Mayer test Djerassi et al. 1953a [Collected: Sonora, Mexico]

TLC examination showed the absence of alkaloids and the strong presence of triterpene glycosides: Kirscher 1982.

Oleanolic acid (An acidic sapogenin) 1.8% dry wt. Djerassi et al. 1953a (Also reported in Kirscher 1977.)

Thurberogenin (A neutral triterpenoid lactone: first reported occurrence) 0.46% dry wt. Djerassi et al. 1953a. (This paper was the first report of triterpenes in cacti.) (It was also reported in Kirscher 1977 & in Jolad & Steeink 1969.)

Queretaroic acid (No details) Gibson & Horak 1978 cited H.W. Kircher (unpublished data); (also reported in Kirscher 1972).

Thurberin (A pentacyclic triterpene; a lupenediol) Jolad & Steeink 1969 See comment under Calenduladiol below

Betulin Jolad & Steeink 1969

Calenduladiol (A triterpenoid diol; \(\Delta^{20,30}\)-lupen-3\(\beta\),12\(\beta\) -diol) Shown to be identical with Thurberin. Kasprzyk et al. 1970 [Previously isolated from the Composite *Calendula officinale* (Marigold) by Kasprzyk & Pyrek 1968]

Kircher 1980 isolated the following (See also in Kircher 1982):

- Lupeol
- Betulin
- Betulinic aldehyde
- Methyl betulinate
- Calenduladiol
- Longispinogénin
- Lupenatriol (Lup-20(29)-en-3\(\beta\),16\(\beta\),28-triol)
- Oleanolic aldehyde
- Methyl oleanolate

(3\(\beta\),6\(\alpha\)Sterol diols were isolated as 2.6% of dry wt. Kircher 1980)

The following 5 sterol diols were isolated and identified in Kircher & Bird 1982. (No concentrations included.)

- Cyclostenol (14\(\alpha\)-Methyl-9,19-cyclo-5\(\alpha\)-cholestan-3\(\beta\),6\(\alpha\)-diol)
- Stenocereol (14\(\alpha\)-Methyl-5\(\alpha\)-cholesta-8,24-dien-3\(\beta\),6\(\alpha\)-diol)
- Macdougallin (14\(\alpha\)-Methyl-5\(\alpha\)-cholestin-8-en-3\(\beta\),6\(\alpha\)-diol)
- Thurberol (5\(\alpha\)-Cholest-8(9)-en-3\(\beta\),6\(\alpha\)-diol)
- Peniocerol (5\(\alpha\)-Cholest-8(9)-en-3\(\beta\),6\(\alpha\)-diol)

Lipids determined to compose 10-17% of the dry weight (comprised of neutral Oleane and Lupene mono-, di- and triols, 0.07% Phytosterols [Cholesterol, Campesterol & Sitosterol] and a large proportion of Dihydroxysterols.) Kircher & Bird 1982 cited Bird 1974.

Lipid content determined to be 11% by dry weight: Kircher 1982.

See comments in Activity Notes.

*Lemaireocereus treleasei* Br. & R.

See as *Stenocereus treleasei*

*Lemaireocereus weberi* (Coulter) Br. & R.

See as *Pachycereus weberi*
Lemaireocereus thurberi
(SRSU)
Lemaireocereus thurberi (BTA)
**Cactus Chemistry: By Species**

*Leocereus bahiensis* Br. & R.
Unconfirmed report of caffeine (0.10-0.35%) in seeds. **Hegnauer 1964 & Mata & McLaughlin 1982 cited Freise 1935.**

*Leocereus bahiensis* (UC) 67.0175 Brazil

*Leocereus thurberi* f. monstrosus (UC) Sonora State, México 65.0848

*Leptocoryphantha macromeris* (Engelmann) Backeberg See as
*Coryphantha macromeris*
*Leptocoryphantha runyonii* (Britton & Rose) Backeberg See as
*Coryphantha macromeris* var. *runyonii*

*Leuchtenbergia principis* Hooker
Reported to contain unidentified alkaloid(s). **Chalet 1980a cited Domínguez et al. 1969.**
See comments in Activity Notes.
<table>
<thead>
<tr>
<th>Lobivia allegriana Backeberg</th>
<th>Hordenine (trace) Follas et al. 1977</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N-Methyltyramine (trace) Follas et al. 1977</td>
</tr>
<tr>
<td></td>
<td>Tyramine (trace) Follas et al. 1977</td>
</tr>
</tbody>
</table>

*Lobivia andalgalensis* (Weber) Br. & R. **IS NOT** *Trichocereus andalgalensis* **Probably is synonymous with** *Trichocereus huasscha*  
See Ritter 1980.

<table>
<thead>
<tr>
<th>Lobivia aurea (Britton &amp; Rose) Backeberg</th>
<th>Hordenine (trace) Follas et al. 1977</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N-Methyltyramine (trace) Follas et al. 1977</td>
</tr>
<tr>
<td></td>
<td>Tyramine (trace) Follas et al. 1977</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lobivia backebergii (Werdermann) Backeberg</th>
<th>Hordenine (0.011% dry wt.) Follas et al. 1977</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N-Methyltyramine (0.0008% dry wt.) Follas et al. 1977</td>
</tr>
<tr>
<td></td>
<td>Tyramine (trace) Follas et al. 1977</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lobivia binghamiana Backeberg</th>
<th>Hordenine (0.004% dry wt.) Follas et al. 1977</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N-Methyltyramine (0.0003% dry wt.) Follas et al. 1977</td>
</tr>
<tr>
<td></td>
<td>Tyramine (trace) Follas et al. 1977</td>
</tr>
</tbody>
</table>

| Lobivia chlorogona Wessn. | Reported to contain Betalains as pigments.  
Wohlpert & Marby 1968 cited Dreiding 1961 |
|----------------------------|-----------------------------------------------|

| Lobivia famatimensis (Spec.) Br. & R. | Reported to contain Betalains as pigments.  
Wohlpert & Marby 1968 cited Dreiding 1961 |
Cactus Chemistry: By Species

**Lobivia formosa (Pfeiffer) Dodds**
Candicine (0.268% [column chromatography] & 0.242% [via precipitation of picrate] All dry wt.)
Nieto et al. 1982

*Lobivia haushua* (Weber) W.T. Marshall = *Lobivia hausha*
Lobivia hausha (Weber) W.T. Marshall See as *Helianthocereus hausha*

**Lobivia pentlandii (Hooker) Britton & Rose**
Hordenine (0.012% dry wt.) Follas et al. 1977.
N-Methyltyramine (trace) Follas et al. 1977.
Tyramine (trace) Follas et al. 1977

**Lophocereus australis (K. Brandegee) Borg**
[Considered a local variant of *L. schottii* by some; Lophocereus schottii var. Australis]
92% water (Inaccurate due to prior removal of core)
Pilocereine [(crude) 0.5% by dry wt; 0.27% yield after purification]
Djerassi et al. 1954c
Lophenol (A sterol) present both free and esterified. Djerassi 1957 cited unpublished analysis by Djerassi, Marfey & Liu

**Lophocereus gatesii M.E. Jones**
91% water by weight
Pilocereine (0.5% by dry wt.)
[Unidentified alkaloids present]
Djerassi et al. 1954c
[Agurell 1969b also appears listed as a reference but only mentions pilocereine. Did not analyze this species.]
Lophenol (A sterol) present both free and esterified. Djerassi 1957 cited unpublished analysis by Djerassi, Marfey & Liu

**Lophocereus mjeckleyanus (Wgt.) Backberg**
See as *Lophocereus schottii forma mjeckleyanus*

**Lophocereus sargentianus ( Orcutt. ) Britton & Rose**
See as *Lophocereus schottii*

---

*Lophocereus gatesii* (HBG)
H 43974 Baja California
Lophocereus schottii (Engelmann) Britton & Rose

“sinta”, “senita”, “cina”, “zina” (Sonora) “garambullo”, “hombre viejo”, “cabeza de viejo”, “pitahaya barbona” (Baja) STANDLEY 1924 91.29% & 92.25% water by weight reported by HEYL 1901. (KIRCHER 1969 found it to range from 80-90%; KIRCHER 1982 listed it with 81% water by weight.)


Pilocereine (novel cactus alkaloid) DIERSASSI et al. 1958c; (0.5% yield by dry wt. DIERSASSI et al. 1953b) (Observed in tlc of WANI et al. 1975); (Noted as present: O’DONOVAN & HORAN 1968 & 1969 & O’DONOVAN et al. 1971); (Not extracted but pharmacologically evaluated by POWELL & CHEN 1956)

WANI et al. 1980 recovered 0.016% [HEYL 1901 isolated 5.8% (Amorphous) & named Pilocereine.]

Pilocereine 0.19% by dry wt. DIERSASSI et al. 1958c; (Observed in tlc: WEST et al. 1975); (Noted as present: O’DONOVAN & BARRY 1974, O’DONOVAN & HORAN 1968 & 1969 & O’DONOVAN et al. 1971)

Pilocereidine 1.456% by dry wt. DIERSASSI et al. 1958c.

Unidentified alkaloids (Observed in tlc diersassi et al. 1975) Lophocereine was reported by WANI et al. 2001 at 0.004% dry weight but it is believed to be an artifact.

AUBRELL 1969b is cited as a reference but only mentions a previous report of pilocereine and lophocereine and did not analyze this species. LUNDSTROM 1971 is also cited; he mentions lophocereine but did not analyze this species. DINGERDISEN & MCLAUGHLIN 1973b also appears listed as a reference but does not mention this species.

LINGERDESS & McLAUGHLIN 1973b & kircher & KIRCHER 1970 cited unpublished analysis by LIU & LEMIN. 1957 cited unpublished analysis by LUNDSTROM 1971 is also cited; he mentions lophocereine but did not analyze this species. DIERSASSI et al. 1980 reported the presence of two alkaloids using MIKES. Both were presented as dimethoxylated THIQs. They suggested the identities as N-Methyloxylated THIQs. They suggested the identities as N-Methyloxylated THIQs. However, this report needs confirmation. Unless MIKES fails entirely for the 1-Isobutyl substituted THIQs, their results stand in direct and complete conflict with the rest of the work published for this species.]

Reported to be devoid of glycosides in DIERSASSI et al. 1958a n-Octyl-alcohol (0.9%) DIERSASSI et al. 1958b Luponol (0.02% via its acetate) DIERSASSI et al. 1958b [Was also reported in KIRCHER 1969 & CAMPBELL & KIRCHER 1980. Noted to be isolated from neutral nonglycosidic fraction KIRCHER 1957 cited unpublished analysis by KIRCHER, MILLS, KRAKOWER, LEMIN & LIU]

Lophenol (A neutral alcohol; 4α-Methyl-Δ7-cholesten-3β-ol [AKA 4α-Methyl-5α-cholest-7-en-3β-ol]) (0.23% dry wt.) DIERSASSI et al. 1958b [Also isolated in DIERSASSI et al. 1958a & KIRCHER 1969 (the latter finding it higher in older stems and in the cortex than in the epidermis) & reported in KIRCHER & HEEU 1970 & CAMPBELL & KIRCHER 1980. Present both free and esterified DIERSASSI 1957 cited unpublished analysis by DIERSASSI, MILLS, KRAKOWER, LEMIN & LIU] Schottenol (Δ7-Ergostan-3β-ol [AKA Δ7-Stigmasten-3β-ol and 5α-Stigmast-7-en-3β-ol]) (0.13%) DIERSASSI et al. 1958b [Also reported by KIRCHER 1969 & KIRCHER & HEEU 1970 & CAMPBELL & KIRCHER 1980] In addition, the following sterols were later reported: Lathosterol (5α-Cholest-7-en-3β-ol)

5α-Campept-7-en-3β-ol

5α-Spinasterol (5α-Stigmasta-7,22E-dien-3β-ol)

5α-Cholesta-8,14-dien-3β-ol [First isolation from plants]

Locereol (4α-Methylcholesta-8,14-dien-3β-ol) [First isolation from plants]

24-Methyleneleophenol (4α-Methyl-5α-ergosta-7,24(28)-dien-3β-ol)

CAMPBELL & KIRCHER 1980 Palmitic acid, Oleic acid, Linoleic acid and Linolenic acid were the main fatty acids in all specimens tested. KIRCHER 1969 Lophocereus schottii notes:

A: There appears to be a typo in one of these papers. DIERSASSI et al. 1953b determined that the majority of this was in the green epidermis (6.7% crude alkaloid); a minor portion in the cortex (1.1% crude alkaloid) and almost no alkaloid in the core & pith (0.2% crude alkaloid).

See comment in Activity Notes.
Lophocereus schottii
(HBG)
H 47600 (BL & JD 687)
**Cactus Chemistry: By Species**

**Lophocereus schottii var. schottii**

and

**Lophocereus schottii var. tenuis**

Determined to have no significant differences in their overall phytochemistry. [Differences however were seen when comparing mature stems with young stems on a single plant or when comparing the nonalkaloidal chemistry of the cortex and epidermis.]

The young stems contained higher proportions of phenolic alkaloids despite having lower alkaloid levels overall.

### L. schottii variety schottii tenuis

<table>
<thead>
<tr>
<th>Phenolic alkaloid fraction (%)</th>
<th>Young stem</th>
<th>Mature stem</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.4%</td>
<td>0.5%</td>
</tr>
<tr>
<td></td>
<td>0.7%</td>
<td>0.6%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total alkaloid fraction (%)</th>
<th>Young stem</th>
<th>Mature stem</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.1%</td>
<td>1.2%</td>
</tr>
<tr>
<td></td>
<td>8.7%</td>
<td>9.1%</td>
</tr>
</tbody>
</table>

Kircher 1969

tlc examination showed the strong presence of alkaloids and the absence of triterpene glycosides.

In general, younger stems contained more Linolenic acid than mature stems.

Lipid content determined to be 6-7% by dry weight: Kircher 1982

**Lophocereus schottii forma mieckleyanus G.Lindsey**

Pilocereine (0.005% yield by dry wt.)

Lophocereine (Observed)

Unidentified alkaloids

West et al. 1975 [West et al. commented that this form proved to be quantitatively the richest in alkaloids but this claim is directly in conflict with their experimental details.]

**Lophocereus schottii (Engel.) Br. & R. forma monstrosus Gates**

AKA “Totem pole cactus”

Pilocereine (0.01% yield by dry wt.)

Lophocereine (Observed)

Unidentified alkaloids

West et al. 1975

**Lophocereus schottii (Engel.) Br. & R. var. Australis (K.Brand.) Borg** See as Lophocereus australis

Lophocereus schottii forma monstrosus (HBG) Both images
Lophocereus schottii
forma monstrosus
Lophocereus schottii forma mieckeyanus
(HBG)

H 296  Baja California
Lophocereus schottii
forma mieckleyanus
(HBG)
H 296
Baja California

Lophocereus schottii
forma spiralis
(UC)
65.0817
Baja California Sur, Mexico
Detailed entries for the known species, some horticultural forms and what may be several varieties can be found in Part A of *Sacred Cacti*.
**Lophophora diffusa (Croizat) H.Bravo**

0.9% total alkaloid (whole plants; dry wt) 98% phenolic.

BRUHN & HOLMSTEDT 1974

Tyramine 0.1% of total alkaloid: ŠTARHA 1997 [Cultivated material: GR 1086]

N-Methylltyramine 0.1% of total alkaloid: ŠTARHA 1997

Hordenine (trace) BRUHN & HOLMSTEDT 1974; 0.5% of total alkaloid [from ŠTARHA 1997]; (In contrast to TODD 1969 who had not observed it in tlc.)

Mescaline (As traces or absent entirely.) Traces in tops & roots (tlc) TODD 1969; Minor base: HABERMANN 1977, 1978a & 1978b (from ANDERSON 1980 & ŠTARHA nd); 0.018% (+ 0.012) HABERMANN 1978a (from ŠTARHA 1997); 0.003% by dry weight (isolated): SINSCALCO 1983 [See Note A]; 1.2% of total alkaloid: ŠTARHA 1997; (Not observed by BRUHN & HOLMSTEDT 1974.)

N-Methylmescaline (traces) BRUHN & HOLMSTEDT 1974; 0.1% of total alkaloid: ŠTARHA 1997

Anhalaline 0.6% of total alkaloid [from ŠTARHA 1997] [Not detected; TODD 1969 [Wild material: collected Queretaro, Mexico]]

O-Methylanhalidine 0.7% of total alkaloid: ŠTARHA 1997 [See Note B]

Anhalamine (no quantification [tlc]- in tops only, not in roots) TODD 1969; 5% of total alkaloid. ŠTARHA 1997

Anhalidine (trace) BRUHN & HOLMSTEDT 1974; 0.1% of total alkaloid. ŠTARHA 1997

Anhalonidine (trace) BRUHN & HOLMSTEDT 1974; (tlc showed in tops & roots: TODD 1969); 3.8% of total alkaloid. ŠTARHA 1997

Anhalonine 0.1% of total alkaloid. ŠTARHA 1997 [Not detected; TODD 1969]

Lophophorine (no quantification, [tlc] present in tops & roots: TODD 1969); 0.1% of total alkaloid ŠTARHA 1997

O-Methylpellotine (trace) BRUHN & AGURELL 1975.

Pellotine (0.75-0.89% [fresh wt]) HEFFTER 1894b. [Also observed as the major base by HABERMANN 1977, 1978a & 1978b (from ANDERSON 1980 & ŠTARHA nd); 2.105% (+ 0.108) HABERMANN 1978a (from ŠTARHA 1997); (TODD 1969 reported it to be the major alkaloid but did not quantify); 86.2% of total alkaloid: ŠTARHA 1997 [Ed.: Please note that ŠTARHA (in GRYGAR 1997 cited ŠTARHA & KUCHYNA 1996 but some included entries are not in ŠTARHA & KUCHYNA 1996. They may refer to otherwise unpublished material but we lack details; most likely due to our lack of understanding of Czechoslovakian.]

Glucaric acid (tlc by KRENSTAD & NORDAL 1975)

Quinic acid (tlc, glc & gc-ms by KRENSTAD & NORDAL 1975)

**L. diffusa Notes:**

**A:** Analyzed as *L. echinata*. This is an incorrect designation for *L. diffusa* that is not uncommonly, but unfortunately, encountered in European collections.

This began when CROIZAT described *L. echinata* as being from Texas and then went on to describe *L. diffusa* as *L. echinata var. diffusa*. *L. echinata* (*L. williamsii var. echinata*) is most commonly used for the greyish, larger & higher alkaloid material found in southern Trans-Pecos Texas and southward into Coahuila. It is probably synonymous with the Coahuilan material NOW being called *L. decipiens* by some European cactophiles. More comments are farther below.

**B:** Possible error on my part. ŠTARHA 1997 lists this as O-Methyl-anhalaline which I assumed is a typo (as a compound cannot exist with this name)
Trouts Notes on Cactus Chemistry

Anhalidine (Trace of the total alkaloid content) ŠťARHA & KUCHYNA 1996; [0.1% of total alkaloid: ŠťARHA 1997]
Anhalamine (4.74% [± 0.32] of the total alkaloid content) ŠťARHA & KUCHYNA 1996; [4.7% of total alkaloid: ŠťARHA 1997]
Anhalonidine (3.45% [± 0.82] of the total alkaloid content) ŠťARHA & KUCHYNA 1996; [3.5% of total alkaloid: ŠťARHA 1997]
Pellotine (88.39% [± 2.12] of the total alkaloid content) ŠťARHA & KUCHYNA 1996; [88.4% of total alkaloid: ŠťARHA 1997]
Anhalonine (0.12% [± 0.02] of the total alkaloid content) ŠťARHA & KUCHYNA 1996; [0.1% of total alkaloid: ŠťARHA 1997]
Lophophorine (Trace of the total alkaloid content) ŠťARHA & KUCHYNA 1996; [0.1% of total alkaloid: ŠťARHA 1997]

Lophophora fricii Habermann

“Ginkangyoku”

[See Note A]
Pellotine (Major) Habermann 1978a (From ŠťARHA n.d.); Anderson 1980 cited Habermann 1977 & Habermann 1978a; [1.819% (± 0.212) (from ŠťARHA 1997 citing Habermann 1978a)]; (65.2% & 65.5% of total alkaloid [See Note B] [ŠťARHA 1997 cited ŠťARHA & KUCHYNA 1996])

Lophophora koehresii

(upper left)

Lophophora fricii (rest of the left hand row)
The photo on left is courtesy of Pierre Gambart

Mescaline (Minor) Habermann 1978a (From ŠťARHA n.d.); Anderson 1980 cited Habermann 1977 & Habermann 1978a; [0.014% (± 0.009) (from ŠťARHA 1997 citing Habermann 1978a)]; (0.9% & 1.1% of total alkaloid ŠťARHA 1997)
Tyramine (0.1% & 0.1% of total alkaloid ŠťARHA 1997)
N-Methyltyramine (0.1% & 0.1% of total alkaloid ŠťARHA 1997)

Lophophora fricii

Notes:
A: Also described as Lophophora williamsii var. koehresii (Rhia) Grym. See Grym 1997.
B: Possible error. ŠťARHA 1997 lists as O-Methylanhalinine See comment in earlier footnote
C: In ŠťARHA & KUCHYNA 1996 this appears as a typo (anhalamine is listed twice). We based our assignment on a comparison of the gc value with those in Starha’s other papers.

Lophophora fricii Habermann

Notes:
A: Published in Habermann 1974b & 1975a.
Specific name is not widely accepted and needs more work to clarify its status and placement.
B: The 2 figures refer respectively to GR 1086 & PR 3293; both were cultivated
C: Possible error. ŠťARHA 1997 lists this as O-Methylanhalinine. See comment in earlier footnote.
See comments in Activity Notes.

Details from both Aragane and Sasaki papers still need to be inserted as finding no mescaline in this species. They also assigned a mistaken identification of Lophophora williamsii var. decipiens despite obtaining them labelled as Ginkangyoku (i.e. L. fricii). Those particular specimens that they reported to contain no mescaline should have been identified as Lophophora fricii.
Lophophora fricii  Parras de la Fuente, Coahuila, Mexico
Habermann’s assignment referred to a rose-violet flower color appearing in European imported & cultivated plants (arising from within lots of material identified as L. williamsii), while his actual description (and type) was based on a Mexican plant purchased from K.H. Uhlig (as L. williamsii) that he felt looked like the same material as was already in European collections, and thus this name, as Habermann described it, cannot be reliably extrapolated to include any of the earlier material referred to by the same name.

Habermann’s comment on his inability to cross-pollinate this “species” with L. williamsii, its varieties, L. fricii or L. diffusa is countered by other horticulturalists who have noted no such difficulty. [See MS Smith 1998 for example.]

Lophophora jourdaniana is not widely accepted and was rejected by Anderson. See Anderson 1980.

The presence of readily visible persistent spines in the available horticultural material may support a separate varietal status or at least indicates this “species” needs additional investigation and, if specific status is warranted, a legitimate name assignment.

B: There appears to be some discrepancy as this is not the major alkaloid with regards to the pellotine present.
C: There appears to be some discrepancy as this is not a minor alkaloid with regards to the mescaline present.
D: Possible error. ŠtAŘHA 1997 lists this as O-Methylanhalidine. See comment in earlier footnote.

Lewin 1894 commented that Hildman isolated an alkaloid in 1889.

Lophophora koehresii
from Koehre’s seeds

Lophophora jourdaniana HABERMANN
[Note A]
Mescaline (Major) HABERMANN 1978a (From ŠTARHA n.d.): ANDERSON 1980 cited HABERMANN 1977 & 1978a; [0.690% (± 0.105) ŠTARHA 1997 cited HABERMANN 1978a (See Note B)]; (31% of total alkaloid ŠTARHA 1997); See comments in Activity Notes.
Pellotine (Minor) HABERMANN 1978a (From ŠTARHA n.d.): ANDERSON 1980 cited HABERMANN 1977 & HABERMANN 1978a; [0.710% (± 0.089) HABERMANN 1978a (from ŠTARHA 1997) (See Note C)]; (17.8% of total alkaloid ŠTARHA 1997)
Tyramine (0.6% of total alkaloid ŠTARHA 1997)
N-Methyltyramine (0.5% of total alkaloid ŠTARHA 1997)
Hordenine (2.9% of total alkaloid ŠTARHA 1997)
N-Methylmescaline (3.2% of total alkaloid ŠTARHA 1997)
Anhalinine (0.6% of total alkaloid ŠTARHA 1997)
O-Methylanhalidine (?) (0.8% of total alkaloid ŠTARHA 1997)
[See Note D]
Anhalidine (3.1% of total alkaloid ŠTARHA 1997)
Anhalamine (1.7% of total alkaloid ŠTARHA 1997)
Anhalonidine (20.1% of total alkaloid ŠTARHA 1997)
Anhalonine (1.1% of total alkaloid ŠTARHA 1997)
Lophophorine (1.4% of total alkaloid ŠTARHA 1997)
Ed.: Please note that ŠTARHA 1997 only cited ŠTARHA & KUCHYNA 1996 but some entries are not in our copy of ŠTARHA & KUCHYNA 1996. They may refer to otherwise unpublished research but we lack details. The values refer to work performed with material cultivated in Germany

Lophophora lutea is another invalid name. It was given by Croizat to material that was said to be yellow in flower, hair and body color. Presently it is used for yellow flowering specimens of L. diffusa as are known in cultivation in European collections.

See more comments in Sacred Cacti Part A
Cactus Chemistry: By Species

(Presidio County, Texas) left  
(Mexico - now in cultivation) above- 
Notice the abundant ripe seeds!

(Jim Hogg County, Texas)
**Lophophora sp. var. Viesca (Vieska), Mex.**

(Wild-collected in Mexico) Sample was 7.6 gm dry (Total alkaloid concentration not included)

- Tyramine (0.03% ± 0.01) of the total alkaloid content: ŠTARHA & KUCHYNA 1996; (0.1% of total alkaloid ŠTARHA 1997)
- N-Methylytyramine (0.08% ± 0.01) of the total alkaloid content: ŠTARHA & KUCHYNA 1996; (0.1% of total alkaloid ŠTARHA 1997)
- Hordenine (6.47% ± 0.29) of the total alkaloid content: ŠTARHA & KUCHYNA 1996; (6.5% of total alkaloid ŠTARHA 1997)
- N,N-Dimethyl-3-methoxy-4-hydroxyphenethylamine (0.02% ± 0.01) of the total alkaloid content: ŠTARHA & KUCHYNA 1996
- N-Methyl-3,4-dimethoxyphenethylamine (0.04% ± 0.01) of the total alkaloid content: ŠTARHA & KUCHYNA 1996
- Lophophorine (0.08% [± 0.02] of the total alkaloid content)
- Anhalonine (0.10% [± 0.02] of the total alkaloid content)
- Pellotine (O-Methylanhalidine (0.07% [± 0.01] of the total alkaloid content)
- N-Methylmescaline (0.09% [± 0.01] of the total alkaloid content)
- 2-Methyl-6,7-dimethoxy-8-hydroxy-3,4-di-hydroisouquinolinium inner salt (0.0008% fresh wt.)
- 6,7-Dimethoxy-8-hydroxy-3,4-di-hydroisouquinolinol (0.0001% fresh weight)
- Anhalonidine (5.32% [± 0.32] of the total alkaloid content)
- 3,4-Dimethoxy-N-methylphenethylamine (trace)
- Anhalinine (0.45% ± 0.06) of the total alkaloid content)
- Anhalidine (0.14% ± 0.01) of the total alkaloid content)
- Anhalamine (6.94% ± 0.30) of the total alkaloid content)
- Anhalomidine (5.32% ± 0.32) of the total alkaloid content)
- Pellotine (76.28% ± 1.92) of the total alkaloid content)
- Anhaloline (0.10% ± 0.02) of the total alkaloid content)
- Lophophorine (0.08% ± 0.02) of the total alkaloid content)
- Lophochillicine (0.16% dry wt. i.e. 2% of 8% total alkaloid content)

**Lophophora williamsii (Lemaire) Coulter**

AKA Peyote and many other names

89% water by weight.

Total alkaloid reported: 8.41% in dried “buttons”; 0.47% in fresh whole plants; 0.2% in fresh roots and 0.93% in fresh tops.

82.5% of the alkaloid total in tops and 75.2% in roots: ANONYMOUS 1959 cited ROUBIER 1927a.

1,2-Dimethyl-6,7-dimethoxy-8-hydroxy-3,4-di-hydroisouquinolinium inner salt (0.00008% fresh wt.)

In tops: 89% water by weight.

Tyramine (0.03% ± 0.01) of the total alkaloid content: ŠTARHA & KUCHYNA 1996; (0.1% of total alkaloid ŠTARHA 1997)

Anhalamine (0.1-0.7% dry wt. has been reported)

3,4-Dihydroxy-5-methoxyphenethylamine (trace) LUNDSTRÖM 1971a

3,4-Dimethoxy-N-methylphenethylamine (trace) LUNDSTRÖM 1971a.

3,4-Dimethoxyphenethylamine (trace) LUNDSTRÖM & AGURELL 1968 and LUNDSTRÖM 1971a.

[4,3,5-trimethoxyphenylalanine [i.e. (3,4,5-Trimethoxyphenethyl)glycine] reported in error (Used only as a reference material- Did not observe in plant). See SETHI et al. 1973. Please note that N-[3,4,5-Trimethoxyphenethyl]-glycine and N-[3,4,5-Trimethoxyphenethyl]-alanine are synonyms for Mescaloxyl acid and Mescaloruvic acid (respectively); See KAPADA & HUSSAN 1972a.]

3-Hydroxy-4,5-dimethoxyphenethylamine [AKA 5-OH-3,4-diMeO-PEA or 3-Demethylmescaleine] (5% of total alkaloid: AGURELL & LUNDSTRÖM 1968); (1-5% of total alkaloid content in fresh material: LUNDSTRÖM & AGURELL 1971b)

Also (identified) by KAPADA et al. 1969 and AGURELL & LUNDSTRÖM 1968

3-Methoxytyramine (trace) LUNDSTRÖM 1971a

Anhalamine (0.1-0.7% dry wt. has been reported) SPÄTH & BECKE 1935b and LUNDSTRÖM 1971b. [Also in HABERMANN 1974a (from ŠTARHA nd)] [8% of total alkaloid content: LUNDSTRÖM 1971b]

Anhalidine (trace) (0.001% dry wt) SPÄTH & BECKE 1935b; (0.16% dry wt. i.e. 2% of 8% total alkaloid content)

LUNDSTRÖM 1971b

Anhalamine (0.01% dry wt.) SPÄTH & BECKE 1935b; (0.04% dry wt.) [0.5% of total alkaloid content: LUNDSTRÖM 1971b]

Anhalomidine (1.12% dry wt.) [14% of total alkaloid content: LUNDSTRÖM 1971b] [ŠTARHA nd cf. HABERMANN 1974a]

Anhalamine (0.24% dry wt.) [3% of total alkaloid content: LUNDSTRÖM 1971b]

Anhalotine (0.0003% dry wt. KAPADA et al. 1968

Candicine. (Presence is unconfirmed and questionable. Detection by MC LAUGHLIN & PAUL 1966 relied entirely on TLC. All other workers were unable to detect it. EX.: See KAPADA et al. 1968 & DAVIS et al. 1983)]

**Lophophora sp. Viesca RS 404**

(SRSU) This is now considered to be a form of *L. fricii*
Lophophora williamsii
In Val Verde County (above); In Terrell County (below)
**Lophophora williamsii** (Lemaire) Coulter (cont.)

Choline (0.005% dry wt.) Kapadia et al. 1968

Dopamine (trace) Lundström 1971a.

Epinine (trace) Lundström 1971a.

Hordenine (0.6-0.7% dry wt.) Lundström 1971b; (0.008% dry wt.) McLaughlin & Paul 1966; Todd 1969 found it only in roots (tlc). [Also in Habermann 1978b (from Štarha nd)]

**[8% of total alkaloid content: Lundström 1971b]**

Isoanhalamine (trace) Lundström 1972

Isoanhalidine (trace) Lundström 1972 & 1971b

Isoanhalonidine (trace) Lundström 1972

Isopellotine (0.04% dry weight) [0.5% of total alkaloid content: Lundström 1971b]

Lophorine (0.4% dry wt.) Lundström 1971b; (0.5% dry wt.) Heffter 1898b. [Also in Habermann 1974a (from Štarha nd)]

[5% of total alkaloid content: Lundström 1971b] (Appeared to be the major alkaloid in 2 varieties of summer collected plants: Todd 1969)

Lophotine (0.0002% dry weight) Kapadia et al. 1968

Mescaline ([0.10-0.9-6.0][-6.3]% dry wt. has been reported [See Note A]) Anonymous 1959, Heffter 1896a, Lundström 1971b, Martin & Alexander 1968 & Siniscalco 1983; Anderson 1980 cited Kelsey 1959 (0.9%), Bergman 1971 (1.5%), Fischer 1958 (3%), Heffter 1896a (4.6-5.6%[-6.3%]); 2.4-2.7 % dry (~400 mg. per 16 grams of dried cactus) Ott 1993 citing Bruhn & Holmstedt 1974 and Lundström 1971b; [Crosby & McLaughlin 1973 stated peyote can reach 6% mescaline but rarely exceeds 1% (dry wt.));

[Top>>Roots; Todd 1969 (See Note B); Siniscalco 1983 reported the isolation of 0.10% (well irrigated), 0.93% (grafted) and up to 2.74% dry weight (after 6 months of dry conditions) from plants cultivated in Italy; 0.1 to 0.2% by fresh weight is common; Friends with extraction experience found fresh Texas plants to average 0.2% mescaline content during 1970s; 75-125 mg of HCl was recovered from 70-140 gm plants greenhouse grown in northern Europe. Lundström & Agurell 1971b (This approaches 0.1% by fresh weight) [Also in Habermann 1978a & 1978b (from Štarha nd)]

**[30% of total alkaloid content: Lundström 1971b]**

0.255% by fresh weight (2.55 mg/gm fresh: average of two specimens; estimated using HPLC) They also reported an average of 1.75% by dry weight. (Ed.: Note the obvious discrepancy) [Container grown in Italy] Gennaro et al. 1996;

[As L. williamsii var. typica Croizat: 0.709% (± 0.032) dry wt. Habermann 1978a (from Štarha 1997)]

Starr Co.: 2.77%; Jim Hogg Co: 3.2%; Val Verde Co: 3.5%; Presidio Co: 3.52%. (Averaged % by dry weight.) Hulsey et al. 2011.

3.80% mature crowns, 2.01% small regrowth crowns. (Jim Hogg Co. - Batched samples. Averaged % was by dry weight.)


1.82-5.50% in crown tissue, 0.125-0.376% in subterranean stem tissue, and 0.0147-0.0520% in root tissue. (Starr Co.; Analyzed individually. All % by dry wt.).

Lophophora williamsii flowering with mature fruit showing abundant seeds
Lophophora williamsii (Lemaire) Coulter (cont.)

Mescaline citrimide (trace) Kapadia et al. 1970
Mescaline isocitrimide lactone (trace) Kapadia et al. 1970
Mescaline maleimide (trace) Kapadia & Fales 1968
Mescaline malimide (trace) Kapadia & Fales 1968
Mescaline succinamide (trace) Kapadia & Hight 1968
Mescaloruvic acid (trace) Kapadia & Hussain 1972
Mescalotam (trace) Kapadia & Fales 1968
Mescaloylic acid (trace) Kapadia & Hussain 1972
N,N-Dimethyl-3-hydroxy-4,5-dimethoxyphenethylamine (0.04% dry weight i.e. 0.5% of 8% total alkaloid content)
Lundström 1971c. [0.5% of total alkaloid content: Lundström 1971b]
N,N-Dimethyl-3-methoxtyramine (trace) Lundström 1971a. [0.5-2% of total alkaloid content: Lundström 1971b]
N-Acetyl-3-hydroxy-4,5-dimethoxyphenethylamine (trace)
Kapadia & Fales 1968
N-Acetylanhalamine (trace) Kapadia & Fales 1968
N-Acetylanhalonine (trace) Kapadia & Fales 1968
N-Acetylmescaline (trace) Kapadia & Fales 1968
N-Formyl-3-hydroxy-4,5-dimethoxyphenethylamine (trace)
Kapadia & Fales 1968
N-Formyl-O-methylanhalonidine (trace) Kapadia & Fales 1968
N-Formylanhalamine (trace) Kapadia & Fales 1968
N-Formylanhalonidine (trace) Kapadia & Fales 1968
N-Formylanhalinine (trace) Kapadia & Fales 1968
N-Formylmescaline (trace) Kapadia & Fales 1968
N-Methyl-3-hydroxy-4,5-dimethoxyphenethylamine (trace)
Lundström 1971c
N-Methyl-3-methoxytyramine (trace) Lundström 1971a. [<0.5% of total alkaloid content: Lundström 1971b]
N-Methylmescaline (0.24% dry wt.) [3% of total alkaloid] Lundström 1971b. See also Spåth & Bruck 1937.
N-Methyltyramine (0.012% dry wt.) McLaughlin & Paul 1966. (trace) Lundström 1971a.
O-Methyl-anhalonidine (0.04% dry wt.) [<0.5% of total alkaloid content] Lundström 1971b
[O-Methylpellotine (Probable erroneous listing. We cannot locate any primary or substantiating source.)]
Pellotine (1.36% dry weight) Lundström 1971b [Also (%) Habermann 1974a, 1978a & 1978b (from Šťarhla nd)]
[17% of total alkaloid content: Lundström 1971]
[As L. williamsii var. typica: 0.296% (± 0.065) Habermann 1978a (from Šťarhla in Grym 1997)]
Peyoglanal (trace) Kapadia et al. 1970
Peyoglutam (trace) Kapadia & Fales 1968
Peyonine (trace) Kapadia & Hight 1968
Peyophorine (trace) Kapadia & Fales 1968; (0.04% dry wt.) Lundström 1971b. [0.5% of total alkaloid content:
Lundström 1971b]
Peyoruvic acid (trace) Kapadia et al. 1970
Peyotine (0.00015% dry wt.) Kapadia et al. 1968
Peyoxylic acid (trace) Kapadia et al. 1970

[Serotonin (a tryptamine) was thought to be observed (but was neither isolated nor the identity actually proven), via ion-interaction HPLC: Gennaro et al. 1996]
Tyramine (0.001% dry wt.) McLaughlin & Paul 1966; (trace) Lundström 1971a. [Also in Habermann 1978b (from Šťarhla nd)]
Bruhn et al. 2008 reported Lopholine, 3,4-Methylenedioxyphenethylamine (Homopiperonylamine), and N,N-Dimethyl-3,4-methylenedioxyphenethylamine (Lobivine) as new minor alkaloids both this species and in San Pedro. This paper and these three identifications need to be questioned or at least viewed with serious reservations.

See comments in Activity Notes.

Glucaric acid (tlc by Kringstad & Nordal 1975)

Oxalate druses are present in abundance.
Rouhier 1927

Lophophora williamsii

Normal growth above & grafted crest below

212
Lophophora williamsii williamsii
(Jim Hogg County, Texas)

Lophophora williamsii echinata
(Terrell County, Texas)
**L. williamsii notes:**

A: Note that this is 63X from min to max.
Peyote plants, collected from the wild in the late 19th century, have been reported that were 63 times stronger than other peyote plants, cultivated and well watered.

B: Troje 1969 presented an interesting tlc assessment of two distinct populations of *L. williamsii.*

His Coahuilan specimens were far more potent than those collected in San Luis Potosi lending support to the claim that the Coahuilan populations are a higher alkaloid form, designated by most as *L. echinata* or *L. williamsii* var. *echinata.*

**Lophophora williamsii var. caespitosa Y. Ito n.n.**

[Varietal name is wisely rejected by most authorities as simply being a multi-headed form that normal growth can take. See Anderson or Benson. Bottom image is a normal wild caespitose plant.]

Mescaline 0.701% (± 0.085) [dry wt?]
Pellotine 0.300% (± 0.095)[dry wt?]

HABERMANN 1978a (from STARHA in GRYM 1997)

Another analysis of this variety was published (in Japanese) by FUJITA et al. 1972. In this paper they reported the four new alkaloids listed under *L. williamsii* above (first 4 on our list) and also Pellotine (0.01%), Anhalidine (0.005%), Anhalonidine (0.001%), Anhalamine (detected), & Lophophorine (detected); All % by fresh wt. They apparently did not detect ANY mescaline (a caespitose diffusa?) but we have some distrust of our translator’s accuracy so mention this with reservations. They analyzed plants grown in Japan.

And apparently named one of their new compounds, Peyotine. SHULGIN & SHULGIN 1997 have pointed out that this is certain to cause confusion at some point down the road due to its use for another compound entirely.

“var. caespitosa” in cultivation
(oz) top right; (California) center

**Lophophora williamsii** (Val Verde Co., Texas) below
Lophophora williamsii var. decipiens Croizat

Varietal name that is wisely rejected by most authorities.

Croizat’s designated type specimen was a drawing (in Britton & Rose 1922), made from a photograph taken of a peyote plant, obtained via France, with no collection or locality information available. His description was additionally based on a plant furnished to him with no origin information. It was apparently identified as being synonymous with the drawing based on it lacking ribs, instead being basally tubercled, and having more prominent flowers. He claims decipiens possesses flowers that “freely reaches out of the top of the plant”. See Anderson and/or Benson and/or Bravo.

Modern attempts to describe the Coahuilan material by this name seem to lack published descriptions that can be demonstrably linked to the type. It is said to have an ashen grey color, light pink flowers and expressing tubercles rather than ribs (the latter form is not infrequently observable as individuals within large populations of normal L. diffusa, L. fricii and L. williamsii) These features (ashen grey coloration, a tuberculate appearance and pink or reddish flowers) can actually be considered to be fairly common for fricii. In fact Koehres & others now logically recognize their “decipiens” as L. fricii var. decipiens.

So far as we can determine the purported synonymity is based entirely on inferences from a couple of points of simple morphology and suppositions based on reported geographical distribution rather than proof. There is no doubt fricii expressed this form though.

Mescaline 0.724% (± 0.092) [dry wt?]
Pellotine 0.288% (± 0.066) [dry wt?]
Habermann 1978a (from Štárha in Grym 1997)

Lophophora williamsii echinata
in Presidio County, Texas

The novel characteristics (including an unusually high number of seeds in the fruit) that are now mentioned in the newer description of var. decipiens were NEVER mentioned by Croizat. It MAY eventually be proven to be synonymous but this is presently still in need of work. Croizat’s ENTIRE Latin diagnosis: “Culta pusilla ca. 5-6 cm. lata. Costis primum ca. 1.1, subtus in tuberculis conicus solutis. Flore roseo, in anthesi tubo elongato primo intuitu peculiari.”

Due to its prior usage, decipiens is AT BEST an invalid name.

It is also possible that this material could be synonymous with that referred to by US authors as Lophophora echinata or Lophophora williamsii var. echinata (a good amount of which does form ribs). Be aware that in Europe material labeled L. echinata is often L. diffusa]

Mescaline 0.724% (± 0.092) [dry wt?]
Pellotine 0.288% (± 0.066) [dry wt?]
Habermann 1978a (from Štárha in Grym 1997)
**Lophophora williamsii var. pentagona Croizat**

[Varietal name is wisely rejected by most authorities as simply being a 5-ribbed form that normal growth can take and it can be found occurring in any Lophophora species. It is not even correct to describe it as a proper form since it is typically transitory. It is common in juveniles but does infrequently persist into adulthood. See Anderson or Benson]

Mescaline 0.714% (+ 0.049) [dry wt?]
Pellotine 0.296% (+ 0.065) [dry wt?]

Habermann 1978a (from Šťáha in Grym 1997)

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**Lophophora williamsii “var. pentagona”**

Or at least it is a plant which was grown from European seed stock sold under this name.

**Lophophora diffusa**

**Lophophora williamsii echinata**
Lophophora williamsii echinata
cristate Lophophora "echinata"

in habitat (Terrell Co., Texas) above

in cultivation below
**Trouts Notes on Cactus Chemistry**

*Machaerocereus* *epica* (Brandeglie) Britton & Rose
See as *Stenocereus eruca*

*Machaerocereus gummosus* (Engelmann) Br. & R.
89.5% (Djerassi) & 74.09% (Heyl 1901) water by weight
[Kircher 1982 reported 80% water by weight]
Gummosogenin (a new triterpene; $\Delta^2$-18$\beta$-oleanene-3$\beta$16$\beta$-diol-28-al) 0.76% dry weight; 0.08% fresh weight.
Djerassi et al. 1954d. First report was Djerassi et al. 1953c citing future publ. [Also in Djerassi et al. 1954a & 1955b.]
Longispinogenin (Reported in Djerassi et al. 1954a.)
Machaeric acid [21-Keto-oleanolic acid; first isolation] 0.125% dry wt. (Isolated via its Methyl ester)
Djerassi et al. 1955b
Machaerinic acid (a 21-hydroxy-oleanolic acid) Traces.
Djerassi & Lippman 1955. [Also in 1954]
HEYL 1901 isolated a hemolytic principle from *Machaerocereus gummosus* and believed it responsible for its activity as a traditional fish poison. He named it Cereinic acid but it was apparently never actually characterized. HEYL reported the dried plant material to have a total saponin content of 24%. TLC examination showed the absence of alkaloids and the strong presence of triterpene glycosides: Kircher 1982 Lipid content 6.5% by dry weight: Kircher 1982

See comment in Activity Notes.
Trouts Notes on Cactus Chemistry

*Maihuenia poeppigii* (Pfeiffer) Schumann

All CO2 uptake occurred entirely during the day through the stems (under well watered conditions)

*Maihueniopsis darwinii* (Henslow) Ritter see as *Opuntia hickenii*

*Maihuenia poeppigii* (UC)

*Mamillopsis senilis* (Loddiges) Weber ex Br. & R.

=Mammillaria senilis* Loddiges ex Salm-Dyck

AKA “Cabeza de viejo”.

Rose 1899 calls it the “Sacred Cactus”

No analysis reported

Rose 1899 suggested this may be an active species based entirely on the fearful reluctance of a Tarahumara to assist Nelson while collecting this cactus and the respectful treatment they applied to the spot where said cacti was harvested.

See comments in the Activity Notes

*Mamillopsis senilis* Photo by Kamm

*Mammillaria aselliformis* W. Watson

See as *Pelecyphora aselliformis*
Maihueniopsis clavaroides
AKA Puna clavaroides

Mammillaria dioica
Trouts Notes on Cactus Chemistry

*Mammillaria centricirrha Lemaire*
Fruit contains Phyllocactin (63.9% of total), Betanin (26.2% of total), Isophyllocactin & Isobetanin. Piattelli & Imperato 1969
The betacyanin Mammillarinin (Betanidin 5-O-(6’-O-malonyl)-beta-sophoroside) was identified as a fruit pigment. Wybraniec & Nowak-Wydra 2007

*Mammillaria craigii LINDSAY*
Needs an analysis.
See comments in the Activity Notes

*Mammillaria crinita DC* 
See as Mammillaria wildii (?) 
Mammillaria dactylithele Labouret 
See as Coryphantha macromeris

*Mammillaria dioica K. BRANDEGEE* 
CO2 uptake occurred entirely at night through the stems (under well watered conditions) 
Nobel & Hartsock 1986

*Mammillaria disciformis DC* See as Strombocactus disciformis

*Mammillaria donatii BERGE ex SCHUMANN* 
A new betacyanin (Betanidin 5-O-(6’-O-malonyl)-beta-sophoroside) was reported and named Mammillarinin. Wybraniec & Nowak-Wydra 2007

*Mammillaria craigii*
Cactus Chemistry: By Species

Mammillaria craigii

Mammillaria dioica

Mammillaria craigii
Mammillaria elongata
(SRSU)
Mammillaria elongata **DeCandolle**  
- β-O-Methylsynephrine (trace)  
- Hordenine (0.0003% dry wt.)  
- N-Methyltyramine (trace)  
- Synephrine (0.0009% dry wt.)  
- Tyramine (trace)  
  *West & McLaughlin 1973*

Mammillaria gracilis **Pfeiffer**  
Structures of protein linked N-glycans in different tissues of this cactus was studied by **Baalen et al. 2006**  
**Baalen et al. 2007** looked on how environmental factors influenced their structure.

Mammillaria grahamii **Engelmann** Needs an analysis  
**Mammillaria grahamii var. olivae (Orcutt)**  
L. **Benson** Needs an analysis  
See Activity Notes.

Mammillaria gummifera **Engelmann**  
A new betacyanin was reported and named Mammillarinin (Betanidin 5-O-(6’-O-malonyl)-β-sophoroside).  
**Wybraniec & Nowak-Wydra 2007**

I have encountered disagreement in splitting up the *heyderi* complex. In particular dividing *hemisphaerica* and *gummifera* from *heyderi*. I like to try to recognize *hemisphaerica* but that one needs better separators than spine count and felt. *M. heyderi* in Texas only works if features Hunt ascribes to *gummifera* are applied for what Powell regards as *heyderi*. I’m following Powell on this last one.

Mammillaria elongata  
above normal; below cristate  
(cristate form lacks published analysis)

Mammillaria elongata var. *rufrocrocea* **K. Schumann**  
Reported to contain Kaempferol & Quercetin (Flavonols)  
**Richardson 1978** (based on acid hydrolysis)

Mammillaria elongata var. *echinaria*  
(HBG)  
Variety lacks published analysis.

Mammillaria gracilis v. fragilis  
(HBG)  
Variety lacks published analysis.
Variety lacks published analysis.
Mammillaria grahamii
(Saguaro National Park, Arizona)
(Crest at SRSU)

Mammillaria hidalgensis
(UC)
Mammillaria heyderi hemisphaerica
(Hidalgo County, Texas)

Mammillaria heyderi
(Val Verde County, Texas)
Mammillaria heyderi
(Terrell County, Texas)
both images
Mammillaria heyderi
(Terrell County, Texas)
Mammillaria heyderi Muehlenpfordt
3,4-Dimethoxy-N-methylphenethylamine (Over 50% of the 10-50 mg of total alkaloid/100 grams fresh) Bruhn & Bruhn 1973 (Also mentioned in Bruhn 1973)
Reported to contain Betalains as pigments. Wohlpert & Marry 1968 cited Wohlpert 1967
Reports of ethnopharmacological use appear to be in error. See Activity Notes for more details.

Mammillaria hidalgensis J. Purpus
Reported to contain Betalains as pigments. Wohlpert & Marry 1968 cited Dreiding 1961

Mammillaria meiacantha
(Field-collected on a ranch near Alpine, Texas)

Mammillaria heyderi var. heyderi
(in habitat: Enchanted Rock, Texas) top left
Appearing in a 1990 field survey as M. gummifera.

Mammillaria heyderi flower
(Germany) Photo by Evil Genius

Mammillaria heyderi var. heyderi
(Terrell County, Texas) center left & bottom right
Mammillaria infernillensis Craig
A new betacyanin (Betanidin 5-O-(6'-O-malonyl)-β-sophoroside) was reported and named Mammillarinin.
Wybraniec & Nowak-Wydra 2007

Mammillaria karwinskiana Martius
A new betacyanin (Betanidin 5-O-(6'-O-malonyl)-β-sophoroside) was reported and named Mammillarinin.
Wybraniec & Nowak-Wydra 2007
Mammillaria karwinskiana
(HBG)

Mammillaria lenta
(UC)

236
Mammillaria krameri MÜHLENPFORDT
A new betacyanin (betanidin 5-O-(6′-O-malonyl)-betasophoroside) was reported and named mammillarinin.
WYBRANIEC & NOWAK-WYDRA 2007

Mammillaria lenta K.BRANDEGEE
Reported to contain unidentified alkaloid(s).
CHALET 1980a cited DOMÍNGUEZ et al. 1969
**Trouts Notes on Cactus Chemistry**

*Mammillaria lewinii* Karsten See as *Lophophora williamsii*
*Mammillaria longimamma* De Candolle See as *Dolichothele longimamma*
*Mammillaria longimamma* sphaerica K. Brandegee See as *Dolichothele sphaerica*
*Mammillaria longimamma* uberiformis Schumann See as *Dolichothele uberiformis*
*Mammillaria macromeris* Engelmann See as *Coryphantha macromeris*

*Mammillaria magnimamma* Haworth
Unidentified alkaloid(s) reported. Hefftter 1898a
Fruit contains Phyllocactin (65.2% of total), Betanin (34.8% of total) and traces of Isophyllocactin & Isobetanin.
Piattelli & Imperato 1969
A new betacyanin (betanidin 5-O-(6′ O-malonyl)-β-sophoroside) was reported and named mammillarinin.
Wybraniec & Nowak-Wydra 2007

*Mammillaria magnimamma* var. *divergens* Haworth
Fruit contains Phyllocactin (80.0% of total), Betanin (10.2% of total), Isobetanin (9.8% of total) and traces of Isophyllocactin.
Piattelli & Imperato 1969

*Mammillaria meiacantha* Britton & Rose
Positive Mayer’s test. GC showed one alkaloid present but it was not identified. Bruhn & Bruhn 1973.
An unidentified alkaloid was reported by Brown et al. 1968.

*Mammillaria melaleuca* Karwinsky ex Salm-Dyck
See as *Dolichothele melaleuca*

*Mammillaria melancentra* Posegel
Acetovanillone (Apocynine) (0.11367% dry wt.)
Mammillarol (a partially characterized triterpenoid) (0.0069% dry wt.)
ACI-9 (A new steroid) (0.0043% dry wt.)

*Mammillaria magnimamma* var. *divergens* Haworth
Fruit contains Phyllocactin (80.0% of total), Betanin (10.2% of total), Isobetanin (9.8% of total) and traces of Isophyllocactin.
Piattelli & Imperato 1969

*Mammillaria meiacantha* (in habitat: Brewster Co., Texas) right
Commonly confused with *M. heyderi* but a spine count (above: SRSU) can readily & easily separate the two species.

2 forms of *Mammillaria magnimamma* - lower row
This particular paper by Dominguez is in reference to *Mammillaria melanocentra* rather than to *Coryphantha runyonii* as is sometimes presented in alkaloid listings. Confusion on synonymy is not just easy but easy to locate.

Nomenclatural synonyms:
- *Mammillaria runyonii* Boed. Mammillarien-Vergleichs-Schlüssel 52. 1933
- *Mammillaria runyonii* (Britton & Rose) Boed.
- *Neomammillaria runyonii* Britton & Rose; Britton & Rose Cactaceae 4: 81. 1923 [24 Dec 1923]

There are many references to *Mammillaria runyonii* Britton & Rose being a synonym for *Coryphantha runyonii*. Including some authoritative databases.

Often this is given as *Coryphantha runyonii* (Britton & Rose) Cory which was published In: Rhodora 38(455): 407. 1936.

Coryphantha runyonii Britton & Rose:
- Coryphantha macromeris subsp. *runyonii* (Britton & Rose)
- N.P. Taylor
- Coryphantha macromeris var. *runyonii* (Britton & Rose)
- L.D. Benson
- Lepidocoryphantha runyonii (Britton & Rose) Backeberg.

Incredibly, Britton & Rose 1923 actually used "runyonii" for two different new species; both of which were discovered by Runyon. However, neither one was as *Mammillaria runyonii*. Hence Cory's use of *Mammillaria runyonii* in 1936 to refer to Britton & Rose's *Coryphantha runyonii* and Boedeker's use of *Mammillaria runyonii* in 1933 to refer to *Mammillaria melanocentra* (Britton & Rose's *Neomammillaria runyonii*) has resulted in some persistent confusion.
Forms of *Mammillaria magnimamma*  
(HBG) top row  
(Oasis) center left

*Mammillaria meiacantha*  
(SRSU)  
bottom row
**Cactus Chemistry: By Species**

**Mammillaria microcarpa Engelmann**

3,4-Dimethoxyphenethylamine (0.0015% ± 0.0006) in chlorophyllous tubercles, 0.0035% ± 0.0027 in cortex tissue, 0.0007% ± 0.0002 in vascular tissue and 0.0008% ± 0.0004 in the root. Knox et al. 1983. [Knox & Clark 1986 found it to be present in only 64% of their samples.]

Hordenine (0.0017% by dry weight) Howe et al. 1977; (0.0035% ± 0.0017) in chlorophyllous tubercles, 0.017% ± 0.0053 in cortex tissue, 0.019% ± 0.012 in vascular tissue and 0.036% ± 0.023 in the root. Knox et al. 1983. [Knox & Clark 1986 found it to be present in 95% of their samples]

N-Methylytryamine (0.0019% dry wt.) Howe et al. 1977; (0.0094% ± 0.0028) in chlorophyllous tubercles, 0.025% ± 0.006 in cortex tissue, 0.014% ± 0.0073 in vascular tissue and 0.014% ± 0.0023 in the root. Knox et al. 1983. [Knox & Clark 1986 found it to be present in all of their samples]

Tyrmine 0.0064% ± 0.0033) in chlorophyllous tubercles, 0.014% ± 0.0099 in cortex tissue, 0.004% ± 0.0028 in vascular tissue and 0.0029% ± 0.0017 in the root. Knox et al. 1983. [Knox & Clark 1986 found it to be present in all of their samples]

(Knox & Clark 1986 looked at 129 individuals from 15 Arizona populations. The occurrences of particular alkaloids showed no clear associations with the geographical distribution.]

*Mammillaria microcarpa* is considered variously either synonymous with *Mammillaria srahamii* or a variety of it. Toss a coin. For sake of aiding keyword searches we kept them separate.

**Mammillaria multiceps Salm-Dyck**

Reported to contain unidentified alkaloid(s). Chalet 1980a cited Dominguez et al. 1969

**Mammillaria neumanniiana Lemaire**

Fruit contains Phyllocactin (50.2% of total), Betanin (30.9% of total), Isophyllocactin (18.9% of total) and traces of Iso-betanin. Piattelli & Imperato 1969

**Mammillaria pilcayensis Bravo**

Seed coats reported to contain guaiacyl/syringyl lignins. Chen et al. 2012

**Mammillaria pusilla (DC) Sweet**

Reported to contain Betalains as pigments.

Wohlpert & Mabry 1968 cited Dreiding 1961

**Mammillaria rhodantha Link & Otto**

Reported to contain Betalains as pigments.

Wohlpert & Mabry 1968 cited Dreiding 1961

**Mammillaria microcarpa**

(SS)
Mammillaria microcarpa
(SS)

Mammillaria grahamii v. microcarpus
(Saguaro National Park, Arizona)
Compare to images under M. grahamii
**Mammillaria roseo-alba Boecker**
A new betacyanin (Betanidin 5-O-(6’-O-malonyl)-β-sophoroside) was reported and named Mammillarinin.
Wybraniec & Nowak-Wydra 2007

**Mammillaria runyonii (Britton & Rose) Boecker**
See as Mammillaria melanocentra

**Mammillaria runyonii (Britton & Rose) Boecker IS NOT**
synonymous with Mammillaria runyonii Cory

**Mammillaria runyonii Cory**
See as Coryphantha macromeris var. runyonii

**Mammillaria saffordii (Britton & Rose) Bravo**
Reported to have no detectable alkaloids in Dingerdissen & McLaughlin 1973b

**Mammillaria senilis** is not the same plant as Mamillopsis senilis but the equating of them appears in the literature. (ex.: Bye 1979, p 35)

**Mammillaria setigera** (M. saetigera? if so = M. hahniana)
Betalains as pigments. Wohlfart & Mabry 1968 cf Dreiding 1961

**Mammillaria sphaerica Dietrich ex Poselger**
See as Dolichothele sphaerica

**Mammillaria tetrancistra Engelmann**
Hordenine (0.0038% (± 0.0023) in chlorophyllous tubercles, 0.013% (± 0.0027) in cortex tissue, 0.026% (± 0.017) in vascular tissue and 0.047% (± 0.03) in the root.) Knox et al. 1983
N-Methylypyramine (0.012% (± 0.0034) in chlorophyllous tubercles, 0.06% (± 0.017) in cortex tissue, 0.022% (± 0.004) in vascular tissue and 0.0094% (± 0.0028) in the root.) Knox et al. 1983 (Wild collected: Arizona)

**Mammillaria zuccariniana Martius**
Fruit contains Phyllocactin (45.2% of total), Betanin (25.3% of total), Isophyllocactin (19.6% of total) & Isobetanin (9.9% of total). Piatelli & Imperato 1969

**Mammillaria zuccariniana (HBG)**
Mammillaria zuccariniana
(Field)
Monvillea spegazzinii

crested horticultural form

Marginitocereus marginatus (DC) Backeberg
See as Pachycereus marginatus

Marshallocereus aragonii (Wehl.) Backeberg
See as Lemaireocereus aragonii
Marshallocereus thurberi (Engelmann) Backeberg
See as Lemaireocereus thurberi

Matucana madisoniorum is erroneously rumored to contain mescaline.
Analysis of it could detect no alkaloid (unpublished GC-MS by Shulgin; personal communication).
See additional comments in Activity Notes.

Melocactus bellavistensis has been purported to have use.
It needs study and an analysis.
See additional comments in Activity Notes.

Melocactus delessertianus Lemaire
Tyramine (no quantification) Doetsch et al. 1980

Melocactus maxonii (Rose) Gürke
3,4-Dimethoxyphenethylamine (less than 0.01% dry wt.) Ma et al. 1986
4-Hydroxy-3,5-dimethoxyphenethylamine (Around 0.01% dry wt.)[?] Ma et al. 1986 (Commercial: CA)
Tyramine (no quantification) Doetsch et al. 1980

Melocactus obtusipetalis Lemaire
Seed coats reported to contain a homopolymer of cafeyl alcohol as C-lignins. Chen et al. 2012

Melocactus peruvianus VaupeL
Reported to contain Betalains as pigments. Wohlpert & Marry 1968 cited Dreiding 1961
Caycho Jimenez 1977 (page 91) asserted that it contains Mescaline but did not offer any supportive reference.
See additional comments in the Activity Notes.
Monvillea spegazzinii (A. Weber) Britton & Rose
Reported to contain Betalains as pigments.
Wohlfart & Mabry 1968 cited Dreiding 1961
*Myrtillocactus cochal* (Orcutt) Britton & Rose

“cochal” Standley 1924: 911

92.6% water by weight [Sandoval et al. 1957 found that 70% water weight was lost when drying 7 days at 35°C.]

Cochalic acid (A triterpene acid; 16-epi-echinocystic acid) 0.56% dry wt. Dierassi et al. 1955c and Dierassi & Thomas 1954; (1.25% by dry wt Dierassi et al. 1957 [a portion of this was via its methyl ether])

Chichipecogenin (A triterpene) 2.47% by dry wt. Dierassi et al. 1957; 0.83% by dry wt. Sandoval et al. 1957 [Collected near Tehuacán, Puebla]

Myrrillogenic acid (A β-Amyrin-type terpene: 3β, 16β, 28-trihydroxy-Δ12-oleanen-29-oic acid [Dierassi & Monsimer 1957]) (0.19% dry wt. via the methyl ether) Dierassi et al. 1957. [Cultivated: Corona, California]

Longispinogenin (0.157% dry wt) Dierassi et al. 1957

Oleanolic acid (via the methyl ether) Sandoval et al. 1957

Dierassi 1957 presents almost the same list but omits oleanolic acid; citing unpublished observations by Dierassi, Monsimer & Thomas
Myrtillocactus eichlamii Britton & Rose
Cochalic acid (0.37% by dry wt via the methyl ether)
Chichipegenin (indicated in their discussion but not listed in the experimental account)
Myrtillogenic acid (0.028% dry wt via the methyl ether)
Oleanolic acid (0.16% dry wt via the methyl ether)
β-Sitosterol (detected)
Maniladiol (0.14% dry wt).
Dierassi et al. 1957 [Collected near Guatemala City] citing unpublished observations by Dierassi & Burstein

Myrtillocactus geometrizans (von Martius) Console
"garambullo" or "padre nuestro" or "blue myrtle" or "billberry cactus"
[Mescaline was apparently reported in error. Weak presence [0.30% by dry weight] was only isolated from plants previously used as grafting stocks for L. williamsii. However, directly in conflict with his experimental account, Siniscalco also includes a closing comment that suggests one of his controls contained mescaline. Siniscalco 1983]
[Alkaloids were only detected in one of the preliminary screenings of this species by Fong et al. 1972. All other tests indicated no alkaloid. All were from Mexico.]
Cochalic acid (0.25% by dry wt via the methyl ether)
Chichipegenin (0.62% by dry wt via the methyl ether)
Myrtillogenic acid (0.14% dry wt via the methyl ether)
Longispinogenin (0.0025% dry wt)
No detectable alkaloid.
Dierassi et al. 1957 [Material was collected at km 205 of Mexico-Laredo Hwy]
Dierassi 1957 cited unpublished observations by Dierassi, Lippman & Monsimer
Chichipegenin, Peniocerol, Macdougallin were reported from an extract of plant and roots.
Cespedes et al. 2005

A study of the flavor of the “berrycactus” decided that nine volatile compounds were the most important components: Furfural, 5-Methyl-2-furancarboxaldehyde, 2(5H)-Furanone, 5-Acetoxymethyl-2-furaldehyde, 2-Cyclohexen-1-ol, Octanoic acid ethyl ester, Decanoic acid ethyl ester, Octanoic acid and Phenylethyl alcohol.
Vazquez-Cruz et al. 2012

See comments in Activity Notes.
cristate *Myrtillocactus geometrizans*

*Myrtillocactus geometrizans var. grandiareolatus* (Bravo) Backeberg

See as *Myrtillocactus grandiareolatus*. Hunt 1999 considers this to be synonymous with *Myrtillocactus geometrizans*

*Myrtillocactus grandiareolatus* Bravo

[See Bravo 1932]

Chichipegenin (nearly 1% by dry wt)
Oleanolic acid (0.2% dry wt. via the methyl ether)

Djerassi et al. 1957 [Collected near Zapotitlán, Mexico]
Djerassi 1957 cited unpublished observations by Estrada & Manjarrez
**Myrtillocactus schenckii** *(Purpus) Britton & Rose*

AKA “vichishova” or “garambillo”

Stellatogenin (0.052% by dry wt)

Oleanolic acid (0.136% dry wt. via the methyl ether)

Djerassi *et al.* 1957 [Collected in Oaxaca, Mexico]

Djerassi 1957 cited unpublished observations by Manjarrez

**Neobuxbaumia euphorbioides** *(Haworth) Buxbaum*

Reported to show no detectable alkaloids (with MIKES) in Unger *et al.* 1980

**Neobuxbaumia euphorbioides**

Lower right
Neobuxbaumia euphorbioides
(HBG)
Neobuxbaumia euphorbioides (HBG)

Salsolidine, Anhalidine and Arizonine in trace amounts. Flores Ortiz et al. 2003 (gc-ms)
Neobuxbaumia scoparia
(HBG)
Neobuxbaumia scoparia
(HBG)
Neobuxbaumia scoparia
(HBG)
**Neobuxbaumia scoparia (Poselger) Backeberg**
Salsolidine, Anhalidine and Arizonine in trace amounts.  
Flores Ortiz et al. 2003 (gc-ms)

**Neobuxbaumia tetetzo (Weber ex Coulter) Backeberg**
No detectable alkaloids.  
Chalet 1980a cited Domínguez et al. 1969 (analyzed as Cephalocereus tetetzo (A. Weber) VaupeL)  
Salsolidine, Anhalidine and Arizonine in trace amounts.  
Flores Ortiz et al. 2003 (gc-ms)

Neogomesia agavioides Castañeda. See as Ariocarpus agavoides

**Neobuxbaumia tetetzo**
(UC)
upper right

**Neobuxbaumia scoparia**
(HBG)
above & below
Neolloydia intertextus (Engelmann) Kimnach
[as Echinomastus intertextus ENGELMANN]

Reported to contain druses of Weddellite.
These druses appeared to be comprised of symmetrical
tetragonal crystals that were piled onto one another.
They were found to possess a $^{13}\text{C}/^{12}\text{C}$ ratio that was 1% higher than the ratio of its environmental atmosphere (the ratio was also richer than was found within its woody tissues).
The cortex of older regions within the stem was found to contain up to 50% of its dry weight as the oxalate.

Rivera & Smith 1979
(Collected in Paradise Canyon, West Texas)
Neolloydia intertextus
(SRU)

260
Neolloydia intertexta var. dasyacantha (Engelmann)

L. Benson

Reported to contain a single unidentified alkaloid when harvested in Spring and no alkaloid when harvested in the Fall. Brown et al. 1968.

Neolloydia odorata was reported to show no detectable alkaloids. Chalet 1980a cited Dominguez et al. 1969

Neomammillaria anything. See under Mammillaria

Neomammillaria runyonii Britton & Rose See as Mammillaria melanocentra [Not a synonym for Coryphantha runyonii]
Neoraimondia ebenacantha
Betulain pigments. WOHLPART & MARR 1968 cited DREIDING 1961
We are unclear if this was Neoraimondia ebenacantha (Hort. non Monv.)
Ytio or Neoraimondia ebenacantha (Monv.) Berg.

Neoraimondia arequipensis var. roseiflora (WEDERMAN
& BACKEBERG) RAUH
3,4-Dimethoxyphenethylamine (less than 0.01% dry wt.)
4-Hydroxy-3,5-dimethoxyphenethylamine (Less than 0.01%
dry wt.)
\textit{Ma et al.} 1986 (Collected by OSTOLAZA #85055)

Neoraimondia macrostibas (SCHUMANN) BRITTON & ROSE
86% water by weight
\textit{no alkaloid}"
A basic, partially crystalline material was obtained. It showed multiple components: all unidentified; ethanol soluble & ether insoluble. Also noted was a gummy ‘non-glycosidic’ neutral material and substantial amounts of an unidentified neutral material (oily or amorphous)
[No saponins or terpenes observed]
DIERASSI \textit{et al.} 1955b [Wild collected; Peru]
This species is in need of further analysis.
See more comments in Part B San Pedro

A claim purporting the presence of mescaline is made by \textit{CAYCHO
Jimenez} 1977 (page 91) but he cites no reference and does not include anything that supports his assertion.
See comments in Activity Notes.
Nopalxochia ackermannii (Haworth) F.M.Knuth
Appears listed as containing an unidentified alkaloid but either the entry included no reference or else the reference that was cited (Brown et al. 1968) did not mention the species. The intended reference was Heftter 1898; who included no additional information.

According to Hortus, the plants propagated under this name are actually a hybrid of this species with a Heliocereus.
Trouts Notes on Cactus Chemistry

**Nopalscoxia phyllanthoides (DC) Br. & R.**
Reported to contain Betalains as pigments.
Betacyanin first reported by Kryz.

**Nopalscoxia phyllanthoides (Now in Disocactus)**

**Normanbokea pseudopectinata (Backeberg) Kladiwa & Boxbaum.**
See as Pelechphora pseudopectinata

The former Notocactus are now in the genus Parodia.

**Notocactus concinnus (Monville) Berger**
Mucilage determined to be comprised of Arabinose (22.0%),
Galactose (42.7%), Galacturonic acid (14.1%), Rhamnose
(7.6%) & Xylose (13.7%).
Moyna & DiFabio 1978 (Analyzed MAM 1219)

**Notocactus mammulosus (Lemaire) A. Berger**
Hunt lists as Notocactus mammulosus (Lemaire) Backeberg
Reported to contain Betalains as pigments.
Wohlpart & Mayry 1968 cited Dreiding 1961

**Notocactus ottonis (Lemaire)**
Berger ex Backeberg & Knuth
Hordenine (%)? DiVries et al. 1971
[N-Me-3,4-DiMeO-PEA has been listed in error. It is not supported
by the reference that was cited: Smith 1977.]
Reported to contain Betalains as pigments.
Wohlpart & Mayry 1968 cited Dreiding 1961

**Notocactus uebelmannianus**
Lacks reported analysis

**Nyctocereus guatemalensis Britton & Rose**
Devoid of glycosides
Dierassi et al. 1953c [Guatemala; cultivated Guatemala City]
Most members of this genus, including this species, have been
transferred elsewhere. (In this case to Peniocereus and absorbed into
Peniocereus hirschtianus (Schumann) Hunt)
The work of Arias et al. 2005 indicates that Nyctocereus should be
preserved only as a monotypic genus (N. serpentinus).
Notocactus scopa (Sprengler) Berg.
From leaves:
- Cholesterol (2.6% of total)
- 24α-Methylcholesterol (12.5% of total)
- Stigmasterol (2.8% of total)
- Sitosterol (73.9% of total)
- 24α-Methylcholestenol (traces)
- Sitostanol (8.2% of total)
  Salt et al. 1987

Obregonia denegrii Frič
Hordenine (0.002% dry wt.) Neal et al. 1971a; (1-10% of 1-10 mg total alkaloids/100 gm. fresh.) Bruhn & Bruhn 1973.
N-Methyltyramine (0.0002% dry wt.) Neal et al. 1971a; (trace)
Tyramine. (Over 50% of 1-10 mg of total alkaloids/100 gm. of fresh) Bruhn & Bruhn 1973
  [All 3 reported in Habermann 1974a (from ŠtArhA nd)]
Quinic acid (tlc & glc by Kringstad & Nordal 1975)
β-Sitosteryl (tentative ID) Dominguez et al. 1969
Anderson 1967 & Dominguez et al. 1969 reported unidentified alkaloids.

Opuntia
More detailed entries for the mescaline containing species can be found in Part A of Sacred Cacti.

In YACOVLEFF & HERRERA 1934, on page 321, in figure 39 [Note 35], is what appears to be a small jointed Opuntioid species. [Note 36]

Figure 39 from Yacovleff & Herrera 1934

It is impossible to accurately determine most species of plants from such ornamental designs but some seem clearly to represent several different species of Opuntias with very different pads and configurations.

Columnar cacti are also represented, as are what appear to us suggestive of maps of occurrence (assuming one knows the point of origin for reference).

Rätsch 1998 shows a quite similar scene on page 507 and assigns San Pedro as a specific identification. Careful examination of the images is suggestive of spinier cacti intended not for ingestion but possibly for basic ash preparation indicating that another species may have been intended. (Note the apparent lime stick and coca bag in the hands of the figures pictured here and in RäTSCH)

Obregonia denegrii
This is believed to be Lophophora’s closest living relative

Opuntia acanthocarpa Engelmann & Bigelow
see as Cylindropuntia acanthocarpa
Opuntia articulata Preiser see as Tephrocactus articulatus
Opuntia basilaris *Engelmann & Bigelow*

Also appears spelled *basilaria*. We went with Benson 1982. 4-Hydroxy-3,5-dimethoxyphenethylamine (Less than 0.01%) Mescaline (0.01% dry wt.) [i.e. 100 mg/1 kg. dry wt]

Ma *et al.* 1986 (Analyzed F. Zeylmaker #8504)

Opuntia bergeriana *Weber*

Fruit contains Betanin (major), Isobetanin, Betanidin and traces of Phyllocactin & Isophyllocactin:

Pialettli & Imperato 1969

Betanin in fruit (biosynthetic study) Miller *et al.* 1968

Flower contains betacyanins: Betanin (major) & Isobetanin.

Pialettli & Minale 1964b

Opuntia bigelovii *Engelmann* see as *Cylindropuntia bigelovii*

Opuntia boldinghii *Britton & Rose*

Fatty acids composition of seed oil (relative percents).

Linoleic acid 67.2±0.1%

Oleic acid 18.0±0.1%

Palmitic acid 10.4±0.1%

Stearic acid 3.0±0.1%

Palmitoleic acid 0.5±0.1%

Linolenic acid 0.3±0.1%

Arachidic acid 0.3±0.1%

Gadoleic acid 0.4±0.1%

García Pantaleón *et al.* 2009

Fruits shown to contain betalains by Viloria-Matos *et al.* 2002. Proximate analyses was performed on fruits and on cladodes by Moreno-Alvarez *et al.* 2003 & 2006. [from García Pantaleón *et al.* 2009]
Opuntia chlorotica
Engelmann & Bigelow

Quercetin-3-glucoside, Quercetin-3-rutinoside, Iso-rhamnetin-3-glucoside, Isorhamnetin-3-rutinoside, Isorhamnetin-3-rhamnosylgalactoside, and Kaempferol 3-galactoside (all flavonoids) in flowers.

Clark & Parfitt 1980
Opuntia brasiliensis (Willdenow) Haworth
See as Brasiliopuntia brasiliensis
Opuntia bradtiana (Coulter) K. Brandegee
see as Grusonia bradtiana
Opuntia clavata Engelmann
see as Corynopuntia clavata

Opuntia comonduensis (Coulter) Britton & Rose
Cholesterol (4.4% of total)
24-Methylcholesterol (8.8% of total)
Sitosterol (86.7% of total)
Salt et al. 1987

Opuntia curvispina Griffiths
Quercetin-3-glucoside, Quercetin-3-rutinoside,
Iso-rhamnetin-3-glucoside, Isorhamnetin-3-rutinoside,
Iso-rhamnetin-3-rhamnosylgalactoside, and Kaempferol
3-galactoside (all flavonoids) in flowers.
Clark & Parfitt 1980
This name is considered unresolved.

Opuntia decumbens Salm-Dyck
Fruit determined to contain betalains. Fischer & Dreiding 1972 & Miller et al. 1968 (Both studied the biosynthesis of Betanin)

Opuntia dejecta Salm-Dyck
Fruit contains Betanin (major), Isobetanin and traces of Phyllocactin. Piatelli & Imperato 1969

Opuntia diademata Lemair
Citric acid (3.0% in stem juice)
Hegnauer 1964 cited Bergström 1934

Opuntia dillenii Haworth See as Opuntia stricta var. dillenii

Opuntia ellisiana Griffiths
Crystalline material isolated from the stems shows a very complex mineral composition that includes:
Whewellite (monohydrated calcium oxalate)
Opal (SiO2)
Calcite (CaCO3)
Glushinskite (dihydrated Magnesium oxalate).
Monje & Baran 2005

Opuntia engelmannii Salm-Dyck
Flower contains Betanin (major), and an unidentified Betacyanin.
Fruit contains Betanin (major), Phyllocactin & Isobetanin.
Piatelli & Imperato 1969
Reported to contain druses of Whewellite.
Rivera & Smith 1979
(collected on the campus of the University of Texas at Austin)

Opuntia elatior Mill.
β-Sitosterol
Opuntiol (0.05% dry wt) (2-Hydroxymethyl-4-methoxy-α-pyrone)
Gangul et al. 1965 (Collected in India)
Narcissin (a flavone) was found in the flowers.
Shahbr & Zaman 1968

Opuntia elatior

Opuntia engelmannii
(Hays County, Texas)
Opuntia engelmannii
(BTA)

270
Opuntia engelmannii
(Hays County, Texas)

Opuntia engelmannii var. linguiformis

Opuntia erinacea var. ursina
(Lower left & right)
Opuntia erinacea Engelmann & Bigelow var. hystricina (Engelmann & Bigelow) L. Benson

Reported by Meyer et al. 1980 to contain traces of unidentified alkaloids.

Opuntia ficus-indica (Linnaeus) Miller

Pads determined to contain 87.4% (young) and 85.4% (mature) water by weight. Kircher 1982

Mescaline (% not given)
N-Methyltyramine (% not given)
Tyramine (% not given)
Four additional unidentified bases present as trace amounts.

El-Moghazy et al. 1982 (Material growing in Egypt.)

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

In cladodes:
Glucose and Galacturonic acid were found to be the primary sugars
Kaempferol and Isorhamnetin glycosides were also detected (as glucosides and rhamnosides).
Calcium oxalate crystals were present in large amounts.
Reported no observable antimicrobial activity.

Mandalari et al. 2009

Myrcene, Limonene & γ-Terpinene (terpenes: small amounts in the de Castilla variety fruit) flash & takahashi 1978. [Also reported the presence of other volatile compounds in the fruit including many alcohols, aldehydes, ketones, esters & hydrocarbons such as Toluene & Methylecyclohexane]

β-Sitosterol Dawder & Fayez 1961; (0.04% dry wt. in flowers)

Arcoleo 1966

var. saboten (leaf & stem): 2 triterpenoids and eight flavonoids.

(6S, 9S)-3-oxo-ceionol-[3-D-glucopyranoside

Corchoionoside C

(+)-Dihydrokaempferol (Aromadendrin)

(+)-Dihydroquercetin (Taxifolin)

Eriodictyol

Kaempferol

Kaempferol 3-methyl ether

Narcissin

Quercetin

Quercetin 3-methyl ether

Lee et al. 2003

Flowers were found to contain the flavonoids: Penduletin, Luteolin, Kaempferol, Quercetin, Quercitrin & Rutin

El-Moghazy et al. 1982

Mucilage was determined to be comprised of D-Glucose, D-Galactose, L-Arabinose, D-Xylose, L-Rhamnose and D-Galacturonic and D-Glucuronic acids.

El-Moghazy et al. 1982

free Lauric acid, Myristic acid, Palmitic acid, Stearic acid and Oleic acid & also the esters of Myristic, Palmitic, Stearic, and Oleic acids. Arcoleo 1966

Reported to contain Betalains as pigments. Wohlpart & Marry 1968 cited Piatelli & Minale 1964

Fruit contains betacyanins: Betanin (major) & Isobetanin. Piatelli & Minale 1964
Indicaxanthin (a betaxanthin) was reported in mature fruit (orange-yellow variety) by Impellizzeri & Piattelli 1972 (Also in Piattelli et al. 1964a & 1964b).

Indicaxanthin & Betanin in fruit. Minale et al. 1965

The concentration of betanin in fruit was found to contain Maleic, Malonic, Malic, Succinic, Indicaxanthin & Betanin in fruit.

Identification of alkaloid and tlc examination showed a small amount of unidentified alkaloid.

1-Methylcitrate, 1,3-Dimethylcitrate, Trimethylcitrate & 1-Methyl-Betalain distribution for three Sicilian cultivars of Opuntia ficus-indica var. saboten 'Makino': Han et al. 2001.

Betain distribution for three Sicilian cultivars of Opuntia ficus-indica was studied by Butera. These cultivars differ by producing either yellow, red, or white fruits due to the combination of two betalains, namely betanin (purple-red) and indicaxanthin (yellow-orange).

They found that the yellow cultivar exhibited the highest amount of betalains, followed by the red and white ones.

White fruit:
Indicaxanthin comprised about 99% of the betalains. Also found polyphenolic pigments.

Yellow fruit:
The ratio of betanin to indicaxanthin was 1.8 (w:w). Also found polyphenolic pigments.

Red fruit:
The ratio of betanin to indicaxanthin was 2.1 (w:w). Found that polyphenol pigments were negligible components.

Butera et al. 2002

Eight flavonoids were isolated from the stems and fruits of Opuntia ficus-indica var. saboten:
Kämpferol
Quercetin
Kämpferol 3-methyl ether
Quercetin 3-methyl ether
Narcissin
(+)-Dihydrokämpferol (Aromadendrin)
(+)-Dihydroquercetin (Taxifolin)
Eriodictyol
along with two terpenoids:
(6S,9S)-3-Oxo-α-ionol-β-D-glucopyranoside
Corchoionoside C
Lee et al. 2003.

Dok-Go et al. 2003 reported:
Quercetin
(+)-Dihydroquercetin
Quercetin 3-methyl ether
These flavonoids were isolated from the ethyl acetate fractions of an extract of the fruits and stems of Opuntia ficus-indica var. saboten.

Cactus Chemistry: By Species

Glucose 35% 21% –
Fructose 29% – –
Protein 5.1% 8.3% 11.8%
Starch yes yes yes
Cellulose 14.4% 29.1% 45.1% (in fibers)
Calcium – 2.09% –
Potassium – 3.4% –

El-Kossori et al. 1998. (All as dry weight)

Fruit sugars were found to include D-Glucose, D-Galactose, L-Arabino, Fructose, & D-Glucuronic and D-Galacturonic acids prior to hydrolysis and showed D-Xylose, L-Rhynose (I cannot locate this name) & L-Rhamnose after hydrolysis.

El-Moghazy et al. 1982.

El-Moghazy mentioned that Awad et al. 1970 & Haralams 1979 had reported Galactose, Arabinose, Xylose, Rhamnose and Galacturonic acid.

de Castilla fruit showed pH 4.85-6.3.

Citrin acid was reported at levels of 0.084-0.12% according to Flath & Takahashi 1976.

Fruit juice of Sicilian cultivars of Opuntia ficus-indica:

pH 6.4-6.5
Sugar content of 11-12% (mainly glucose and fructose)
L-ascorbic acid content of 31-38 mg/100 grams.
Manganese(II) (1.7-2.9 ppm)
Iron(III) (0.6-1.2 ppm)
Zinc(II) (0.3-0.4 ppm)
The metal ions appeared to be present mainly in the skin of the fruit or were “trapped” inside of the pulp.

Gurrieri et al. 2000

Linoleic acid was determined to be the major fatty acid in the seed oil (61.01%), with Oleic (25.52%) and Palmitic (12.23%) acids. Myristic, Stearic and Arachidonic acids were also present in lower concentrations.

Özcan & Al Juhaimi 2011

Similar results were reported for oil extracted from Opuntia ficus-indica seeds. The oil constituted 13.6% of the whole seed. 16% saturated fatty acid, with a linoleic acid content of 63.66% followed by oleic 18.34%, palmitic 12.84% and stearic acid 2.81%.

El Finzi et al. 2013

See comments in Activity Notes.

Fruit fragrance has been studied: “In cactus pear, R-(–)-linalool is present in an enantiomeric excess of 36%.”

Sitrit et al. 2004 cited Wecklerle et al. 2001

E-2-hexenal, 1-hexanol, E-2-hexen-1-ol, E-2-nonenol and E,Z-2,6-nonadienol are considered to be responsible for the melon-like character.

Wecklerle et al. 2001

Also, reported by Wu et al. 2008:
Aspergilkeatal (A new spiroketal)
Physcion
Ásterric acid

All three of which were isolated from a culture broth of Aspergillus terreus (An endophytic fungus found associated with the stems of Opuntia ficus-indica).
Volatile compounds identified in the fruit of *Opuntia ficus indica* by HRGC-MS

<table>
<thead>
<tr>
<th>Compound</th>
<th>Enantiomeric ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methyl butanoate</td>
<td>Methyl 2-methyl-butanoate</td>
</tr>
<tr>
<td>2-Methyl-3-butene-2-ol</td>
<td>Hexenal</td>
</tr>
<tr>
<td>3-Pentanol</td>
<td>1-Butanol</td>
</tr>
<tr>
<td>1-Pentene-3-ol</td>
<td>3-Pentene-2-ol</td>
</tr>
<tr>
<td>Z-3-Hexenal</td>
<td>1, 8-Cineol</td>
</tr>
<tr>
<td>E-2-Hexenal</td>
<td>2-Pentylfuran</td>
</tr>
<tr>
<td>3-Methyl-3-butene-1-ol</td>
<td>1-Pentanol</td>
</tr>
<tr>
<td>Methyl 3-hexenoate</td>
<td>Hexyl acetate</td>
</tr>
<tr>
<td>Acetoal</td>
<td>E-2-Pentene-1-ol</td>
</tr>
<tr>
<td>E-2-Heptenal</td>
<td>Z-2-Pentene-1-ol</td>
</tr>
<tr>
<td>E-2-Hexenyl acetate</td>
<td>1-Hexanol</td>
</tr>
<tr>
<td>E-3-Hexen-1-ol</td>
<td>Z-3-Hexen-1-ol</td>
</tr>
<tr>
<td>Nonanal</td>
<td>Methyl 2-(methylthio)-acetate</td>
</tr>
<tr>
<td>E-2-Hexen-1-ol</td>
<td>Z-2-Hexen-1-ol</td>
</tr>
<tr>
<td>E-2-Octenal</td>
<td>Acetic acid</td>
</tr>
<tr>
<td>1-Octene-3-ol</td>
<td>1-Heptanol</td>
</tr>
<tr>
<td>Methyl 3-hydroxybutanoate</td>
<td>E,E-2,4-Heptadienal</td>
</tr>
<tr>
<td>E-2-Hepten-1-ol</td>
<td>Linalool</td>
</tr>
<tr>
<td>1-Nonene-3-ol</td>
<td>1-Octanol</td>
</tr>
<tr>
<td>E, Z-2, 6-Nonadienal</td>
<td>Methyl benzoate</td>
</tr>
<tr>
<td>E-2-Octen-1-ol</td>
<td>1-Nonanol</td>
</tr>
<tr>
<td>2-Methylbutanoic acid</td>
<td>γ -Hexalactone</td>
</tr>
<tr>
<td>E-2-Nonenal</td>
<td>Methyl salicylate</td>
</tr>
<tr>
<td>E, Z-2,6-Nonadienol</td>
<td>1-Phenylethanol</td>
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<tr>
<td>Hexanoic acid</td>
<td>Geraniol</td>
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<tr>
<td>Benzyl alcohol</td>
<td>Perillalcohol</td>
</tr>
<tr>
<td>Octanoic acid</td>
<td>γ-Nonalactone</td>
</tr>
<tr>
<td>Methyl cinnamate</td>
<td>γ-Decalactone</td>
</tr>
<tr>
<td>Nonanoic acid</td>
<td>Decanoic acid</td>
</tr>
<tr>
<td>γ-Dodecalactone</td>
<td>Dodecanoic acid</td>
</tr>
</tbody>
</table>

*Weckerle et al. 2001*

*Opuntia guatemalensis* Britton & Rose  
Fruit contains Betanin (major), and an unidentified Betacyanin.  
*Piattelli & Imperato 1969*

*Opuntia hickenii* Britton & Rose  
Candicine (%?) *Nieto 1987*

*Opuntia humifusa* Rafinesque-Schmaltz  
No detectable alkaloid reported by *Meyer et al. 1980*  
Lutein (A carotenoid: Xanthophyll), Carotene & possibly Rhodoxanthin (in pads).  
*Romarin 1946.*  
Quercetin was reported from the pads.  
See comments in *Activity Notes.*  
*Cho et al. 2006*  
(Wild collected in New Jersey)  
Cholesterol (5.0% of total)  
24'-Methylcholesterol (8.0% of total)  
Sitosterol (87.0% of total)  
*Salt et al. 1987*
Opuntia humifusa (= Opuntia compressa)  
(UC) 56.0585 Georgia  
above & center left  
Originally wild collected in Georgia.  Photographed in December after hard freezing conditions.  This plant will recover just fine.

Opuntia littoralis  
(UC) 85.1239  
Santa Cruz Island, Santa Barbara Co, California  
right & below  
Originally wild collected in southern coastal California
Opuntia littoralis
(UC) 85.1239
Opuntia lindheimeri
(BTA)
277
Opuntia lindheimeri Engelmann
Meyer et al. 1980 reported to contain unidentified alkaloids. Reported to contain Betacyanins as pigments. Mabry et al. 1963 Isorhamnetin 3-rutinoside, Isorhamnetin 3-rhamnosylgalactoside, Quercetin, and Isorhamnetin 3-galactoside (all flavonoids) in flowers. Clark & Parfitt 1980
Hyperin (Quercetin-3-galactoside), Narcissin (Isorhamnetin-3-rutinoside), Isorhamnetin-3-galactoside, Isorhamnetin-3-rhamnogalactoside (flavonol glycosides; pigments from flowers).
Rosler et al. 1966
Del Weniger 1984 related an amusing tale concerning this species. Apparently Engelmann based this species’ description on the pads of one species and the fruit of another. When discovering his error he corrected the description to being partly O. engelmannii and partly what he thought was a hybrid. The latter became O. leptocarpa “so there is nothing left to be O. lindheimeri”

Opuntia littoralis (Engelmann) Cockerell
var. littoralis
Quercetin-3-glucoside, Quercetin-3-rutinoside, Isorhamnetin-3-glucoside, Isorhamnetin-3-rutinoside, Isorhamnetin-3-rhamnosylgalactoside, and Kaempferol 3-galactoside (all flavonoids) in flowers. Clark & Parfitt 1980

Opuntia littoralis (Engelmann) Cockerell
var. martiniana (L. Benson) L. Benson
Quercetin-3-glucoside, Quercetin-3-rutinoside, Isorhamnetin-3-glucoside, Isorhamnetin-3-rutinoside, Isorhamnetin-3-rhamnosylgalactoside, and Kaempferol 3-galactoside (all flavonoids) in flowers. Clark & Parfitt 1980

Opuntia longispina Haworth
Whewellite was identified as druses. Monje & Baran 2002

Opuntia macrocentra
(Hudspeth County, Texas)
Opuntia littoralis var. austrocalifornica
(HBG)
Opuntia macrocentra Engelmann
Meyer et al. 1980 reported as containing unidentified alkaloids. Reported to contain Betalains as pigments. Wohlpert & Marby 1968 cited Wohlpert 1967 (as Opuntia violacea) Flavonol production was found to be largely reduced when grown in the absence of UV rather than in sunlight. Berger et al. 2007.

Opuntia maldonadensis Arechavaleta
Hordenine (%)? DeVries et al. 1971

Opuntia matudae Scheinvar cv. Cuaresmeño
"Xoconostle"
Gallic, Vanillic, 4-Hydroxybenzoic acids, Catechin, Epicatechin, and Vanillin were detected in the soluble phenolic fractions of the fruit. Guzmán-Maldonado et al. 2010

Opuntia megacantha
Most view as a spiny wild Opuntia ficus-indica.

See comments in Activity Notes.
Opuntia macrocentra
(near Sanderson, Texas)
Opuntia microdasys (Lehmann) Pfeiffer

Whewellite was identified as druses.

Monje & Baran 2002

Opuntia microdasys v. albispina (HBG)

Opuntia microdasys
86.1310 San Luis Potosí, México (UC)

Even wet with rain those glochids mean trouble.

Opuntia microdasys
(Mendocino Coast Gardens)
left
variegated *Opuntia monacantha*
(Cactus Country)
variegated *Opuntia monacantha*  
(Cactus Country)
Opuntia monacantha Haworth
Flower contains Betatin (major), and Isobetatin.
Fruit contains Betatin (30.2% of total), Isobetatin (24.8% of total), an unidentified Betacyanin, Betanidin and Isobetanidin.
Piattelli & Imperato 1969
Mucilage polysaccharide - 0.53% of total weight of fresh plant.
Uronic acid content of polysaccharide: 25%
Rhamnose: arabinose, galactose, xylose (1:3:3.5:1.5)
Mindt et al. 1975

Opuntia polyacantha Haworth
(SRSU)
above & lower right

Opuntia pachypus K.Schumann
see as Austrocylindropuntia pachypus

Opuntia paraguayensis K.Schumann
Fruit contains Betanin (major), Isobetanin, and Phyllocactin.
Piattelli & Imperato 1969

Opuntia phaeacantha Engelmann was reported by Meyer et al. 1980 to contain unidentified alkaloids.

Opuntia phaeacantha Engelmann var. discata (Griffiths) L.Benson & Walkington and var. major Engelmann
Quercetin-3-glucoside, Quercetin-3-rutinoside, Isorhamnetin-3-glucoside, Isorhamnetin-3-rutinoside, Isorhamnetin-3-rhamnosylgalactoside, and Kaempferol 3-galactoside (all flavonoids) in flowers. Clark & Parfitt 1980

Opuntia pilifera Weber was reported to contain no detectable alkaloids in the screenings of Fong et al. 1972
Opuntia monacantha  
(UC) 50.2013  Argentina & Uruguay

Opuntia polyacantha var. erinacea  
(UC) 86.1634  
White Mountains, Inyo County, California

Opuntia polyacantha var. erinacea  
(UC) 86.0921  
Santa Rosa Mountains, Riverside Co., California
Opuntia polyacantha Haworth

Approximately 90% water by weight.
Opuntiol (0.007% dry wt) (an α-pyrone: See O. elatior)
Positive Mayer’s test for alkaloids but none identified.
Telang 1973 [Collected at Drumheller, Alberta, Canada]

Fruit contains Betanin (major), Isobetanin & Betanidin. Pietelli & Imperato 1969
Opuntia phaeacantha
(Hudspeth Co, Texas)

Opuntia pubescens Wendl. ex Pfeiffer See comments in Activity & Mythology notes

Opuntia ritteri Berger
Fruit contains Betanin (major), Isobetanin and Phyllocactin.
Piattelli & Imperato 1969
Opuntia phaeacantha (UC) collected from a wild population at Cuyama, Santa Barbara County, in southern California.
Opuntia robusta WENDL.
Reported to contain Isorhamnetin, Quercetin & Kaempferol (Flavonols) RICHARDSON 1978 (based on acid hydrolysis)

Opuntia spp. hybrids
Variable amounts of Quercetin-3-rutinoside, Quercetin-3-glucoside and Kaempferol-3-glucoside (flavonoids) were comparatively reported in the flowers of 6 hybrids (and 3 species). CLARK et al. 1980 [Collected east of Florence, Arizona]

Opuntia streptacantha LEMAIRE
Fruit contains Betanin (major), Isobetanin, Phyllocactin & Isophyllocactin PIATTELLI & IMPERATO 1969

See comment in Activity Notes.

Opuntia stricta (HAW.) HAW. (var. ?) was reported by MEYER et al. 1980 to contain unidentified alkaloids.

“Opuntia stricta” extract. Stable as a natural food pigment. Was suggested to be a good commercial choice due to betanin concentrations and low pH.

CASTELLAR et al. 2006.
CASTELLAR et al. 2003 had reported 80 mg betanin /100 g fresh fruit.
Opuntia streptacantha
(BTA)
Trouts Notes on Cactus Chemistry

Opuntia stricta (Haw.) Haw. var. dillenii (Ker-Gawler) L. Benson

Unidentified alkaloids reported by Meyer et al. 1980.
Arabinogalactan (a polysaccharide composed of L-Arabinose & D-Galactose 1:3) isolated from dried fruit in 0.5% yield. Shivastava & Pande 1974
Known as Xian Ren Zhang in Chinese.

Qu isolated (from aqueous ethanolic extract of fresh stems):
- Opuntiol (0.0032%)
- p-Hydroxybenzoic acid (0.0023%)
- L-(−)-Malic acid (0.0019%)
- Opuntioside I (0.078%) [an α-pyrone]

Arabinogalactan (a polysaccharide composed of L-Arabinose & D-Galactose 1:3) isolated from dried fruit in 0.5% yield. Shivastava & Pande 1974

Known as Xian Ren Zhang in Chinese.

Opuntia dillenii

仙人掌 (Opuntia dillenii) 似乎被给定为几种Opuntia物种。

仙人掌

Ferulic acid (0.00053%)
4-Ethoxyl-6-hydroxymethyl-α-pyrole (0.00013%)
1-Heptanecanol (0.0019%)
Vanillic acid (0.00035%)
Isorhamnetin-3-O-rutinoside (0.0070%)
Rutin (0.00014%)
Kaempferol 7-O-β-D-glucopyranosyl-(1→4)-β-D-glucopyranoside (0.0001%) [a flavonol glycoside]
3-O-Methylquercetin (0.00015%)
Manghaslin (0.003%)
Ethyl 3,4-dihydroxybenzoate (0.00014%)
3,4-Dihydroxybenzoic acid (0.00041%)
(all % as dry weights)

Plant material was harvested in Hainan, China. Qu et al. 2002

Earlier (in 2000) Qiu had isolated:
- Quercetin
- 3-O-Methyl quercetin
- Kaempferol
- Kaempferide
- Isorhamnetin
- β-Sitosterol
(from Qu et al. 2002 citing Qu et al. 2000)

Betanin 18.2 ± 1.8 15.7 ± 1.8
Isobetanin 19.1 ± 0.1 19.2 ± 1.0
Ascorbic acid 15.1 ± 0.6 1.2 ± 0.1
Catechin 22.7 ± 0.7 18.0 ± 0.2 35.6 ± 3.7
p-Coumaric acid nd 0.6 ± 0.0 2.2 ± 0.1
Epicatechin 10.9 ± 0.2 17.1 ± 0.1 31.8 ± 1.1
Ferulic acid nd 4.0 ± 0.1 10.2 ± 1.2
Gallic acid 2.7 ± 0.03 4.0 ± 0.6 2.6 ± 0.1
Quercetin nd 4.6 ± 0.1 33.5 ± 1.6
Rutin nd nd 0.3 ± 0.0
Sinapinic acid nd nd 26.8 ± 1.4
nd = below detection limits Chang et al. 2008

Opuntia tomentella Berger

Fruit contains Betanin (major), Isobetanin, Phyllocactin and traces of Isophyllocactin Piattelli & Imperato 1969

Opuntia dillenii

(UC)
Opuntia tomentosa Salm-Dyck
Citric acid (1.2% in stem juice)
Hegnauer 1964 cited Bergström 1934
Fruit contains Betanin (major), Isobetanin, Phyllocactin and traces of Isophyllocactin Piattelli & Imperato 1969

Opuntia vulgaris Mill
Hordenine (%?) DeVries et al. 1971
Opuntin B (new alkaloid)
4-Hydroxyproline
Tyrosine
Jiang et al. 2003
β-Sitosterol (used whole plant) Anjanevulu et al. 1965.
Ascorbic acid & Dehydroascorbic acid.
Meyer & McLaughlin 1982 cited Giral & Alvarez 1943.
Friedelin (0.01% dry wt.), Friedelan-3α-ol (0.001% dry wt.),
Taraxerone (0.0025% dry wt.) & Taraxerol (0.005% dry wt.):
Fruit contains betacyanins: Betanin (major) & Isobetanin.
Piattelli & Minale 1964
Reported to show the presence of waxy materials and some sort of a rubber in the studies of De Graff 1896.
Hobschette 1929
See comment in Activity Notes.

Opuntia violacea Engelmann var. macrocentra (Engelmann) L. Benson
See as Opuntia macrocentra Engelmann

Opuntia stricta var. dillenii
(UC) 50.1999 “USA, West Indies, Venezuela”
Trouts Notes on Cactus Chemistry

Opuntia wilcoxii
Flavonol production in was found to be largely reduced when grown in the absence of UV rather than in sunlight. Berger et al. 2007

Pachycereus calvus (Watson) Britton & Rose
See as Pachycereus pringlei

Pachycereus chrysomallus (Lemaire) Britton & Rose
Traces of unidentified triterpene(s). Djerassi 1957 cited unpublished observations by Djerassi & Marfey

Pachycereus gaumeri Britton & Rose
See as Pterocereus (?) gaumeri
Pachycereus gigas (Backeberg) Backeberg
See as Pachycereus weberi

Pachycereus grandis Rose
Glucaric acid (a lactone-forming acid) (tlc)
Isocitric acid (a lactone-forming acid) (tlc & gle) Kringstad & Nordal 1975

Pachycereus hollianus (Weber) Buxbaum
See as Lemaireocereus hollianus

Pachycereus marginatus
(HBG)
Interestingly, if we compare the reported chemical profiles as concerns *Lemaireocereus*, *Lophocereus*, *Marginatocereus*, *Pachycereus*, *Stenocereus* and similar giant Ceroids, it suggests that this species should probably be renamed *Lophocereus marginatus*. 
**Pachycereus marginatus** *(DeCandolle) Britton & Rose*

AKA “órgano”

Pilocereine Over 0.076% [fresh wt] (Additional alkaloid was obtained but it is unclear how much was pilocereine and what was unidentified material) Djerassi *et al.* 1954c

[Collected from wild: State of Hidalgo, Mexico]

[Agurell 1969b also appears listed as a reference. He mentioned this species in passing but did not analyze it.]

Lophocereine was reported in mass fragmentography by Lindgren *et al.* 1971 [Djerassi *et al.* 1954c, also appears listed as a reference but did not report this alkaloid.]

Unidentified alkaloids also present. Djerassi *et al.* 1954c (Djerassi reported no detectable triterpenes)

Isocitric acid (tlc & gle by Kringstad & Nordal 1975)

Quinic acid (tlc & gle by Kringstad & Nordal 1975)

[Unger *et al.* 1980 reported the presence of Salsolidine and N-Methylheliamine but their conclusion needs questioning. A similar discrepancy exists for *L. schottii*. See comments under its entry.]

[Cereine, Pachycereine and Ochoterenine were reported by Roca 1930. Djerassi *et al.* 1954c felt all three names should be removed from the literature due to their lack of characterization. See more details in Roca 1931 & 1932]
Pachycereus marginatus
(HBG)
**Pachycereus marginatus**  
(SRSU)

**Pachycereus pecten-aboriginum (DC) Britton & Rose**

Notice the discrepancies between the published accounts. Additional work is needed to adequately explain the details.

3,4-Dimethoxyphenethylamine (trace) Bruhn & Lindgren 1976 [Material from Michoacan, Mexico].

3-Hydroxy-4-methoxyphenethylamine (1-10% of 1-10 mg of total alkaloid/100 gm fresh) Agurell et al. 1971b; [Obtained via commercial sources in Germany & the Netherlands]; Strömström & Bruhn 1978 could not detect this alkaloid; nor did Bruhn & Lindström 1976b [Both used material collected from wild: Michoacán, Mexico].

3-Methoxytyramine (detected) Strömström & Bruhn 1978 [Sole phenethylamine they reported (major alkaloid in the phenolic fraction).]

Arizoline (detected) Strömström & Bruhn 1978

Carnegine [Heyl 1928 isolated and named Pectenine (pecten- in); it was shown by Späth & Kuffner 1929 to be identical to Carnegine] (However, Agurell et al. 1971b & Bruhn & Lindgren 1976 & Strömström & Bruhn 1978 could NOT detect carnegine.) [Possibly detected by Unger et al. 1980 but MIKES does not differentiate between aromatic isomers.]

Heliamine (Minor: 22 mg from 4.3 kg fresh [as HCl])

Strömström & Bruhn 1978

Isosalsoleine (detected) Strömström & Bruhn 1978

Salsoline (detected) Strömström & Bruhn 1978

Salsolidine (Major alkaloid: (at 282 mg from 4.3 kg fresh) by Bruhn & Lindgren 1976 & by Strömström & Bruhn 1978 [Unger et al. 1980 DID NOT detect Salsolidine (using MIKES)]

Agurell et al. 1971b noted that other alkaloids were present but reserved presenting details for a later paper that we have not been able to locate (citing it as “Kapidia & Agurell”)

Quinic acid (tlc & glc by Kringstad & Nordal 1975)

**Pachycereus pecten-aboriginum**

Unger et al. 1980 reported N-Methylheliamine, Weberidine & N-Methylpachycereine using MIKES. They also reported 4 other isoquinoline alkaloids but it is unclear which isomers were actually detected.
In the alkaloid screenings of Smolenski et al. 1973, this species showed strongly positive results in the ribs, weaker results in the roots and negative results in the stem (with ribs removed?)
Pachycereus pecten-aboriginum
Pachycereus pringlei (S. Watts) Br. & R.

AKA “saguessa” or the “elephant cactus”
This species is most commonly called “cardon” (a name that is also
used for several other Mexican Cereoids)
3,4-Dimethoxyphenethylamine (gc-ms) [“not yet rigidly
proven”]
Carnegine (gc-ms)
N-Methylheliamine (gc-ms)

Crockett & Shulgin 1999 (Personal communication;
unpublished findings)
N-Methylmescaline (gc-ms) Shulgin 2001 (Personal
conversation)
Heliamine (0.017% by dry wt)
Lemaireocereine (Detected)
Tehuanine (0.05% dry wt.)
Weberine (Detected)

Mata & McLaughlin 1980d
Tehuanine- N-oxide (0.014% yield by dry wt.) PumMangura
et al. 1982b
Glucaric acid (tlc by Kringstad & Nordal 1975)
Isocitric acid (tlc & glc by Kringstad & Nordal 1975)

[Unger et al. 1980 reported 5, possibly 6, quinoline alkaloids. Two
were identified, as N-Methylheliamine and Weberidine, but we could
not determine the isomeric identities of the others. All by MIKES.]

See comments in Activity Notes.
Trouts Notes on Cactus Chemistry

*Pachycereus pringlei*
(BTA)
Pachycereus sp. (unidentified; collected in Mexico) was reported to show a very strong preliminary alkaloid screening but only gave positive results in the confirmatory tests for quaternary alkaloids.
Smolen斯基 et al. 1972

Pachycereus tehuantepecanus T. MacDougall & H. Bravo
[Baekberg considered this species to be synonymous with Pachycereus pecten-aboriginum.]
Tepenine (no details)
Tehuanine (no details)
Lundstrom 1983 & Mata & McLaughlin 1980d cited Weisenborn (personal communication 1978: Unpublished data). Kapadia et al. 1970c mentions that J. Weisenborn (at Squibb) first presented this in a discussion during the 5th Ann. Meeting of the American Society of Pharmacognosy June 22-25, 1964 (Pittsburgh, PA) and that it was planned for publication submission. It evidently never was.

Pachycereus tetetzo (A. Weber) Ochot. See as Cephalocereus tetetzo
Pachycereus thurberi Britton & Rose See as Lemaireocereus thurberi

Pachycereus pringlei
The form determined to be active by Earl Crockett

Pachycereus queretaroensis (Weber) Britton & Rose. See as Lemaireocereus queretaroensis
Pachycereus schottii (Engelmans) Hunt See as Lophocereus schottii

Pachycereus pringlei
**Pachycereus weberi (Coulter) Backeberg**

AKA "candelabro" & "cardon"

Anhalidine (no quantification) Rouš et al. 1985
Anhalonidine (0.01% dry wt.) Djerassi et al. 1954c. (traces)
Mata & McLaughlin 1980c; (NOT observed by Rouš et al. 1985)
O-Methylpellotine (no quantification) Rouš et al. 1985; Unger et al. 1980
Pellotine (0.0005% dry wt.) Mata & McLaughlin 1980c; (no quantification) Rouš et al. 1985
5,6,7-TriMeO-THIQ (Nortehuanine) (0.0095% [as HCl] dry wt.) Mata & McLaughlin 1980c; (no quantification) Rouš et al. 1985
7,8-DiMeO-THIQ (Lemaireocereine) (0.003% [HCl] dry wt.) Mata & McLaughlin 1980c; (no quantification) Rouš et al. 1985 [Pumilangura & McLaughlin 1981a used this species as the source of their reference material for Lemaireocereine]
7-MeO-THIQ (Weberidine) (0.00024% dry wt.) Mata & McLaughlin 1980c; (no quantification) Rouš et al. 1985
6,7-Dimethoxy-THIQ (Heliamine) (0.0155% dry wt.; also 0.05% [all HCl]) Mata & McLaughlin 1980c; (no quantification) Rouš et al. 1985
Backbergenine (no quantification) Rouš et al. 1985
Carnegine (no quantification) Rouš et al. 1985
Dehydroheliamine (no quantification) Rouš et al. 1985
Dehydrolomaireocereine (no quantification) Rouš et al. 1985
Dehydronortehuanine (no quantification) Rouš et al. 1985
Dehydropachycereine (no quantification) Rouš et al. 1985
Dehydrosalsolidine (no quantification) Rouš et al. 1985
Dehydronorweberine (no quantification) Rouš et al. 1985
Isobackbergenine (no quantification) Rouš et al. 1985
Isornorweberine (no quantification) Rouš et al. 1985
Isopachycereine (no quantification) Rouš et al. 1985
Salsolidine (detected with MIKES) Unger et al. 1980
Isosalsolidine (no quantification) Rouš et al. 1985
Isorweberine (no quantification) Rouš et al. 1985
Norweberine (no quantification) Rouš et al. 1985
2-Methyl-6,7-dimethoxy-THIQ (N-Methylheliamine: O-Methylcorypalline) (Detected by MIKES Unger et al. 1980) (0.0012% [HCl] dry wt.) Mata & McLaughlin 1980c; (no quantification) Rouš et al. 1985

**Pachycereus weberii (Mesa Garden)**

N-Methylpachycereine (no quantification) Rouš et al. 1985
Pachycereine (no quantification) Rouš et al. 1985
2-Methyl-5,6,7-triMeO-THIQ (Tehuanine) (0.105% & 0.1% [HCl] dry wt.) Mata & McLaughlin 1980c; (no quantification) Rouš et al. 1985; Detected with MIKES (?) Unger et al. 1980
2-Methyl-5,6,7,8-tetraMeO-THIQ (Weberine) (0.0012 [HCl] dry wt.) Mata & McLaughlin 1980c; (no quantification) Rouš et al. 1985; Detected with MIKES Unger et al. 1980
Four other THIQs were reported by Rouš et al. 1985 but they were uncertain of the positions of the methoxy groups on the aromatic ring due to the identification by MIKES. Similarly, for the same reason, it does not appear possible to assign precise isomeric identity to several of the THIQs reported in Unger et al. 1980 (2 appeared to be O-Methylanhalonidine and O-Methylpellotine but we cannot state this with certainty).

**Pachycereus weberi** was reported to show positive results in the alkaloid screenings of Fong et al. 1972
[3-OH-4-MeO-PEA is listed in error, the reference cited, Smith 1977, does not mention this species.]
Djerassi et al. reported no detectable triterpenes.
Lemairin (0.018% yield by dry wt.) (a glucoside) Mata & McLaughlin 1980a
Glucaric acid (tlc by Kringstad & Nordal 1975)
Isocitric acid (tlc & glc by Kringstad & Nordal 1975)
**Trouts Notes on Cactus Chemistry**

**Parodia mutabilis Backeberrg**

**Parodia procerata Ritter**
Volatile compounds in floral scent have been studied. Dehydrogeosmin - Minor volatile in floral scent. Sesquiterpene alcohol 1 - Trace volatile in floral scent. Sesquiterpene alcohol 2 - Minor volatile in floral scent. **Schlumberger et al.** 2004 (in tepals; gc-ms)

**Parodia sanguiniflora Backeberrg**

**Parodia stuemeri (Werdermann) Backeberrg**

**Parodia tuberculosa Cárdenas**

**Pelecyphora aselliformis Ehrenber**
"peyote", "peyotillo" **Standley** 1924: 973
62% water by weight. **Neal et al.** 1972 [300 dried plants weighed 5.5 kg]
Tyramine (Less than 0.0001% [fresh wt]) **Starha** 1994 [Seed grown in Czechoslovakian greenhouses]
N-Methylyraining (0.0002% [fresh wt]) **Starha** 1994
Hordenine (10-50% of the 1-10 mg of total alkaloids/ 100 grams fresh) **Agurell et al.** 1971b [Obtained via commercial source in the Netherlands]; (10-50% of 10-50 mg of total alkaloids/ 100 gm. fresh. Not major alkaloid.) **Bruhn & Brunn** 1973; (Major alkaloid. 0.00063% dry wt) **Neal et al.** 1972; (0.0007% [fresh wt]) **Starha** 1994
3,4-Dimethoxyphenethylamine (trace) **Neal et al.** 1972; (0.0002% [fresh wt]) **Starha** 1994
N-Methyl-3,4-dimethoxyphenethylamine (trace) **Neal et al.** 1972
N,N-Dimethyl-3-hydroxy-4,5-dimethoxy-phenethylamine (0.00018% dry wt.: Minor alkaloid) **Neal et al.** 1972; (10-50% of 10-50 mg of total alkaloids/ 100 gm. fresh: Major alkaloid) **Bruhn & Brunn** 1973.
Mescaline (Less than 0.00002% dry wt) **Neal et al.** 1972 [Plants obtained commercially. Not indicated if field collected or seed grown]; (0.003% dry wt.) **Siniscalco** 1983 [Plants grown in Italy]; (Less than 0.0001% [fresh wt]) **Starha** 1994. Not observed by other workers (including **Agurell et al.** 1971b [Material cultivated in Europe] & **Bruhn & Brunn** 1973 [Material was field collected in Mexico]).
N-Methylymescaline (trace) **Neal et al.** 1972
Anhalidine (0.000067% dry wt) **Neal et al.** 1972; (10-50% of 1-10 mg total alkaloids per 100 grams of [fresh wt]) **Agurell et al.** 1971b & **Bruhn & Brunn** 1973; (Less than 0.0001% [fresh wt]) **Starha** 1994
Pellotine (0.000009% dry wt) **Neal et al.** 1972; (Less than 0.0001% [fresh wt]) **Starha** 1994
[PEA, N-Me-PEA, 4-MeO-PEA and N-Me-4-MeO-PEA have been erroneously listed for **Pelecyphora aselliformis**. The cited reference, **Neal et al.** 1972, ran these 4 alkaloids as their dansyl-derivatives using pure reference compounds. They were NOT found in the plant.] Unidentified alkaloids reported by **Reko** 1928.
Quinic acid (tlc & gle by **Kringstad & Nordal** 1975)
Pelecyphora aselliformis
Pelecyphora aselliformis
(Living Desert)

Pelecyphora pseudopectinata Backeb
See as Turbinicarpus pseudopectinatus

Peniocereus fosterianus Cutak
Chichipecenin (a triterpene) (in stem)
Peniocerol (1% by dry wt. in root) (a sterol: cholest-8-en-3β,6α-diol)
Dierassi et al. 1961 [From State of Colima, Mexico]

Peniocereus greggii & Peniocereus striatus
See comment under Activity Notes.

Peniocereus greggii
(both above) lacks reported analysis
**Pereskia aculeata Miller**

"groselero" (Cuba), "Barbados gooseberry",
"Spanish Gooseberry" Standley 1924

Tyramine (no quantification)
Doetsch et al. 1980

Citric acid (2.3% in stem juice) Hegnauer 1964 cited Bergström 1934

All CO₂ uptake occurred during the day through the stems (under well watered conditions) Nobel & Hartsock 1986

Cholesterol (2.5% of total sterols)
24-β-Methylcholesterol (18.7% of total sterols)
Stigmasterol (6.3% of total sterols)
Sitosterol (72.5% of total sterols)
Salt et al. 1987

**Pereskia autumnalis (Eichlam) Rose**

Phenethylamine (no quantification)
Tyramine (no quantification)
Doetsch et al. 1980

**Pereskia bleo DC**

Reported to contain Quercetin & Kaempferol (Flavonols)
Richardson 1978 (based on acid hydrolysis)

**Pereskia corrugata Cutak**

Tyramine (no quantification)
3,4-Dimethoxyphenethylamine (0.0009%)
3-Methoxytyramine (no quantification)
Mescaline (0.0005% dry wt.)
Doetsch et al. 1980

**Pereskia cubensis Britton & Rose**

Tyramine (no quantification) Doetsch et al. 1980

**Pereskia godseffiana (Sandwith) Knuth**

Tyramine (no quantification) Doetsch et al. 1980

**Pereskia grandiflora Hort.**

Tyramine (no quantification)
β-Hydroxymescaline (no quantification)
Doetsch et al. 1980

Betalamic acid in flowers. Piattelli 1981 cited Chang et al. 1974 but this reference is incorrect as they only investigated *Portulaca grandiflora*.
[A number of color forms and F1 hybrids have been surveyed for betalains. Piattelli 1981 cited Otani & HagIwara 1969. This reference has not been located but it too may also be suspect]

**Pereskia grandifolia Haworth**

Tyramine (no quantification)
3-Methoxytyramine (no quantification)
4-Methoxy-β-hydroxyphenethylamine (no quantification)
Doetsch et al. 1980

Flowers contain Betanin (major), and an unidentified Beta-cyanin. Also traces of Isobetanin & Phyllocactin Piattelli & Imperato 1969 [As Rhodocactus grandifolius (Haw.) Knuth].
Reported to contain Quercetin & Kaempferol (Flavonols)
Richardson 1978 (based on acid hydrolysis)

All CO₂ uptake occurred entirely during the day through the leaves (under well watered conditions)
Nobel & Hartsock 1986
Pereskia grandifolia fruit reported to contain a saponin of oleanolic acid. Methyl oleanolate was found to be the sapogenin with D-Glucose and D-Glucuronic acid as the sugars. 

Sahu et al. 1974

Seeds of Pereskia grandiflora (L) next to Pereskia grandifolia (R)

Pereskia grandifolia considered to be synonyms

Considered to be synonyms

Pereskia grandiflora
(Nature’s Curiosity)

Pereskia grandiflora
(Logee’s)
Pereskia grandifolia
(HBG)
cristate
*Pereskia grandifolia*
Pereskia pititache (Karwinsky) Britton & Rose
Phenethylamine (no quantification)
Tyramine (no quantification)
Doetsch et al. 1980

Pereskia tampicana Weber
Phenethylamine (no quantification)
Tyramine (no quantification)
3,4-Dimethoxyphenethylamine (0.0025%)
4-Methoxy-β-hydroxyphenethylamine (no quantification)
Mescaline (0.0013% dry wt.)
Doetsch et al. 1980
[3-MeO-β-hydroxy-PEA has been listed in error. The cited reference, Doetsch et al. 1980, did not report this compound.]

Pereskia tampicana Mexico 59.0652

Pereskia tampicana Mexico 59.0652

Pereskiopsis chapistle (Weber) Britton & Rose
“chapizti” Standley 1924
Phenethylamine (no quantification)
Tyramine (no quantification)
4-Methoxy-β-hydroxyphenethylamine (no quantification)
3-Methoxytyramine (no quantification)
Doetsch et al. 1980

Pereskiopsis porteri (Brandegee) Britton & Rose
“alcajer” (Baja California) Standley 1924
Reported to contain Kaempferol (a Flavonol)
Richardson 1978 (based on acid hydrolysis)
88% of the CO₂ uptake occurred during the day through the leaves (under well watered conditions)
Nobel & Hartsock 1986

Pereskiopsis scandens Britton & Rose
Tyramine (no quantification)
3,4-Dimethoxyphenethylamine (0.0029%)
Mescaline (0.0022% dry wt.)
Doetsch et al. 1980

Phyllocactus ackermannii Link See as Nopalxochia ackermannii

Pereskiopsis porteri above & right
Trouts Notes on Cactus Chemistry

Phyllocactus hybridus
Flower contains betacyanins: Betanin (major), Isobetanin, Phylloactin & Isophylloactin. Piattelli & Minale 1964a & 1964b (Also Minale et al. 1966 [Collected near Naples, Italy])

Pilocereus chrysacanthus Weber
N-Methyl-3,4-dimethoxyphenethylamine (Major alkaloid. 0.006% fresh) Bruhn & Sánchez-Mejarada 1977 [Wild collected; Puebla, Mexico]
Reported as showing no detectable alkaloids in the screenings of Fong et al. 1972
Quinic acid (tlc, glc & gc-ms by Kringstad & Nordal 1975)

Pilocereus chrysomallus Lemarie See as Backebergia militaris
Pilocereus euphorbioides (Haw.) Rümpler See as Neobuxbaumia euphorbioides

Pilocereus gaumeri (Br. & R.) Knuth is NOT synonymous with Pterocereus (?) gaumeri
Pilocereus giganteus Rümpler See as Carnegiea gigantea
Pilocereus glaucescens Labouret See as Cephalocereus glaucescens

Pilocereus gounellei (Weber) Byles & Rowley
“alastrado”
Unconfirmed report of caffeine (0.15-0.22%) in its seeds. Hegnauer 1964 & Mata & McLaughlin 1982 cited Freise 1935. This alkaloid identification is highly questionable.

Pilocereus guerreronis (Backeberg) Byles & Rowley
N-Methyl-3,4-dimethoxyphenethylamine (~ 0.042% (~60% of 0.07% total alkaloid) [fresh wt] Recovered 0.012%)
N,N-Dimethyl-3,4-dimethoxyphenethylamine (approximately 0.025% fresh wt. (~35% of 0.07% total alkaloid) Recovered 0.0044% as pure compound.)
O-Methylcorypalline (i.e. N-Methylheliamine) (trace)
Lindgren & Bruhn 1976 [Wild collected; Guerrero, Mexico]
Pilocereus leucocephalus Poselger See as Cephalocereus leucocephalus

**Pilocereus maxonii (Rose) Knuth**
- Tyramine (trace)
- N-Methyltyramine (trace)
- N-Methyl-3-methoxytyramine (0.002% dry wt.)
- N,N-Dimethyl-3-methoxytyramine (0.004% dry wt.)
- 3,4-Dimethoxyphenethylamine (trace)
- N-Methyl-3,4-dimethoxyphenethylamine (trace)

Pummaungura et al. 1977.

Pilocereus nobilis Haworth See as Cephalocereus nobilis
Pilocereus pasacana Weber See as Trichocereus pasacana
Pilocereus sargentianus Orcutt See as Lophocereus schottii
Pilocereus schottii (Engelmann) Lemaire See as Lophocereus schottii
Pilocereus schottii Lemaire See as Lophocereus schottii
Pilocereus senilis (Haw.) Pfeiffer See as Cephalocereus senilis
Pilocereus thurberi Rümpler See as Lemaireocereus thurberi

Pilosocereus chrysacanthus (Weber) Byles & Rowley See as Pilocereus chrysacanthus
Pilosocereus gaumeri (Bl. & R.) Backeberg is NOT synonymous with Pterocereus (?) gaumeri
Pilosocereus glaucescens (Lab.) Byles & Rowley See as Cephalocereus glaucescens
Pilosocereus guerreronis (Backeberg.) Byles & Rowley See as Pilocereus guerreronis
Pilosocereus leucocephalus (Poselger) Byles & Rowley See as Cephalocereus leucocephalus
Pilosocereus maxonii (Rose) Byles & Rowley See as Pilocereus maxonii
Pilosocereus nobilis (Haw.) Britton & Rose See as Cephalocereus nobilis
Pilosocereus pachycladus
(Cactus Country)

Trichocereus sp mislabeled Pilosocereus pachycladus
(Altman)
Polaskia chende (Gosselin) Gibson & Horak
“chende”, “chente”, “chinoa” Standley 1924: 899
3,4-Dimethoxyphenethylamine (less than or around 0.01% dry wt.) Ma et al. 1986
4-Hydroxy-3,5-dimethoxyphenethylamine (Around 0.01% dry wt.) Ma et al. 1986
Mescaline (Around or less than 0.01%.) Ma et al. 1986
Oleanolic acid
Oleanolic aldehyde
Erythrodiol
Shamma & Rosenstock 1959 (didn’t include starting weight)
Strongly positive in alkaloid screening of Fong et al. 1972
Oleanolic acid & Chichipegenin were reported to be present.
Gibson & Horak 1978 cited Bravo & Cox 1958
Polaskia chende
Polaskia chende
**Polaskia chichipe** *(Goselin)* Backeberg  
“chichipe”, “chichibe” Stanley 1924: 898  
69.8% water by wt.  
Reported no detectable alkaloids.  
Oleanolic acid (as 0.008% dry wt via its methyl ester)  
Chichipeggenin (a triterpene & tetrol) (0.083% dry wt.)  
Sandoval *et al.* 1957 [Wild collected; Puebla, Mexico]  
Longispinogenin Gibson & Horak 1978 cited Djerassi 1957

**Pseudolobivia kermesina** *Krainz.*  
Tyramine (0.0002% dry wt.)  
3,4-Dimethoxyphenethylamine (trace)  
Follas *et al.* 1977

*Polaskia chichipe*  
(Photo by Johnny B. Goode)  
Labeled *Echinopsis kermesina*  
(Berkeley Botanical Gardens)  
(i.e. *Echinopsis kermesina* Argentina 68.0681)
*Trouts Notes on Cactus Chemistry*

**Pterocereus foetidus** Th. MacDougal & F. Miranda

3,4-Dimethoxyphenethylamine (around 0.01% dry wt.)
4-Hydroxy-3,5-dimethoxyphenethylamine (Less than 0.01% dry wt.)
Ma et al. 1986

**Pterocereus (?) gaumeri** (Britton & Rose) Th. MacDougall & F. Miranda

[Given by MacDougall & Miranda as a provisional name]
3,4-Dimethoxyphenethylamine (less than or around 0.01% dry wt.) Ma et al. 1986
4-Hydroxy-3,5-dimethoxyphenethylamine (Around or less than 0.01% dry wt.) Ma et al. 1986
Mescaline (Less than 0.01%) Ma et al. 1986
Pterocereine [a unique glucosylated cactus THIQ] (0.062% by dry wt) Mohamed et al. 1979

Also reported to contain the tetrahydroisoquinoline Deglucopterocereine. (yield of 0.164% dry wt) Mohamed et al. 1979

(This compound appears to be potentially pharmacologically active but lacks any published evaluation. It is formed via acid hydrolysis of Pterocereine so it is probable that at least part (and perhaps all) of their product was an extraction artifact.) Unidentified alkaloids reported to present. Mohamed et al. 1979
Deglucopterocereine-N-oxide (0.038% yield by dry wt) Pumangura et al. 1982b

**Puna clavarioides** (Pfeiffer)

Whewellite was identified as druses.
Monje & Baran 2002

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**Pterocereus gaumeri** labeled as *Anisocereus gaumeri* (HBG)

**Pterocereus foetidus** (HBG)

**Quiabentia chacoensis** (SRSU)
Quiabentia chacoensis  
Reported to contain Quercetin (a Flavonol)  
Richardson 1978 (based on acid hydrolysis)  
88% of the daily CO₂ uptake occurred through the leaves during the daytime but some occurred at night (under well watered conditions)  
Nobel & Hartsock 1986

Pyrrhocactus strausianus  
Weddellite was identified as druses, prisms & crystal sand.  
Monje & Baran 2002

Rauhocereus riosaniensis  
Backberg needs an analysis.

Quiabentia chacoensis  
(SRSU) entire page

Rathbunia alamosensis  
(Coulter) Britton & Rose  See as Stenocereus alamoensis
Trouts Notes on Cactus Chemistry

Rebutia arenacea Cárdenas
Dehydrogeosmin - Major volatile in floral scent.
Sesquiterpene alcohol 1 - Minor volatile in floral scent.
Sesquiterpene alcohol 2 - Minor volatile in floral scent.
Schlumberger et al. 2004 (in tepals; gc-ms)

Rebutia fabrisii Rausch
Emission rates varied up to 12-fold between individuals
Dehydrogeosmin - Major volatile in floral scent.
Sesquiterpene alcohol 1 - Minor volatile in floral scent.
Schlumberger et al. 2004 (in tepals; gc-ms)

Rebutia krainziana W. Kesselring

Rebutia margarethae Rausch
Weddellite was identified as druses.
Monje & Baran 2002

Rebutia marsoneri Werdermann
Dehydrogeosmin - Major volatile in floral scent.
Sesquiterpene alcohol 1 - Minor volatile in floral scent.
Sesquiterpene alcohol 2 - Minor volatile in floral scent.
Schlumberger et al. 2004 (in tepals; gc-ms)

Rebutia miniscula K. Schumann

Rebutia pseudodeminuta Backeberg
AKA “Wallflower-crown”

Rebutia senilis Backeberg
AKA “Fire-crown cactus”


**Rhipsalis baccifera**

*Rhipsalis baccifera* (JS Mueller) Stearn is listed as containing unidentified alkaloid(s) by Shulgin & Shulgin but no reference was included.

**Rhipsalis cassytha Gaertner**

Citric acid (2.2% in stem juice) Hegnauer 1964 cited Bergström 1934

Listed as containing unidentified alkaloid(s) by Shulgin & Shulgin but no reference was included.

See comment in Activity Notes.

**Rhipsalis conferta Salm-Dyck**

See comment in Activity Notes.

**Rhipsalis gaertneria var. Mackoy**

Citric acid (2.9% in stem juice)

Hegnauer 1964 cited Bergström 1934

**Rhipsalis juengeri Barthlott & N.P.Taylor**

(\% = Relative percent of total fruit volatiles)

10-Methylnonan-2-one (36.0%)  
Undecan-2-one (26.95%)  
Unidentified: possibly Methyl undecenone (12.3%)  
8-Methylnonan-2-one (1.918%)  
Linalool (1.86%)  
Styrene (2.4%)  
Heptan-2-one (1.2%)  
6-Methylheptan-2-one (0.4%)  
9-Methyldecanal (0.217%)  
Nonanal (0.2%)  
Nonan-2-one (0.86%)  
2-Undecanol (0.53%)  
8-Methylnonanol (0.494%)  
Benzaldehyde (0.352%)  
6-Methylhept-5-en-2-one (0.19%)  
Hexadecane (0.133%)  
Decanal (0.12%)  
Tetradecane (0.115%)  
Octan-2-one (0.1%)  
Benzyl acetone (0.097%)  
Octanal (0.072%)  
Benzyl acetate (0.067%)  
Benzyl alcohol (0.064%)  
Oct-1-en-3-ol (0.059%)  
Tridecan-2-one (0.48%)  
7-Methyloctan-2-one (0.035%)  
Oxan-2-one (0.035%)  
Dodecane (0.034%)  
Naphthalene (0.03%)  
Decan-2-one (0.023%)  
trans-Anethole (trace)  
α-Cedrene (trace)  
Coumarin (trace)  
p-Cymene (trace)  
Limonene (trace)  
3-Methylbut-2-enyl acetate (trace)  
Methyl decanoate (trace)  
Methyl salicylate (trace)  
Phenoxyethanol (trace)  
α-Pinene (trace)  
α-Selinene (trace)

Schlumberger et al. 2006

**Rhipsalis mesembryanthemoides Standl.**

Mesembryanthemoidigenic acid (0.36%) (A dihydroxy triterpene acid) Tursch et al. 1965 [Collected in the State of Guanabara, Brazil]

**Rhipsalis paradoxa Salm-Dyck**

Citric acid (2.3% in stem juice) Hegnauer 1964 cited Bergström 1934

**Rhipsalis regnellii Lindb.**

Citric acid (4.5% in stem juice) Hegnauer 1964 cited Bergström 1934
Rhipsalis rhombea PFEIFFER
Citric acid (1.6% in stem juice) HEGNAUER 1964 cf. BERGSTROM 1934

Rhipsalis teres (VELLOZO) STEUDEL
Appears listed as containing unidentified alkaloid(s) but either the entry included no reference or else the reference that was cited (BROWN et al. 1968) did not mention the species.

Rhipsalis virgata WEBER
Citric acid (1.8% in stem juice) HEGNAUER 1964 cf. BERGSTROM 1934

Rhipsalis warmingiana K. SCHUMANN
Citric acid (3.1% in stem juice) HEGNAUER 1964 cf. BERGSTROM 1934
Listed as containing unidentified alkaloid(s) by SHULGIN & SHULGIN but no reference was included.

Rhodocactus spp. See as Pereskiopsis spp.

Ritterocereus griseus (HAWORTH) BACKEBERG
See as Lemaireocereus griseus

Ritterocereus hystrix (HAWORTH) BACKEBERG
See as Lemaireocereus hystrix

Ritterocereus montanus (BRETTON & ROSE) BACKEBERG
See as Stenocereus montanus

Ritterocereus pruinosus (OTTO) BACKEBERG
See as Lemaireocereus pruinosus

Ritterocereus queretaroensis (WEBER) BACKEBERG
See as Lemaireocereus queretaroensis

Ritterocereus weberi (COULTER) BACKEBERG
See as Pachycereus weberi

Rooksbya euphorbioides (HAWORTH) BACKEBERG
See as Neobuxbaumia euphorbioides

Roseocactus fissuratus See as Ariocarpus fissuratus

Roseocereus tephrocatus (LAB.) BACKEBERG = Trichocereus tephrocatus No analysis reported but one seems needed.

Schlumbergera bridgesii (LEMAIRE) LOFGREN
Cholesterol (traces)
Avenasterol (8.5% of total)
24¢-Methylcholesterol (10.2% of total)
Sitosterol (81.3% of total)
SALT et al. 1987
Listed as containing unidentified alkaloid(s) by SHULGIN & SHULGIN but no reference was included.

Schlumbergera russelliana (HOOKER) BRETTON & ROSE
Listed as containing unidentified alkaloid(s) but either the entry included no reference or else the reference that was cited (BROWN et al. 1968) did not mention the species.

Schlumbergera truncata (HAWORTH) MORAN
Analyzed as Zygocactus truncatus (HAWORTH) SCHUMANN “Christmas Cactus”
Citric acid (1.3% in stem juice) HEGNAUER 1964 cf. BERGSTROM 1934.
[It was found to contain no Isocitric acid by SODESTROM 1962.]
Reported to contain Betalains as pigments. WOHLPART & MABRY 1968 cited DREIDING 1961.
Also caffeic acid. AARDVARK 2006 cf. SCHULTE & RAUFFAU 1990

Schlumbergera x buckleyi (T. MOORE) TJADEN
“Christmas cactus”
The betalains:
Betalamic acid
Betanidin 5-O-(2'-O-β-D-apiofuranosyl-6'-O-malonyl)-β-D-glucopyranoside
Betanin
Phyllocactin (6'-O-malonyl/betanin)
Isophyllactin
Iso-2'-apiosyl-betanin
Vulgaxanthin I
and 7 others were detected in the flowers.
KOBAyASHI et al. 2000
William Buckley produced this hybrid in the late 1840s between S. russelliana and S. truncata.

KOBAyASHI et al. 2000 made the comment that the pigments of Schlumbergera truncata’s petals showed “almost the same betalain pattern as that of Schlumbergera x buckleyi petals”.
Kobayashi did not include any actual details.

Selenicereus coniflorus (WEINGART) BRETTON & ROSE
See comment in Activity Notes.
**Cactus Chemistry: By Species**

*Selenicereus grandiflorus* (Linnaeus) Britton & Rose

"gigante" (Durango), "organillo" (Tamaulipas) Standley 1924

Tyramine (0.3% dry wt) Wagner & Grevel 1982a

Hordenine (0.001% dry wt) Petershofer-Halbmeyer et al. 1982

[N-methyltyramine appears to be an erroneous entry in the literature. EAMP 1999. See comments in Activity Notes.]

Unidentified alkaloid(s) reported in Brown et al. 1968 (3 major and 4 minor alkaloids; one of which had a MW of 330+25.)

[An uncharacterized alkaloid named Cactine was previously reported by Sultan 1891.]

Claims of digitalis-like cardioactive glycosides, appearing in the literature, are ALL unsupported errors.

See additional comments in Activity Notes.


Flavonol-3-glycoside, and two glycosides of Isorhamnetin (isorhamnetin-3-β-galactoside AKA Cacticin: 0.02% dry wt. & Isorhamnetin-3-β-rutinoside AKA Narcissin & Lycorine: 0.05% dry wt.) were isolated from flowers by Hörhammer et al. 1966.

*Soehrensia bruchii* (Br. & R.) Backeberg see as *Trichocereus bruchii*

*Solisia pectinata* (B.Steinn.) Britton & Rose

N-Methyltyramine (10-50% of 10-50 mg of total alkaloids/100 gm. fresh.)

Hordenine (Over 50% of 10-50 mg of total alkaloids/100 gm. fresh.)

Bruhn & Bruhn 1973

*Solisia pseudopectinata* Backeberg

See as *Pelecyphora pseudopectinata*

*Stenocactus multicostatus* (Hildmann) A.Berger

See as *Echinofossulocactus multicostatus*
Stenocereus alamosensis (Coulter) A.Gibson & Horak

AKA “cina” or “sina”

Interestingly, this analysis suggests that this species might be better grouped with the species we have listed under Lemaireocereus.

Oleanolic acid was reported to be present. Gibson & Horak 1978 cited Bird 1974

Gummososide A methyl ester

Gummososide A

Kakuta et al. 2012

Kircher 1982 lists Longispinogenin as being present in higher concentrations than in Machaerocereus gummosus and the sterol diols being lower. Gummosogenin, Machaeric acid and Machaerinic acid also present but no details included.

TLC examination showed no detectable alkaloids and the very strong presence of triterpene glycosides: Kircher 1982

Lipid content was 5.6% by dry weight: Kircher 1982

See comment in Activity Notes.
Stenocereus alamosensis
(BTA)
Stenocereus beneckei (Ehrenberg) Buxbaum
3,4-Dimethoxyphenethylamine (less than or around 0.01% dry wt.) Ma et al. 1986 (HBG 32973)
4-Hydroxy-3,5-dimethoxyphenethylamine (Around 0.01% dry wt.) Ma et al. 1986
Mescaline (Less than 0.01%.) Ma et al. 1986
Queretarolic acid (A dihydroxy triterpene acid; in hydrolyzed saponin) No isolation details included. Dierassi et al. 1955a.
[Also isolated by Dierassi et al. 1956b]
Lupenone (wax component) (0.12% by dry wt) Kinoshita et al. 1992 (Also by Wollenweber & Dörr 1995)
Lupeol (wax component) (0.04% by dry wt) Kinoshita et al. 1992 (Also by Wollenweber & Dörr 1995)
Oleanolic acid (detected; in hydrolyzed saponin) Dierassi et al. 1956b
β-Amyrin (In the surface wax; in a 1:1:3 ratio with Lupeol & Lupeone) [Grown in Germany] Wollenweber & Dörr 1995
Stenocereus eruca (Brandegee) Gibson & Horak
“chirinola”, “chirinole”, “chilenola” Standley 1924: 3,4-Dimethoxyphenethylamine (less than 0.01% dry wt.)
Ma et al. 1986 (Baja, Mexico; AC Gibson 3625)
4-Hydroxy-3,5-dimethoxyphenethylamine (Around 0.01% dry wt.) [?] Ma et al. 1986
Mescaline (Less than 0.01% [?]) Ma et al. 1986
Stellatogenin (a triterpene) 0.07% [fresh wt] (3.1 gm from 4.5 kg [fresh wt]) Djerassi et al. 1955b
Betulinic acid (a triterpene) (Identified as present via the methyl ester) Djerassi et al. 1955b.
Other compounds appeared to be present: Djerassi et al. 1955b.
(Analysis usually as Machaerocereus eruca)

Two lectins (MEAI and MEAII) were isolated and partially characterized. They were the first lectins to be isolated from cacti.

Zenteno et al. 1988
Zenteno described the purified lectins as being “glycoproteins containing 36% (MEA,) and 24% (MEA,) of total carbohydrate, respectively. They do not contain sialic acid, but are rich in glucose, galactose, L-rhamnose and xylose; in addition, mannose is present as well as some L-arabinose in MEA1.”

Stenocereus eruca
(All HBG except for top left image at Cactus Country)
Stenocereus eruca
Cactus Chemistry: By Species

and four known triterpenes
Betulnic acid
Oleanolic acid
Stellatogenin
Thurberogenin
Ys. et al. 1998

Oleanolic acid
Thurberogenin
Queretaragic acid
Treleasenic acid
Machaerogenin
Morolic acid
Machaeoragic acid
21-Ketobetulnic acid
16β-Hydroxybetulnic acid
22β-Hydroxystellatogenin
Desoxypithyrrigenin
Stellatogenin
Betulnic acid
Yang et al. 1998

Two new triterpene saponins:
3-O-β-D-xylopyranosyl-(1→2)-β-D-glucopyranosyl-(1→2)-
β-D-glucuronopyranosyl stellatogenin (They named it Stellatoside B.)
3-O-α-L-rhamnopyranosyl-(1→2)-[α-L-rhamnopyranosyl-
(1→3)]-β-D-glucuronopyranosyl betulnic acid 28-O-α-L-
rhamnopyranosyl ester (They named it Erucasaponin A.)
Okazaki et al. 2007

Stellatoside C, D & E
Stellatoside B methyl ester
Stellatoside C methyl ester
Thurberoside A
Phillyriside A
Treleaseside A
Kakuta et al. 2012 (all new triterpene saponins)

See comments in Activity Notes.

Stenocereus griseus (Haworth) Buxbaum See as Lemaireocereus griseus
Stenocereus gummosus (Brandeghe) A.Gibson & Horak
See as Machaeocereus gummosus
Stenocereus hystrix (Haworth) Buxbaum See as Lemaireocereus hystrix
Stenocereus longispinus (Br. & R.) Buxbaum See as Pachycereus marginatus
Stenocereus marginatus (DCandolle) Buxbaum See as Pachycereus marginatus
Stenocereus montanus (Britton & Rose) Buxbaum See as Lemaireocereus montanus
Stenocereus pruinosus (Otto) Buxbaum See as Lemaireocereus pruinosus
Stenocereus quevedonis (Weber) Buxbaum See as Lemaireocereus quevedonis

Stenocereus eruca
(Cactus Country)
Stenocereus stellatus (Pfeiffer) Riccobono

“tuna”, “joconostle” STANLEY 1924: 899
87.4% water by weight DIERASSI et al. 1955b
3,4-Dimethoxyphenethylamine (around 0.01% dry wt.)
4-Hydroxy-3,5-dimethoxyphenethylamine (around 0.01% dry wt.)
Mescaline (0.01% dry wt.) MA et al. 1986 (HBG 34963)
Stellatogenin (a neutral triterpene lactone (80% of neutral fraction); first isolation but not clear if S. erica or S. stellatus was first) (2.2% by dry weight) [In another experiment in same paper they obtained 1.7% (crude)] Also in KOYAMA et al. 1993 Thurberogenin 15% of neutral fraction [DIERASSI 1957 thought this might be an artifact] Also in KOYAMA et al. 1993
Oleanolic acid (0.009% by dry wt) (Isolated via the methyl ester)
[Also in KOYAMA et al. 1993]
Betulinic acid (0.376% by dry wt) (Isolated via the methyl ester)
DIERASSI et al. 1955b [Collected: Mexico] Also KOYAMA et al. 1993
Stellatogenin 3-O-α-L-rhamnopyranosyl(1→4)-α-L-rhamnopyranosyl(1→2)-β-D-glucuronopyranoside (They named it Stellatoside) 0.01% in cultivated plants and 0.22% in wild ones (dry weight).
Oleanolic acid 3-O-α-L-rhamnopyranosyl(1→3)-β-D-glucuronopyranosyl 28-O-D-glucopyranoside (0.10% in cultivated plants and 0.02% in wild ones).
IMAI et al. 2006
Species was reported as containing triterpenoid saponins but devoid of alkaloid; according to DIERASSI & LIPPMAN 1954 & DIERASSI et al. 1954c; citing L.H. Liu (unpublished observation from DIERASSI’s lab)
Flower contains Betanin, Phyllocactin, Isobetanin, 2 unidentified Betacyanins & traces of Isophyllocactin. PIATTELI & IMPERATO 1969

Stenocereus thurberi (Engelmann) Backebeg
See as Lemaireocereus thurberi
Stenocereus thurberi (Engelmann) Buxbaum
See as Lemaireocereus thurberi

Stenocereus stellatus
(Huntington Botanical Gardens)
type page
Stenocereus treleasei (Britton & Rose) Backeberg
“tunillo” Standley 1924: 899
82.6% water by weight
3,4-Dimethoxyphenethylamine (around 0.01% dry wt.)
4-Hydroxy-3,5-dimethoxyphenethylamine (Around 0.01% dry wt.)
Mescaline (0.01% dry wt.) Ma et al. 1986
Stellatogenin 0.64% dry wt. [Also observed in Dierassi & Mills 1958]
Thurberogenin 0.02% dry wt. [Dierassi 1957 thought this might be an artifact]
Oleanolic acid 0.1% (via its methyl ester) [Also observed in Dierassi & Mills 1958]
Would not rule out possibility of traces of Betulinic acid.
Dierassi et al. 1956a [Collected in Oaxaca, Mexico].
Treleasegenic acid (a triterpene) Dierassi & Mills 1958
Oxyallobetulin was also listed in Dierassi 1957 who thought this might be an artifact.

Stenocereus weberi (Coulter) Riccobono. See as Pachycereus weberi
Stenocereus weberi (Coulter) Buxbaum See as Pachycereus weberi
Stenocereus treleasei
(HBG)
**Stetsonia coryne (Salm-Dyck) Britton & Rose**

Tyratramine (10-50% of 1-10 mg of total alkaloids/100 grams fresh.)
N-Methyltyramine (1-10% of 1-10 mg of total alkaloids/100 grams fresh.)
3-Methoxytyramine (Over 50% of the 1-10 mg of total alkaloids/100 grams fresh.)
3,4-Dimethoxyphenethylamine (trace)
Mescaline (0.1-1.0 mg per 100 grams fresh.)
Anhalonidine (trace)
Anhalidine (trace)

Agurell *et al.* 1971b [Obtained via commercial sources in Germany & the Netherlands] (Did not analyze for 4° amines such as coryneine.)

Coryneine (1% dry wt.) Reit *et al.* 1935 [Collected from the wild in Argentina.]

[Oxycandicine is simply a synonym for Coryneine.]
Stetsonia coryne
(maybe var. procerā?)
(LA Arboretum)
Stenosoria coryne (HBG)
Strombocactus disciformis (DC) Br. & R.
Reported to contain Isocitric acid (tlc & gle by Kringstad & Nordal 1975)

Strombocactus disciformis

Stetsonia coryne
(LA Arboretum)

monstrose Strombocactus disciformis
**Tephrocactus articulatus (Pfeiffer) Hunt**
Whewellite was identified as druses.

**Monie & Baran 2002** [Examined as Tephrocactus articulatus and separately as Tephrocactus glomeratus]

**Tephrocactus aurantiaca Lindley**
Hordenine (%) De Vries et al. 1971
Mucilage determined to be comprised of Arabinose (30.8%), Galactose (38.3%), Galacturonic acid (6.6%), Rhamnose (10.3%) & Xylose (14.0%), Moyna & DiFabio 1978 (Analyzed MAM 1307)
*Tephrocactus soehrensii* (Britton & Rose) Rowley
Reported to contain Betalains as pigments.

*Tephrocactus soehrensii* (HBG)

*Tephrocactus glomeratus* (HBG) considered synonymous with *T. articulata*

*Thelocactus bicolor* (Cactus Country)
lower right two images
Thelocactus bicolor (Galeotti) Britton & Rose
AKA Glory of Texas
Reported to contain unidentified alkaloids. Chalet 1980a cited Dominguez et al. 1969
Itesmol (a steroid; 0.15% dry wt.) Dominguez et al. 1968
Eisacol (a triterpenoid) Dominguez et al. 1968
Two unidentified components. Dominguez et al. 1968

Thelocactus lophothele

Thelocactus bicolor
Thelocactus pseudopectinatus (Backeb erg) Anderson & Boke. See as Pelecyphora pseudopectinata

Thelocactus spp. A number of Thelocactus species were said to have been found devoid of alkaloid but their specific identities were not included. West et al. 1974

Thelocactus lophothele

Thelocactus rinconensis
Trouts Notes on Cactus Chemistry

Two names appeared that seem to have created a divergent mess involving the name “bicolor”.

Thelocactus setispinus:
Cactus bicolor Terán & Berlandier, 1832
Echinocactus hamatus Muehlenpfordt, 1848
Echinocactus muehlenpfordtii Fennel, 1847
Echinocactus setispinus Engelmann, 1845
Echinocactus setispinus var. cachetianus Labouret, 1853
Echinocactus setispinus var. hamatus (Muehlenpfordt) Engelmann, 1850
Echinocactus setispinus var. mierensis K. Schumann, 1898
Echinocactus setispinus var. orcuttii
Echinocactus setispinus var. setaceus Engelmann, 1850
Ferocactus setispinus (Engelm.) L.D. Benson, 1969
Hamatocactus bicolor (Terán & Berlandier) I.M.Johnston, 1924
Hamatocactus setispinus (Engelmann) Britton & Rose, 1922
Hamatocactus setispinus var. hamatus (Muehlenpfordt) Borg, 1937
Thelocactus setispinus (Engelmann) E.F. Anderson, 1987
Thelocactus setispinus var. cachetanium (Labouret) Pilbeam, 1996
Thelocactus setispinus var. hamatus (Muehlenpfordt) Pilbeam 1996
Thelocactus setispinus var. mierensis (K. Schumann) Pilbeam 1996
Thelocactus setispinus var. muehlenpfordtii (Fennel) Pilbeam 1996
Thelocactus setispinus var. orcuttii (K. Schumann) Pilbeam 1996

Thelocactus setispinus (East of Rio Grande City, Starr County, Texas) left
(SRSU) right
Thelocactus bicolor
(Cactus Country)
Trouts Notes on Cactus Chemistry

Thelocactus sausseri
(HBG)
above

Thelocactus rinconensis
(Cactus Country)

Thelocactus sp. unlabeled possible hexaedrophorus
(Cactus Country)
below
It would be quite surprising if this, not atypical, *pachanoi* did not contain mescaline.
Trichocereus andalgalensis (Weber) Kreuzinger
Hordenine (%) Nieto 1987
Candicine (%) Nieto 1987
Great confusion exists in horticulture concerning this plant. Several combinations have been made under this name involving at least two separate plants. See Ritter for a discussion.

Trichocereus argentinensis b.n. Hort. B. Ressler
A stout peruvianoid-macrogonoid said to reach up to 8-9 (10?) inches in diameter. Initially mislabeled Cereus argentinensis, it is assumed to have originated in northern Argentina.
In pictures it looks very bluish-blushed (See Ressler’s website) and interestingly similar to what is pictured on page 41 in Innes & Glass 1991 mislabeled Cereus peruvianus with its origin given as Argentina! Roberto Kiesling, in correspondence, insists that nothing like this occurs in Argentina and the origin information is mistaken.
Needs an analysis and taxonomic study. It is difficult to imagine this does nto contain mescaline.
Also see an authentic Cereus argentinensis in Innes & Glass 1991

Trichocereus andalgalensis
Above: probably = T. huascha (see also) (UC)
Below: probably = Lobivia andalgalensis (SS)

Trichocereus argentinensis sensu Bob Ressler

Trichocereus atacamensis
Photo by Jon Hanna
Trichocereus atacamensis
(Philippi) Marshall
(San Pedro de Atacama, Chile)

Needs an analysis.
See comment in Activity Notes.

Trichocereus atacamensis
San Pedro de Atacama, Chile

Photos by correspondent requesting anonymity

Trichocereus bridgesii
(Bolivia)
Photo by correspondent requesting anonymity
*Trichocereus macrogonus* (GF) above
*Trichocereus bridgesii f. brevispinus* (Field) right
*Trichocereus macrogonus giganteus* (NMCR) below

*Trichocereus peruvianus* form (Matucana)
Photo by Grizzly (wild plant)
Trichocereus bridgesii (Salm-Dyck) Britton & Rose
AKA San Pedro & achuma (Bolivia)
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)
[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.]
Mescaline (Over 25 mg. per 100 grams fresh.)
Agurell 1969b [Obtained via European commercial sources]
0.56% (dry green outer tissues) Serrano 2008 (Wild harvested; La Paz, Bolivia)
0.18% (dry outer green tissues) Ogunbede 2009 (Bob Gillette commercial nursery stock in California)
[All forms & varieties of this species are said to contain levels of mescaline ranging from nearly inactive to potent: Conversations with friends, Davis 1983, Davis 1997, Davis 1999 & also the 1998 Entheogen Review 7 (3): 70-71.]

See additional comments in Activity Endnotes.
Trichocereus bridgesii
(RS)

Plant is designated thusly for being found sold as “San Pedro” in an Amsterdam smartshop. We do not know its original source.

Trichocereus bridgesii Bolivia 53.0162
(Above & lower left)
Trichocereus bridgesii
(Field)

354
My best guess is that *Trichocereus* sp. SS02 will prove to be synonymous with *Trichocereus aff. bridgesii* (H 79960).
Trichocereus bridgesii
H70760
(HBG)
Trichocereus bridgesii (Field)
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)
The degree of sliminess for T. bridgesii is claimed by growers to range from extreme to almost lacking.

Trichocereus sp. Standard
Originally known as "standard peruvianus" this appears to be an excellent bridgesii form.
Presence of mescaline is proven in multiple human bioassays.
Specifically raised as sacramental species but lacks an analysis.

Trichocereus sp. W. Baker 5452
Collected by Julio Cruz at Murillo, Jayuri Province, Bolivia, on 20 March, 1983.
The original herbarium vouchers were submitted as Trichocereus pachanoi but it is clearly a form of bridgesii.

Presence of Mescaline was proven both through human bioassays and unpublished analysis (Anonymous sources; personal communication.)
Purported to have indigenous use but that claim lacks details or a reference.
Lacking a published analysis.

The monstrose forms of T. bridgesii have been purported to be especially active in human bioassays.
Ogunbede 2010 analyzed the short jointed monstrose form and determined it to contain only 0.48% mescaline in the dried outer green tissues.
Trichocereus bridgesii
monstrose
*Trichocereus bridgesii*
long-form
(Left column & upper right)

Photo by Patrick Noll
*Trichocereus bruchii* (Britton & Rose) Ritter
Flower contains Betanin (major), Phyllocactin, Isobetanin, Isophyllocactin & an unidentified Betacyanin.
Piattelli & Imperato 1969

variegated *Trichocereus bruchii* (Huntington)
Photo by Kamm

*Trichocereus bruchii* Argentina 74.0146 (UC)
Left-hand column
Trichocereus bruchii  Argentina 74.0146 (UC)
Trichocereus camaraguensis Cardenas
Tyramine (trace)
N-Methyltyramine (trace)
3-Methoxytyramine (trace)
3,4-Dimethoxyphenethylamine (trace)
Agurell 1969b [European commercial sources]

Trichocereus camaraguensis
Photos by Joylene Sutherland
Note the two flower forms. The second one is suspected of being a possible hybrid.

Trichocereus camaraguensis
Photos above by Joylene Sutherland

Trichocereus camaraguensis
(UC)
Trichocereus camaraguensis
(Field)
Trichocereus cephalomacrocostibas
Trichocereus candicans (Gill.) Britton & Rose
Tyramine (trace) Mata et al. 1976a. Also reported in Mata et al. 1976b
N-Methyltyramine (0.004% by dry weight) Mata et al. 1976a;
Also isolated in Mata et al. 1976b. Not observed by Agurell 1969b
Hordenine (over 50% of over 50 mg total alkaloids/ 100 gm fresh) Agurell 1969b [Obtained via European commercial sources]; (Variable from 0.5 to 5%) Reti 1950; also Castrillón 1950 & Reti 1933.
Candicine (Variable. 0.5 to 5%) Reti 1950 also Reti 1933 and Castrillón 1950
2 unidentified trace alkaloids detected Mata et al. 1976

Trichocereus cephalomacrostibas Rauh & Backeberg
Needs an analysis (Also called a Haageocereus. Now it is considered to be a Weberbauercereus)
This was purported to contain mescaline by Caycho Jimenez but no reference was included with the claim.
See comments in the Activity Notes.
Trichocereus candicans
(HBG)
Trichocereus candicans
(Field)
Trichocereus candicans
(Field)
Trichocereus chalaensis RAUH & BACKEBERG

Needs an analysis
See images in the San Pedro book.

Trichocereus chiloensis (COLLA) BR. & R. See as Trichocereus chilensis

Trichocereus chilensis (COLLA) BRITTON & ROSE
AKA buisco
Candicine (trace) CORTES et al. 1972
“no triterpenes or alkaloids” “essentially devoid of alkaloids”

β-Sitosterol
Unidentified material believed to be a straight chain alcohol
[mp 82-82.5° [α]D –11°] (also described in this paper as a long chain aliphatic alcohol and an aromatic alcohol.) It was thought to resemble n-Nonacosan-10-ol but mmp was depressed.

DERRASSI et al. 1956a [Material from Chile]
β-O-Palmityl longispinogenin (olean-12-ene-3β,16β,28-triol-3-palmitate) in 1% yield. MORALES & McLAUGHLIN 1989 (Collected in Chile)
[AGURELL 1969b (Obtained via European commercial sources) reported it devoid of alkaloids but specifically did not look for quaternary amines like Candicine]

This species is variable and has a number of known forms
Trichocereus chilensis Chile 52.1507
(UC)

Trichocereus chilensis H 20932
(HBG)

Trichocereus chilensis Chile 52.0568
(UC)
Trichocereus chilensis
Chile 52.0568
Elqui Province
(UC)
Trichocereus chilensis Chile 55.0643
Curico Province
(UC)
Trichocereus chilensis
Chile 55.0643  Curico Province (left column)
Chile 52.0555  (right column)
(UC)
Trichocereus courantii (K. Schumann)

BaCKeBERG

Tyramine (trace)
3,4-Dimethoxyphenethylamine (1-10% of 1-10 mg of total alkaloids/ 100 grams fresh)
3-Methoxytyramine (1-10% of the 10-50 mg of total alkaloids/ 100 grams fresh)
N-Methyl-3-methoxytyramine (10-50% of 10-50 mg of total alkaloids/ 100 grams fresh)
N-Methyltyramine (Over 50% of 10-50 mg of total alkaloids/ 100 grams fresh)

Agurell et al. 1971b [Obtained via commercial source in the Netherlands]

[The typo 2-Methoxytyramine has been published.]

Trichocereus crassicostata Ritter

Needs an analysis & taxonomic study

Trichocereus cuzcoensis Britton & Rose

Common names: “Giganton” and “Jahuackollai”

Tyramine (trace) Agurell et al. 1971b
3-Methoxytyramine (Over 50% of the over 50 mg of total alkaloids/ 100 grams fresh) Agurell et al. 1971b
3-Hydroxy-4,5-dimethoxyphenethylamine (trace) Agurell et al. 1971b

Mescaline (0.5-5 mg. per 100 grams fresh) Agurell et al. 1971b. [Also identified by Lindgren et al. 1971]
0.0% Cotaruse, Arequipa
0.0% Huaytampo, Cuzco
0.0% Huacarpay, Cuzco
0.0% Capacmarca, Cuzco

Serrano 2008 (All were wild collections)

[4-MeO-PEA appears listed in error. The claim is not supported by any of the references cited.]
Trouts Notes on Cactus Chemistry

“no triterpenes or alkaloids” [Run with a second procedure and reported traces of non-phenolic basic material]

Djerassi et al. 1956a [Material from Cuzco, Peru]

β-Sitosterol (a sterol) Djerassi et al. 1956a

Unidentified alcohol that was also reported in *T. chiloensis* (see under). Djerassi et al. 1956a

*Trichocereus cuzcoensis* PCH 1812

Collected in 1957 by Paul C. Hutchison, on 11 November, on the road to Puno, 35 km. north of Cuzco, Province Quispicanchis, Department Cuzco, Peru. 3100 m.

Color differences reflect whether the plant receives adequate shade during the day.
Trichocereus escayachensis needs an analysis.
Trichocereus fulvilanus  Ritter
Tyramine (10-50% of over 50 mg of total alkaloids/ 100 grams fresh)
N-Methyltyramine (10-50% of over 50 mg of total alkaloids/ 100 grams fresh)
Mescaline (trace)
Agurell et al. 1971b [Commercial German source]
Backeberg 1959 viewed this as possibly synonymous with T. deserticolus but, based on seed coat morphology, Friedrich & Gläetzle 1983 considered the two to be separate species. Hunt sided with Backeberg. See Part B San Pedro

Trichocereus fulvilanus
**Trichocereus grandiflorus**

This appears presented as a DMT container in both the underground literature and on the Internet. This arose from a preliminary report by Sasha Shulgin that he had observed what he suspected was DMT in GC-MS. He was unable to duplicate his observation but, upon flowering, discovered that he had used a yellow flowered form rather than the red-flowered one used in his initial analysis. It is unclear whether this was the cause for the disparate results or if a contaminated GC-MS was the culprit. Sasha suspects the latter.

All of the various forms of plants known in horticulture within and around this name are in need of further investigation; both as chemical investigation and taxonomic study. (Masochists only need apply.)

See comments on synonyms under **Trichocereus huascha**

**Trichocereus grandiflorus (red-flowered)** see **Trichocereus huascha**

**Trichocereus grandiflorus (white-flowered)**

There have been anecdotal reports of activity or the claim for mescaline in material called **Trichocereus grandiflorus**. While purely speculative, perhaps the mislabeled material depicted on page 78 of *Part B San Pedro* might provide one suggestion as to a possible source for this rumor?

**Trichocereus huanucoensis H.Johnson**

[Ex: UC Botanical Gardens (H. Johnson; Peru 56.1153; also in the Huntington as HBG18568. Released into horticulture by Johnson as *T. huanucoensis* and by HBG as HBG18562.]

Needs an analysis. One human bioassay using 500 gm fresh wt of 1 version of the horticultural material sold under this name reported a pronounced stimulant but not hallucinogenic action. ANONYMOUS 2000

It has conflicting bioassay reports with at least one claiming the presence of mescaline. ANONYMOUS

It should be stressed that there appears to be 3 distinct versions in botanical gardens bearing this name and at least one additional offering in horticulture. The source for the material at both the Huntington & Berkeley Botanical Gardens was Harry Johnson, Sr., of Paramount California (better known as the source for the Paramount hybrids).

Harry Johnson, Sr. field collected the seeds in Peru (in 1956) so a possibility exists that the seeds produced F1 hybrids.

See *Part B San Pedro* for images.
Trichocereus huanucoensis

The plant growing at UC depicted on this page is sometimes proposed to be a mislabeled *pachanoi*.

If it is correctly identified there are two forms at UC. One is located in a bed in front of the arid greenhouse and also in a bed in the desert garden near *Opuntia cylindrica*. Another form shown on the next page exists in the desert garden as well.

Both are distinct from the form growing at the Huntington - also from Johnson’s seeds.

See comments and more images in San Pedro.
Trichocereus huanucoensis (UC) Form present in the main desert garden
Notice the odd strap-like growth of tissue.

*Trichocereus huanucoensis* (HBG)
Trichocereus huascha (Weber) Britton & Rose

Hordenine (Sole alkaloid. 10–50 mg/ 100 gm of fresh plant)

Agurell 1969b [Obtained via European commercial sources];
(trace) Follas et al. 1977 [Follas analyzed as Lobivia huascha
(Weber) W.T.MARSHALL.]

N-Methyltyramine (trace) Follas et al. 1977

Tyratmine (trace) Follas et al. 1977

**Note on T. huascha:**

In partial contrast to Ritter, Hunt considers the following to be
synonyms of Echinopsis huascha (Weber) Friedrich & Rowley
(and this summation ignores all purely horticultural and ill-defined
material such as the orange flowered “grandis”)

Chamaecereus grandiflorus (Britton & Rose) Fric

Echinopsis huascha (Weber) Friedrich & Rowley This is the name
most commonly accepted at the present time.

Echinopsis lobivioides Backeberg

Echinopsis pecheretiana (Backeberg) Friedrich & Rowley [In horti-
culture this has lemon-yellow flowers]

Echinopsis rowleyi (Friedrich) Kiesning

Helianthocereus andalgalensis (Weber) Backeberg

Helianthocereus grandiflorus (Britton & Rose) Backeberg

Helianthocereus huascha (Weber) Backeberg

Helianthocereus hyalacanthus (Spegazzini) Backeberg

Helianthocereus pecheretianus Backeberg

Lobivia andalgalensis (Weber ex Schumann) Britton & Rose (See
photos under T. andalgalensis and under T. grandiflora)

Lobivia grandiflora Britton & Rose

Lobivia huascha (Weber) W.T.MARSHALL

Lobivia hyalacantha Spegazzini

Lobivia purpureoalata Ritter

Pseudolobivia lobivioides (Backeberg) ex Krainz

Trichocereus andalgalensis Hosseus

Trichocereus catamarcensis Ritter

Trichocereus grandiflorus Backeberg

Trichocereus huascha (Weber) Britton & Rose

Trichocereus lobivioides Graeser & Ritter ex Ritter

Trichocereus rowleyi Friedrich

Friedrich & Glaetzle 1983 kept huascha and rowleyi separate based
on their seed-coat morphology.

(Note also that we disregard much of this; pending the location of some
sort of published research or clarifications. Ideally this would take
the form of a Monograph for the supergenus Echinopsis.)

Also note that any Trichocereus lobivioides grandiflorus is likely
to be a hybrid. These are commercially available in red and other
colorful flowers.

*T. huascha,* as available in horticulture, is offered in both a yellow and
red flowered form.

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*Photo by Kamm*
Trichocereus huascha (red flowered)
HBG: above; LA Arboretum: below
Trichocereus knuthianus
(Field)
Trichocereus knuthianus BACKEBERG

Tyramine (10-50% of 10-50 mg of total alkaloids/100 grams fresh)
3-Methoxytyramine (10-50% of 10-50 mg of total alkaloids/100 grams fresh)

Agurell et al. 1971b [Obtained via commercial source in the Netherlands]

This species needs additional analysis. Some of the material bearing this label is reported to be hallucinogenically active. At least part of the commercial material available under this name is something else. The latter is sometimes referred to as T. peruvianus var. knuthianus which appears to lack any published description.

See also T. peruvianus var. knuthianus also (under T. peruvianoids) It is unclear but likely that this is only an undescribed synonym for T. knuthianus -- more study of the chemistry is needed.
Trichocereus lamprochlorus
(UC)
Trichocereus litoralis (Johow) Looser
Lacks an analysis

Trichocereus litoralis
Trichocereus lamprochlorus (Lemaire) Backeberg
Hordenine (over 50% of 10-50 mg total alkaloids/ 100 gm fresh) Agürell 1969b [Obtained via European commercial sources]
Candicine (trace) Reti 1933, Reti & Arnold 1935 & Reti 1950

Trichocereus macrogonus (Salm-Dyck) Riccobono
Tyramine (1-10% of 10-50 mg total alkaloids/ 100 gm of fresh) Agürell 1969b
3-Methoxytyramine (1-10 % of 10-50 mg total alkaloids/ 100 gm fresh.) Agürell 1969b
3,4-Dimethoxyphenethylamine (1-10% of 10-50 mg total alkaloids/ 100 gm fresh) Agürell 1969b [Obtained via European commercial sources]
Mescaline (5-25 mg. per 100 grams fresh.) Agürell 1969b
[Human bioassays suggest that this value might be low for many specimens. Conversations with friends & the 1998 Entheogen Review 7 (3): 71. MANY horticultural offerings appear to be quite potent while others are demonstrably weak. It is unclear how much of this is strain related and how much reflects variability within a given strain. Great confusion, or at least disagreement, apparently exists concerning what is and what is not this species.]
[3,4-diMeO-5-OH-PEA and 3,5-diMeO-4-OH-PEA are also listed, in error, for this species. The reference cited, Agürell 1969b, did not report either compound.]

Trichocereus macrogonus
(Huntington Botanical Gardens)

A more detailed discussion of Trichocereus macrogonus and its forms can be found in Part B San Pedro
Trichocereus macrogonus
(Huntington Botanical Gardens)
Trichocereus macrogonus
(Huntington Botanical Gardens)
No mucilage studies have been located thus far but it should be noted that some strains are exceedingly slimy and other much less so.

Amazingly, Albesiano & Kiesling merged *T. macrogonus* and *T. peruvianus* as *T. macrogona* subsp. *macrogona*.

A number of triterpene saponins have been reported. Pachanol A (the hydrolyzed sapogenin) by Takezawa *et al* 1993 Bridgesides A1, C1, C2, D1, D2, E1 & E2 (oleanane type) Pachanosides C1, E1, F1 and G1 (pachanane type) [Revised structure of Pachanol C to 21β-acetyloxy-3β,14β, 30-trihydroxy-panic-12-en-28-oic acid 14β,28-lactone] by Okazaki *et al*. 2011.
Trichocereus macrogonus
(Field)
Trichocereus macrogonus (NMCR) At NMCR in 2010

Trichocereus macrogonus (NMCR) Cutting in 2011
Trichocereus macrogonus monstrosus
This name appears listed in Kreuzinger 1935.
Is this plant in Germany of the same lineage? Who knows?
Photo by Evil Genius

Some of the names associated with *macrogonus*
All of the images below appear to be out-of-copyright. If I am in error and the use of any is objectable, please contact me for immediate removal and replacement of this PDF.

*Salm-Dyck circa 1840*

*Schumann circa 1900*

*Berger in 1906*

*Backeberg circa 1930*

*“Berol.” in 1909*

Watch for a far more detailed account of this name in the forthcoming works ”*The Macrogonus Onus*” (2014) and *Sacred Cacti* 4th edition. Part B. *San Pedro*.
Trichocereus sp. SS01
Originally encountered unlabelled growing in someone’s garden
Trichocereus pachanoi
(Cactus Country)
Trichocereus manguinii Backeb erg
3-Methoxytyramine (1-10% of 10-50 mg of total alkaloids/100 grams fresh)
Hordenine (10-50% of the 10-50 mg of total alkaloids/100 grams fresh)
N-Methyltyramine (10-50% of 10-50 mg of total alkaloids/100 grams fresh)
Tyramine (10-50% of 10-50 mg of total alkaloids/100 grams fresh)
Agurell et al. 1971b [Commercial source in the Netherlands]

Trichocereus pachanoi Britton & Rose
AKA “San Pedro”, “achuma”, “aguacolla”, “huachuma”, “giganton” & many other common names
93.5% water by weight according to Poisson 1960.
Tyramine (trace) Agurell 1969a and Agurell 1969b
3-Methoxytyramine (0.01% by dry weight) Crosby & McLoughlin 1973 [Obtained via Californian commercial sources];
(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]
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 & McLoughlin 1973] up to 2.0% [Poisson 1960] have been reported from dry plants. [See also Turner & Heyman 1960 (Collected in Peru) who reported 0.9% by dry weight in misidentified plants] From 0.109%-2.375% dry wt. (6 specimens) was estimated photometrically in Swiss cultivated plants by Helmlin & Brenneisen 1992 [See Note below];
0.310% mescaline by fresh weight (3.10 mg/gm fresh as the average of three specimens; estimated using HPLC) They also reported an average of 2.06% by dry weight.
(Ed.: Notice the obvious discrepancy.) Grown in Italy.
Gen narro et al. 1996;
Gonzales Huerta 1960 recovered 4.5% mescaline from the outer tissues of correctly identified Peruvian plants. She reported being able to obtain this yield only when using the approach of Folkers & Koniuszy 1939 rather than that described in Cruz Sanchez 1948.
Cruz Sanchez 1948 reported recovering 5% dry wt; using only the outer layer of flesh (misidentified as Opuntia clyndrica).
[Alkaloid values are often very low in many cultivated plants but the controlling factors are not clear. Species appears highly variable in potency & palatability.]

See comments in Activity Notes.
*Trichocereus pachanoi* (Strybig clone)
Trouts Notes on Cactus Chemistry

[A gc estimate of 0.155% mescaline 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]; [Alkaloid values are commonly low in many cultivated plants.] 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, LUNSTROM 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
Bridgegenins A, B & C
KINOSHTA et al. 1995

Some modern analytical reports for Peruvian pachanoi
Specimens not obviously being cultivated:
0.00% Cataratas, Otuzco, La Libertad
0.00% El Alisal, San Marcos, Cajamarca
0.45% Kuntur Wasi, San Pablo, Cajamarca
1.14% Laquipampa, Ferrehafe, Lambayeque
0.23% Moyán, San Vincente, Lambayeque
0.28% Puykate, Ferrehafe, Lambayeque
0.94% Toconoha, Chota, Cajamarca
0.38% Yanasara, Sánchez Carrión, La Libertad
Specimens obviously maintained as cultivated plants
0.55% Arequipa, Arequipa
0.80% Arequipa, Arequipa
0.86% Quecheha, Arequipa
1.13% Pueblo Libre, Lima
All of the above were reported in CIUNO et al. 2009 (Using dried outer green tissue)
No note included as to whether under cultivation
1.4% Barranca
0.78% Chiclayo
Both reported by REYNA PINEDO & FLORES GAÉRCS 2001
4.7% Matucana (harvested in Peru; analyzed in USA)
OGUNBEDDE 2010 (Using dried outer green tissue)

Trichocereus pachanoi above & below
(collected near Matucana; analyzed by Ogunbedde)
Trichocereus pachanoi (Arequipa, Peru) left
**T. pachanoi notes:**

Note that this is nearly 23X from max to min (i.e., a San Pedro specimen was observed that was almost 23 times stronger than another San Pedro that was simultaneously being evaluated). Notice also that Gennaro’s estimation was even higher.

A far more detailed look at this species (and many more images) can be found in **Part B San Pedro**

**Bruhn et al.** 2008 reported lophophine, 3,4-methylenedioxyphenethylamine (homopiperonylamine), and N,N-dimethyl-3,4-methylenedioxyphenethylamine (lobivine) to be new minor alkaloids in this species and in peyote. This paper needs to be viewed with reservations. See comments in **Activity Notes**.

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**Trichocereus pachanoi** (front)

**compared to**

**Trichocereus peruvianus** (back)

Both cultivated by GF in USA (Upper right image)

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**Trichocereus pachanoi**

(from Karel Knize in Lima, Peru)

Above & lower right
Trouts Notes on Cactus Chemistry

Albesiano & Kiesling renamed *T. pachanoi* as *Trichocereus macrogonus* subsp. *pachanoi*.

*Trichocereus pachanoi*

(Cactus Country)
Trichocereus pachanoi
(Field)
MS Smith commented that the description for *pachanoi* gives the hairs of the flower and ovary as black (see example below - we would call these dark brown rather than black but they are darker and sparser). MOST *pachanoi* in U.S. cultivation on the other hand has woolly white to brown hairs on both ovary/fruit and flower tube.

US material also has much more indentation compared to the smoother edged appearance of wild material commonly encountered in Peru & Ecuador (and elsewhere).

Clarification is needed.
growing in a shaman’s garden in southern Peru.
*Trichocereus pachanoi* KK591
(Knize)
Trichocereus pachanoi from Karel Knize in Peru. Above was labeled KK339; Upper right was unlabeled; Cutting below was provided by Knize as Trichocereus peruvianus KK242 f. Matucana.

Another cactus that appears to be a spinier variant of Trichocereus pachanoi (lower right) was encountered by Grizzly in Mendoza, Argentina. He commented that it was extensively cultivated in private gardens and often showed signs of heavy harvesting.
Trichocereus pachanoi

Cultivated under the mistaken name Trichocereus peruvianus Huancabamba.

0.54% mescaline by dry wt.
Grown by Oasis from seeds collected at Huancabamba.

Ogunbede 2010 (Using dried outer green tissue)
1.2% mescaline by dry wt.
Grown by SS from the same seed lot.

Trichocereus pachanoi
(“peruvianus Huancabamba”)
Trichocereus peruvianus (pachanoi) Huancabamba
(Oasis from Mesa Garden seeds)
Trichocereus pachanoi
(Field)
**Trichocereus pachanot?**

This is by far the most commonly represented horticultural form of *pachanoi* in commerce in the USA and possibly also Australia (far more abundance of genetic diversity exists in Oz than in the USA).

My present suspicion is that this may be a hybrid that has displaced bona fide *pachanot* as the predominate cultivar in the US. I do not suspect malice or deliberate deception just simple displacement over time due to the vast numbers generated by both individual growers and by commercial propagation operations due to its far greater growth rate & overall vigor, cold/heat tolerances and rot resistance when compared to a bona fide *Trichocereus pachanoi*.

My present GUESS based on its flowers, habit and intense vigor is that this may be a *bridgesii* crossed with a *pachanot* or something similar but whether work is ever done that is capable of establishing this one way or another remains to be seen. It might be a product of horticulture but there is some, presently anecdotal, evidence to suggest it might have entered cultivation as a Bolivian collection during Harry Blossfeld's Andean expedition.

An error that I (Trout) have helped to widely propagate is referring to this cultivar as Backeberg's clone. Whether there really is such a thing as a clone line from Backeberg's hands that can be identified in horticulture cannot presently be established despite the best efforts of friends in Germany.

If Backeberg did bring a clone line into horticulture it would be a bona fide *pachanoi* and not the cultivar I have so often in past years mistakenly called Backeberg's clone.

See the growing summary of thoughts and photos at: “*pachanoi* or *pachanot*?”  

The main body of this thought is also now attached to the San Pedro PDF also located at the same website.

Presence of mescaline is established through innumerable human bioassays despite it not being clear if it has ever seen formal published analysis.

Pumangura's 0.155% material may also have been this plant but I cannot determine this one way or the other. It is tempting to think of other low values in the literature as being from the same source but is is clear that at least some came as seedlings which were produced by one or more of the many Western greenhouses supplied from known commercial collectors of wild seeds such as Karel Knize or Friedrich Ritter or Harry Johnson and others AND there are two Peruvian samples that produced 0.00% mescaline for Cjuno so only more questions arise if looking closely at what little is known.

It IS clear that its mescaline content is generally low: typically it is less than 0.2% by dry weight. In the otherwise unpublished isolations appearing online values for mescaline concentrations falling in the range of 0.1% to less than 0.05% are the most common.

Based on their bioassay results it is believed by several anonymous correspondents that other alkaloids such as 3-Methoxytyramine and DMPEA may also be present.

*Trichocereus pachanot*  
(RBG)
Trichocereus pachanoi
(A typical Western cultivar)
Trichocereus pachanoi “Super Pedro”

Wild collected in Ecuador in the late 1980s; now in cultivation in Australia.
Trichocereus aff. pachanoi (Peru 64.0762)
(Clone wild collected by Paul C. Hutchison, Jerry K. Wright & R.M. Straw on August 8, 1964 as PCH et al. 6212)
0.82% mescaline by dry weight. (HPLC)

Ogunbodede 2010 (using green outer tissue)
Originally collected from shaded canyon of Rio Marañon, Chagual, Huamachuco, La Libertad, above Chagual, 5 km below Aricapampa. Elev. 2740 m.
Trichocereus aff. pachanoi PCH et al. 6212
closer view
Trichocereus cv. ‘Tom Juul’s Giant’ [Note 6]
Unclear in origin prior to Tom Juul. Peru seems probable.
1.4% Ogunbede 2010 (using dried green outer layer)
Presence of Mescaline was both demonstrated by human
bioassay and confirmed previously by gc-ms. but it should
be emphasized that there are conflicting reports ranging
from full activity at 4-6 inches to powerful trips with 1 foot
to complete inactivity with 2 feet.) See the 1998 Entheogen
Review [7 (3): 70] and [7 (4): 99-100] Bioassay information
came from various friends.
See more details and lots of images in Part B San Pedro

Trichocereus pachanoi cv. Juul’s Giant
Upper left was in Tom Juul’s garden
Trouts Notes on Cactus Chemistry

Juul’s Giant appears to be highly variable in potency with some apparently being completely inactive. It is purported by some users to contain additional alkaloids and this has been supported in some but not all gc-ms.

At least 2 forms are in cultivation. GC-MS by Shulgin showed them to be distinct from each other chemically even though the original source was believed to be identical (Jim Daniel)

Juul’s Giant (A):
Unknown Isoquinoline was 90%
Mescaline less than 10%
minor Isoquinoline (not identified)
3 trace Isoquinolines (not identified)
[In a second sampling mescaline was the major alkaloid]

Juul’s Giant (JM):
Major alkaloid was an Unknown compound
Second largest peak in the graphs appears to be a lab artifact.
Also observed some sort of phenylethanol

See more details in Part B San Pedro.

It actually gets more complicated as Sasha commented he had thusfar run gc-ms on 5 samples, several of which were from the same form, and came up with 5 different results.
Trichocereus pallarensis Ritter
0.47% (dry outer green tissues) Ogunbede 2010 (From F. Ritter seed obtained from Winter in 1960; also depicted on entire page.)

Trichocereus pallarensis
Now relabelled Echinopsis sp.
Trichocereus pallarensis
Now relabelled Echinopsis sp.
Trichocereus pallarensis
Now relabelled Echinopsis sp.
Trichocereus pasacana (Weber) Britton & Rose
Candicine (0.08% dry wt.) Meyer & McLaughlin 1980;
(0.075% dry wt.) Davis et al. 1983
Hordenine (no quantification) Meyer & McLaughlin 1980;
(over 50% of 1-10 mg total alkaloids/ 100 gm fresh)
Agurell 1969b
N-Methyltyramine (no quantification) Meyer & McLaughlin 1980
Tyramine (no quantification) Meyer & McLaughlin 1980
Has been reported to have stimulant activity in human bioassays.
Anonymous source (via Voogelbreinder)
Trichocereus pasacana Bolivia 55.0259
(Above & left hand column)

Trichocereus pasacana Argentina 90.0989

Trichocereus pasacana inermis Frič 1928 was said to be a synonym for Echinopsis valida Monville in Kreuzinger 1935.
Trichocereus pasacana
(Cactus Country: top left; Field: rest of page)
Trichocereus peruvianus Britton & Rose

AKA “San Pedro”, “San Pedro Macho”, “cuchuma”, “Peruvian Torch” and a number of other common names.

Appears to be 90% water by weight (See Note A).

Tyramine (over 50% of 1-10 mg total alkaloids/100 gm fresh - mescaline was not reported but two minor unknowns were present.) Agurell 1969b [Obtained via European commercial sources]; (0.0085% dry wt.) Pardanani et al. 1977 [Grown from seed in California]

3-Methoxytyramine (trace) Agurell 1969b; (0.01% dry wt.) Pardanani et al. 1977.

3,4-Dimethoxyphenethylamine (trace) Pardanani et al. 1977.

4-Hydroxy-3,5-dimethoxyphenethylamine (0.0035% dry wt.) Pardanani et al. 1977.

Mescaline (0.817% dry wt.) Pardanani et al. 1977 (See Note B) [Underground mythology claiming that 1) this species has 10X the concentration of T. pachanoi & 2) that it is comparable to peyote in potency, appears to have no basis in fact (See Note C). We have been told that a half inch slice of a large fresh stem would yield 500 milligrams of mescaline but this lacks any sort of confirmation. Turner 1998 (Entheogen Review 7 (1): 18.) recommended 4 inches of a 4-1/2 inch diameter plant for the same amount. The amount used in Turner’s dose would indicate no more than 0.8% dry or 0.08% fresh wt. (See Note D) Other human bioassays (Anonymous) indicated that twice this much was required for the same dosage] Many appear to be weaker than this. 0.05% fresh weight may be a better estimate of an average value for good peruvianus strains.

Mescaline was not detected by all investigators including BOTH Agurell 1969b and Dierassi et al. 1955 (Note E)

2-Chloro-mescaline (0.016% dry wt.) Thought to be an extraction artifact. Pardanani et al. 1977

Traces of an unidentified triterpene lactone

Dierassi et al. 1955b [Wild collected: Peru]

Unidentified waxy solid (0.22% by dry wt)

Dierassi et al. 1955b

T. peruvianus notes:

A: Based on one evaluation of a basal slice taken from T. peruvianus ‘Blue Form’.

B: Pardanani et al. 1977 reported the material they analyzed as being KK242 grown in California by Abbey Garden (from Knize seed) What they specifically analyzed is therefore really anyone’s guess at this point but an educated guess would be that it was one of the spiny forms of KK242 as these are what predominately has been produced from Knize’s KK242 seeds. See the assorted KK242 images included in San Pedro for an illuminating look.

C: This only approaches being a true statement if selectively comparing the only published isolation of mescaline from T. peruvianus with the lowest testing T. pachanoi reported to date.

The highest T. pachanoi with a mescaline isolation reported is well over twice Pardanani’s value and an additional estimate exists that is nearly 3 times higher (Please remember that T. pachanoi exists which is many times stronger than other T. pachanoi.) Similarly, the lowest published value for T. pachanoi [0.109%] is greater than the lowest published value for L. williamsii [0.1%]

Both images are Trichocereus peruvianus
Approximation based on a fresh weight determination of 128.5 grams per inch for a 3.75 inch in diameter *Trichocereus* specimen.

The material did give a positive Mayer test, but the ether soluble fraction tested neutral and they were unable to isolate any crystalline material so Djerassi concluded it contained no alkaloid. Agurell on the other hand WOULD have observed even traces of mescaline had they been present.

**Important comment:**
Every horticultural form and variety of *T. peruvianus* lacks a published analysis; except for two versions of “KK242”, one from Knize seed and one from a Knize cutting, the undefined commercial European material was examined by Agurell and the Peruvian material that was screened by Djerassi.

A negative alkaloid analysis was also reported by a friend working with 1.5 year old material grown from seed in New Zealand but this however turned out to be material misnomered *Trichocereus peruvianus trujilloensis*. This was a Dick Van Geest collection that is not a *Trichocereus*. See more comments in San Pedro.

Species appears to be highly variable in potency & palatability. To complicate matters further; even material from the same origin appears highly variable in alkaloid content. Whether this is the result of differences in season, environment, water or time of day of harvest has not been established.

To complicate matters even further still; material from a single clone has been reported to be highly variable in alkaloid content when bioassayed repeatedly.

More study is clearly needed.

Trichocereus peruvianus
Peru 48.1540
(UC)
(Above)

Trichocereus peruvianus
Peru 52.0752
(UC)
Trichocereus peruvianus Peru 48.1540
(BBG)

Trichocereus peruvianus
(Matucana, Peru)

Lower 2 photos by Grizzly
Trichocereus peruvianus

(GF)
Trichocereus peruvianus
(GF)
Trichocereus peruvianus
(GF)
Trichocereus rosei #2 (peruvianus)
(Field)
Trichocereus rosei #2 (peruvianus)
(Field)
Trichocereus rosei #1 (T. peruvianus)
left column
Trichocereus rosei #2 (T. peruvianus)
right column
(Field)
Trichocereus peruvianus
cv. “Blue form”
*Trichocereus peruvianus*

f. Ancash
*Trichocereus peruvianus*
cv. KK338
above
Trichocereus peruvianus KK242
0.817% Mescaline. Seed grown by Abbey Garden using KK242 seeds from Karel Knize.
[Paranani et al. 1977 (Using intact plant)]
0.24% K242 propagated from a live cutting sent by Karel Knize.
[Ogunbode 2010 (Using dried outer green tissue)]

Widely asserted to be nearly useless or totally inactive according to anecdotal bioassay accounts.
Some of this is believed to be the result of some confusion between peruvianus and cuzcoensis in some commercial seeds originating from Karel Knize in Peru. See MS Smith online for comments and the photograph at the bottom of this page. While it is certainly true that there are abundant occurrences of cuzcoensis produced from Knize seeds that were mislabelled KK242 this does not include a huge number of KK242 specimens worldwide which are peruvianus or pachanoi. There are also unmistakable Trichocereus bridgesii specimens which have been grown from Knize’s KK242 seeds.

A plant obtained as a live cutting from Karel Knize in Peru as Trichocereus peruvianus KK242 Matucana has been shown to be as active as many pachanoi plants according to its grower.

Trichocereus peruvianus [or aff. pachanoi?]
0.25% Mescaline. Chavin de Huantar, Huari, Ancash
[Chung et al. 2009 (Using dried outer green tissue)]
Images can be found online of the cacti growing at Chavin de Huantar.

Grown from seeds sold by Knize as
Trichocereus peruvianus KK242

Regrowth on cutting analyzed by Ogunbode
Trichocereus peruvianus KK242
(Oz)
grown from Knize seed by Mulga

Trichocereus peruvianus KK242
cutting obtained from Knize via AH

Trichocereus peruvianus KK242 f. Matucana

Trichocereus peruvianus KK242
as seen by Karel Knize

Trichocereus peruvianus KK242 Rio Chillon
cutting obtained from Knize
Trichocereus peruvianus KK242 Rio Chillon
Obtained as a cutting from Knize
Trichocereus sp. SS03
(An unlabelled Peruvianoid)

Originally from a large adult growing in the remnants of Ed & Mary Gay's collection.
Trichocereus pachanoi × peruvianus
F₁ hybrid created by GF
from Elzner’s pachanoi & peruvianus
Trichocereus pachanoi × peruvianus
F1 hybrid created by GF
from Eltzner’s pachanoi & peruvianus
Trichocereus poco BACKEBERG
Hordenine (over 50% of 1-10 mg total alkaloids/ 100 gm of fresh plant) AGURELL 1969b [European commercial sources]
Trichocereus poco
Trichocereus puquiensis Rauh & Backeberg
Determined to contain Mescaline. (Details farther below.)
Trout’s Notes on Cactus Chemistry

0.28% Chavíña, Lucanas, Ayacucho
0.13% Chumpí, Parincochas, Ayacucho
0.11% Incuyo, Parincochas, Ayacucho
0.50% Vado, Lucanas, Ayacucho
SERRANO 2008 & CHUNO et al. 2009 (Wild Peruvian collections)

0.13% mescaline (From a clone collected by Paul Hutchison)
OGUNBEDDE 2010
[Both accounts above analyzed dried outer green tissues.]

The monstrose form has been reported to be mescaline containing in human bioassay.

20 inches was described as being of “medium strength” (Correspondent requesting anonymity)
Trichocereus purpureopilosus WGT.
Tyramine (10-50% of 10-50 mg of total alkaloids/100 grams fresh) Agurell et al. 1971b
N-Methyltyramine (10-50% of 10-50 mg of total alkaloids/100 grams fresh) Agurell et al. 1971b [Obtained via commercial source in the Netherlands]

Trichocereus purpureopilosus
Flower picture by Jon R. Hanna

Trichocereus riomizquiensis Ritter
0.40% grown from Ritter’s seed (FR 856)
Ogunbedede 2010 (dried outer green tissue)

Trichocereus purpureopilosus
Seedling photos by Evil Genius

Trichocereus riomizquiensis motherplant in 2010
(NMCR)
Trichocereus riomizquiensis Ritter
aka Echinopsis pachanoi subsp. riomizquiensis sensu Nigel Taylor
Trichocereus riomizquiensis
regrowth on the cutting analyzed by Ogunbedede
(The mother was grown at NMCR from “FR856” seeds that Horst obtained from Fernando Caralt de Riviere.)

Trichocereus santaensis OST 92701
top shows an older column with much sun
above shows new growth in very little sun
(This specimen was analyzed by Ogunbedede)
Trichocereus santaensis
H 76747 (FK 873) ISI 97-37

FK 873 was collected by Fred Kattermann at 7900 ft. altitude, 3 km south of Mancos, Carhuaz Prov., Ancash Dept., Peru.
*Trichocereus santaensis*

(HBG via SS)

Ostolaza collected seeds ca. 3000 m in the Santa Valley of Peru
**Trichocereus santaensis Rauh & Backeberg**

Successful bioassay reported by source requesting anonymity.
0.31% Mescaline. Mancos, Yungay, Ancash

Cuñó et al. 2009 (Wild Peruvian collection.)
0.32% (using OST 92701 seed-grown in cultivation.)

Ogundebede 2010

(Everything above using dried outer green tissue.)

Palomino’s 1972 dissertation details the process he used for isolating alkaloids and describes their physiological effects on mice (with results that were strongly reminiscent of the comments in Cruz Sanchez 1948)

He described *Trichocereus santaensis* as being of “low toxicity.” (Meaning low alkaloid?) Oddly, it never mentioned how he identified the plant or what the alkaloids were.

Our thanks to Dr. Carlos Ostoala for completing the details concerning this obscure paper.
Trichocereus santiaguensis
(Cactus Country)
Trichocereus santiaguensis (Spegazzini) Backeberg
Hordenine (10-50% of the 1-10 mg of total alkaloids/100 grams fresh) Agurell et al. 1971b [commercial sources in Germany & the Netherlands]
Tyramine (10-50% of 1-10 mg of total alkaloids/100 grams fresh) Agurell et al. 1971b

Trichocereus santiaguensis
above
Considered to be conspecific with T. spachianus. Hunt 2006

Trichocereus schickendantzii (Weber) Britton & Rose
N-Methyltyramine (trace) Agurell 1969b
Hordenine (over 50% of 1-10 mg total alkaloids/100 gm fresh) Agurell 1969b [Obtained via European commercial sources]

Trichocereus schickendantzii f. cristata is listed as an available horticultural offering in Kreuzinger 1935.
Trichocereus schoenii RAUH & BACKEBERG
Mescaline was isolated from three wild Peruvian collections:
0.22% Cotahuasi, La Unión, Arequipa (June)
0.20% Pampacola, Castilla, Arequipa (July)
0.14% Huambo, Arequipa (April)
All of above from SERRANO 2008 & CIUNO et al. 2009
(dried outer green tissue; all percentages by dry weight)
See also the work of CHOQUENAIRA et al. 2007
Trichocereus schoenii is now merged with T. cuzcoensis.
Trichocereus scopulicola **Ritter**

0.85% Grown from **FR 991** seed by NMCR

Ogunbedede 2010 (dried outer green tissue)

Despite some earlier attempts to reject this as an invalid species, Hunt recognizes it as a valid *Echinopsis* species: *Echinopsis scopulicola* (Ritter) Mottram - presenting as the describer someone who has neither written nor published a taxonomic description! [Personal communication with Roy Mottram]

First demonstrated to contain mescaline based on human bioassays.

See **Activity Notes**.
Trichocereus scopulicola
(Cactus Country)
Trichocereus scopulicola
(Cactus Country)
Next to a bridgesii column on the left.
Trichocereus scopulicola  (Cactus Country)
Trichocereus scopulicola (Australia)

Trichocereus scopulicolus RITTER See as Trichocereus scopulicola RITTER.

This descriptionless name appeared in Backeberg’s Cactus Lexicon, seemingly to bring the spelling into line with the other Trichocereus species. Backeberg commented that no description was available. Evidently his dislike/hatred of Ritter caused him to not obtain any of Ritter’s three published descriptions.

T. scopulicola is presently suspected of being extinct in the wild.
Trichocereus spachianus (Lemaire) Riccobono
AKA “White torch”
Tyramine (trace) Mata et al. 1972, also reported in Mata & McLaughlin 1976. Not observed by Agurell 1969b. N-Methyltyramine (0.007% dry wt.) Mata et al. 1972, also reported in Mata & McLaughlin 1976; Not observed by Agurell 1969b. Hordenine (over 50% of 1-10 mg total alkaloids/ 100 grams fresh) Agurell et al. 1971b [Obtained via commercial source in Germany].

Trichocereus smrzianus

Trichocereus skottsbergii Backeberg
N-Methyltyramine (1-10% of 10-50 mg of total alkaloids/ 100 grams fresh) Agurell et al. 1971b
Hordenine (Over 50% of the 10-50 mg of total alkaloids/ 100 grams fresh) Agurell et al. 1971b [Obtained via commercial source in Germany]


Trichocereus smrzianus

Trichocereus spachianus (Lemaire) Riccobono
AKA “White torch”
Tyramine (trace) Mata et al. 1972, also reported in Mata & McLaughlin 1976. Not observed by Agurell 1969b. N-Methyltyramine (0.007% dry wt.) Mata et al. 1972, also reported in Mata & McLaughlin 1976; Not observed by Agurell 1969b. Hordenine (over 50% of 1-10 mg total alkaloids/ 100 grams fresh) Agurell et al. 1971b [Obtained via commercial source in Germany].

Trichocereus smrzianus

Trichocereus smrzianus
Trichocereus skottsbergii in Bolivia
Photo by correspondent requesting anonymity
Trichocereus spachianus
(Field)
There are many named and unnamed *Trichocereus* cultivars, forms or maybe even some species that are in need of analysis and/or have been determined to be active in human bioassays. Several are on the pages that follow but most are omitted from this work due to it being unnecessarily redundant with the contents of the San Pedro book. See **Part B San Pedro** for details and many images. There is a pdf available at http://troutsnotes.com/pdf/SP.html.
Trichocereus sp.

We presently do not know the correct identification of this plant. It resembles *bridgesii, uyupampensis* and *knuthianus* (and several other species) but does not seem to be an exact fit for any.

These photos were taken of a plant that used to be in Tom Juul’s garden.

This plant has been proven to be a mescaline container through human bioassay. Correspondent requesting anonymity in 2005.
*Trichocereus* sp. Peru 65.0715

(UC)

Wild collected as cuttings; known locally in Peru as “San Pedro”.
Lacks an analysis.

More recently this SPECIMEN was relabeled *Echinopsis macrogona* Ecuador 58.1079.
Go figure as to how a name, point of origin AND an accession number can change after so many years.
Trichocereus sp. N.Chile (Torres & Torres)
Presence of Mescaline has been proven by human bioassay
Torres & Torres 1995
Lacking published analysis.

Trichocereus sp. SS02 (a T. bridgesii form) Reported to be a reliably effective form in multiple human bioassays; presence of mescaline demonstrated in GC-MS (seemingly as sole alkaloid?) Needs taxonomic study and an analysis.
Anonymous 1999 & 2000. 3 images on this page.
Trichocereus strigosus (Salm-Dyck) Britton & Rose
Tyramine (trace) Nieto et al. 1982
Hordenine (Sole alkaloid present. 10-50 mg/100 grams fresh: Agurell et al. 1971b [Commercially obtained greenhouse material grown in Germany]. (0.139% dry wt.: Nieto et al. 1982)
Mescaline (trace) Nieto et al. 1982
Candicine (0.11% dry wt.) Nieto et al. 1982 [Material from Argentina; Medoza and San Juan provinces]
[One unidentified base also reported. Nieto et al. 1982]
Trichocereus tacaquirensis (Vauel) Cardenas ex Backeb erg

Needs an analysis. Trichocereus taquimbulesis Cardenas is now considered a subspecies of E. tacaquirensis by Hunt.
Probably *Trichocereus tacaquirensis* (Bolivia)

Photo by correspondent requesting anonymity

*Trichocereus taquimbalsis* (Mesa Garden)
Trichocereus taquimbalesis CARDENAS

3-Methoxytyramine. (trace)
Hordenine (1-10% of 10-20 mg total alkaloid/ 100 gm)
3,4-Dimethoxyphenethylamine (trace)

Mescaline (5-25+ mg. per 100 grams)

AGURELL et al. 1971b [Obtained via commercial source in the Netherlands] (all % are as fresh weight)

See comments in Activity Notes.
Trichocereus taquimbalesis

(H 53086 Bolivia; ISI 98-20)
From a plant collected by E. Aquilar (M.Kinnaeh et al. 2760B) at Toco, Cliza, Cochabamba Dept., Bolivia.
Trichocereus taquimalensis (HBG)
R. Kiesling s.n.
(H 68146; ISI 98-21)
Collected in southern Bolivia.

481
Trichocereus taquimbalensis
(HBG)
Trichocereus tarmaensis needs an analysis.

See more images in San Pedro.
Trichocereus tarmaensis
(UC)
Trichocereus tephrocactus
(Field)
Needs an analysis. Now considered Harrisia tetracantha.
Trichocereus terscheckii (Parmentier) Britton & Rose
92-95% water by weight Reti & Castrillón 1951
Total alkaloid content varied between 0.25-1.2% dry wt. Reti & Castrillón 1951 [Collected from the wild in Argentina]
3,4-Dimethoxyphenethylamine Observed as minor alkaloid by Shulgin in GC-MS
N-Methyl- 3,4-dimethoxyphenethylamine Observed as minor alkaloid by Shulgin in GC-MS
N,N-Dimethyl-3,4-dimethoxyphenethylamine Observed as minor alkaloid by Shulgin in GC-MS
Mescaline (5-25+ mg. per 100 grams fresh.) (Major alkaloid) Agurell 1969b [Obtained via European commercial sources]; [Also noted in Agurell 1969b: “contains rather exclusively mescaline”]
(Minor alkaloid [Reported a yield of 4 gm. from 10 kg. dry: 0.04% dry wt]; sometimes entirely absent in higher alkaloid material) Reti & Castrillón 1951. Found to be the major alkaloid by Shulgin in GC-MS (material from NW Argentina)
N-Methylmescaline Observed by Shulgin in GC-MS
Anhalonine (trace detected) Reti & Castrillón 1951. Shulgin unable to detect in GC-MS
Needs further analysis. Unpublished GC-MS has variously shown mescaline as the only alkaloid, the major of multiple alkaloids or only a minor alkaloid.
(Conflicting analysis seems to be the norm. An hplc example taken from the Internet: 0.061% [sic] mescaline content by dry wt. Of 0.72% total alkaloid: 16% was mescaline [0.11%], 44% was Anhalonine or some PEA 0.32[], 30% was either methyl or dimethyl mescaline [0.22%] and 10% was an unidentified PEA [0.07%]. There appears to be mathematical errors in this account so it should all be viewed with caution. For instance 16% of 0.72 is 0.11 not 0.061)
The claim of DMT being in this cactus resulted from an unfortunate typo by Schultes & Hofmann; intending N,N-Dimethylmescaline not N,N-Dimethyltryptamine. This error has sadly taken on a life of its own via the counterculture rumor mills.

See comments in Activity Notes.
Trichocereus terscheckii

(UC) Planted by Myron Kimnach more than 50 years before this image was taken.
Myron has now outlived this gigantic plant.
*Trichocereus terscheckii* (UC) from the southern part of its range
Trichocereus thelegonoides (Spegazzini) Britton & Rose
Hordenine (Sole alkaloid; 10-50 mg/100 grams fresh)  
Agurell et al. 1971b [Obtained via commercial source in Germany]

Trichocereus thelegonoides (spegazzini) Britton & Rose
Hordenine (Over 50% of the 10-50 mg of total alkaloids/100 grams fresh)  
Agurell et al. 1971b [Obtained via the Kew Royal Botanical Gardens & a commercial source in Germany]

Trichocereus torataensis Ritter Needs an analysis Considered a synonym of T. peruvianus by Hunt

Trichocereus tulhuayacensis Ochoa
Claim for the presence of mescaline is made by Caycho Jimenez 1977 (page 91) but he cites no reference to support his assertion.
See comments in Activity Notes.

Trichocereus tunariensis Cardenas
Tyramine (10-50% of 10-50 mg of total alkaloids/100 grams fresh)  
Agurell et al. 1971b
Hordenine (10-50% of the 10-50 mg of total alkaloids/100 grams fresh)  
Agurell et al. 1971b [Obtained via commercial source in the Netherlands]
Trichocereus thelegonus
(HBG)

490
Trichocereus thelegonus
(Field)
Trichocereus totorensis
(Field)

This species presently lacks an analysis.
Trichocereus uyupampensis  BACKEBERG

0.053% Ogunbedede 2010

UC records indicated this was grown from a clone deposited at Monaco by Backeberg. (Analysis using dried outer green tissue) I presently (2012) believe this plant to be misidentified. The results of the analysis performed by Ogunbodeede were accurate but the identification of this species by Monaco was not.
Said to be *Trichocereus uyupampensis* (UC)
Trichocereus validus (Monville) Backeberg
Mescaline (Over 25 mg. per 100 grams fresh.) Agurell et al. 1971b [Obtained via the Kew Royal Botanical Gardens]
Note that there are SEVERAL unrelated plants stuffed into this name as represented in horticulture. NOT synonymous with Echinopsis valida which is short and clumping. It has been uselessly redesignated as Echinopsis sp. by Hunt. The stout, taller columnar form apparently rarely offsets, and is MOST LIKELY what was analyzed by Agurell. Its not possible to know with any certainty.

Seemingly without further comment or a reference, Hunt inexplicably refers to this as = T. uyupampensis.

Echinopsis forbesii was said to be synonymous with Echinopsis valida Monville by Britton & Rose

Trichocereus terscheckii was said to be synonymous with Echinopsis valida Monville in Kreuzinger 1935
Trichocereus validus
(SS)
Trichocereus validus
(Field)
from Blossfeld’s Andean expedition
Trichocereus validus

(Field: top left; Cactus Country: other two)
Trichocereus vollianus
(Cactus Country)
Trichocereus vollianus Backeb erg
Mescaline (traces by dry weight)
Siniscalco 1983

Trichocereus werdermannianus Backeb erg
Tyrmine (trace) Agurell 1969a and 1969b
3-Methoxytyramine (trace) Agurell 1969b
3,4-Dimethoxyphenethylamine (1-10% of 10-50 mg total alkaloids/100 gm fresh) Agurell 1969b [Obtained via European commercial sources]
4-Hydroxy-3,5-dimethoxyphenethylamine (trace) Agurell 1969b; (0.1% of total alkaloid) Agurell 1969a
Mescaline (5 to 25+ mg. per 100 grams fresh.) Agurell 1969a and 1969b
[3,4-diMeO-5-OH-PEA is also listed, in error, for this species. Neither Agurell 1969 nor T.A. Smith 1977, the references cited, reported this compound.]
Human bioassays have found this species to be highly variable; it is claimed that some are active and others are not. Anonymous source relayed via MS Smith 1998
Reported in some human bioassays to be 2-3X as strong as T. pachanoi. 1998
Entheogen Review 7 (3): 70-71.

Trichocereus volcanensis
Lack an analysis

According to David Hunt’s CITES Cactaceae Checklist werdermannianus no longer existed and was absorbed into terscheckii. This was done apparently without further comment and with no reference to any source that did not keep them separated.
In Hunt’s Cactus Lexicon they reappeared as separate species.
Patching the hole in the Rules of Nomenclature which permits this type of casual publication of taxonomic nomenclatural decision making will be required if cactus taxonomy is ever to become a branch of science. It is often regarded as science but the reality is that taxonomy needs to require the same proofs or reference to published reasoning that is demanded by good science.
In this case I can only scratch my head and wonder.
Amusingly, almost as fast as Anderson published the merger in The Cactus Family, some botanical gardens such as UC changed the name tags on their werdermannianus specimens.
Trichocereus werdermannianus
Bolivia 71.0083

Relabelled *T. terscheckii* following the publication of Anderson’s *The Cactus Family.*
Trichocereus werdermannianus Bolivia 71.0083

entire page

Everything on this page was relabelled *T. terscheckii* following the publication of Anderson's *The Cactus Family*.

*Tunilla soehrensii* (Britton & Rose) D.R. Hunt & Iliff
See as *Tephrocactus soehrensii*
A comment on the state of the genus Turbinicarpus.
Many members of this genus has been repeatedly shuffled and recombinated as various varieties, subspecies and forms of each other with seemingly little to no agreement with earlier workers. This seemingly constant revision with its novel recombinations of former species within one species or another (and the repetition of the same but with totally different subspecific assignments) is a major source of the confusion in horticulture; (especially among those growers who disdain the use of trinomials).
It is also a major source of the assorted labeling inconsistencies that the careful reader will notice below. We have left all Turbinicarpus depicted as they were labeled (altering only their subspecific placements for the sake of uniformity) since all are either in the collections of serious Turbinicarpus collectors/growers or botanical gardens. We are certainly not qualified to sort out the taxonomic mess known as the genus Turbinicarpus but look forward to the day that DNA work begins to help set it on a more sound basis.
Our choices of synonyms used do not indicate our agreement with them, we have simply attempted to present this in a manner enabling the reader to see what analytical work has been done. We suggest that any taxonomic treatments of the genus or relationships within it be viewed with a healthy dose of caution pending DNA work.
Another problematic issue regards the fact that most of the Turbos are highly variable based on conditions of growth and that European labelings frequently conflict with the presented identifications of North American horticultural material.
We therefore present the following, largely, as they were labeled. Caveat lector!

Turbinicarpus alonsoi Glass & Arias
(% dry weight)
N-Methyltyramine (0.0052 ± 0.0008%) 
Hordenine (0.0048 ± 0.0008%) 
N-Methyl-3,4-dimethoxyphenethylamine (0.0020 ± 0.0005%) 
Pellotine (0.0075 ± 0.0009%) 
Štarha et al. 1999b
[All Turbinicarpus species analyzed by Dr. Štarha were seed grown in Czechoslovakian greenhouses.]

Turbinicarpus dickisoniae (Glass & Foster) Glass & Hofer See as Turbinicarpus schmiedickeanus ssp. dickisoniae
Turbinicarpus flaviflorus G.Frank & Lau See as Turbinicarpus schmiedickeanus ssp. flaviflorus
Turbinicarpus gracilis Glass & Foster See as Turbinicarpus schmiedickeanus ssp. gracilis
cristate *Turbinicarpus hoferi*  

*Turbinicarpus laui* Glass & Foster Needs an analysis.  
*Turbinicarpus jauernigii* G.Frank Needs an analysis.

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*Turbinicarpus lauii*  

*Turbinicarpus klinkerianus* Backeberg & H.J. Jacobsen See as  
*Turbinicarpus schoenrickeanus* ssp. klinkerianus  
*Turbinicarpus krainzianus* (G.Frank) Backeberg See as *Turbinicarpus pseudomacrochele* ssp. krainzianus  
*Turbinicarpus krainzianus* var. minimus See as *Turbinicarpus pseudomacrochele* ssp. krainzianus f. minima

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*Turbinicarpus jauernigii*
Trouts Notes on Cactus Chemistry

Turbinicarpus lausseri

Needs an analysis.

*Turbinicarpus lausseri*

Photo by Johnny B. Goode

Turbinicarpus lilinkeudus

Needs an analysis.

*Turbinicarpus lilinkeudus*

Photo by Johnny B. Goode

Turbinicarpus lophophoroides (Werdermann) Buxbaum & Bäckeberg

Phenethylamine (1.04% ± 0.27) of total alkaloid fraction of Over 500 mg total alkaloids per 100 gm of fresh plant

Tyramine (1.82% ± 0.17) of total alkaloid fraction of Over 500 mg total alkaloids per 100 gm of fresh plant

N-Methyltyramine (0.13% ± 0.11) of total alkaloid fraction of Over 500 mg total alk./100 gm of fresh plant

Hordenine (91.69% ± 0.54) of total alkaloid fraction of Over 500 mg total alkaloids per 100 gm of fresh plant

Mescaline (Trace detected)

N-Methylmescaline (0.51% ± 0.11) of total alkaloid fraction of Over 500 mg total alk./100 gm of fresh plant

N,N-Dimethylmescaline (Trace detected)

O-Methylanhalidine (0.55% ± 0.02) of total alkaloid fraction of over 500 mg total alk./100 gm of fresh plant

Anhalinine (0.15% ± 0.08) of total alkaloid fraction of Over 500 mg total alkaloids per 100 gm of fresh plant

Anhalonidine (2.37% ± 0.12) of total alkaloid fraction of Over 500 mg total alkaloids per 100 gm of fresh plant

Pellotine (0.46% ± 0.08) of total alkaloid fraction of Over 500 mg total alkaloids per 100 gm of fresh plant

Štarha et al. 1999c
Turbinicarpus pseudomacrochele
Trout's Notes on Cactus Chemistry

Turbinicarpus lophophoroides ssp. jauernigii (Frank) Battaia & Zanovello See as Turbinicarpus jauernigii
Turbinicarpus macrochele (Werdermann) Buxbaum & Backeberg See as Turbinicarpus schmiedickeanus ssp. macrochele
Turbinicarpus macrochele ssp. macrochele var. polaskii P. Lechner & Jantsch See as Turbinicarpus schmiedickeanus f. polaskii
Turbinicarpus macrochele var. schwarzi f. polaskii Kladiwa See as Turbinicarpus schmiedickeanus f. polaskii
Turbinicarpus polaskii Backeberg See as Turbinicarpus schmiedickeanus f. polaskii

Turbinicarpus panarito Needs an analysis.

Turbinicarpus pseudomacrochele ssp. krainzianus (G. Frank) Glass & Foster
Phenethylamine (1.12% ± 0.14% of total alkaloid fraction of 250-500 mg total alkaloids per 100 gm of fresh plant)
Tyramine (0.98% ± 0.18% of total alkaloid fraction of 250-500 mg total alkaloids per 100 gm of fresh plant)
N-Methyltyramine (Trace detected) [Not listed in Štarha 2001c]

Hordenine (49.60% ± 0.55% of total alkaloid fraction of 250-500 mg total alkaloids per 100 gm of fresh plant)
Mescaline (2.48% ± 0.19% of total alkaloid fraction of 250-500 mg total alkaloids per 100 gm of fresh plant)
N-Methylmescaline (3.27% ± 0.09% of total alkaloid fraction of 250-500 mg total alk./ 100 gm of fresh)
N,N-Dimethylmescaline (2.89% ± 0.15% of total alkaloid fraction of 250-500 mg total alk./ 100 gm of fresh)
[Candicine is also listed in Štarha 2001c but the only citation given is Štarha et al. 1999c which does not support it.]
O-Methylanhalidine (0.77% ± 0.04% of total alkaloid fraction of 250-500 mg total alk./ 100 gm of fresh)
Anhalinine (29.24% ± 0.04% of total alkaloid fraction of 250-500 mg total alk./ 100 gm of fresh)
Anhalonidine (2.44% ± 0.13% of total alkaloid fraction of 250-500 mg total alk./ 100 gm of fresh plant)
Pellotine (0.36% ± 0.08% of total alkaloid fraction of 250-500 mg total alkaloids per 100 gm of fresh plant)
Štarha et al. 1999c

Dehydrogeosmin - Minor volatile in floral scent.
Sesquiterpene alcohol 1 - Trace volatile in floral scent.
Sesquiterpene alcohol 2 - Minor volatile in floral scent.
Schlumberger et al. 2004 (in tepals; gc-ms)

Turbinicarpus pseudomacrochele (Backeberg) F. Buxbaum & Backeberg
Hordenine (Sole alkaloid. 1-10 mg of total alkaloids/ 100 gm. fresh.) Bruhn & Bruhn 1973
Turbinicarpus pseudomacrochele
ssp. kraizianus seedling
Mesa Garden 1288.7

Turbinicarpus pseudopectinatus (Backeberg)
Glass & Foster
Hordenine (Over 50% of over 50 mg of total alkaloids/100 gm. fresh.) Bruhn & Bruhn 1973
Phenethylamine (0.98% ± 0.12) of total alkaloid fraction of over 500 mg total alkaloids per 100 gm of fresh plant
Tyramine (3.18% ± 0.19) of total alkaloid fraction of over 500 mg total alkaloids per 100 gm of fresh plant
N-Methyltyramine (25.15% ± 1.21) of total alkaloid fraction of over 500 mg total alkaloids per 100 gm of fresh plant

Hordenine (62.11% ± 2.42) of total alkaloid fraction of over 500 mg total alkaloids per 100 gm of fresh plant
N-Methylmescaline (1.11% ± 0.13) of total alkaloid fraction of over 500 mg total alkaloids per 100 gm of fresh plant
N,N-Dimethylmescaline (Trace detected)
O-Methylanhalidine (1.92% ± 0.15) of total alkaloid fraction of over 500 mg total alkaloids per 100 gm of fresh plant
Anhalinine (2.88% ± 0.15) of total alkaloid fraction of over 500 mg total alkaloids per 100 gm of fresh plant
Štárha et al. 1999 (P. pseudopectinata was analyzed as Turbinicarpus synonym. Seed grown in Czechoslovakia)
Trout's Notes on Cactus Chemistry

*Turbinicarpus schmiedickeanus*

*Turbinicarpus pseudomacrochele*

*Turbinicarpus schmiedickeanus ssp. flaviflorus* (HBG)
Trouts Notes on Cactus Chemistry

*Turbinicarpus roseiflorus* (Backeberg) G. Frank

Needs an analysis.

*Turbinicarpus schmiedickeanus* (Bödeker) Buxbaum & Backeberg

Also encountered *schmiedeckianus*; we used the spelling of Glass & Foster 1977

- Phenethylamine (1.1% ± 0.12) of total alkaloid fraction of 100-250 mg total alkaloids per 100 gm of fresh plant
- Tyramine (5.46% ± 0.14) of total alkaloid fraction of 100-250 mg total alkaloids per 100 gm of fresh plant
- N-Methyltyramine (Trace detected) [Not listed in Štarha 2001c]
- Hordenine (43.02% ± 1.86) of total alkaloid fraction of 100-250 mg total alkaloids per 100 gm of fresh plant
- N-Methylmescaline (1.02% ± 0.21) of total alkaloid fraction of 100-250 mg total alkaloids per 100 gm of fresh plant
- N,N-Dimethylmescaline (Trace detected)
- O-Methylanhalidine (2.76% ± 0.42) of total alkaloid fraction of 100-250 mg total alkaloids per 100 gm of fresh plant
- Anhalinine (17.19% ± 1.00) of total alkaloid fraction of 100-250 mg total alkaloids per 100 gm of fresh plant
- Anhalonidine (19.86% ± 1.41) of total alkaloid fraction of 100-250 mg total alkaloids per 100 gm of fresh plant
- Pellotine (9.02% ± 0.06) of total alkaloid fraction of 100-250 mg total alkaloids per 100 gm of fresh plant

Štarha *et al.* 1999c
**Trouts Notes on Cactus Chemistry**

**Turbinicarpus schmiedickeanus ssp. dickisoniae**

*(Glass & Foster)* N.P. Taylor

- Phenethylamine (1.70% ± 0.15) of total alkaloid fraction of 250-500 mg total alkaloids per 100 gm of fresh plant
- Tyramine (2.59% ± 0.13) of total alkaloid fraction of 250-500 mg total alkaloids per 100 gm of fresh plant
- N-Methyltyramine (0.51% ± 0.02) of total alkaloid fraction of 250-500 mg total alkaloids per 100 gm of fresh plant
- Hordenine (42.45% ± 0.45) of total alkaloid fraction of 250-500 mg total alkaloids per 100 gm of fresh plant
- Phenethylamine (1.01% ± 0.21) of total alkaloid fraction of 100-250 mg total alkaloids per 100 gm of fresh plant
- Tyramine (3.08% ± 0.08) of total alkaloid fraction of 100-250 mg total alkaloids per 100 gm of fresh plant
- N-Methyltyramine (Trace detected)
- Hordenine (Trace detected)
- Phenethylamine (Trace detected)
- Tyramine (Trace detected)
- N-Methyltyramine (Trace detected)
- Hordenine (Trace detected)

**Turbinicarpus schmiedickeanus ssp. flaviflorus**

*(FranK & Lau)* Glass & Foster

- Phenethylamine (3.08% ± 0.08) of total alkaloid fraction of 100-250 mg total alkaloids per 100 gm of fresh plant
- Tyramine (3.08% ± 0.08) of total alkaloid fraction of 100-250 mg total alkaloids per 100 gm of fresh plant
- N-Methyltyramine (Trace detected)
*Trxin ricarpus schmiedickean us*
ssp. *dickisoniae*
(HBG)
Turbinicarpus schmiedickeanus ssp. flaviflorus
Field collected in Mexico H 61445
(HBG)
Trouts Notes on Cactus Chemistry

_Turbinicarpus schmiedickeanus ssp. gracilis_ (Glass & Foster) Glass
Tyramine (4.98 ± 0.28% of total alkaloid content)
N-Methyltyramine (trace)
Hordenine (48.15 ± 0.97% of total alkaloid content)
O-Methylanhalidine (2.48 ± 0.42% of total alkaloid content)
Anhalinine (20.69 ± 1.12% of total alkaloid content)
Pellotine (7.92 ± 0.56% of total alkaloid content)
Anhalonidine (trace)
Štarha 2001c cited Štarha 2001b

_Turbinicarpus schmiedickeanus ssp. gracilis_ H 60025 Mexico (specimen collected by Dickson) (Huntington)

_Turbinicarpus schmiedickeanus ssp. klinkerianus_ (Backeberg & Jacobson) N.P.Taylor
Tyramine (2.95 ± 0.15% of total alkaloid content)
N-Methyltyramine (trace)
Hordenine (52.15 ± 0.40% of total alkaloid content)
N-Methylmescaline (trace)
O-Methylanhalidine (2.78 ± 0.40% of total alkaloid content)
Anhalinine (37.15 ± 0.90% of total alkaloid content)
Pellotine (0.43 ± 0.15% of total alkaloid content)
Anhalonidine (trace)
Štarha 2001c cited Štarha et al. 2000

_Turbinicarpus schmiedickeanus ssp. klinkerianus_ f. schwarzi (Shurly) Panarotto See as _Turbinicarpus schmiedickeanus ssp. schwarzi_
Turbinicarpus schmiedickeanus ssp. macrochele
(Werdermann) Glass & Foster
Tyramine (2.90 ± 0.15% of total alkaloid content)
N-Methyltyramine (trace)
Hordenine (49.01 ± 1.38% of total alkaloid content)
O-Methylanhalidine (2.50 ± 0.30% of total alkaloid content)
Anhalinine (35.42 ± 0.85% of total alkaloid content)
Pellotine (0.03 ± 0.10% of total alkaloid content) [Given on p. 89 but not included in its by-species listing on p. 52]
Anhalonidine (trace)
Štarha 2001c cited Štarha 2001b

Turbinicarpus schmiedickeanus f. polaskii
Tyramine (2.93 ± 0.20% of total alkaloid content)
N-Methyltyramine (trace)
Hordenine (49.11 ± 1.18% of total alkaloid content)
O-Methylanhalidine (2.58 ± 0.25% of total alkaloid content)
Anhalinine (36.88 ± 0.92% of total alkaloid content)
Pellotine (0.38 ± 0.10% of total alkaloid content) [Given on p. 89 but not included in its by-species listing on pp. 51-52]
Anhalonidine (trace)
Štarha 2001c cited Štarha 2001b

Our suspicion is that the photo on the bottom left may be a polaskii (which has been a variety of macrochele and also a form of schwarzii) Careful reading of the various descriptions for its assorted name proposals is urged for any who aren’t already confused enough.

Turbinicarpus schmiedickeanus ssp. macrochele

Turbinicarpus schmiedickeanus ssp. macrochele

Turbinicarpus schmiedickeanus f. polaskii
Trout's Notes on Cactus Chemistry

**Turbinicarpus schmiedickeanus ssp. schwarzi**  
*(Shurly) N.P. Taylor*

- Phenethylamine (1.07% [± 0.42] of total alkaloid fraction of 250-500 mg total alkaloids per 100 gm of fresh plant)
- Tyramine (2.92% [± 0.25] of total alkaloid fraction of 250-500 mg total alkaloids per 100 gm of fresh plant)
- N-Methyltyramine (Trace detected) [Not listed in Štarha 2001c]
- Hordenine (48.81% [± 2.72] of total alkaloid fraction of 250-500 mg total alkaloids per 100 gm of fresh plant)
- Mescaline (1.26% [± 0.21] of total alkaloid fraction of 250-500 mg total alkaloids per 100 gm of fresh plant)
- N-Methylmescaline (0.98% [± 0.24] of total alkaloid fraction of 250-500 mg total alkaloids per 100 gm fresh)
- N,N-Dimethylmescaline (Trace detected) [Not listed in Štarha 2001c]
- O-Methylanhalidine (2.82% [± 0.41] of total alkaloid fraction of 250-500 mg total alkaloids per 100 gm fresh)
- Anhalinine (39.57% [± 1.14] of total alkaloid fraction of 250-500 mg total alkaloids per 100 gm of fresh plant)
- Anhalonidine (0.52% [± 0.11] of total alkaloid fraction of 250-500 mg total alkaloids per 100 gm of fresh plant)
- Pellotine (0.41% [± 0.11] of total alkaloid fraction of 250-500 mg total alkaloids per 100 gm of fresh plant)
  
*Štarha et al. 1999c*
Turbinicarpus schmiedickeanus ssp. schwarzi

Turbinicarpus schmiedickeanus ssp. schwarzi f. rubriflorus
Tyramine (2.90 ± 0.12% of total alkaloid content)
Hordenine (48.99 ± 0.40% of total alkaloid content)
O-Methylanhalidine (2.51 ± 0.25% of total alkaloid content)
Anhalinine (37.58 ± 1.83% of total alkaloid content)
Pellotine (0.33 ± 0.10% of total alkaloid content)
Štarha 2001c: the actual primary source citation is unclear to me. (It was not given separately in the by-species listing. The data above appears on page 89. The by-species listing for schwarzi appears to imply that Štarha 1999 and/or Štarha et al. 1999c was the reference(s) BUT neither one is listed for O-Methylanhalidine or for Pellotine in the by-species entry on page 52.)

Both photos are of the same specimen.

Turbinicarpus schmiedickeanus f. polaskii
(seedling from Mesa Garden: catalog #1293) lower left
Trouts Notes on Cactus Chemistry

Wigginsia tephracantha
LinK & otto D.M.Porter
Hordenine (%) DeVries et al. 1971
Weddellite & α-quartz were identified as druses, bipyramids (few) & crystal sand (abundant).
Monje & Baran 2002

Wigginsia paucicostata
This species and all Wigginsia on this page, other than W. arechavaletai, are now lumped into Parodia sellowii.

Wigginsia arechavaletai
Mucilage determined to be comprised of Arabinose (2.1%), Galactose (18.3%), Galacturonic acid (20.8%), Rhamnose (51.6%) & Xylose (2.7%).
Moyna & DiFabio 1978 (Analyzed MAM 1694)

Wigginsia erinacea (Haworth) D.M.Porter
Hordenine (%) DeVries et al. 1971
Mucilaginous polysaccharide was found to be 0.31% percentage of total weight of fresh plant.
Uronic acid content of polysaccharide: 51%
Rhamnose: arabinose, galactose (3.7:1:2.7)
Mindt et al. 1975

Wigginsia macrocantha (Arechavaleta) D.M.Porter
Hordenine (%) DeVries et al. 1971

The former members of Wigginsia have been placed in Parodia.
Want more Trout?

The 4th edition of Sacred Cacti is now online!
http://SacredCacti.com/

Cactus Chemistry By Species
The work that you are now reading. Also available in an illustration-free version for easier use by researchers.

San Pedro
http://troutsnotes.com/pdf/SP.pdf

All of these titles are available for free pdf download at http://troutsnotes.com.

Opening comments from Sacred Cacti

The Cactus Alkaloids
formerly known as Appendix A
Activity (& Mythology) Notes

Images from
ENGELMANN 1859
DIGUET 1928
THOMPSON 1898
TROUT 2013
5 San Pedros

The “5 San Pedros” purportedly recognized by some Peruvian shamans (Personal communication with a correspondent in South America requesting anonymity)

Photos to the immediate right & occurring later herein were used with permission.

These plants were said to have been collected in the vicinity of Matucana, Peru except for the one on the far right which was purported to be a bridgesii from Huanuco.

Attempts to obtain live cuttings including the dark pachanoi second from the right procured the specimen that was analyzed by Ogunbodede.

See comments and images for the one second from the far left under Haageocereus acranthus

See comments and images for the one on the far right under Lemaireocereus laetus and Lemaireocereus matucanense.

I know little about them beyond the unconfirmed claim that they are said to be used by shamans in Peru as San Pedro.

Additional photographs of the plants that were shipped from Peru are on the previous page.
The word ‘mythology’ appears in the title for an important reason. In the section that follows many medical and ethno-medicinal applications are mentioned. This is historical information that has been collected from the literature and the inclusions should not be assumed to mean that they are accurate or appropriate or effective in their recorded applications. None of this should this be regarded as a recommendation to employ any of these for any application or taken as a suggestion about how to treat any medical conditions. Ethnographic and anthropological accounts in particular may actually be mistakenly overlaying linear Western concepts onto comments made by nonlinear thinkers, especially when they assert hallucinogenic activity. If no bioassay was performed or recorded by the worker reporting those particular claims it needs to be regarded as only anecdotal hearsay.

**Acanthocereus pentagonus**
(This is now *Acanthocereus tetragonus*)
Antihelminthic activity (no detail or reference). Soulaire 1947
Has an edible fruit. Standley 1924: 906-907

**Aporocactus flagelliformis**
Dried flowers are used for “heart affections” in the form of an infusion.
The juice of the stems is caustic and used internally as a vermifuge. This application is claimed to be dangerous. Standley 1924: 917
Pronounced antihelminthic activity.
Flower infusion is used in Mexico against eclampsia.
Flowers are sold in markets under the name *flor del cuerno* (horn flower.) Comments lacked details or references. Soulaire 1947

*Flora of the Americas: Acanthocereus pentagonus* (domesticated in Starr County, Texas) above

*Acanthocereus pentagonus* flowering in Austin, Texas

*Acanthocereus pentagonus* (domesticated in Starr County, Texas) above
Cactus Chemistry: By Species

*Ariocarpus bravoanus*
Lacks any published analysis.
Used for medicinal purposes Miller 2000
Ethanolic extract is used externally as analgesic in Mexico.
Anonymous 2000

*Ariocarpus bravoanus ssp. hintonii*
Lacks published analysis.
Used as an externally applied analgesic in Mexico.
Anonymous 2000

*Acanthocereus pentagonus*
(HBG) above; (Austin, Texas) below

*Ariocarpus fissuratus*
(Terrell County, Texas)
Ariocarpus fissuratus

“peyote cimarron” (see comments below)
“sunami” (Tarahumara).

LUMBOLTZ 1902 claimed that an intoxicating drink was prepared from this species by the Tarahumares. The plant was said to be “even more powerful than wanamé” and used similarly. In the region of the headwaters of the Rio Concho, PENNINGTON 1963 (p. 159) includes it as a “narcotic” cacti and noted that the expressed juice from Ariocarpus fissuratus was sometimes added to tesguino by the Tarahumana to “make the corn beer more enjoyable.”

Calling it “peyote” Havard 1896 made a similar comment that it was eaten raw or added to liquor to increase the effects. It is not adequately clear though that Havard was not confusing this plant with West Texas peyote. STANLEY 1924 also refers to the use of this name but says it is incorrect.

Older tubercles are said to be smoked in Mexico for “mildly hallucinogenic effects” lasting several hours. ANONYMOUS 2000.

“Consumed fresh or ground in water, it was taken in the same manner as Lophophora. This “hikuli” was also used as a stimulant by the runners.” BYE 1979

While peyote cimarron sensu Thord-Gray would appear to be a different plant, this has become its common name both in Mexico and among Western drug users. (STANLEY 1924 also gave this name) As recently as the late 1970s a person could find this cacti being offered for sale under that name by street vendors in Austin, Texas. While the anecdotal accounts of friends said they were the wrong plants that did not have the same activity as peyote, they were being sold specifically intended for drug use purposes.

LUMBOLTZ 1902 also made the comment “Robbers are powerless to steal anything where Sunami calls soldiers” Chewed and placed upon bruises, bites and wounds. PENNINGTON 1963:186

Ariocarpus retusus

Used for fever. JOHNSON 1999

Reported to be smoked as a recreational inebrient similarly to Ariocarpus fissuratus.

The rare Huichol shaman is said to use 2 tubercles as an oral dose after a 5 year apprenticeship. ANONYMOUS 2000

STANLEY 1924 notes the use of “peyote” as a common name but says that it is incorrect.

SOULARIE 1947 commented that this species enjoys the same reputation in Mexico as peyotl but did not include a reference.

Huichol: tsuwiri

Furst comments that a person with an impure heart, meaning a person who has not properly purified themselves prior to their peyote journey may be tricked into thinking this plant was peyote “because it is capable of sorcery and deception.”

Furst was told by Huichols it was “very dangerous” to eat. Interestingly saying a person “who had a “Huichol heart” would not be fooled into doing so.”

Furst described the effects as being Datura-like and characterized by unpleasant delusions ranging from terrifying hallucinations to obsessions with sexual partners who had not been properly confessed prior to the pilgrimage.

“Afterwards they become more afflicted and frightened. Because they begin to see many things. Terrible, crazy things. Animals they see, animals which are poisonous...There before them a deep pit, very large, very dark. They jump into this pit, escaping from those animals. It is as if one had thrown these animals at them, great heaps of those snakes, great heaps of those scorpions, as if from a basketful of those animals. But no, there are no animals. There are no snakes. There are no scorpions. There is no pit. There is where he jumped, where he fell in his terror, there is no pit. Only the ground, only the sand with the cactus thorns which pierce him.” FURST 1971

Ariocarpus kotschoubeyanus

Ethanolic extract of whole plant used externally as analgesic for blows & bruises. Posted at http://www.ariocarpus.tsnet.co.net & www.brunt.demon.co.uk/cactus/mexico/img2054-55.html

Said to show some type of activity in human bioassay but to be “more mild” than A. fissuratus. ER 1999
Ariocarpus kotschoubeyanus

Ariocarpus retusus
**Astrophytum asterias**

Called “peyote” according to STANDLEY 1924
Sometimes collected by South Texas peyote distributors and
given as good luck fetish to NAC members. Occasionally
reported to be eaten by NAC members. TERRY 2007.
Anecdotal accounts from drug users report this species to
be inactive. One of several cactus species sold by Austin,
Texas street vendors in the 1970s as “peyote cimarrón.”

**Astrophytum capricorne**

Antimicrobial activities studied in GARZA PADRÓN 2010.

**Astrophytum myriostigma**

Called “peyote cimarrón” (in Durango) STANDLEY 1924
Antimicrobial activities studied in GARZA PADRÓN 2010.
Jackrabbits are said to become visibly intoxicated from
eating this plant and to develop a taste for it. ENTHEOGEN
REVIEW 1998
Brasiliopuntia brasiliensis

Roots have antipyretic properties.
The fruit gives a refreshing drink that is effective against scurvy.
Branches are used as a calming poultice for sciatica.
Sap has been used for swelling of eyelids.
Soulaire 1947

An unidentified Opuntia species was claimed by Rivier & Lindgren to be incorporated into ayahuasca as an admixture called tchait. More recently Antonio Bianchi & Giorgio Samorini presented it to only be used alone, as a hallucinogen, due to the mixture being “too strong”. Bianchi & Samorini 1993 included an image of the leaves on page 38 that suggested to this author that it was possibly a Brasiliopuntia. Field work by R. Stuart in 2001 proved that the identity was Brasiliopuntia brasiliensis. (Bob Wallace funded the research.)

Stuart had been provided with the source’s contact information by Antonio Bianchi. Stuart went to Peru and undertook a course of introduction to the plant that was guided by the shaman. Stuart collected live material for propagation, and prepared herbarium vouchers - positively establishing the identity of the plant.

While in Peru Stuart also bioassayed it multiple times; first under guidance of the shaman and later independently. After repeated failures while working directly with the shaman, Stuart concluded anything he was experiencing was entirely due to the green tobacco that was being added to the expressed juice of the tchait leaf. Stuart tested this by secretly ingesting a much larger amount of the plant without tobacco and in combination with an MAOI.

Stuart proposed that the story may have been created to satisfy the questions of ethnobotanists desiring to be told of even more ayahuasca admixtures. Perhaps bolstered by noticing the ethnobotanists were not checking the claims with bioassays.

The interesting and entertaining account of his adventure can be found in the 2002 Entheogen Review.
Felger & www.youtube.com/watch?v=6_-kNjwVO2g.

In particular, almost no one, in this case except Vitalis, sounded but included no more details. 1 tablespoon of the green outer layer was believed to be a dose for that person and the physical distress he reported was 2.5 tablespoons of the outer green layer sounded like a strong dose to the masses would seem like a counterproductive approach?.

The responses to his on-line video are intriguing. Many aspects are reminiscent of Earl’s account of the cardon. In particular, almost no one, in this case except Vitalis, sounded like they had more than one experience with it.

In an article on his website entitled “Ever Tried This PsychoActive Cactus?” Vitalis comments: “So, I was hesitant to leak this news…. but I just couldn’t hold it in any longer! “Yes, its true… the Arizona State Flower grows atop a Psychedelic Cactus!”

“I tried eating a couple tablespoons of the dark inner bark a year ago after seeing this video and reading the page on your website. I definitly noticed strong effects within half an hour of consumption. The world became extremely dreamlike and I drifted in and out of conciousness into a lucid dream state. (my first experience with lucid dreaming). Overall it was like no other psychoactive I’ve ever experienced, but the taste is worse than anything I’ve ever eaten.”

posted on an on-line drug forum:
“tried it once never again. My eye was twitching and I could feel if wiggle in a bad way when I looked around. Coordination totally fucked up. Felt like if was toxic to the nerves. My body was tense and shaking. Felt like I was starving but couldn’t eat. I was completely restless and couldn’t find a comfortable position. Kept getting the hiccups and feeling the cactus coming up. Finally puked. It feels like you have Parkinson’s or something. Mild visuals with some weird auditory hallucinations. Feels toxic overall it’s not worth it. Just thinking of that taste turns my stomach, that sandy textured bitter flesh.”

Eek

In Vooglebreinder a comment in Ratsch (1998, 155) is noted: “The Seri refer to saguaro as a Peyote substitute, suggesting a possible psychoactive use for the plant, although no specifics concerning such a use are available.” Unfortunately Ratsch employs this dubious statement as a photo caption without any comment or a pertinent reference.

Psychoactive had “The sap, which flows from the cactus when it has been wounded, is very bitter. When ingested, it typically produces nausea and dizziness (Bruhn & Lundstrom 1976, 197).” but their cited source does not say that.

The most common are people who insist the saguaro is not active (seemingly based only on never having heard this before); some are so certain of this they are aggressive, rude and hostile.

The second most common response is outrage for his cutting on a cactus that many people love.

Among the replies to Vitale’s youtube video are two bioassay comments:

“tried it once never again. My eye was twitching and I could feel if wiggle in a bad way when I looked around. Coordination totally fucked up. Felt like if was toxic to the nerves. My body was tense and shaking. Felt like I was starving but couldn’t eat. I was completely restless and couldn’t find a comfortable position. Kept getting the hiccups and feeling the cactus coming up. Finally puked. It feels like you have Parkinson’s or something. Mild visuals with some weird auditory hallucinations. Feels toxic overall it’s not worth it. Just thinking of that taste turns my stomach, that sandy textured bitter flesh.”

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In Vooglebreinder a comment in Ratsch (1998, 155) is noted:

“The Seri refer to saguaro as a Peyote substitute, suggesting a possible psychoactive use for the plant, although no specifics concerning such a use are available.” Unfortunately Ratsch employs this dubious statement as a photo caption without any comment or a pertinent reference.

Psychoactive had “The sap, which flows from the cactus when it has been wounded, is very bitter. When ingested, it typically produces nausea and dizziness (Bruhn & Lundstrom 1976, 197).” but their cited source does not say that.
Carnegiea gigantea
younger areoles (Sul Ross) top
older areoles (Tucson, AZ) bottom
Conflict seemingly exists surrounding analytical reports concerning the alkaloids that are present in Saguaro (suggesting a high degree of variability based on presently undefined factors). It may just be a matter of age and part analyzed but the question is one for a future worker to resolve.

For a summarized overview:
Gigantine was only reported in substantial amounts during analysis of wild collected adult cacti and was found to be higher in the growing tips. (see Brown et al. 1972)
BRUHN & LUNDSTRÖM 1976b reported isolating 22 mg of gigantine from 15 kilos of fresh material. It was not reported in greenhouse grown plants, nor in young plants grown outdoors in Arizona. (see BRUHN et al. 1970).

BRUHN et al. 1970 and BRUHN & LUNDSTRÖM 1976) found salsolidine to be the major alkaloid, whereas BROWN et al. 1972 did not observe salsolidine in any samples they tested. They did agree that carnegine was present in decent amounts.
Trouts Notes on Cactus Chemistry

Cereus peruvianus

There are references to this plant as being hallucinogenic and as containing Mescaline. Both of those assertions are clearly in error.

ROUHIER 1927 is thus far the earliest instance of the mistaken claim that I can locate. From page 73:

"Le Cereus peruvianus est le seul représentant de la famille des Cactées, à côté naturellement du Peyotl, qui ait été utilisé par les Indiens dans le sorcellerie."

"Cereus peruvianus is the only representative of the family of the Cactaceae, next to of course peyote, which has been used by the Indians in witchcraft"

The reference to COBO 1653: 451 on page 90 in ROUHIER where he equates this species with "la diabolique huachuma" clearly indicates that this was based entirely on confusion with San Pedro (T. pachanoi). Rouhier’s mistake was repeated in HOBSCETTE 1929, JACQUET 1934 and also in SOULAIRO 1947. Hobschette and Soulaire both included Cobo’s description which leaves no doubt that Cobo was discussing San Pedro.

Cereus quadrangularis

DUKE cited HARTWELL for its use in cancers.

Cephalocereus leucocephalus

Fruit used for producing tesquiino.

PENNINGTON 1963

Corynopuntia reflexispina

Used traditionally for treating diarrhea. JOHNSON 1999

Cereus hexagonus

DUKE cites PITTIER for its use as diuretic and for enterrhagia.

Cereus jamaracu

DAVET 2005 reported some antimicrobial and antifungal activity.

Cereus peruvianus var.

(HBG)
**Cereus repandus**

Duke lists uses for diarrhea and as shampoo or soap.

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**Cereus repandus**

(HBG)

left column & upper right

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**Corynopuntia reflexispina**

(Wiggers & Rollinson)

Backeberg

Diarrhea. Duke

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**Coryphantha compacta**

(Cactus Country) center right

(Huntington) bottom right
Coryphantha compacta

Tarahumara names:
“bakana”; “bakánawa”; “wichuri”; “Santa Poli” (BYE 1979)

Bye reported finding this to be a powerful medicinal plant employed by Tarahumara shamans and feared by some of the Tarahumara. It was regarded as a form of hikuri and Bye suspects it to be referable to bakanawa in Bennett and Zingg.

While an analysis of the Tarahumara “bakana” was said to be underway in BYE 1979, the results were either not published or the analysis was not performed.

Thord-Gray 1955 described “baka-nawa” as the most feared plant next to hi-kuri (p. 573)

“This is a quite a common small ball-cactus, apparently inoffensive but considered very “powerful medicine.”

“In certain sections of Tarahumara it this plant is used in place of peyote.” (Thord-Gray 1955: 84)

“.baka-nori has a ball shaped root and is used the same way. It may be the same plant.” (Thord-Gray 1955: 84)

The roots of both of these cacti are said to be “chewed and then rubbed on the legs of the runners to make them light of foot.” (Thord-Gray 1955: 345) Its application is often topical.

Bennett & Zingg commented that it was a common ball cactus they were cautioned not to touch. Their informant said it was second only to hikuri in power. Later in their account they say “The users consider this root more powerful than peyote.”

It was said to be used as a cure by shamans but that it could not be kept for more than three years by any one individual and needs to be sold or hidden after that point.

“The whole root is stirred in boiling water and used as a drink or application for many diseases. It is applied to the back for sickness in the lungs.”

“The small ball is chewed by the shaman, and the patient anointed with it wherever he feels pain.” “During a race the shaman continually chews a bit to have it ready for the runners who tire.”

“The plant is so strong that runners anoint themselves with it three days before an important race.”

The plant is said to be used by shamans, not peyoteros. The shamans make special trips to obtain it. Bennett & Zingg were told that the plant must be harvested on Friday and smoked with incense. Anyone is permitted to harvest or carry the cactus but it is mostly used by the shamans. The shamans carry small bits of the root in their bags. The root has many uses.

“Losing or burning one of the plants makes it very angry, and the offender is apt to become sick, turn crazy, or die. When one sleeps near the roots, he may hear singing as it moves about. By chewing it a bit, the singing becomes clearer.”
Coryphantha Chemistry: By Species

Coryphantha macromeris

Claims for mescaline’s presence in these two species appear in the literature erroneously.
Barceloux presents C. macromeris as a mescaline containing cacti for no clear reason other than perhaps thinking rumors of use indicate that mescaline is present.
This species is purported to be a mild hallucinogen in its own right for reasons other than mescaline.
The claim purporting hallucinogenic activity first appeared in Ott 1976 who cited his own unpublished lab notes and Jerry McLaughlin, unpublished data, as his references. Schultes & Hofmann included Ott’s observation in Botany & Chemistry... and in Plants of the Gods. However, in his later works Ott began citing Schultes & Hofmann’s secondary reference (to him!) and ceased to cite either himself or Dr. McLaughlin.
Coryphantha runyonii appears to be listed seemingly for nothing more than being considered to be a varietal form of Coryphantha macromeris. Its reported analysis is commonly merged with that of C. macromeris in phytochemical databases.
Neither species has ever been found to contain mescaline.

Counterculture ‘new age’ churches (such as “Crystal”) have been established declaring Coryphantha macromeris as their sacrament. The literature we have seen suggests that they might be less than informed. We have been unable to locate even a single person who has actually tried it.
The plant is also rumored to be one fifth as strong as the peyote cactus. Which I suspect is due to a comparison of the mg/kg figures in the literature. This would place an effective dose in excess of two pounds of plant material; if thought of in terms of weight for weight equivalence of cacti.
However, this is likely to be in error as it must be remembered that, while macromerine has been reported to be one-fifth the potency of mescaline, the reported percentage of occurrence is around one tenth that normally encountered in peyote for mescaline.
This implies that, if it were active as a hallucinogen, 50 times more plant material would be required, not 5. There is also the reality that this plant lacks a thorough analysis and one of the alkaloids noted as present but unidentified possesses MAOI capabilities. Shulgin proposed a “cactihuasca” potential for Coryphantha species based on reported MAOI properties of some of the Coryphantha alkaloids. (Shulgin in a personal conversation during 2005)

We have, so far, been unable to find any other person who has sampled this plant. Surely there must be someone which implies that either every single person who tried it found that it was so incredibly good they didn’t want to share it and independently suppressed the knowledge or else it was not worth bothering to recount. I’d lean towards the latter notion myself.
Mescaline would seem obvious as a preferable alternative, especially as current law potentially considers macromerine to be a controlled substance thanks to the modern blanket of illegality.
My only bioassay involved around half a pound (nearly half of one large and very old plant) harvested while frozen in mid-winter.
Nausea was pronounced and lengthy (far worse on both counts than with peyote), there was a distinct pharmacological action but it was an insufficient dose to enable a hallucinogenic experience.

There were persistent side effects such as a weird feeling of unreality and a strange shiny plastic appearance to objects which lasted for several weeks after ingestion.

I found it more weird than anything else with an underlying sense of borderline irritability that reminded me more of ephedrine or Catha edulis leaf.

While it is clearly in need of further evaluation, there are no plans or desire to evaluate it at a higher level. [Its worth recalling that J.R. Briggs felt similarly after sampling a partial peyote button.]

The lengthy after effects causes some empathy for the assertion that permanent insanity could result from the use of Coryphantha species by people who weren’t prepared. While thinking it unlikely, the possibility of prolonged effects or after effects had been considered before hand, due to the warnings, and so, while concerned and in some spots challenged, I was not overly worried. If a person experienced this and was not prepared, or was unstable to begin with, the duration and weirdness of the side-effects might potentially cause them some problems.

Its important to mention that if either macromerine or normacromerine is indeed a hallucinogenic alkaloid, or if normacromerine is, they would be the ONLY N-methylated phenethylamines that are known to be hallucinogenic.

N-methylation normally ameliorates hallucinogenic activity, doing so even on DOM (STP). If *any* activity remains on an N-methylated phenethylamine it is generally that of an amphetamine type stimulant.

As is noted under normacromerine in The Cactus Alkaloids, the conjecture by Shulgin (personal communication) concerning potential interactions of this alkaloid with known MAOI Coryphantha alkaloids needs some study.

**Coryphantha palmeri**

There is an odd report by DOMINGUEZ et al. 1970 that seems to have been left uninvestigated by later workers.

In this paper they mention that Coryphantha palmeri was employed as a "narcotic." They observed 4 spots during tlc but were unable to get the alkaloid they isolated to crystallize and never identified it. (They did identify other nonalkaloidal components by mp, tlc, IR, UV, MS and NMR.) This is often cited as a report finding no alkaloid in this species. We do not think the issue is settled yet. More work is needed.

**Coryphantha palmeri**

(HBG)

**upper right**
**Cactus Chemistry: By Species**

**Cylindropuntia acaanthocarpa**

Ingested for gastrointestinal disturbances. **JOHNSON 1999**

**Cylindropuntia bigelovii (Engelmann) Knuth**

Used as a diuretic. **JOHNSON 1999 & DUKE**

**Cylindropuntia leptocaulis**

Mexico: “tasajillo”, “tasajulla”, “garumbulo”

**CASTETTER & OPLER 1936** reported a claim purporting psychoactivity from fruit consumption but I am unable to find anyone who can reproduce these results in their bioassays.

They were said to have such “pronounced narcotic effects that the Indians will not walk close to plants which bear them, and they claim that eating a single fruit will make one “drunk and dizzy.”” [Never mind that the fruit have tiny glochids.]

I would suspect that this might have arisen out of a Mescalero’s sense of humor. I can almost hear the words “Hey cowboy, ...”

They are commonly included on the lists of the cactus species fruit eaten as food by the indigenous southwestern peoples.

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**Coryphantha runyonii seedlings**

(SRSH)

**Cylindropuntia leptocaulis fruit**

(BTA)
Terrecyclic acid A (TCA) was also determined to be active as a small-molecule inducer of the heat shock response and showed anticancer activity. It was suggested that it affects pathways involved with oxidative and inflammatory cellular stress responses.

*Turbyville et al.* 2005

**Cylindropuntia versicolor**

Chemical studies performed on *Aspergillus terreus* yielded interesting products. (It was inhabiting the rhizosphere of *Opuntia versicolor*.) Among them was (+)-Terrecyclic acid A which was found to be “capable of disrupting the cell cycle through an apparent arrest to progression at the G(1) and G(2)/M phases in this p53 competent cell line.”

*Wiérant et al.* 2003

**Cylindropuntia whipplei**

Used to treat diarrhea. *Johnson* 1999

**Dolichothele uberiformis**

The juice from this cactus injected into a frog rapidly caused its death. (from *Soulaire* 1947) This refers to a brief comment made in *Lewin* 1894.

*Echinocereus enneacanthus*

Employed in Dropsy; Used as Piscicide & Vermifuge. *Duke* cited *Krochmal & Krochmal* 1973

Called the “strawberry cactus” due to its fruit. *Standley* 1924

**Echinocereus stramineus**

“pitahaya”

Prized for its edible fruit, *Standley* 1924

**Dolichothele uberiformis**

(California Cactus Center)

**Cylindropuntia versicolor fruit**

(Saguaro National Park)
Echinocereus coccineus
Echinocereus salm-dyckianus
Echinocereus triglochidiatus

Bennett & Zingg 1935 do not mention any drug use of any Echinocereus despite making comment on their commonness.

Tarahumara name: “hikuri”; “wichuri”
Mexican name: “pitallita”

Bye reported that Echinocereus triglochidiatus Engelm. and E. salm-dyckianus Scheer “are “hikuri” of the sierras and can be used in the same manner as the preceding types although they are not as powerful.”

Bye 1979

“High mental qualities are ascribed especially to all species of Mammillaria and Echinocactus, small cacti, for which a regular cult is instituted. The Tarahumara designate several varieties as hikuli, though the name belongs properly only to the kind most commonly used by them. These plants live for months after they have been rooted up, and the eating of them causes a state of ecstasy. They are therefore considered demi-gods, who have to be treated with great reverence, and to whom sacrifices have to be offered.”

Lumholtz (1902: 303) uses the name Echinocactus but his accompanying illustration is very clearly that of an Echinocereus.

It seems certain that what Bye referred to as Echinocereus triglochidiatus was Echinocereus coccineus. Confusion between the two species is quite common but Echinocereus triglochidiatus has a more northerly distribution.

I am only aware of one person bioassaying this plant. He told me he experienced something vague and weird but was unable to obtain any interesting results despite subsequently isolating pure alkaloids and ingesting them alone and combined with an MAOI.
Trouts Notes on Cactus Chemistry

Echinocereus coccineus v. rosei
(Hudspeth Co., Texas) above

Echinocereus coccineus
(cultivated Austin, Texas) lower right

Echinocereus in
Lumholtz 1902
Compare this to the Echinocereus coccineus images.

Echinocereus coccineus v. gurneyi
(Sul Ross) center image on left

Echinocereus coccineus v. rosei
(Sul Ross) upper right

Echinocereus coccineus
(cultivated Austin, Texas) lower right

542
Echinocereus coccineus var. paucispinus
(Val Verde Co., Texas) above & right

Echinocereus coccineus var. rosei
(Hudspeth Co., Texas) above

**Echinocereus coccineus**
(hedgehog cactus)

**Echinocereus chrysocentrus**
(golden spined strawberry)

**Echinocereus fendleri**
(desert strawberry)

**Echinocereus leeanus**
(salmon-flowered hedgehog)

**Echinocereus rigidissimus**
(rainbow cactus)

were all valued for their fruit by the Mescalero.

*Castetter & Opler 1936: 41*

The Isleta in New Mexico ate the pulp of *Echinocereus triglochidiatus* after baking it or making it into a candy with sugar. *Echinocereus fendleri* and *Echinocereus gonacanthus* were roasted and used as food by the Cochiti.

Several species are valued as food but more are highly regarded for their fruit.

*Castetter 1935: 26*

Arizona hedgehog cactus (*Echinocereus triglochidiatus var. azonicus*) was reported by Crosswhite 1992 as being under threat of illegal poaching for its purported DMT content. One has to wonder how much incidence of this actually existed before this report and how much, if any, has occurred after it.

Speculations by Crosswhite that its “[...] evolutionary
tory history may be linked to trading by the prehistoric Salado
culture, implying that the species may actually be an early
cultivar” does not seem to be based on anything that is real.

An aqueous decoction of *Echinopsis multiplex* showed *in vivo* tumor growth inhibition activity and increased the survival time of rats with solid tumor S180 and Lewis pulmonary carcinoma. (p.o. 30 g/kg and 60 g/kg). *In vitro* study of their plasma showed that it inhibited DNA synthesis in YAC-1 tumor cells and significantly suppressed the proliferation of EAC tumor cells (antineoplastic effect). CHEN *et al*. 1999
Trouts Notes on Cactus Chemistry

*Echinocereus mammillosus* Rümpler

Soulaire 1947 says it has a “narcotic” action and, in animals, a lethal dose causes death by respiratory depression.

*Echinocereus reichenbachii*

Remington et al. 1918 appears to have somehow confounded this with *Pachycereus pecten-aboriginum* when saying:

“From *Cereus Caespitosus* Engl. and A. Gray, Heyl separated an alkaloid, pectenine, which, according to Heffter (A. Pharm., 1901, cxxxix, s. 462), produced both in cold and warm blooded animals tetanic convulsions with heightened reflexes. According to the experiments of Mogilewa, the alkaloid acts upon the isolated frog’s heart as a depressant.”

Grieve 1931 appears to draw from this source when writing:

“*Cereus caespitosus*. An alkaloid separated from this variety, called Pectenine, produces tetanus convulsions in animals.”

*Cereus caespitosus* became *Echinocereus reichenbachii*. The comments by Heffter appear within the pages of Heyl 1901 but this paper does not discuss *Cereus caespitosus*.

All of the varieties of bona fide *Echinocereus reichenbachii* appear to lack any analysis?

*Epiphyllum oxypetalum*

A comment appeared in the *Entheogen Review* that a large doses of a water extract cause “hallucinations” (DeKorne 1997).

In checking the purported reference (Huson 2001) Aardvark 2006 discovered not only was the claim taken from Grieve 1931 but it actually referred to *Selenicereus grandiflorus* rather than to *Epiphyllum oxypetalum*!

*Epiphyllum oxypetalum* apparently has some type of pharmacological/physiological actions.

All in isolated tissue preparations:

“decreased the flow rate of perfusion fluid in isolated guinea-pig lungs.”

“shortened the guinea-pig tracheal chain.”

“increased the spontaneous activity of the rat and mouse jejunum and elicited contraction of the guinea-pig ileum”

The responses of the tracheal chain and the ileum were similar to the responses produced by acetylcholine or by histamine. Chow found this could be blocked or reversed by atropine and by chlorpromazine.

“caused a shortening of the rat aortic strip which was antagonized by phenolamine.”

“exhibited both inotropic and chronotropic effects on isolated rat auricles and hearts, which could be blocked by propranolol.”

“produced slow contraction of the nictitating membrane in anesthetized cats. This response was readily abolished by phenolamine.”

Chow et al. 1977 (Above was from the English abstract.)


I have not yet obtained that paper.

*Epiphyllum phyllanthus*

Duke’s database lists this species being used as “cardiac” & “tonic” citing Duke 1972

Serves as a bandage for burns & wounds. Soulaire 1947

Tested in animals for possible antidepressant effects. Choice based on “being traditionally used for the treatment of bad dreams, witchcraft, or madness”, according to a Guaymi Indian informant. Aardvark 2006 cited Anderson 2004a

*Epiphyllum spp.*

Culina: “Wamapanako” (Rivier & Lindgren 1977)

Sharanahua: “Pukara” (Pinkley 1969)

“Pokere” (Rivier & Lindgren 1977)

An unspecified *Epiphyllum* species is said to be used by the Peruvian Sharanahua as an ayahuasca admixture. (appearing in Rivier & Lindgren’s 1972 listing)

Only one leaf of the *Epiphyllum* species is added to ayahuasca or else its unboiled juice is consumed along with the prepared hoasca.

Homer Pinkley 1969 commented that there is an herbarium voucher of the *Epiphyllum* (made by L. Rivier & I. Rüff) present in the Economic Herbarium of Oakes Ames at Harvard.


An unspecified *Epiphyllum* species is said to be used as an appetite stimulant in Costa Rica. Aardvark 2006 cited Anderson 2004b.

**WORLDS WONDER REMEDY**

Report of the Council on Pharmacy and Chemistry

Worlds Wonder Remedy is said to be prepared by macerating “the leaves of certain cactus plants, among them being the ‘Alligator Tail Cactus’, the ‘Philo’ cactus and several other species of cactus” in brandy. No evidence is submitted in regard to the properties of the “Alligator Tail,” the “Philo” cactus and the identities and properties of the "other species." Neither are the quantities of the leaves in a given amount of the wonder remedy declared. It is claimed “We have also found this medicine to be very good for nervousness, headache and all pains of the body, especially stomach trouble, indigestion, causes of the stomach and we have also given it to people sick at this time of the year and they did not know what it did but made them feel fine."

The Council has no evidence that this preparation has the claims unwarranted and preposterous.

**American Medical Association 1918**

Maybe “Philo cactus” intended *Phyllocactus* but I do not have a guess for “Alligator tail cactus”. *Aloe vera*, several other *Aloe* species, and a rampant *Kalanchoe* amazingly all are known by the common name ‘Alligator cactus’.
Epiphyllum oxypetalum
(SRSU)
Epithelantha micromeris

Asserted hallucinogenic based on some intriguing statements but this may be a cross-cultural conceptual force-fitting?

“Mulato” (Tarahumara)
“This is believed to make the eyes large and clear to see sorcerers, to prolong life and to give speed to the runners.”
Lumholtz 1902
Thord-Gray 1955 purported this to be the Tarahumara’s “peyote mulato”: “…credited with great intellectual and moral qualities. A small dose of this plant will open the busi-ra (eyes). One can then clearly see the evil wizards and witches. It will prolong life and increase the speed of a runner in a race.”

“Rosapara”
Described as a “more advanced vegetative stage of the preceding species—though it looks quite different, being white and spiny. This, too, must only be touched with very clean hands, in the moral sense.”
Lumholtz comments that the only people who are allowed to handle it are those “well baptised” and that “It is a good Christian and keeps a sharp eye on the people around it; and when it sees anyone doing some wrong, it gets very angry, and either drives the offender mad or throws him down precipices. It is therefore very effective in frightening off bad people, especially robbers and Apaches.”
Lumholtz 1902

Epithelantha micromeris
(California) above; (Prague) right
Image on right courtesy of Martin Terry

Mentioned by Pennington 1963: 166 as a “narcotic” cactus with use similar to Lophophora. Said to not be available at that time in Tarahumara country. “Specimens of Epithelantha micromeris in possession of Indians near Guaguachic and Nararachic are claimed to have been brought from slopes of ranges northeast of Valle de Allende, beyond the Rio Florida.”

“The whole plant, as well as the fruit (although it is considered less effective), is used to stimulate and protect runners (Lumholtz 1902- Pennington, 1963). “… use appears to be restricted to the upper regions of the Rio Conchos.”
Bye 1979

The phrase “much less effective” is interesting. This author has eaten the fruit of this cactus many times and never experienced stimulation, or any other effect, even faintly. Standley noted that they are considered edible in México and called chilotes. Standley 1924- 933

West & McLaughlin 1977 demonstrated the (rather consistent) toxicity of the saponin extract when injected into mice. Toxicity ranged from death within 24 hours at 100 mg/kg to death within 1 hour at 1 gram per kg.]
Ferocactus covillei = Ferocactus emoryi

Used for treating sores. Duke.

Ferocactus sp

Used for headaches, chest and women’s complaints. Duke
**Haageocereus (Weberbauerocereus) acranthus**
This species appears to lack published analysis.
It was asserted to contain mescaline in Caycho Jimenez who made this claim without including a reference.
This first image was sent to me to illustrate material that was purportedly being used by shamans in Peru.

**Haageocereus (Weberbauerocereus) cephalomacroostibas**
AKA Trichocereus cephalomacroostibas
This species also lacks any published analysis.
Asserted to contain mescaline in Caycho Jimenez who made this claim without including a reference.

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*Trichocereus spachianus* is a clear mislabel.
The spines were said to be badly damaged when transported.

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*Haageocereus acranthus*
The two cuttings which were shipped from Peru.
The visible grey fungus and black rot rapidly consumed them.
Hylocereus monacanthus (Lemaire) Britton & Rose

The fresh juice extracted from leaves and fruits was said to be taken orally and purported to be used in “sorcery” and for the “liver” in Vilcabamba, Ecuador. Beiar et al. 2002.

This putative entry into the literature appeared under the name of the unrelated columnar cactus Cephalocereus royenii (aka Pilosocereus royenii). However, the herbarium voucher shown is of a Hylocereus rather than a Pilosocereus. Similarly the common names listed (Pitayo, Pitaya, Pitahaya) are commonly applied to Hylocereus species but not for P. royenii.

Beiar et al. (2002: 248-249) also included as synonyms Hylocereus lemairei (now Hylocereus monacanthus), Hylocereus ocamponis, and Hylocereus polyrhizus which are three completely different plants that are all presently recognized as separate species.

There is clearly much confusion within that account as to what plant is actually used.

Hylocereus ocamponis (Salm-Dyck) Britton & Rose See comment above under Hylocereus monacanthus

Hylocereus polyrhizus (F.A.C.Weber ex K.Schum.) Britton & Rose
See comment above under Hylocereus monacanthus

Harrisia divaricata (Lamark) Lourteig

Antihelmintic (no reference included)
Remington et al. 1918

Harrisia nashii Britton (now H. gracilis)
Vermifuge (Haiti) - Štarha 2001

Harrisia martinii
(Cambridge Botanical Garden)
Analysis not yet reported.


**Hylocereus undatus**

Caustic stem juice employed internally and externally for a vermicide. The internal use is said to be dangerous. Widely cultivated for its fruit.

*Standley* 1924: 913

*Hylocereus polyrhizus* (HBG)

*Hylocereus costaricensis* (HBG) lower right

*Hylocereus undatus* (HBG) all four of the above

(Not including the *Acanthocereus* on the left in front.)
Cactus Chemistry: By Species

*Lemaireocereus hystrix*

[Name accepted as *Stenocereus fimbriatus* -- commonly encountered as synonym *Stenocereus hystrix]*

Duke cites Hartwell for “*Cereus fimbriatus*” being used for warts.

This species appears in the analytical literature only under the more commonly encountered synonym *Lemaireocereus hystrix*.

*Lemaireocereus hystrix* from Jamaica was analyzed by Carl Djerassi in the 1950s and was reported to be devoid of alkaloid. It was found to contain an uncharacterized triterpene lactone that he termed the hystrix lactone. This lactone also showed up in several other species of *Lemaireocereus*.

More recently one ethnobotanical supplier has been claiming this plant to at least sometimes be potent with mescaline.

The first cutting I obtained did resemble the material growing in the greenhouse at the Huntington. (The Huntington material was collected from Puerto Rico).

He also commented that only material growing in one stand on the Dominican Republic was active and not the others growing elsewhere on the island. How this was determined, how it was first determined to be active and why it was suspected of being a hybrid (and with what), were not known to him.

The claim is that this material is mescaline containing and found to be active in human bioassay at 20 grams of dried material but it was commented on by the vendor that too much rain had reduced the potency in at least one harvest so he changed the estimated dosage range to 20-40 grams.

I have been unable to locate anyone bioassaying anything except for pre-prepared dried commercial flesh.

It needs an analysis starting with a living cactus. My two attempts to obtain live material proved problematic.

*Lemaireocereus hystrix*

(Dominican Republic)

The material being sold under this name as live cuttings and dried outer flesh first appeared labeled *Trichocereus cuzcoensis*. It then was renamed as a *peruvianus* variety and then a *peruvianus* hybrid before settling on *Stenocereus hystrix*.

When I asked the owner about the name and identification he said the name was assigned by a botanist who examined the vegetative material.
Lower image above & the upper right 2 images show the first attempt being unpacked (2 cuttings); one cutting arrived alive but rapidly rotted -- looking similar to how the other had arrived. The ID is correct as the areole shape demonstrates.

The second shipping attempt of Ethnogardens.
Freshly cut plants shipped wrapped in plastic and dripping liquid. A matching set intended for analysis was delivered inside of a trash bag inflated with the gases produced. Dr. Terry directed it to their microbiology people rather than analyze what was felt to be a compromised sample.
Over 20 years ago, Wade Davis purported that cactus was used as a San Pedro substitute by a shaman near Huancabamba. It was purportedly called pishicol by Davis’ informant although our contact said it was locally called San Pedro.

Human bioassays of cultivated material have thus far been without results although I am only aware of two attempts neither of which included the amount used or the form of preparation.

In his 1983 paper on “Plants of the San Pedro Cult” Davis claimed that herbarium vouchers had been prepared and that an analysis was ongoing but did not mention the results in either Davis 1997 or 1999. Correspondence with Davis & D.M. McKenna established that an analysis was never performed.

This is listed as a good species in Hunt 2006, yet Hunt also comments: “doubtfully distinct from Armatoocereus laetus”

This cactus is purported to be employed as a type of San Pedro in parts of Peru. (Information from Grizzly; personal communication) It is claimed to be “strong”.

Independent confirmation of that activity has not been performed. As was also the case with Davis, Grizzly and friends did not bioassay the plant so the claim remains anecdotal.

That particular population needs analysis.
Wild *Lemaireocereus matucanense* above Matucana, Peru.
All four photos by Grizzly

*Leuchtenbergia principis*

Purported to be used for treating wounds in “beasts of burden”. STANLEY 1924: 934

It may be unrelated but in a massive rat invasion of my cactus nursery many years ago this was one of a very few species left completely untouched even as seedlings.
Cactus Chemistry: By Species

Nopalea cochenillifera
(Hebbronville, Texas)
lower image

Leuchtenbergia principis
(UC) 85.1428 México
upper image
Trouts Notes on Cactus Chemistry

*Lemaireocereus thurberii*
Fruit used by the Tarahumara for producing *tesgüino*. Pennington 1963
Fruit colors the urine like blood. Standley 1924: 901

*Lemaireocereus queretaroensis*
Called “*pitahaya*” due to edible fruit. Standley 1924
Used in Mexico as a purgative. Soulaine 1947

*Lophocereus schottii*
Felger & Moser 1991 mention that the *senita* is one of the three plants that the Seri believe was once a human.
Traditionally used for cancer. Duke (Hartwell)
Antimicrobial & other biological activities studied in:
Fimbres & García 1998
Morales 2006
Rico-Boradilla et al. 2001
Lack of the appropriate enzyme for converting cholesterol into 7-dehydrocholesterol (termed the “Neverland” gene) makes this plant an obligate food source for *Drosophila pachea*. Without consumption of Lathosterol it would be unable to successfully mature.
Lang et al. 2012

*Cultivated Lophophora fricii* were reported nonhallucinogenic at 3 gm/kg in Habermann 1978a.

*Cultivated Lophophora jourdaniana* were bioassayed successfully (for mescaline) at 3gm/kg in Habermann 1978a.

Lewan 1894 commented that “Hildman” isolated an alkaloid in 1889 and showed that it caused convulsions in frogs. This was apparently personal communication with Lewin rather than published work.
"The dried plants have been in use among the native people [in Mexico] since precolumbian times, and are still employed, although their use is forbidden by law."
"[...] the general effects are somewhat like those resulting from the use of hashish."

Standley 1924
"...used by Rio Grande Indians to produce intoxication -- similar to cannabis, during religious ceremonies;"
"Heart and respiratory stimulant, tonic, adjuvant to digitalis, narcotic, slightly slows pulse, produced mental and physical weariness, sleep without antoward symptoms; excessive quantities produce spasms resembling strychnine poisoning; pneumothorax, tuberculosis, angina pectoris, asthmatic dyspnea, hysteria."

Culbreth 1927

The equating of peyote's activity with that of either opium or hashish is common in the early literature.

Green plants are “chewed and placed upon bruises, bites and wounds.” (Pennington 1963)

“anodyne, antirheumatic, bitter, cardiac, cardiotonic, emetic, entheogen, febrifuge, intoxicant, lactogogue, narcotic, panacea”

Johnson 1999 ref#6
“arthritis, backache, common cold, corns, diabetes, fever, gastrointestinal disturbances, headache, infection, influenza, orthopedic ailments, sunstroke, tuberculosis, venereal ailments, wounds”

Johnson 1999 ref#7
“...many uses in folkloric medicine including the treatment of arthritic, consumption, influenza, intestinal disorders, diabetes, snake and scorpion bites and datura poisoning.”
“The Huichol rub the juices of fresh peyote into wounds to prevent infection and to promote healing.”
“It is used to gain knowledge, prophesize the future, and for almost every type of illness. It is also applied externally to painful joints.”

Johnson 1999

Extract is used externally for bruises, fractures, rheumatism, swellings and joint pain in the form of liniment, ointments and cremes. Used orally or topically as an analgesic. Commerically produced and marketed on-line there is also a cottage industry that exists producing pomada de peyote.

In the region of the headwaters of the Río Concho, Pennington 1963:159 noted that the expressed juice from Lophophora williamsii was sometimes added to tesgüino to “make the corn beer more enjoyable.”
HAVARD had made a very similar claim.

The plant has many folk medicinal applications. See Sacred Cacti or Anderson or McLoughlin for a listing of additional uses.
Trouts Notes on Cactus Chemistry

Machaerocereus gummosus

“pitaya agría”, “pitahaya agría”, “pitahaya”, “agría”
Crushed stems sometimes thrown into water to stupefy fish.
Bears a popular fruit called tajuá (Cochimí).

Standley 1924
Antimicrobial & antineoplastic activities studied in Morales 2006
General phytochemical screening in Garza Padron 2005

Mamillopsis senilis

Bruhn 1973a noted that Dr. J.N. Rose mentioned Mamillopsis senilis as a “sacred cactus” of the Tarahumara in his article entitled “Notes on useful plants of Mexico” [Rose 1899].

Bye 1979 refers to the plant as “Mammillaria senilis” and mentions that Rose “related an incident of Nelson who, while collecting in southern Chihuahua, reported encountering a Tarahumara who was fearfully reluctant to assist in collecting a similar cactus”.

Rose had given the name as “Mammillaria senilis” stating the potential of deferring to Weber’s new Mamillopsis once he had seen it flower.

Rose speculated that this could be the “hikora rosapara” mentioned by Lumholtz.

He related an account of E.W. Nelson in 1898:
“This is one of the sacred plants of the Tarahumari Indians and I was informed that the Indians who have had little intercourse with the Mexicans can not be induced to touch one of them. The specimens I secured were gathered by a Tarahumari man living on the ranch where I stopped. When I told the Indian to gather the plants from the top of a great rock he hesitated and only did it when I insisted upon his compliance. In pulling the specimen loose he tore on another plant and before descending he raised the fallen plant and replacing its root in position he packed the soil very carefully about it. This little incident illustrates the respect in which these people hold this plant.” (Rose 1899: 258)

The Genus Mammillaria

The milky sap of some species were used to remove warts.

Standley 1924: 975

Duke/ Martínez mentions use for earaches, dysentery, insecticidal, poison (not indicated whether as poison or for treating poisoning), pulicide, purgative, snake repellent.

Mammillaria grahamii (sunset cactus)
Mammillaria grahamii var. olivae (snowball pincushion)
Mammillaria mainae (horned toad cactus)
all have fruit that were valued by the Mescalero.

Castetter & Opler 1936: 41

With the three notable exceptions of the analysis of Mammillaria microcarpa (considered either synonymous with or varietal of Mammillaria grahamii), and of M. heyderi (which was determined to contain no hallucinogenic alkaloids), and of the related M. meiacantha, which was reported to contain one unidentified alkaloid, there has been no chemical work performed for Mamillopsis senilis or any the species of Mammillaria claimed to be held in high respect by the Tarahumara (such as Mammillaria grahamii var. olivae).

Unless one wants to also count Lewin 1894b reporting several Mammillaria species to be nontoxic,

Amusingly, entirely based on Bruhn’s comments that Mammillaria heyderi had been reported to have been used ethnobotanically and that he had found that it contained N-methyl-DMPEA, this alkaloid found itself mistakenly listed in Usdin & Efron (and beyond) as a known hallucinogenic compound.

Mammillaria arietina Lemaire

Lewin 1894 commented that this species was found to be nontoxic. [Now considered a synonym of Mammillaria magnimamma var. arietina (Lem.) Salm-Dyck]

Mammillaria centricirrhra var. pachythele

Lewin 1894 commented that this species was found to be nontoxic. [Mammillaria centricirrhra Lemaire is now considered a form of Mammillaria magnimamma]
Mammillaria craigii

"Tarahumara names: "wichuri"; "witculiki" (Bennett & Zingg 1935), "wichuriki" (Thord-Gray 1955). Mexican names: "peyote de San Pedro"; "biznaga" (Bennett & Zingg 1935; Thord-Gray 1955)

"In the Barranca de Batopilas, M. craigii is respected by all Tarahumara. Mistreating it, such as making botanical specimens of it, is considered very dangerous and terrifies many natives who may see it being collected by a botanist."

Bye 1979

Field work by Bye established that M. craigii LINDSAY and not M. heyderiI was the cactus discussed by Bennett & Zingg 1935 & Thord-Grey 1955 under the name "wicha-ri-ki".

This is commonly implied to have hallucinogenic activity or even to have fruit which is hallucinogenic but careful reading is suggested as the comments from Bennett & Zingg clearly said “The small, red fruit is sweet and casually eaten.” And what was said by Thord-Grey 1955: “It has a small red fruit which is eaten. This plant is greatly feared, as it is supposed to have magical powers. […] The shaman also uses this plant as a very important medicine to clear his vision so that he can see sorcerors and prolong life. The medicine will also make the foot light and increase the speed of a runner in a race.”

Thord-Gray also commented “…It matters not how well the suku-ru-ame [witch] is hidden, the shaman can see him clearly.”

“The heart of the cactus is used to cure or relieve headaches. After the spines are removed, the plant is cut up into two or more pieces, roasted for a few minutes and then part of the stuff is pushed into the ear.”

Thord-Grey 1955: 483

After similarly discussing its application for a headache remedy Bye goes on to comment “The upper portion of the plant is said to be the most effective. The top, with the spines removed, is ingested and is said to put one to sleep soon. During this sleep, the person “travels” to distant places and sees brilliant colors. If the person is not prepared, it will drive him crazy. Its effects are said to be similar to “hikuli”.

It is unclear where this comment came from. I’m assuming from Bye’s informants rather than a confusion with his account for M. grahamii v. olivae.

Mammillaria craigii currently lacks any published analysis. It has however been reported to be used in Oz as recreational drug. The dose is said to be a single specimen 4 inches or so in diameter. The spines are first removed and the entire body of the plant eaten. Fortunately there are a large number of large seed grown specimens available.

Friends with first-hand experience describe it as being MD-MA-like. Whether this is realistic or if it just an expression of the “tastes-like-chicken” phenomenon, where people describe something new by comparison to the closest thing in their experience, I do not know.

It is said by different bioassayists to be only mildly or not particularly hallucinogenic but with a euphoric component and pleasant stimulation causing it to become popular in at least some small subsets of the many Australian dance circles. Clearly more work is needed.
Mammillaria craigii (SS)

Mammillaria grahamii (BTA)
**Mammillaria grahamii var. oliviae**

"Tarahumara name: "hikuri"
Mexican name: "peyote"

Small clusters of this cactus (Fig. 3) are found on the slopes of Barranca de Batopilas and are reported to be the actual "hikuri" of this region. It is said to be distinguished from similar species of Mammillaria by the reddish central spines and the reddish vascular tissue in the plant stem. The fruit and top of the plant with the spines removed are eaten and are said to cause drowsiness followed by "travel" with brilliant colors. It is taken by the shaman and participants during special ceremonies. If improperly used, the plant can cause a person to go crazy. Specimens of this Tarahumara "peyote" are awaiting analysis."

Bye 1979

I have been unable to locate the results of that analysis or determine if it occurred.

Somehow M. grahamii found itself added to the list. Castetter & Opler 1936 mention Mammillaria grahamii and var. oliviae as having fruit which are eaten as food.

**Mammillaria heyderi**

In 1935 Bennett & Zingg reported on the use of Mammillaria heyderi by the Tarahumara.

Thord-Gray & Robert A. Bye Jr. later published comments that among its many magical powers the plant was used for locating wizard and increasing speed in runners. It was also said to be used for inducing sleep during which time shamans would travel to distant places and see brightly colored things.

"...greatly feared for its magical powers. This medicine will clear his vision. It matters not how well the suku-ru-ame [witch] is hidden, the shaman can see him clearly."

Thord-Gray 1955

These assertions were apparently considered by later workers to be conclusive proof of hallucinogenic use. Perhaps noteworthy is the fact that no Western workers ever bioassayed the plant.

In 1973 Jan Bruhn commented on the results of an analysis reporting the presence of N-Methyl-DMPEA while repeating the claim of those earlier workers.

Interestingly, as a result of that paper (Bruhn & Bruhn 1973) a person can find this substance listed as a hallucinogen in a number of academic and on-line resources based entirely on that single report of its occurrence in this species. It is even common to find this plant discussed as a hallucinogen and that activity attributed to this alkaloid despite there being no report of a bioassay and the pure compound apparently never having seen any pharmacological evaluation.

Most pertinently, but incredibly having no impact on the persistence of the above accounts, in Bye's 1979 report on the hallucinogenic plants used by the Tarahumara it was determined that the species employed by the Tarahumara was not Mammillaria heyderi but Mammillaria craigii.

Pennington 1963:118 mentions Mammillaria heyderi only in regards to its fruit being used as food.
Trouts Notes on Cactus Chemistry

Duke lists uses for earache, headache, deafness and longevity. He also reiterates the erroneous claim it is used as a hallucinogen.

**Mammillaria magnimamma**

Lactogogue. Duke

**Mammillaria microcarpa**

Earache. Duke (Unclear if this is in reference to its synonymity with Mammillaria grahamii and that species described use or if this was as independent claim.)

**Mammillaria polythele Martius**

Lewin 1894 commented that this species had been found to be nontoxic.

**Mammillaria pulchra Haworth**

Lewin 1894 commented that this species was found to be nontoxic. *M. pulchra* is not currently recognized.

**Matucana madisoniorum**

White flowered variant

Material collected by Hutchison.
**Cactus Chemistry: By Species**

**Matucana madisoniorum (Hutchison) Rowley**

*Matucana madisoniorum* is rumored variously to be used in Peruvian native medicine and to contain mescaline.

It presently appears that rumors of this species as either 1) a hallucinogen or 2) a mescaline container are erroneous.

Until fairly recently this species was rare in cultivation. When it was discovered it was a rare cacti in the wild suggesting that any medicinal usage would have to be very localized. Furthermore when Hutchison returned to the original type locality he was unable to locate any plants remaining. Their absence was suspected to be the result of an abundance of local goats. Other occurrences have been found.

It is unclear why Paul Hutchison thought it contained mescaline or why he believed it to have ethnomedical applications or if these are mistaken conclusions reached by others.

It would also be valuable to track down any actual field reports of use and determine what application they actually had. Cacti are used for MANY purposes by native cultures; hallucinogenesis is only one. An anti-infective topical agent seems every bit as likely.

Additionally analysis of it has produced no evidence of evidence of mescaline or of any other alkaloid (unpublished GC-MS by Shulgin; personal communication) Shulgin’s analysis was performed on a specimen provided to him by one of Hutchison’s former students and was a clone from a plant from the original type collection. I saw the specimens that were extracted (and helped him mince the fresh plants with heavy scissors) so can say they were very typical looking, nearly bald with a few weak spines. Sasha kept live plants for voucher material.

Rumors of that particular material being a mescaline container are clearly erroneous. Regardless, this entire genus deserves a detailed analysis.

**Melocactus bellavistensis**

*Melocactus bellavistensis* has been purported to have hallucinogenic use in Catamayo Valley in Ecuador. Kvist & Moraes, 2006.

There are many problems with the claims around this plant. Most notably the apparent unavailability of its primary reference: Vivanco 2000. It probably merits an analysis but needs some published primary work that is not made of unobtainium.

Claims about this plant presently should be regarded with some reservation. There were some additional comments on it made by Peter Gorman (who refers to it as the “moon cactus”) that really do not deserve even this much of a mention. (In High Times and on his webpage.)

**Melocactus depressus Hooker**

An arabinogalactan from this species was reported to show activity at stimulating phagocytosis. Silva & Parente, 2002

**Melocactus peruvianus**

(Caycho Jimenez 1977 (page 91) asserted that it contains mescaline but did not offer any supportive reference. An analysis may be indicated but the origin for the claim seems questionable.)

**Melocactus peruvianus Vaupel**

(Modified from Ritter 1981; figure 1171)
Melocactus peruvianus
(BTA)

Melocactus depressus
from
Curtis 1839 The Botanical Magazine
Cactus Chemistry: By Species

Myrtillocactus geometrizans

“garamballo”

Pulp is used in Mexico as a diuretic & antipyretic.
SOU LAIRE 1947.

Peniocerol, Macdougallin and Chichipegenin from an
extract of plant and roots were all reported to have insecticidal
and insect growth regulation activity.
CÉSPEDES et al. 2005

Sometimes called the berry cactus or the billberry cactus.
Fruit is popular and sold fresh or dried in local Mexican
markets.
Fruit are referred to as garambullos or billberries.

Neoraimondia macrostibas

Said to be incorporated into the drink known as cimora.
CRUZ SANCHEZ 1948 (as Cereus macrostibas)
This is presented as being in combination with other cacti
and plants.
See a more detailed discussion in OTT 1993 & in Sacred
Cacti Part B. San Pedro pages 110-112.

To locate a color PDF of the San Pedro book:
http://troutsnotes.com/pdf/SP.pdf

Neoraimondia macrostibas v. roseiflora
Tucume, Peru
Photograph by N. Logan

Myrtillocactus geometrizans
flowering & fruit
(HBG)
Trouts Notes on Cactus Chemistry

*Nopalea cochenillifera* (L.) SALM-DYCK

“nocheznopalli” (Nahuatl), “nopal de San Gabriel” (Oaxaca) “tuna mansa” (Puerto Rico), “tuna”, “nopal” (El Salvador) Joints used as poultice for articular rheumatism, erysipelas, ophthalmia, earache and toothache. STANLEY 1924

Pink or red floral tissues used as refreshing tea. SOULAIRE 1947

An important host plant for cochineal insects (hence its name).

*Nopalea karwinskiana* (SALM-DYCK) SCHUMANN

“nopalillo de flor” (Jalisco), “nopalillo” Root said to be used as remedy for dysentery. STANLEY 1924

Obregonia denegrii

DUKE lists as used for Antibiotic, Poison (unclear if used as a poison or as a remedy for poisoning), Sympathomimetic.

*Nopalea cochenillifera* (HBG) H 48668 Upper left (Hebbronville, Texas) Upper right & below

The cochineal insect was also commercially cultivated on *Opuntia elatior* MILL., *Opuntia horrida* SD, *Opuntia nopalilla* KARW., *Opuntia Hernandezii* DC, *Opuntia tuna* MILL., & *Pereskia bleo* DC. SOULAIRE 1947
Cactus Chemistry: By Species

**Opuntia basilaris**

- Used as an analgesic.
- Employed to treat skin ailments and warts.  
  **JOHNSON 1999**
- Warts - HARTWELL

**Opuntia dillenii** see as **Opuntia stricta** var. dillenii

**Opuntia echinocarpa**

An ethyl acetate extract derived from a strain of *Fusarium oxysporum* (mitosporic Hypocreales; an endophytic fungi inhabiting the stem tissue of *Opuntia echinocarpa* AKA “silver cholla”) were reported, using bioassays, to possess activity for the inhibition of metastasis [Using the wound-healing assay (WHA)] and proliferation/survival [MTT assay].  
  **BASHIVAL et al. 2007**

**Opuntia elatior**

Antiseptic, Bilioussness, Boils, Coughs, Expectorant, Guinea-worms, Inflammation, Ophthalmia, Pertussis, Sores & Spasms.  
  **DUKE**

**Opuntia engelmannii**

“Cactus apple”

“Arizona cactus pear extracts effectively inhibited cell growth in several different immortalized and cancer cell cultures, suppressed tumor growth in nude mice, and modulated expression of tumor-related genes. These effects were comparable with those caused by a synthetic retinoid currently used in chemoprevention trials.”  
  **ZOU et al. 2005**

The owner of the company making this product told me that it is obtained from *Opuntia engelmannii.*  

Used to treat “women’s ailments”.  
  **JOHNSON 1999**

**Opuntia ficus-indica**

- Used as a diuretic and for treating diarrhea.  
  **SOULAIRED 1947**
- Flowers employed for dysentery.
- Poultice used for “various painful conditions”, ulcers, sores & boils.  
  **EL-MOGLAZY et al. 1982**
- Used as an emollient.
- Used to treat calluses, corns, leprosy, measles, tumors.  
  Also for kidneys.  
  **JOHNSON 1999**
- **DUKE** lists uses as: Burn (Radiation), Callus, Corns, Decongestant, Diabetes, Diarrhea, Diuretic, Emollient, Internal ulcer, Kidney, Leprosy, Measles, Piles, Scald, Sore, Sunburn, Tumor & Wounds.
- Anti-hyperglycemic effects were only evident in temporarily hyperglycemic mice.  
  **ALAICON-AGUILAR et al. 2003**

The betalain distribution and antioxidant activity for three Sicilian cultivars of *Opuntia ficus-indica* was studied by Butera.  

The antioxidant activities of methanolic extracts from the edible pulp of the three cultivars were investigated as was the amount of reducing capacity for purified betanin and indicaxanthin. The yellow cultivar exhibited the highest amount of betalains, followed by the red and white ones.

The methanolic fruit extracts showed a marked antioxidant activity (measured as 6-hydroxy-2,5,7,8-tetramethylchroman-2-carboxylic acid (Trolox) equivalents per gram of pulp), dose-dependently inhibited the organic hydroperoxide-stimulated red cell membrane lipid oxidation, and inhibited metal-dependent and metal-independent low-density lipoprotein oxidation. The extract from the white fruit showed the highest protection in all models of lipid oxidation.

Purified betanin and indicaxanthin were both reported to be more effective at scavenging the [2,2'-azinobis(3-ethylbenzothiazoline-6-sulfonic acid)] dianionmum salt cation radical than Trolox.  
  **BUTERA et al. 2002**

The 8 flavonoids isolated from the ethyl acetate fractions of an extract of the fruits and stems of *Opuntia ficus-indica* var. *saboten* had antioxidant activity and neuroprotective effects studied. All found to be active at inhibiting lipid peroxidation and free radical scavenging. Quercetin and its 3-methyl ether were found to inhibit XO activity (in vitro). Quercetin was more active than (+)-di-hydroquercetin. Quercetin 3-methyl ether was the most active.  
  **LEE et al. 2003**

**Opuntia fragilis**

Used for skin ailments & throat ailments.  
  **JOHNSON 1999**

**Opuntia fulgida**

**DUKE** lists uses for: Toothache, Diarrhea & Short-windedness.
Trouts Notes on Cactus Chemistry

Opuntia humifusa (= Opuntia compressa)

Used to treat skin ailments. Johnson 1999
Extract of the pads was shown to possess potent antioxidant, radical scavenging and anti-inflammatory activity.
One of the active radical scavengers was determined to be quercetin. Cho et al. 2006
Lloyd Brothers (1903, 1908) says Opuntia rafinesquei (now Opuntia humifusa) has been “inexcusably substituted” for Selenicereus grandiflorus.

Opuntia imbricata
Decoction of fruit used to set cochineal dye. Standley 1924

Opuntia lindheimeri
Used for bruises (veterinary), dyspepsia, mumps, swelling.
Johnson 1999, Duke

Opuntia megacanthus
Showed activity at reducing plasma glucose but was suggested to demonstrate possible kidney toxicity (in rodents). Bwiti et al. 2000
Employed as a laxative. Johnson 1999
Used for inflammation, pregnancy. Johnson 1999
Pads used as a poultice. Duke
Standley 1924: the “best edible tunas” come from this species.

Opuntia megarhiza
Employed for treating fractures & inflammation. Johnson 1999
Palmer reported the fleshy roots to be used as poultices for fractures and inflammation. Standley 1924

Opuntia humifusa (UC) native to Georgia

Young Opuntia megarhiza (Silver City, NM)
White tufts, occasional on pads above, are cochineal

570
Opuntia moniliformis (L.) Steudel

Used to treat tumors. Johnson 1999 (from Hartwell)

Opuntia phaeacantha Engelmann

“Tulip prickly pear”
Use in “women’s ailments” Johnson 1999

Opuntia plumbea Rose

Used for skin ailments & “women’s ailments”. Johnson 1999

Opuntia polyacantha Haworth

Used in folk medicine for backache, diarrhea, moles, warts, & wounds Johnson 1999 (Hart was source for the first two.) The word “poison” is listed in Johnson 1999 but it is not clear if that means being used as a poison or for treating poisoning.

Opuntia pseudo-tuna Salm-Dyck

Used for treating tumors. Johnson 1999 (from Hartwell)

Opuntia rafinesquei Engelmann

See under Opuntia humifusa.

Opuntia reflexispina Wiggers & Rollinson

See as Corynopuntia reflexispina

Opuntia reticulata

A semimonstrose plant known as Opuntia zebrina, Opuntia zebrina forma reticulata and Opuntia dillenii forma reticulata

Purgative & anthelminthic.
Root has dental application.
Soulaire 1947

Opuntia spp.

Young joints are applied as poultices to reduce inflammation. Standley 1924

Duke lists as being used for:
Opuntia pubescens

AKA Gorondilla, Golondrina
Boiled aqueous extract of leaf pulp is used to remove obstructions from the urinary tract (in combination with other herbs)
Beiar et al. 2002. (Vilcabamba, Ecuador)
Opuntia pubescens
(LA Arboretum)
Opuntia streptacantha
(BTA)
**Cactus Chemistry: By Species**

**Opuntia streptacantha**

An extracted fraction believed to be proteinaceous in nature was found to inhibit replication of a number of DNA and RNA viruses in vitro and in vivo.  
Ahmad et al. 1996

Administration of a stem extract to mice, horses, and humans was reported to inhibit replication of a number of RNA- and DNA-viruses including Equine herpes virus, Herpes simplex virus Type 2, HIV-1, influenza virus, pseudorabies virus, and respiratory syncitial disease virus. The active component was not identified but was suspected to be proteinaceous. Ahmad et al. 1996

A “highly stable trypsin-like proteinase inhibitor” was isolated from the seeds and characterized. Torres-Castillo et al. 2009

No anti-hyperglycemic effects observed, except in alloxan-diabetic mice. Alarcon-Aguilar et al. 2003

**Opuntia stricta var. dillenii**

most often analyzed as Opuntia dillenii

Used to treat pimples. Johnson 1999

Guineaworms, Ophthalmia, Pimples, Sores, Syphilis. Duke  
“Actions: Promotes the flow of ch ‘i, invigorates blood circulation, clears up heat, removes toxin.”

Chest & abdominal pain due to nervousness, dysentery, hemorrhoids, cough, sore throat, lung abscess, mastitis, snakebite. 30-60 grams fresh stem is given as a dose Hsu et al. 1986

Employed in Chinese folk medicine for diabetes, gastric ulcer & inflammatory conditions. An aqueous ethanolic extract of stems showed significant radical scavenging activity. Qiu et al. 2002

Loro et al. 1999 reported that the aqueous extract of Opuntia dillenii fruit exhibited central analgesic properties associated with an anti-inflammatory action. Analgesic & anti-inflammatory effects were found to be present in the fruit, flowers & stem but were the most pronounced in the alcohol extract of the fresh flowers. Ahmed et al. 2005

Methanolic extract of cladodes and also purified Opuntioside-I, an α-pyrone glycoside that had been isolated from the cladodes, showed potent hypotensive activity in vivo. Saleem et al. 2005

**Opuntia tuna (L.) Mill.**

Used to treat asthma, diarrhea, gonorrhea, rheumatism. Johnson 1999 (from Krochmal & Krochmal 1973)

Stems are boiled and used as poultice for rheumatism. Johnson 1999

Fruit for asthma, diarrhea, gonorrhea. Johnson 1999

**Pachycereus marginatus**

“hair black”, “inflammation” Martinez 1969

**Opuntia stricta var. dillenii (UC)**
Cactus (Opuntia vulgaris) is called “thorny, useless.” The author was told that black people in Oklahoma burn off the spines and apply a slice of the pad to corns to relieve pain.

One treatment said to be used for removing warts “is that of rubbing them with prickly pear (Opuntia vulgaris). A split joint of the same plant is also applied to relieve inflammation from insect stings or bites.”

Tantaquidgeon 1942. A study of Delaware Indian medicine practice and folk beliefs.

A familiar problem arises here in that this claim is being voiced by a nonbotanist; Opuntia vulgaris does not occur in that part of the world. This might be assumed to be in reference to Opuntia polyacantha but it might also mean Opuntia fragilis or Opuntia macrorhiza or another species.
Pachycereus pringlei
(Cambridge Botanical Garden)
Trouts Notes on Cactus Chemistry

**Pachycereus pecten-aboriginum**

Mexican: “cardon”, “hecho”

One Tarahumara name, wichowaka, appears to be derived from wichuwa-ka; a term meaning “crazy” or “demented”.

The plant is said to be used by crushing young branches to yield a juice which is added to 3 times as much water and then consumed. A fermented version is said to be purgative.

Bye described the juice expressed from its stems as being “occasionally used by the Tarahumara of the western barrancas to induce visions, along with quick intoxication during “tesguinadas”.”

**Bye 1979**

Pennington 1963: 166-167 mentions this as being one of the “narcotic” cacti used similarly to Lophophora.

“**There is some minor utilization of juice from young branches of cawe (Pachycereus pecten-aboriginum)** in ceremonies held in western canyons. A piece of the branch is crushed in a hollow rock and the expressed juice is added to water, about one part of juice to three parts of water. This mixture is claimed to produce the same effect as drinking a "mixture of jíkuri and water, and results in dizziness and visions." Pennington 1963

In spite of long reported accounts of *Pachycereus pecten-aboriginum* (and others) being used ritually, and chemical evaluations being done, there has apparently been no published pharmacological assessment concerning which, if any, of its contained alkaloids are entheogenically active.

**Bruhn & Lindgren 1976** found the main alkaloid to be salsolidine in the wild plants they tested. This physiologically active alkaloid is not a hallucinogenic compound although it is thought to play a role in perceptual disturbances experienced by alcoholics.

This certainly is an area both ripe and long overdue for an evaluation. [Reit 1950 notes that both Carnegie and Pilocereine are known to be fairly toxic in mammals.]

Pennington’s ethnological account mentioned that young branches are used, as opposed to young plants or older branches. Gigantine was found to be most prevalent in the growing tips of saguaro branches and was not observed in younger cultivated plants, so perhaps may be some rationale to the selection of this part of adult plants of *P. pecten-aboriginum*. Alkaloids often vary in levels and actual composition between plant parts and it is not uncommon for active growth to have an entirely different composition in some plants.

The chemical evaluations concerning this particular plant (at least those we have seen) have not taken this into account. Native people who have an intimate familiarity with plants rarely do anything without purpose. Such things are often overlooked or dismissed as trivial or unimportant. They may be, and sometimes are, but one cannot automatically assume they can be disregarded.

Used in Mexican folk medicine:

- Gastric ulcers (Citing Bravo 1964)
- Cancer remedy (Citing Hartwell 1968)

(Both of which mention rather than being a primary account.)

Heliamine was reported to inhibit the growth of sarcoma 45 in rats by 60-79%, in Chachoyan et al. 1973.

**Strombom & Bruhn 1978**

Pachycereus pecten-aboriginum (Oz)
One of the three cacti that the Seri believe used to be human, Pachycereus pringlei

Earl Crockett concluded elements in Baja cave art represented the cardon in a supernatural context.

Using a unique combination of Baja cave art, literature searches, intuitive guidance and personal courage Earl eventually harvested a section of cactus, cooked it into a tea in his hotel room, returned to the rock shelter that had been his inspiration, and ingested it. In doing so, Earl uncovered the activity of the cardon. He presented a story of his experience that he believed put him in contact with both the plant and the people who once used it. He described hearing their language, seeing their dress, manners & customs, and watching their lives.

Following his adventure Earl sought out Sasha Shulgin in an attempt to stimulate more research into this plant and its bioactivity.

A nice account of the next part of the story appears at: http://www.mdma.net/alexander-shulgin/professor-x.html

"So Shulgin dissolved the extract of the cactus into fruit juice, then poured a 4-ounce cup for each person. But his experiment went awry. "At about the two-hour point, my visual experiences became totally swamped by an overwhelming fear of moving," recalls Shulgin, the 77-year-old chemist who introduced ecstasy to the world. His wife, Ann, had an even more severe reaction. Out on the deck, she remembers, "I could see the full moon shining down on me with what felt like chilling contempt, and I thought, "What an awful, stupid way to die." With her pulse racing, she went inside to check on her husband, who was upstairs in one of the bedrooms, lying still in the dark. "He said he was OK as long as he didn't move." Early the next morning, Shulgin assembled his test group, still in pajamas, to assess the effects of the cactus extract. All 12 of them had taken the same compound, but half had become violently ill, while the other six had the kind of pleasant but unremarkable experience Shulgin expected. The results, he decided, were inconclusive."
In a series of personal conversation between 2001-2005 Shulgin commented on his observation of N-Methyl-mescaline in the plant and its possible significance. He said that he suspected, despite its established lack of interesting properties, it was probably the active compound, enabled to be active orally by due to the presence of one or more MAOIs. Sasha referred to the combination as cactihuasca. He also lamented about the difficulty of finding bioassayists for completing this research. Apparently this was due to a heavy body load for both the plant and pure compound combinations. This is essentially where the matter still stands today, a decade later.
Cactus Chemistry: By Species

*Pachycereus pringlei* has been reported to be used for:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aches</td>
<td>Earache</td>
</tr>
<tr>
<td>Blood clotting</td>
<td>Evil eye</td>
</tr>
<tr>
<td>Bruises</td>
<td>Fever</td>
</tr>
<tr>
<td>Burns</td>
<td>Hemorrhoids</td>
</tr>
<tr>
<td>Digestive</td>
<td>Headache</td>
</tr>
<tr>
<td>Cancer: stomach</td>
<td>Kidney problems</td>
</tr>
<tr>
<td>Cancer: uterus</td>
<td>Pimples problems</td>
</tr>
<tr>
<td>Cough</td>
<td>Poor circulation</td>
</tr>
<tr>
<td>Cramps</td>
<td>Poisonous snake bites</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Rheumatism (also in Johnson 1999)</td>
</tr>
</tbody>
</table>

Suspected of being the plant *Clavigero* 1789 described being used by missionaries for creating a balsam for wounds and bruises by boiling down the juice of its branches. *Stansley* 1924: 895

*Pelecyphora aselliformis*

“peyote”, “peyotillo”  
Used in San Luis Potosí for treating fevers. *Stansley* 1924: 973  
*Duke* lists also used for anodyne, antibiotic, rheumatism.

*Peniocereus greggii* (Engelmann) Britton & Rose  
“night-blooming cereus”, “reina de noche”, “ho’o’k iwa”, “huevo de venado”  
Fruit mixed with deer grease is used as a salve for sores.  
*Castetter* & *Underhill* 1935: 65  
Used as a plaster for lung inflammation, similarly to *P. striata* below. *Castetter* & *Bell* 1937: 42

*Peniocereus striatus* (Brandegee) Buxbaum  
as *Wilcoxia striata* (T. S. Brandegee) Britton & Rose  
“cardoncillo”, “dahila-rooted cereus”, “pitahayita”, “jarramatraca”, “racamatraca”, “sacamatraca”  
Valued medicinally in Baja California.  
“The tubers are sometimes crushed and a cloth saturated with the juice applied to the chest for lung troubles.” *Goldman* 1916: 356  
“A cloth saturated with the juice of the crushed roots is sometimes applied to the chest to relieve inflammation of the lungs.” *Stansley* 1924: 903  
“A cloth saturated with juice of the crushed roots was applied to the chest to relieve inflammation of the lungs.” *Castetter* & *Bell* 1937: 42

*Pereskia aculeata*

Fruits expectorant and antisyphilitic. *Soulaire* 1947

*Pereskia bleo*

Known as expectorant and antisyphilitic. Used in the treatment of yellow fever. Its sap is used to clarify water. *Soulaire* 1947  

Whole plant is used to treat gastrointestinal problems (Panama) *Sim* *et al.* 2010a cited *Gupta* *et al.* 1996.  
Cytotoxic effects (apoptosis) on various cancer cell lines. *Sim* *et al.* 2010a cited *Er* *et al.* 2007, *Sri Nurestri* *et al.* 2008 & *Tan* *et al.* 2005. *Tan* *et al.* 2005 had demonstrated a cytotoxic activity against the human breast carcinoma T47-D cell line. *Er* *et al.* 2007 reported some degree of antiproliferative activity against some cell lines under some conditions but also noted a mutagenic potential in the presence of liver enzymes.  
Acute toxicity studies for this & *P. grandifolia* produced no deaths so the LD₅₀ of the methanolic extract was estimated to be in excess of 2.5 grams/kg of body weight. *Sim* *et al.* 2010a

*Pereskia grandifolia*

“Jarum Tijuh Bilah” (Malaysia)  
Used in local Malaysian folk medicine for the treatment of cancer & tumors, atopic dermatitis, diabetes, gastric pain, headache, high blood pressure, inflammation, rheumatism, ulcers and “for revitalizing the body”.  
The fresh leaves are usually consumed raw or as a decoction. *Sim* *et al.* 2010 cited *Goh* 2002 & *Ražmet* 2004.  
Cytotoxic effects on various cancer cell lines. *Sim* *et al.* 2010 cited *Sri Nurestri* *et al.* 2009 & *Tan* *et al.* 2005.  
Fruit reportedly used to reduce swellings. *Sahu* *et al.* 1974 (citing *Anonymous* 1969: 309)

*Pereskia guamacho*

Gum used in lung disorders and catarh.  
Leaves used in enemas or as flavoring in herbal teas.  
Fruit are refreshing, diuretic and produce a pleasant drink. *Soulaire* 1947  
Used as cicatrizant, refrigerant, suppurative. Used for inflammation, sores, syphilis. *Johnson* 1999

*Pilosocereus royenii*

“Royen’s Tree Cactus” lacks any published analysis.  
(As *Cephalocereus royenii*) Fresh juice extracted from leaves and fruits was purportedly taken orally and used in “sorcery” and for the “liver” in Vilcabamba, Ecuador. *Beiar* *et al.* 2002.  
However, this seems likely to be in error. *Beiar* *et al.* 2002 (248-249) also includes as synonyms three completely different plants that are presently recognized as *Hylocereus* species. Furthermore all of the common names that are given are common for *Hylocereus* rather than *Pilosocereus* species AND their photograph of an herbarium voucher clearly appears to be of a dried *Hylocereus* rather than a *Pilosocereus*. See additional comments under *Hylocereus monacanthus.*
Trouts Notes on Cactus Chemistry

*Hylocereus monacanthus*

Entry into the literature appeared as the unrelated columnar cactus *Cephalocereus royenii* (aka *Pilosocereus royenii*). However, Beiar et al. (2002: 248-249) also included as synonyms *Hylocereus lemairei* (now *Hylocereus monacanthus*), *Hylocereus ocamponis*, and *Hylocereus polyrhizus* which are three completely different plants that are all presently recognized as separate species.

There is clearly much confusion within that account as to what plant is actually used as the herbarium voucher shown is of a *Hylocereus* rather than a *Pilosocereus*. Similarly the common names listed (Pitayo, Pitaya, Pitahaya) are commonly applied for *Hylocereus* species but not for *P. royenii*.

The fresh juice extracted from leaves and fruits was said to be taken orally and purported to be used in “sorcery” and for the “liver” in Vilcabamba, Ecuador. Beiar et al. 2002.

*Rhipsalis cassytha*

Antihelmintic activity. *Soulaire* 1947

*Rhipsalis conferta*

The juice from this cactus caused death by cardiac arrest when injected. (from *Soulaire* 1947)

This refers to comments made by Lewin in 1894 concerning the results of his experiments on cold blooded animals. (I am unaware of any good or useful outcomes ever being reported after injecting cactus juice into an animal.)

*Rhipsalis pachyptera PfFeiFFer*

Fruit is used for fevers in Brazil. *Soulaire* 1947

*Pilosocereus royenii*

Peter Island
Photograph copyright by Bill Linton
Cactus Chemistry: By Species

Pereskia aculeata
(SRSU)
Selenicereus witti
(Cambridge Botanical Garden)
Cactus Chemistry: By Species

Cereus Bonplandii J. PARMENTIER ex PFEIFFER

This is an old name that is usually considered to be a synonym or a variety of Selenicereus grandiflorus.
It is claimed to posses the same properties as S. grandiflorus but the Lloyd Brothers’ Drug Treatise dismisses this.
“FITCHI” was mentioned as regarding this to be an “antipsoric of remarkable power” and purported curing eczema, deposits in urine, dropsy of cardiac and renal origin, neuralgia & insanity. CLARKE also indicates the stem tincture for emaciation, affections of the heart and of the kidneys.
CLARKE 2002 (1900)

Selenicereus coniflorus

“…gathered in large quantities in Veracruz and shipped to the United States for use in preparation of medicine.” STANDELEY 1924: 914
The intended application was not mentioned.

Selenicereus grandiflorus

Drug extracted from plant used to treat rheumatism.
STANLEY 1924: 914
Used for dropsy according to JOHNSON 1999.
“Cardiac stimulant (tonic), diuretic, similar to digitalis, but non-cumulative, counter-irritant; cardiac palpitation and weakness, heart failure from valvular disease, angina pectoris, aortic regurgitation, dropsies, low fevers, Graves disease, tobacco toxemia, sexual exhaustion.”
CULBRETH 1927

From the Lloyd Brothers 1903/1908 "Drug treatise": Used in Jamaica & in Mexico for fevers, breathing difficulties, In excess amounts acts as an irritant producing diarrhea, increases size of pulse, calming to stomach, raises blood pressure and body temperature, useful for cases of impotency in young men, as a sexual tonic for women, dyspepsia, Grave's disease, angina, anti-tobacco smoking aid, aortic hypertrophy, nerve sedative, relieves symptoms of menopause, emmenogogue, neuritis, nerve tonic & restorative

More widely reknown as a cardiotonic. More words on that follow.
A thoughtfully concerned comment cautioning that Selenicereus grandiflorus contained cardiac glycosides appeared at the Cactus_etc chat group.
An on-line search reveals no shortage of claims asserting the presence as well as claims of the absence of cardioactive glycosides in Selenicereus grandiflorus but none find it necessary to include a reference to an actual evaluation.
Vogel et al. 2005 asserts it to be “Digitalis-like” in either its effects or application (said table did not differentiate them) and warned: "Increases effects of hypoglycemics; may enhance effects of cardiac glycosides, angiotensin-converting enzyme inhibitors, antiarrhythmics, beta-blockers, and calcium channel blockers.”

Ernst 2003 and “Data extracted from” FUGH-BERMAN 2000 were given as the references. The 2003 article cited Ernst 2000 as his source. When contacted, Dr. Ernst very graciously provided me with a copy of that elusive paper. This proved to contain a previous presentation of the aforementioned information.
Fetrow & Avila were pharmacists who assembled what they intended to serve as a medical & health professional’s reference work on this subject.
Fetrow & Avila flatly stated: “The plant contains a digitalis-like glycoside, either cactine or hordenine (N,N-dimethyl-4-hydroxy-beta-phenethylamine).”
Fetrow & Avila might have gleaned their assertion from elsewhere or it might reflect merely a bad verbal assemblage or translation of what they encountered elsewhere.
However, let's consider that rather densely inaccurate line that states Selenicereus grandiflorus to contain a cardioactive glycoside, either cactine or hordenine.
Cactine is generally believed to be synonymous with at least one of the known phenethylamines, usually it is said to be a synonym of hordenine. One must, however, ask the question of whether it was this or tyramine, or if it was one or more alkaloids. So far as I can tell, new plant material or medicinal preparations were what was always extracted for analysis and no actual samples of Sultan’s ‘cactine’ were ever analyzed by later workers.
While hordenine, tyramine and N-methyltyramine are thought to be mild stimulants with an indirect action on the heart, they are all simple phenethylamine alkaloids and they are not glycosides. And none of them possess any digitalis-like activity.
Hordenine and tyramine have been reported to be present in at least potentially pharmacologically significant amounts for someone brewing a tea from dried stems (See respectively Petershofer-Halbmeier et al. 1982 and Wagner & Grevel 1982a) but, as mentioned in an earlier post, the reports of these two alkaloids in this species have always been at odds with each other rather than their being reported as co-occurring.
I can also locate a referenceless claim on-line for the occurrence of N-methyltyramine in this species but not an analytical account that reported its presence. This claim was encountered within a summary report on the veterinary use of a homeopathic solution of Selenicereus grandiflorus that was posted in 1999 by “The European Agency for the Evaluation of Medicinal Products. Veterinary Medicines Evaluation Unit.” My request for clarification, emailed to their posted contact address, was returned as undeliverable.
These alkaloids are also not thought to be particularly active as cardiotonics. In a referenceless claim in Fetrow & Avila it was asserted that the believed mechanism of action of Selenicereus grandiflorus had not been supported in humans and that earlier work had found its preparations inert. While one can find at least assertions to the contrary in medical literature stretching back into the 1800s. It is just as easy to locate agreements with their conclusions.
Even if however the contained alkaloids turn out to be effective cardiotonics (which most workers consider doubtful), the most commonly used - and studied - form appears to be a
1:100 homeopathic dilution; which should not be expected to contain pharmacologically meaningful amounts of alkaloid. Many workers have used dried and prepared stems for making a tincture.

The Lloyd Brothers 1903/1908 “drug treatise” insisted that in addition to high quality and an adequate dosage (not homeopathic), the use of fresh plant juice for preparing the tincture was crucial for it retaining good activity. Finley Ellingwood, writing in that treatise (p.6), claims that the accounts of ineffectuality revolve around heated, poorly prepared or otherwise inactive versions.

Their account of its actions bear reading as they do not suggest it to be particularly toxic or Digitalis-like although they do include descriptions of many actions on cardiac function. (That work is available on-line in PDF format.)

Fetrow & Avila continued and pointed to a more recent study in rats and dogs reporting “a positive inotropic effect on the heart with increased systolic and diastolic pressures and peripheral blood flow volume.” (This was in reference to HAPKE 1995 who evaluated pure hordenine using very high dosages.) They ended their entry with an ‘analysis’ beginning with the peculiar statement “Although night-blooming cereus contains a digitalis-like glycoside, its use as a substitute for digitalis preparations (digoxin or digitoxin) or treatment of heart-related disorders has not been evaluated in humans.”

Fetrow & Avila’s only references were HAPKE 1995 and WADWORTH & FAULDS 1992.

The first paper discusses a pharmacological evaluation of hordenine and makes no mention of cardioactive glycosides, digitalis-like alkaloids or Selenicereus grandiflorus. The second paper appears to have only marginal connectiveness, at best, to the pharmacology of Selenicereus grandiflorus and none to the subject of digitalislike cardioactive glycosides. As was true for HAPKE 1995, it does not even mention these compounds or Selenicereus grandiflorus.

While the glycosides cacticin, narcissin and flavonol-3-glycoside were reported as being isolated from its flowers by HORHAMMER et al. 1966, I cannot determine that any of the three other than narcissin has ever seen pharmacological evaluation. Whatever evaluation narcissin has seen is apparently limited to a Chinese language article so I am presently unable to glean more. As its concentration in Selenicereus grandiflorus is believed to be 0.05% by dry weight and its activity appears to revolve around decreased capillary permeability, it seems unlikely to make a significant contribution toward a purported digitalis-like action.

My present GUESS is that someone somewhere saw that “glycosides” were reported from the flowers of the plant, noticed that the species was considered to be cardioactive in application and assumed there was a connection between the two that is, so far as I can determine, unwarranted. It could simply be that casual reading caused someone to mistakenly link the words “cardioactive” and “glycoside” together into the familiar phrase “cardioactive glycosides”. Whatever the case this appears to have occurred fairly early in its clinical history.

Melero 2000 includes a very nice discussion of cardioactive steroids and glycosides that clearly shows that these particular compounds are quite different from any of the steroids or glycosides reported as occurring within any member of the Cactaceae, including Selenicereus.

Most glycosides have little or no discernible pharmacological activity of any type.

Several other earlier claims asserting that cardioactive glycosides occur in this species have been encountered but I have not yet obtained their purported references, when references are included. (For instance PETERSHOFER-HALBMEYER et al. 1982 made a unclearly referenced statement purporting a digitalislike substance -- “[...] digitalisähnliche Stoffe zurückgeführt werden.” In their listed references we did find another source that similarly made the claim “[...]” digitalisähnliche Stoffe enthalten soll.” Interestingly, that paper by Frohne 1977 enclosed digitalislike in quotation marks. Frohne did not include any references but did comment that anyone newer work on the pharmacology or establishing the structures of what is responsible was not known to him.)

Standley 1924 also makes the unreferenced statement “Action similar to digitalis” which no doubt lodged in some people’s mind.

Part of this topic achieving life that it was not warranted was probably due to the fact that medical professionals helped propagate the line both on-line and in prestigious peer reviewed journals. Peer review only works when said peers take the time to review the details of published data.

If it concerns something deemed trivial, such as in this case a plant species that was not in use by modern medicine, it is easy for no one to care enough to look deeper, especially if the mistake appears in a commentary supporting the lack of use.

My thanks go to Dr. Edzard Ernst for graciously providing a copy of his paper from Perfusion, also to Leo Martin for providing several very pertinent references and to Dr. Martin Terry for his help in obtaining some obscure papers.

Selenicereus grandiflorus (Austin, Texas)

Obtained from a consumer who combines with T. pachanoi
**Stenocereus alamosensis**

Anti-type I allergy activity of the saponins with RBL-2H3 (Rat basophilic leukemia) cells was studied by measuring the β-hexosaminidase release inhibitory activity. Gummososide A methyl ester was found to show activity ($IC_{50} = 99.5 \text{ lM}$).

*KAKUTA et al. 2012*

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**Stenocereus eruca**

Anti-type I allergy activity of the saponins with RBL-2H3 (Rat basophilic leukemia) cells was studied by measuring the β-hexosaminidase release inhibitory activity. Thurberoside A exhibited mild activity ($IC_{50} = 166.9 \text{ lM}$).

*KAKUTA et al. 2012*

Machaerogenic acid was reported to be an antagonist of the CCR6 receptor in a biological screening by ROTH 2011.

*Stenocereus eruca*  
aka  
*Macachrocereus eruca*  
(Cactus Country) above

*Stenocereus alamosensis*  
(BTA) left
Trichocereus atacamensis

*Trichocereus atacamensis* (San Pedro de Atacama, Chile) has been reported to have mild stimulant activity in human bioassays. [Dosage was 6-8” of a single rib. ANONYMOUS]. Analysis is lacking.

Trichocereus bridgesii

Mescaline estimates based on isolations that have been posted on-line by anonymous sources in Oz have largely been between 0.12% to 0.23% with the occasional strain giving 1-2%

The common reports of potency greater than seems to be able to be accounted for by the reported mescaline content (based on human bioassays) has lead a number of people to speculate that an MAOI or some other interactive alkaloid may also be present. More research seems warranted.

Bridgesii is not just potent but apparently used at the folk level. For example, one correspondent requesting anonymity has reported that *bridgesii* was used commonly, but privately, in Bolivia and was abundant both in the wild and cultivation. He found numerous examples of intensive propagation as well as heavily harvested plants. The reported potency was described as “phenomenal”.

While Miguel Kavlin has claimed he could not find it in use by anyone other than himself in Bolivia, Darylene Dickson reported it being used there and sold in La Paz. However she misidentified it as *T. pachanoi* due to its name San Pedro.

Part of this may stem from an eradication campaign aimed at *bridgesii* stands around major urban areas, conducted by the Bolivian military around the end of the 1970s. This was apparently in response to an influx of “hippies”. One individual recalled seeing soldiers shaving the head of a long haired man in public by during that time period. (Personal communication with Bolivian correspondent requesting anonymity)

Murple also made an interesting comment that he was unable to locate any stands of *bridgesii* in the La Paz area that did not show signs of heavy harvesting. He claimed to have encountered a quarter mile hedge of *bridgesii* in which he was unable to find a single stem that had not seen a harvest.

Trichocereus chiloensis

Used to treat tumors. JOHNSON 1999 (i.e. HARTWELL)

Trichocereus cuzcoensis

Sold in Cuzco as a hair rinse. KAMM personal communication. Used for treating cancer. JOHNSON 1999 (i.e. HARTWELL)

Plant shown on lower right was sold as *Trichocereus cuzcoensis* but was obviously misidentified. The dried commercial material purported to be from this plant that was field collected at Huamanga near Cuzco in Peru is proven to contain mescaline in human bioassays. Doses of 20 grams are reported by bioassayists. It may not be a *Trichocereus*.

An identification and an analysis is needed.
**Trichocereus grandiflorus**

This species has a report of activity purportedly due to its mescaline content. It is my belief that this involved a misidentified plant and that no bona fide *T. grandiflorus* contains any mescaline.

Possibly it was the result of the plant shown to the right that was once sold by NMCR. The cactus depicted is almost certainly a mescaline container.

I have not been able to track that list back to its origin but the account gives it as having white flowers. The *T. macrogonus/peruvianus* shown will certainly have white flowers.

Below are three images of an actual white-flowered *T. grandiflorus*.

Sold misidentified as *T. grandiflorus* (NMCR) Photos by MS Smith
Trichocereus growing near Huanuco, Peru
Photos by Grizzly
Trichocereus growing in and around Huanuco, Peru
Photos by Grizzly
Trichocereus huallanca or huayanca.

This name is not published. Nor is published with its variant spelling T. huayanca.
This is not simply not a good Trichocereus species name, this plant is not a Trichocereus.
In fact it is unmistakably an Opuntia of some sort, most likely in what is now termed the Austrocylindropuntia. It does not appear to be Opuntia cylindrica despite the general resemblance.
A number of similar appearing species are known, for instance Opuntia kuehrichiana, but I have no clue about the actual identity of this Opuntia species.
More information and an analysis would be nice but perhaps a waste of time? My present suspicion is this claim is a scam as the dried material on the right is sold by the same vendor represented as being as flesh from this plant. Despite a cutting being organized, no live material was included in the shipment.
Notice that those dried pieces came from a columnar cactus with straight ribs and not from this plant which is imbricate? There seems to be too much wrong with this picture to encourage me to waste much more time on it.

Labeled as Trichocereus macrogonus but appearing different from most macrogonus so far encountered.
It does resembles the macrogonus that I obtained from Abbey Garden in 1980 (which was grown from Knize’s seeds).
A shortish-spined *Trichocereus pachanoid* cutting sent from Peru starting to grow longer spines.
Trouts Notes on Cactus Chemistry

Plant below (a *pachanoi*) was not identified but was said to be employed as *San Pedro* in Peru. Cutting sent from Peru is on page 593.

**Trichocereus pachanoi**

Widely employed as a sacramental brew for treating and diagnosing illnesses. Used for spiritual, shamanic & religious purposes; credited with enhancing precognition & health. Heaven 2013

Employed as emetic, entheogen & hypnotic Johnson 1999

Used for enteritis, evil-eye, gastritis, pneumonia, sterility. Johnson 1999

Monstrose forms are rumored to be especially active in human bioassays. (Anecdotal claim made by vendors in the Lima plant drug market)

Ostolaza 1996 illustrated the cristate form being depicted in a supernatural context by the Paracas culture in Peru. See more in *Sacred Cacti Part B San Pedro*.

**Trichocereus Schoenii**

Grizzly encountered specimens in Colca Canyon, Peru showing evidence of intensive repeated harvesting suggesting its use for brew preparation. (Personal communication 2005)

**Trichocereus Scopulicola**

First proven to contain Mescaline based on human bioassays. In the US this was using NMCR grown material but no actual details were included beyond an opinion of substantially greater potency than *Trichocereus pachanoi*. (Personal communication from Margadarsh)

In Oz this was using material that was seed grown from Ritter FR991 seeds initially but by the late 1960s Australian commercial cactus producers in Victoria began successfully producing and distributing their own seeds.

Personal communication from Snu Voogelbreinder reported good results with 800-1000 gm fresh wt. of Australian material.

Voogelbreinder also determined that modern human sacramental usage was wider and older than suspected; by people mistakingly thinking it was *T. pachanoi*!

It might be suspected that this may eventually prove to be true for any indigenous users as well since bridgesii and pachanoi are apparently used interchangeably in Bolivia by people who would not consider this to be substantially different.

As the species is currently believed to be extinct in the wild this is rather a moot point.

**Trichocereus Schoenii**

Grizzly encountered specimens in Colca Canyon, Peru showing evidence of intensive repeated harvesting suggesting its use for brew preparation. (Personal communication 2005)
seed-grown *Trichocereus scopulicola*  
(Seeds from SS)
Trouts Notes on Cactus Chemistry

Trichocereus spachianus
Reported to be “psychoactive” but “different than San Pedro” by ANONYMOUS in correspondence 1998. Another correspondent claims to have determined it to be utterly inactive based on their bioassays. Another reported becoming “deathly” ill for a few hours. Needs further analysis.

Trichocereus terscheckii
Reported fully active in human bioassays conducted in California. Some were stronger than others while others had simple stimulant effects. ANONYMOUS; in correspondence 1998. Forms with simple stimulant action were described by one user as feeling like “dirty speed”. ANONYMOUS; in correspondence 2006.

Trichocereus taquimbalensis
D.M. TURNER asserted successful bioassays but included no details. GRIZZLY reported encountering specimens in Bolivia showing evidence of harvesting on a scale suggestive of brew preparation. (Personal communication 2005)
Cactus Chemistry: By Species

**Trichocereus tulhuayacensis**

A claim for the presence of mescaline is made by **Caycho Jimenez** 1977 (page 91) but he cites no reference to support his assertion. The presence of mescaline would not be surprising in this species.

*Trichocereus* mailed from Peru by Knize: *pachanoi* L; no label; *tulhuayacensis*; *peruvianus* R. *tulhuayacensis* was sold as a red flowered *peruvianus*.

Encountered for sale in the Chiclayo, Peru market. Photo by Hubie Smidlock

**Unidentified cactus species:**

*Trichocereus tulhuayacensis*
In considering these cacti, it is important to keep in mind that cacti have many folk uses -- not just use as hallucinogens. They are common and popularly used as hair rinses, in healing baths, for washing clothing, for treating fevers, stomach or intestinal complaints, as poultices and for “purifying water”. The latter I am assuming is in reference to removing heavy metal contamination as is now being done industrially using Opuntia cuticles? See Barrera-Díaz et al. 2005 & 2006 & Fox et al. 2012.

A future entry on this subject is coming to this book. Drinking water polluted by toxic metal run-off from mining activities and/or volcanic soils is common in the Andes. Opuntia epidermis has proven to be highly effective at adsorbing heavy metals.
Cactus Chemistry: By Species

Traditional ethanol-sources

*Cephalocereus leucocephalus*

See comments within *Lemaireocereus thurberi* below.

*Carnegiea gigantea*

Fruit syrup is used to prepare an intoxicating beverage.

STANDLEY 1924: 909

The only important intoxicating beverage used by the Papago is said to be a cider made from the fruit of the saguaro.

In its habitat, the brew making process is a matter of elaborate ceremony for every village with the brewing, the drinking and the intoxication itself being vital parts of the annual ritual for bringing rain.

While individual families brew their own at home, there is a communal co-creation of the ceremonial brew and the council house is kept warm by a small fire to aid the fermentation process. Each family contributes a jar of boiled juice.

As soon as the juice is decanted from its air-tight container into a large jar, it is mixed with four times as much water. Sometimes a starter from a previous batch may be added if the fermentation is too slow.

Fermentation is allowed to proceed for seventy-two hours.

“The resulting drink, called navai’t, is a crimson-colored sort of cider with a slightly nauseating taste, which, when drunk in the ritual quantity induces vomiting. This beverage is almost impossible to keep, therefore the tradition is that the whole supply must be consumed within twenty-four hours.”

CASTETTER & UNDERHILL 1935: 26

*Lemaireocereus thurberi*

In the southern part of their territory, the Papago made a drink similar to navai’t using the fruit of *Lemaireocereus thurberi*. It was the ceremonial drink for that region.

CASTETTER & UNDERHILL 1935: 26

“Fruits of *Lemaireocereus Thurberii* and *naplsora* (*Cephalocereus leucocephalus*), are used in preparing a fruit tesgüino in western canyons. Pulp from ripe fruit is mashed upon a mataka or upon any convenient rock. The juice is collected and mixed with water which is boiled for several hours and set aside to ferment. The common catalyst is batari, bark of *kakwari* (*Randia echinocarpa, R. Watsoni* and *R. laevigata*) and kaya (*Coutarea pterosperma*), which is readily available in the canyons.”

PENNINGTON 1963: 155.

STANDLEY suggested the early accounts of a cardon that created a brew which turned the urine red-like-blood referred to *Lemaireocereus Thurberii*.

Pachycereus pecten-aboriginum

Bye described the fresh juice expressed from young branch tips of the stems of this plant as finding occasional use “[... by the Tarahumara of the western barrancas to induce visions, along with quick intoxication during ‘tesguinadas’. The sap may be added to corn ‘tesguino’ or cooked and fermented alone, although this last preparation is said to act as a strong purgative.”

BYE 1979

Other cactus fruit

*Ferocactus* and *Opuntia* species provide fruit to the Tarahumara that, when they are available in sufficient quantities, are mashed and strained free from seeds. This juice is then diluted with water and boiled in the same manner as the other tesgüinos.

Pennington comments that in the Urique Canyon strained but undiluted and unboiled juice obtained from fruits of any of the local cactus species is put in the sun to ferment for several hours. “It is said to turn to ‘wine’ very quickly and when drunk produces a heady sensation that does not last as long as that caused from drinking boiled tesgüino. There is a tradition in the canyons that the setting aside of fruit juice for quick fermentation was formerly a widespread practice.”

PENNINGTON 1963: 155.

The Papago once made a fermented drink from *Opuntia engelmannii* fruit but this was never extensively used and lacked any ceremonial significance.

CASTETTER & UNDERHILL 1935: 26

*Colonche* is boiled and fermented *Opuntia* fruit juice.

*Nochote* or *nochocle* is a fermented brew made from *Opuntia* fruit juice, pulque and water.

STANDLEY 1924: 865

Ripe *Opuntia engelmannii* fruit
(near Rio Grande City in Starr County, Texas)
### Acacia berlandieri Bentham

<table>
<thead>
<tr>
<th>Compound</th>
<th>Spring (all via gc-ms) ppm</th>
<th>Late fall (all via gc-ms) ppm</th>
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</thead>
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<tr>
<td>Phenethylamine</td>
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<td><strong>3.2</strong></td>
<td><strong>30.2</strong></td>
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<td>Musk ambrette</td>
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### Acacia rigidula Bentham

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<td>Dopamine</td>
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<td>36.1</td>
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<tr>
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<td>N-Methyl-3-methoxytyramine</td>
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<tr>
<td>3,4-Dimehtoxy-4-methoxyphenethylamine</td>
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<td>N-Methyl-3-hydroxy-4-methoxyphenethylamine</td>
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<td>Nornicotine</td>
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<td>84.3</td>
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</table>

*Identity and amount present was inferred from the corresponding styrene
It was brought to my attention by Sasha Shulgin that there were some odd discrepancies in the accounts of Clement. Despite repeated attempts to learn answers, apparently no one connected with authorship of this paper has been willing to respond to several professional researchers attempting to obtain clarification. Most glaring: not all the novel compounds that their paper claimed were synthesized as reference materials have a published synthesis (personal communication with Sasha).

More recent work, published in Pawal et al. 2013, was unable to detect the presence of mescaline, mescaline derivatives or any of the purported amphetamines but it supported the prior analytical work by Camp et al. All of the other novel results in Clement’s accounts need a confirmation by someone or they should similarly be considered to be suspect.

See a review and commentary at http://sacredcacti.com/blog/acacia/
References

[Brackets around a title indicate it is likely an English translation of the actual title.]
Incomplete citations or the use of the qualifier “From” indicates that the paper listed was a second-hand reference. This often means that this work was unavailable to us but was the reference cited by our source.


Agurell, Stig (1969) Experientia, 25: 1132. “Cactaceae alkaloids. VIII. N-Methyl-4-methoxy-phenethylamine from Lepidocorypha runyonii (Br. & R.).” [This actually should be (1969a) but, due to their use by ourselves and others in works concerning only mescaline producing cacti, it was felt that changing the other two to b and c, respectively, would create more confusion than it would alleviate.]


Albesiano, Sofia & Roberto Kiesling (2012) Haseltonia, 17: 24–34. “Identity and neotypification of Cereus macrogonus, the Type of the generic name Trichocereus (Cactaceae).”


Altschul, Siri Von Reis (1973) Drugs and foods from little-known plants. Harvard University Press


**“Peyotl.”**


Anonymous (All other than 1959 and 1969 above) indicates correspondence or reports from workers who requested anonymity.


Backeberg, Curt (1977) *Cactus Lexicon. Enumeratio


Bezerra, J.D.P. et al. (2013) *Symbiosis*, 60: 53–63. “Fungal endophytes from cactus *Cereus jamacaru* in Brazilian tropical dry forest: a first study.” (Jadson D. P. Bezerra,
Trouts Notes on Cactus Chemistry

Marília G. S. Santos, Renan N. Barbosa, Virginia M. Svedese, Débora M. M. Lima, Maria José S. Fernandes, Bruno S. Gomes, Laura M. Paiva, Jarcilene S. Almeida-Cortez & Cristiana M. Souza-Motta


Britton & Rose (1919) Volume One.

Britton & Rose (1920) Volume Two.

Britton & Rose (1922) Volume Three.

Britton & Rose (1923) Volume Four.


Bruhn, Jan G. & Catarina Bruhn (1973) *Economic Botany*, 27: 241-251 “Alkaloids and Ethnobotany of Mexican Peyote Cacti and Related Species.” (Nice anthropological review of other sacred cacti. Their chemical analysis did not include any quaternary or neutral compounds.)


of 10 mexican prickly pear cultivars by high-performance liquid chromatography and electrospray ionization mass spectrometry.”


caffeyl alcohol in plant seeds.” (Fang Chen, Yuki Tobimatsu, Daphna Havkin-Frenkel, Richard A. Dixon & John Ralph)


Chow, S.Y. et al. (1977) Taiwan Yi Xue Hui Za Zhi (Journal of the Formosan Medical Association), 76 (12): 916-925. [Pharmacological studies of Chinese herbs (6) Pharmacological effects of Epiphylloxus oxypetalum Haw.] (article is in Chinese with an English abstract.) (Sien-Yao Chow, Chieh-Fu Chen & Shih-Ming Chen)


Clavijero, Francisco Javier (1789) Historia de la antigua ó Baja California, Four Volumes. Venice. Reprinted in 1852 by Impr. de J.R. Navarro (México) and in 1970 by Miguel Leon-Portilla (México).


Cooper, M. et al. (2013) Strength Testing and Material Characterization of Cactus Spines. Senior Project, Materials Engineering Department California Polytechnic State University, San Luis Obispo, 26 pages. (Mary Cooper, Jeff Goldstein, Tom Tarlton)

Correspondents requesting anonymity indicate people sharing bioassay information and or analytical data but wisely requesting their identities be omitted due to the current state of illegality for both mescaline possession and usage. The Entheogen Review contains the published accounts; personal communications with the bioassayist(s) were the source for the others


Cruz Sánchez, Guillermo (1948) “Estudio Farmacologico de la Opuntia cylindrica.” PhD Thesis; Instituto de Farmacologia y Terapeutica Universidad Nacional Mayor de San Marcos, Lima, Peru. (pp. 10-36) [This was clearly Trichocereus pachanoi that was misidenticated as Opuntia cylindrica.]

Cruz Sánchez, Guillermo (1948) Revista de la Farmacología y Medicina Experimental. (Lima) 1: 143-?. “Farmacologia de Opuntia cylindrica.” [From GUTIÉRREZ-NORIEGA; also given as 143ff]

Trouts Notes on Cactus Chemistry


Diaz, J.L. (1977) Annu. Rev. Pharmacol. Toxicol. 17: 647 [from Shulgin & Shulgin; Vol. 17 was stolen from our library]


(Hyang Dok-Go, Kwang Heun Lee, Hyoung Ja Kim, Eun Ha Lee, Jiyong Lee, Yun Seon Song, Yong-Ha Lee, Changbae Jin, Yong Sup Lee & Jungsook Cho)


Duke (no date) came from the online reference site below.

Duke, James A. (1985) CRC Handbook of Medicinal Herbs. ISBN 0-8493-3630-9. [For folk uses of San Pedros: Duke cited J. A. Duke & K.K. Wain (1981) Medicinal Plants of the World (Computer Index with over 85,000 entries. 3 volumes; 1,654 pages) This one of Duke’s primary references for his published claims but it is poorly to awkwardly referenced. Duke often cites himself as a primary reference even when it is clear that the material was derived from elsewhere in the published literature. See in “Dr. Duke’s Phytochemical and Ethnobotanical Databases.” at www.ars-grin.gov/duke. Duke’s comment on that site’s reference page might be found illuminating: “Please note that this is far from a complete list of references used by the database, and many more will be documented as time is allotted for such weighty matters.”


El-Kossori, R.L. (Computer Index with over 85,000 entries. 3 volumes; 1,654 pages) This one of Duke’s primary references for his published claims but it is poorly to awkwardly referenced. Duke often cites himself as a primary reference even when it is clear that the material was derived from elsewhere in the published literature. See in “Dr. Duke’s Phytochemical and Ethnobotanical Databases.” at www.ars-grin.gov/duke. Duke’s comment on that site’s reference page might be found illuminating: “Please note that this is far from a complete list of references used by the database, and many more will be documented as time is allotted for such weighty matters.”


Engelmann, George (1852) American Journal of Science and Arts


Förster, C.F. (1861) Hamburger Gartenz 17: 164 “Cereus lage-naeformis.”


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Grieve, Maud (1931) A Modern Herbal: the medicinal, culinary, cosmetic and economic properties, cultivation and folk-lore of herbs, grasses, fungi, shrubs & trees with all their modern scientific usages. J. Cape.


Haagen-Smit & Olivier, private communication with L. Reti.


Habermann, Vlastimil (1974b) Kaktusy 10: 123-127, 144. [“Lophophora fricii Habermann species nova.”] (From Anderson 1980 & Grym)


Habermann, Vlastimil (1975b) Kaktusy, 11: 3-6, 24. “Lophophora joudaniiana Habermann species nova.”

Habermann, Vlastimil (1975c) Kaktusy, 54-57, 80-82 “Rod Lophophora Coulter.” [From Grym 1997]


Habermann, Vlastimil (1978a) Biochimia, 43: 246-251. [“Estimation of Mescaline and Pellotine in Lophophora COULTER Plants (Cactaceae) by Oscillographic Polarography.”]


Howe, R.C. et al. (1977) a *Phytochemistry*, 16 (1): 151. “N-Methyltyramine and hordenine from *Mammillaria microcarpa*.” (Robert C. Howe, Jerry L. McLaughlin & Duwayne Statz)


Jones, Orlando (1890) *British Medical Journal*, January 11: 70. [From Hobschette 1929]


CHECK THAT DATA FROM 1899 WAS INSERTED

Norio Kondo & Hiroshi Yuasa)


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Trouts Notes on Cactus Chemistry

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Trouts Notes on Cactus Chemistry

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Trots Notes on Cactus Chemistry


Aporocactus flagelliformis 260-261
Cereus grandiflorus 249-250
Eriocereus jasberrit 240
Eriocereus tehraphcactus 244-245
Myrtlicactus geometrizans 224-225
Pilocereus ephorobioides 254-255
Piptanthocereus benecket 226-227
Piptanthocereus jamacaru 229-230
Piptanthocereus persianus 232-233
Stenocereus stellatus 253-254
Trichocereus macrogonus 236-237
Trichocereus spachianus 237-238


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et al


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Cereus strigosus

Salm-Dyck, JOS. de (1850)

Cacteæ in Horto Dyckensi cultæ

Salm-Dyck, Jos. de (1845)

Cactæ in Horto Dyckensi cultæ

Cereus chiloensis

Cereus gladiatus

Cereus intricatus 43 & 194

Cereus lamprochloras 43 & 195

Cereus longispinus 44 & 196

Cereus macrogonus 46 & 203

Cereus nigricans 46 & 202

Cereus spachianus 43 & 194

Cereus tenuispina 62

Cereus Terscheckii 46

Cereus validus 48

Echinopsis bridgesii 38 & 181

Echinopsis valida 39 & 181

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“Secondary metabolites from Opuntia ficus-indica var. saboiten.” (Muhammad Saleem, Hyoung Ja Kim, Chang Kyun Han, Chang Bae Jin & Yong Sup Lee)


[From Britton & Rose]


Cereus strigosus: 27

Cereus candidans: 27

Cereus chilensis: 27

Cereus chilensis f. fulvibarbis: 27

Cereus chilensis f. brevispinulus = C. quinero: 27

Cereus gladiatus: 28


266 pages + 1 page addendum.

Cereus brevispinulus 51

Cereus bridgesii 48 & 208-209

Cereus candidans 43

Cereus chilensis 44 & 198

Cereus chiloensis 44

Cereus eburneus 47

Cereus Forbesii 47 & 206

Cereus fulvibarbis 44

Cereus fulvispinus 46

Cereus gladiatus 48
Trouts Notes on Cactus Chemistry

Minor = Greater than 1% but less than 10% of total volatiles
Trace = Less than 1% of total volatiles

All of the volatiles were found to be emitted by the perianth.
Strongest emission was from the inner and middle tepals and the weakest was from the outer tepals.


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Drugs and Foods from Little-

Voss, A. (1872)


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1961


Yingkun in the literature See as Qiu.


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**Trichocereus giganteus** obtained as a cutting from Knize
Echinocereus rigidissimus var. rubrispinus
(NM) cultivated
Symbols

1,2-Dimethyl-6,7-dimethoxy-8-hydroxy-3,4-dihydroisoquinoline 208
1-(2-Hydroxy-5-methylphenyl)-ethanone 123
1,3,5-Trimethyl benzene 123
1,3,6,8-Tetrahydroanthraquinone 88
1,3-Dimethylcitrate 273
1,4-Benzenediamine 601
1,8-Cineole 274
1-Butanol 274
1-Heptanecanol 292
1-Heptanol 274
1-Hexanol 273, 274
1-Methyl-6,7-dimethoxy-8-hydroxy-3,4-dihydroisoquinoline 208
1-Methylcitrate 273
1-Methylmalate 273
1-Octanol 274
1-Octene-3-ol 274
1-Pentanol 274
1-Pentene-3-ol 274
1-Phenylethanol 274
2-(1’Pentenyl)-furan 123
2,3,5,5,8,8-Hexamethyl-cycloocta-1,3,6-triene 123
2,3-Epoxy geraniol 123
2,4,6-Cycloheptatrien-1-one 2,5-Dihydroxy-4-isopropyl- 123
2,6-Dichloro-mescaline 206
2’-Apiosyl-betanin 167, 168, 169
2’-Apiosyl-isobetanin 167, 168, 169
2’-Apiosyl-isophyllocactin 167, 168, 169
2’-Apiosyl-phyllocactin 167, 168, 169
2-Chloro-mescaline 206
2-E-6E-Farnesol 123
2-Hepten-50
2-Hydroxymethyl-4-methoxy-a-pyrone 268
2-Hydroxystaevianthone 88
2-Methoxypheophenol 4-(1’E)-3-Hydroxy-1-propenyl)- 123
2-Methoxystaraine 375
2-Methyl-3-buten-2-ol 274
2-Methyl-5,6,7,8-tetraMeO-THIQ 304
2-Methyl-6,7-dimethoxy-

8-hydroxy-3,4-dihydroisoquinoline 208
2-Methyl-6,7-dimethoxy-THIQ 304
2-Methylbutanoic acid 274
2-Methyl-eicosane 123
2-Methyl-nonadecane 123
2-Methyl-octadecane 123
2-Oxo-citronellol 123
2-Pentylfuran 274
2-Undecanol 325
3,3’-Dimethylquercetin 292
3,4,5-Trihydroxy-phenethylamine 600
3,4,5-Trihydroxyphenethylamine structure 671
3,4,5-Trimethoxyphenethyl- 600
3,4,5-Trimethoxyphenethylalanine 208
3,4,5-Trimethoxyphenethylalanine structure 672
3,4-Dihydro-6,7-diMeO-8-OH-1,2-diMe-isoquinolinium structure 675
3,4-Dihydro-6,7-diMeO-8-OH-1-Me-isoquinoline structure 675
3,4-Dihydro-6,6-diMeO-8-OH-2-Me-isoquinolinium ion structure 675
3,4-Dihydro-6,7-diMeO-8-OH-IQ structure 675
3,4-Dihydro-5-methoxyphenethylamine 208 structure 671
3,4-Dihydroxybenzoic acid 40, 292
3,4-Dihydroxyphenethyltrimethyl ammonium 601
3,4-Dimethoxy-5-hydroxyphenethylamine 600
3,4-Dimethoxy-a-methyl-5-hydroxyphenethylamine 600
3,4-Dimethoxy-b-hydroxyphenethylamine structure 670
3,4-Dimethoxy-N-formyl-b-hydroxy-N-methyl-phenethylamine 69
3,4-Dimethoxy-N-methylphenethylamine 11, 13, 17, 22, 23, 36, 65, 67, 69, 70, 73, 102, 109, 111, 208, 233 structure 670
3,4-Dimethoxy-N,N-dimethylphenethylamine 22, 36, 69, 109, 111 structure 671
3,4-Methylenedioxypheophenethylamine 212, 403
3,5-Dimethoxy-4-hydroxyphenethylamine 203, 208, 600
3,7-Dimethyl-1,5-octadiene-3,7-diol 50
3,7-Dimethyl-6-octen-1-ol 123
3a-Cumyl-1,3,4-oxidialolidine-2,5-dione 600
3b,6ASterol diols 188
3b, 16b, 28-Trihydroxy-D12-oleanen-29-oic acid 247
3-Demethylmescaline 208
3-Hydroxy-4,5-dimethoxyphenethylamine 208, 375, 399
structure 671
3-Hydroxy-4-methoxy-phenethylamine 600
3-Hydroxy-4-methoxyphenethylamine 298
structure 670
3-Methoxy-4-hydroxyphenethyltrimethylammonium 601
3-Methoxyphenethylamine 36
3-Methoxytyramine 33, 35, 36, 39, 86, 93, 111, 127, 169, 208, 298, 309, 313, 337, 352, 363, 375, 386, 390, 399, 429, 479, 501, 600
structure 670
3-Methyl-3-butene-1-ol 274
3-Methylbut-2-enyl acetate 325
3-Nitrotyramine 56
structure 671
3-OH-4-MeO-PEA 304
3-O-Methyl quercetin 292
7-O-β-D-glucopyranoside 292
3-Oxo-alpha-ionol-β-D-glucopyranoside 273
3-Oβ-D-Xylopyranosyl-(1→2)-β-D-glucopyranosyl-stellatogenin 333
3-Pentanol 274
3-Pentene-2-ol 274
3a,19R-Dihydroxygermanican-28-oic acid 331
3a-Hydroxytaraxastan-28,20α-olide 331
4-(1E)-3-Hydroxy-1-propenyl-2-methoxyphenol 123
4,4-Dimethyl-cholesta-22,24-dien-5-ol 123
4,8-Dihydroxy-2-methyl-THIQ 98
4,22-Stigmastadiene-3-one 123
4a-Methyl-5α-cholest-7-en-3β-ol 195
4a-Methyl-5α-cholesta-7,22E-dien-3β-ol 195
4a-Methylcholesta-8,14-dien-3β,6α-diol 188
4a-Methylcholesta-8,14-dien-3β-ol 195
5a-Stigmaster-7-en-3β-ol 195
5a-Stigmasta-7,22E-dien-3β-ol 195
5-Hydroxycarnegine 40
5-Methoxy-N,N-dimethylhistamine 112
5-Methoxy-N,N-dimethyltryptamine 112
5-Methyl-2-furancarboxaldehyde 249
5-O-[6’-O-(3”-hydroxy-3”-methyl-glutaryl)-β-D-glucopyranoside 168
5”-O-E-Feruloyl-2’-apiosylbetanin 167, 168, 169
5”-O-E-Feruloyl-2’-apiosylsobetanin 167, 168, 169
5”-O-E-Feruloyl-2’-apiosylisophyllumocactin 167, 168, 169
5”-O-E-Feruloyl-2’-apiosylphyllocactin 167, 168, 169
5”-O-E-Feruloyl-2’-apiosylsobetanin 167, 168, 169
5 San Pedros 523
Activity note 523
6,7-Dimethoxy-8-hydroxy-3,4-dihydroisoquinoline 208
6-Hydroxy-2-methyl-THIQ 98
6-Methoxy-THIQ 98
6-Methyl-5-hepten-2-one 123
6-Methylhept-5-en-2-one 325
6-Methylheptan-2-one 325
6-Octen-1-ol 123
3,7-Dimethyl-123
6′-O-malonylbetanin 168
6′-O-Malonylbetanin 326
(6S,9S)-3-Oxo-alpha-ionol-β-D-glucopyranoside 273
(6S,9S)-3-Oxo-ceionol-[3-D-glucopyranoside 272
6β-Hydroxystigmast-4-ene-3-one 292
7,8-DiMeO-THIQ 304
7,8-Dimethoxy-3,4-dihydroisoquinoline 36
7-Dehydrocholesterol 558
7-Hydroxy-6-methoxy-2-methyl-tetrahydroisoquinoline 169
7-MeO-THIQ 304
7-Methylheptan-2-one 325
7-Oxositosterol 292
8-Hydroxy-2-methyl-THIQ 98
8-Methylnonan-2-one 325
8-Methylnonanol 325
9-Methyldecanal 325
10-Methylundecan-2-one 325
Trouts Notes on Cactus Chemistry

14a-Methyl-5α-cholesten-8-en-3β,6a-diol 188
14a-Methyl-5α-cholesta-8,24-dien-3β,6a-diol 188
14a-Methyl-9,19-cyclo-5α-cholestan-3β,6a-diol 188
16-epi-Echinocystic acid 247
16α-Hydroxybetulinic acid 331
16β-Hydroxybetulinic acid 333
16α-β-Hydroxystellatogenin 331
16β-β-Hydroxystellatogenin 333
21-Hydroxy-oleanolic acid 220
21-Ketobetulinic acid 331, 333
21-Keto-oleanolic acid 220
21β-Acetyloxy-3β,14β,30-trihydroxypachan-12-en-28-oic acid 14β,28-lactone 393
22-Stigmasten-3-one 123
22α-Hydroxystellatogenin 331
22β-Hydroxystellatogenin 333
24-Ethyl-5β-cholest-9-ene-6β,12α-diol 292
24-Ethyl-6β-[β-D-glucopyranosyl]oxy]-5β-cholest-9-ene-12α-ol 292
24-Methylenelophenol 195
27-Desoxyphillyrigenin 331
32.3056 424, 426
48.1540 431
49.1579 429
50.1998 501
50.1999 293
50.2013 286
52.0568 371, 372
52.0752 431
52.0762 429
52.1507 371
53.0162 351, 352, 353, 357, 358
53.1153 174
54.0189 36
55.0259 425
55.0261 449
55.0643 373, 374
56.0508 501
56.1153 379
59.0652 313
59.1463 187
65.0387 177
65.0715 474
65.0817 200
65.0839 477
65.0848 191
67.0175 191
68.0138 187
68.0235 52
68.0679 121
68.0681 321
71.0083 502, 503

abdominal pain 575
Acacia berlandieri 600
Acacia rigidula 600, 601
Trouts Notes on Cactus Chemistry

Acanthocereus pentagonus 11
Activity note 524, 525
flower 524
images 524
Acanthocereus tetragonus 11
Acetic acid 274
Acetoin 274
Acetovanillone 238
aches 581
achuma 352, 399
ACI-9 238
Activity Notes 521
agria 560
aguacolla 399
alastrado 314
alcabar 313
aldehydes 272
Alhagi pseudalhagi 601
unidentified 88, 109, 132
alkaloid summary
by species 7
Alkane 139
Alkene 139
allo-Ocimene 123
Allyldimethyl(prop-1-yynyl)silane 123
Aminobutyric acid 168
Amphetamine 600
structure 669
Amyl salicylate 123
Amyrin 98, 169
structure 679
analgesic 525, 526, 559, 569, 575
Ancash 440
anesthetized cats 546
Anethole 325
angina pectoris 559, 585
Anhalamine 137, 139, 143, 144, 147, 148, 153,
155, 157, 160, 163, 203, 204, 206, 208, 214,
600, 601
structure 674
Anhaladine 35, 139, 143, 144, 148, 153, 155, 157,
160, 163, 165, 203, 204, 206, 214, 253,
257, 304, 306, 337, 600, 601
structure 674
Anhalinine 139, 143, 144, 147, 148, 150, 153, 155,
157, 159, 160, 163, 165, 203, 204, 206, 208,
506, 508, 509, 511, 512, 515, 516, 517, 518,
520
structure 674
Anhalonidine 139, 143, 144, 147, 148, 153, 155,
157, 159, 160, 163, 165, 203, 204, 206, 208,
214, 304, 337, 506, 508, 511, 512, 515, 516,
517, 520, 600, 601
structure 674
Anhalonine 139, 143, 144, 147, 148, 150, 153,
155, 157, 160, 163, 165, 203, 204, 206, 208,
486
structure 674
Anhalonium elongata
See as Ariocarpus trigonus 11
Anhalonium jourdanianum 206
analysis 11
Anhalonium lewini 11
image 521
Anhalonium williamsii 11
image 521
Anhalotine 208
structure 675
Anisocereus foetidus 11
Anisocereus gaumeri 11, 322
anodyne 559, 581
antagonist
CCR6 receptor 587
antibiotic 568, 581
anticancer activity 540
antihelminthic 524, 582
anti-hyperglycemic effects 569
anti-inflammatory 570, 575, 581
anti-metastatic activity 569
antimicrobial 528, 560
antineoplastic 560
antineoplastic activity 121
antineoplastic effect 545
antioxidant 569, 570
antiproliferation 569
antipyretic 529, 567
antirheumatic 559
antiseptic 569
antisyphilitic 581
antitumor 121
anti-type I allergy activity 587
aortic regurgitation 585
Apigenin 8-C-glucoside 292
Apocynine 238
apoptosis 581
Aporocactus flagelliformis
Activity note 524
analysis 11
Aposphaerin C 88
appetite stimulant 546
a-pyrone 287
Aquilar 480
Arabinogalactan 292, 565
Arabinose 37, 40, 84, 263, 264, 272, 273, 292,
341, 519
Arachidic acid 266
Arachidonic acid 273
Argentina 32.3056 424, 426
Argentina 56.0508 501
Argentina 68.0681 321
Argentina 74.0146 361, 362
Argentina 74.0151 379
Argentina 90.0989 425
Ariocarpus agavooides
analysis 11
image 11, 12
Ariocarpus bravoanus
activity note 525
flower 11
image 11
ssp. hintonii
activity note 525
var. hintonii 13
flower 13
Ariocarpus denegrii 11
Ariocarpus disciformis 11
Ariocarpus fissuratus
activity note 526
analysis 13
detail 15
flower 16
image 13, 14
images 525, 526
in habitat 525, 526
intermedius
flower 16
seedlings 525, 526
var. fissuratus
analysis 13
var. hintonii
flower 13
var. lloydii
analysis 17
flower 18
image 12, 17, 18
Ariocarpus furfuraceous 17
Ariocarpus hintonii
flower 17
Ariocarpus kotschoubeyanus
activity note 526
analysis 17
flower 527
image 17
var. elephantidens
flower 18
image 18
var. macdowellii
flower 18
water content 17
Ariocarpus retusus
activity note 526
analysis 17
flower 20
image 20, 21, 521
images 527
monstrosus 20
var. furfuraceous 17
water content 17
Ariocarpus scaphirostris
analysis 22
image 22
Ariocarpus trigonus
analysis 23
flower 22, 23
image 22, 23
Ariocarpus williamsii 23
Arizona cactus pear 569
Arizona hedgehog cactus 543
Arizona state tree 530
Arizonine 40, 253, 298
structure 673
Armatocereus laetus 24
activity note 555
Armatocereus matucanense 555
in habitat 556
Aromadendrin 272, 273
arthritis 559
articular rheumatism 568
Ascorbic acid 41, 273, 292, 293
Aspergilketal 273
Aspergillus terreus 93, 273, 540
a-Spinasterol 195
structure 679
Asterredione 93
Asterric acid 273
Asterriquinone C 93
Asterriquinone D 93
asthma 575
asthmatic dyspnea 559
astringent 571
Astrophytum 24
cv Onzuka 24, 25, 27
cv. Superkabuto 26
Astrophytum asterias
analysis 24
image 23, 24
in habitat 23
Astrophytum asterias X myriostigma
flower 528
image 528
Astrophytum capricorne
activity note 528
flower 528
image 528
Astrophytum myriostigma
activity note 528
analysis 24
flower 24, 528
image 24, 25, 27, 528
Trouts Notes on Cactus Chemistry

Oenzuka 27
zoobioassay 24
Atacama Desert 10
atopic dermatitis 581
atropine 546
Austrocylindropuntia cylindrica
analysis 28
entry 28
flower 28, 29
fruit 28, 29, 30
image 28, 29, 31
Austrocylindropuntia exaltata
analysis 30
Austrocylindropuntia pachypus
analysis claimed 32
entry 32
image 32
Austrocylindropuntia subulata
analysis 33
image 33, 34
Avenasterol 326
ayahuasca admixture 37, 529, 546
Ayahuasca book 691
Aztekium ritteri
analysis 35
entry 35
image 35
Azureocereus ayacuchensis
analysis 36
Azureocereus imperator
image 36

B
baboso 178
backache 559, 571
Backeberg
image 396
Backebergia militaris
analysis 36
Backebergine 36, 304
structure 673
Backeberg's clone 413
bakanana 536
bakanawa 536
Baker 5452 358
balsam 581
b-Amyrin 330
structure 679
b-Amyrin-type terpene 247
bandage 546
Barbados gooseberry 309
barb-wire cactus 11
batar 599
Bauml et al. 1002 61
BDV 1008 188
beasts of burden 556
Benzaldehyde 123, 325
Benzoic acid 50
Benzy1 acetate 325
Benzy1 acetone 325
Benzy1 alcohol 123, 274, 325
Benzy1 benzoate 123
Benzy1 isovalerate 123
Benzy1 salicylate 123
Benzy1 tiglate 123
Bergamotene 139
Berge
image 396
Berol. 396
berrycactus 249
Berry cactus 567
best edible tunas 570
Betacyanin 11, 264, 266, 268, 272, 274, 278, 285,
293, 309, 314, 334, 361
Betaine 601
Betalains 17, 49, 56, 102, 143, 153, 165, 192, 233,
241, 243, 245, 246, 262, 264, 268, 272, 280,
306, 309, 326, 327, 342, 343
Betalamic acid 326
Betanidin 43, 56, 168, 266, 285, 287
5-O-(2’-O-β-D-Apiofuranosyl-
6′-O-malonyl)-β-D-glucopyranoside 326
5-O-[(5′-O-E-feruloyl)-
2′-O-β-D-apiofuranosyl-6′-O-malonyl]]
-β-D-glucopyranoside 326
Betanidin 5-O-(6′-O-malonyl)-beta-sophoroside 235, 243
Betanidin 5-O-(6′-O-malonyl)-beta-sophoroside 224
Betanidin 5-O-(6′-O-malonyl)-β-sophoroside 227
Betanidin 5-O-β-sophoroside 167, 168, 169
Betanin 11, 37, 43, 45, 56, 130, 165, 167, 168,
169, 224, 238, 241, 243, 266, 268, 272, 274,
285, 287, 288, 290, 292, 293, 309, 314, 326,
334, 361
Betaxanthin 168, 273
Betulin 177, 188
structure 679
Betulinic acid 180, 187, 309, 331, 333, 334, 335
structure 679
Betulinic aldehyde 188
b-Hydroxy-mescaline
structure 672
b-Hydroxymescaline 309
Bianchi & Samorini 529
Big nipple cactus 70
biliousness 569
billberries 567
Trouts Notes on Cactus Chemistry

billberry cactus 249
bioassay 529
birretta de obispo 24
bitaya mawali 578
bites 526, 559
bitter 559
BL & JD 687 195, 196
blood circulation 575
blood clotting 581
blood pressure 581
blows & bruises 526
blue form 439
blue myrtle 249
b-Methoxy-3,4-dihydroxy-5-methoxyphenethylamine 600
b-Methoxy-3,4-dimethoxy-N-methylphenethylamine 67, 69
b-Methoxy-3,4-dimethoxy-N,N-dimethylphenethylamine 67, 69
structure 671
b-O-Ethylsynephrine 98
structure 669
boils 569, 571
Bolivia 50.1998 501
Bolivia 53.0162 351, 352, 353, 357, 358
Bolivia 55.0259 425
Bolivia 55.0261 449
Bolivia 65.0839 477
Bolivia 68.0679 121
Bolivia 71.0083 502, 503
b-O-Methylsynephrine 67, 69, 73, 98, 227
structure 669
bonete 24
b-O-Palmityl longispinogenin 370
Borzicactus sepium
  analysis 37
  image 37
Brassiiopuntia brasiliensis
  activity note 529
  analysis 37
  illustration 529
  image 37, 529
  images 529
  See as Brassiiopuntia brasiliensis 268
brew 594
Bridgeside A1 393
Bridgeside C1 393
Bridgeside C2 393
Bridgeside D1 393
Bridgeside D2 393
Bridgeside E1 393
Bridgeside E2 393
Bridgesigenin A 358, 401, 588
structure 679
Bridgesigenin B 358, 401
structure 679
Bridgesigenin C 401
structure 679
Browningia 39
Browningia candelaris
  analysis 39
Browningia hertlingianus
  image 38
Browningia nobilis
  image 38
Browningia pilifera
  image 38
Browningia sp
  image 38
Browningia utcubambensis
  image 38
bruises 526, 559, 570, 581
b-Sitosterol 48, 73, 102, 127, 183, 249, 265, 268,
  272, 293, 370, 376
structure 679
Bufo alvarius 8
buisco 370
burns 546, 569, 581
  radiation 569
busi-ra 548
C
  cabeza de viejo 195, 222
Cacticin 327
cactihuasca 537
Cactine 327, 585
cactus apple 569
cactus fruit 599
Cactus grandiflora 37
cafeyl alcohol 245
caffeic acid 326
Caffeine 48, 165, 191, 314
Calcite 268
Calcium oxalate 111, 272
Calenduladiol 188
structure 679
Calendula officinales 188
California 286
Calipamine 67, 69
  structure 670
caliz 169
callus 569
calluses 569
calming 529
Calycotomine
  structure 674
Cereus macrostibas 567
Cereus peruvianus
  activity note 534
  analysis 49
  flower 50
  formae monstrosus
    analysis 53
  fruit 49
  fruit analysis 50
  image 47, 49, 50, 51
  images 534
  mislabeled 348
  monstrosus 53
  new growth 9
  Schumann 1921 534
  var. reclinatus 49
Cereus peruvianus monstrosus
  analysis 53
  image 53
Cereus repandus
  activity note 535
Cereus rosei 53
Cereus sp
  analysis 53
  analysis purported 53
  image 53
  unidentified 53
Cereus speciosus
  analysis 56
Cereus sp. Peru 68.0235 52
Cereus stenogonus
  analysis 56
  XHeliaporus smithii
    analysis 56
Cereus tephrcanthus bolivianus 52
Cereus thouarsii
  analysis 56
Cereus validus
  analysis 56
  image 56
  water content 56
chacouli 169
Chaetochiversins 88
Chaetomium globosum 88
Chamaecereus silvestrii
  analysis 56
  flower 54, 55
  image 54
chapintli 313
chaute 13, 17
chautele 13, 17
Chavin de Huantar 442
chawe 578
chenda 317
chente 317
chest 549
chest pain 575
chichibe 321
chichipe 321
Chichipegenin 247, 249, 250, 308, 317, 321, 567
  structure 679
Chile 52.0568 371, 372
Chile 52.1507 370, 371
Chile 55.0643 373, 374
chilenola 331
china 317
chirinola 331
chironole 331
chlorotrimeton 546
Cholesta-22,24-dien-5-ol
  4,4-Dimethyl-123
Cholestane
  structure 679
Cholesterol 169, 188, 268, 274, 309, 326, 558
  structure 679
Choline 56, 601
cholla gum 84
Christmas cactus 326
Christmas Cactus 326
chronotropic 546
Chryasazin 88
cicatrizant 581
cider 599
cimora 567
cina 195, 328
circulation 581
cis-β-ocimene 123
Citral 123
Citric acid 109, 165, 268, 273, 293, 309, 325, 326
  clears up heat 575
Cleistocactus baumannii
  analysis 56
  flavispinus 57
    image 57
Cleistocactus jujuyensis
  analysis 56
  image 57
Cleistocactus parviflorus
  analysis 56
Cleistocactus smaragdiflorus
  analysis 56
Cleistocactus strausii
  analysis 56
Cleistocactus straussii
  analysis 56
  flower 58
  image 56
cliza 480
Cobo 534
coca bag 265
cohal 247
Cochallic acid 247, 249
structure 679
cochineal dye
fixing 570
cochineal insects 568
host 568
cold 559
colonche 599
colors urine red 558
commercial fruit 168
consumption 559
convulsions 546
Copiapoa 56
Corchoionoside C 272, 273
corns 559, 569
Coryneine 337, 601
structure 670
Corynopuntia clavata
analysis 59
Corynopuntia emoryi
analysis 59
image 59, 136
Corynopuntia invicta
analysis 60
image 59, 60
Corynopuntia kunzei 136
Corynopuntia reflexispina
activity note 534, 535
Corynopuntia schottii
analysis 63
image 63, 64
Corynopuntia stanlyi
var. kunzei 61, 62
analysis 94
var. stanlyi
analysis 59, 94
Corypalline 169
structure 673
Coryphantha bumamma 65
analysis 65
Coryphantha calipensis 67
analysis 67
Coryphantha cf radians 73
Coryphantha compacta
activity note 536
flower 536, 537
images 535
Coryphantha cornifera 67
analysis 67
flower 66
var. echinus 67
analysis 67
Coryphantha durangensis 69
analysis 69
Coryphantha echinus 69
Coryphantha elephantidens 69
activity note 537
analysis 69
flower 69, 537
image 537
images 537
Coryphantha greenwoodii
analysis 69
Coryphantha macromeris 70, 537, 538
activity note 537
analysis 70
bioassay 537
images 537, 538
runyonii
activity note 537
var. runyonii
analysis 70
short spined 70, 71, 72
Coryphantha missouriensis
analysis 73
Coryphantha ottonis
analysis 73
Coryphantha palmeri
activity note 538
analysis 73
Coryphantha pectinata
analysis 73
Coryphantha poselgeriana
analysis 73
image 74
Coryphantha radians 73
Coryphantha ramillosa 10
analysis 73
image
flower 76
Coryphantha runyonii
image 74
Coryphantha runyonii 73
activity note 537
seedling 539
Coryphantha scolymoides
analysis 80
Coryphantha vivipara 80
analysis 77
var. arizonica
analysis 80
Coryphanthine 69
structure 669
cough 569, 575, 581
Coumarin 325
counter-irritant 585
Coutarea pterosperma  599
cramps  581
Cranopsis alvaria  8
crazy  548
cristate
Echinopsis multiplex  545
Lophophora williamsii
echinata  9
Trichocereus pachanoi  594
Campbell, Earl  579
Crosby & McLaughlin 1973  399
Cruz, Julio  358
Cruz Sánchez 1948  28, 399
Crystal  537
crystal sand  323, 519
Cúaresmeño  280
cuchuma  429
cuerno  11
cultivar  543
Cycloocta-1,3,6-triene
2,3,5,8,8-Hexamethyl-  123
Cyclostenol  188
structure  680
Cylindropuntia acanthocarpa  80, 83
activity note  539
analysis  81
Cylindropuntia aff. acanthocarpa  80, 84
image  84
Cylindropuntia aff. echinocarpa  84, 85
image  84
Cylindropuntia bigelovii
analysis  81
Cylindropuntia bigelovii
activity note  539
Cylindropuntia cf. fulgida
image  84
Cylindropuntia echinocarpa
activity note  569
analysis  84
Cylindropuntia fulgida
analysis  84
mamillata
image  84
Cylindropuntia imbricata  86, 87
analysis  86
flower  86, 87
fruit  86, 87
Cylindropuntia kleiniae
analysis  86
image  87, 88
Cylindropuntia leptocaulis
activity note  539
analysis  88
fruit  539
image  88
Cylindropuntia ramosissima  89
Cylindropuntia spinosior  90, 91, 92, 93
analysis  93
Cylindropuntia versicolor  93, 94, 540
activity note  540
analysis  93, 540
Cylindropuntia whipplei
activity note  540
analysis  94
Cymene  325
cytotoxic  581
D
D7-Ergosten-3b-ol  195
D7 Stigmaster-3b-ol  195
D9(11)-12-oxo-oleane  127
D12-18b-Oleanene-3b,16b-diol-28-al  220
D-20,30-Lupen-3b,12b -diol  188
dagger cactus  177
dahlia-rooted cereus  581
datura poisoning  559
Daucosterol  292
Deca lactone  274
Decan-2-one  325
Decanal  123, 325
Decanoic acid  274
Decanoic acid ethyl ester  249
de Castilla  272, 273
decongestant  569
deer grease  581
Deglucopterocereine  322
structure  675
Deglucopterocereine-N-oxide  322
structure  675
Dehydroascorbic acid  293
Dehydrogeosmin  94, 98, 102, 119, 121, 139, 144, 1
53, 306, 324, 508
Dehydroheliamine  36, 40, 304
structure  673
Dehydrolemaireocereine  36, 304
structure  673
Dehydronorweberine  304
structure  676
Dehydropachycereine  304
structure  676
Dehydrosalsolidine  40, 304
structure  673
Denmoza rhodacantha  94
analysis  94
dermatitis  581
desert strawberry  543
Desoxyphylllyrigenin  333
detectable alkaloids  53
devil's head 107
diabetes 559, 569, 575, 581
diarrhea 534, 535, 540, 569, 571, 575
digestive problems 581
Digitalis 585
digitalis adjuvant 559
Digitalis-like 585
digitalis-like cardioactive glycosides 327
Dihydrokaempferol 112, 272, 273
Dihydrokaempferol 7-O-glucoside 112
Dihydromyricetin 112
Dihydromyricetin 7-O-glucoside 112
Dihydroquercetin 112, 272, 273, 569
Dihydroquercetin 7-O-glucoside 112
Dihydroxysterols 188
Dimethyltryptamine 112, 379, 486
diuretic 534, 539, 567, 569, 571, 585
Djerassi
aviso concerning 10
DMT 112, 379, 486, 543
Dodecalactone 274
Dodecanate 123, 325
Dodecanoic acid 274
Dolichothele baumii
analysis 94
Dolichothele longimamma 96, 97, 98
analysis 98
Dolichothele melaleuca
analysis 97, 98, 99
Dolichothele sphaerica 100
analysis 98
Dolichothele surculosa 101, 102
analysis 102
Dolichothele uberiformis 101, 102, 540
Activity note 540
analysis 102
images 540
Dolichotheline 94, 98, 102
Doña ana 70
Dopamine 40, 210, 600, 670
Dormentane 73
dropsy 540, 585
Drosophila pachea 558
drunk 539
druses 56, 86, 109, 147, 212, 259, 268, 278, 285, 322, 323, 324, 519
Dumortierigenin 172
structure 680
Dumortierigenin 3-O-α-L-rhamnopyranosyl (1→2)-β-D-glucopyranosyl(1→2)-
β-D-gluconopyranoside 172
Dumortierinoside A 172
Dumortierinoside A methyl ester 172
dysentery 560, 568, 571, 575
dyspepsia 570
dyspnea 559
dysuria 571

E
E-2-Hepten-1-ol 274
E-2-Heptenal 274
E-2-Hexen-1-ol 273, 274
E-2-Hexenal 273, 274
E-2-Hexenyl acetate 274
E-2-Nonenol 273, 274
E-2-Octen-1-ol 274
E-2-Octenal 274
E-2-Pentene-1-ol 274
E-3-Hexen-1-ol 274
EAMP 1999 327
earache 560, 564, 568, 581
Earl Crockett 579
Echinocactus arechavaletai 102
Echinocactus caespitosus
analysis 102
Echinocactus concinus 102
Echinocactus grandis
analysis 102
Echinocactus horizontalonius
analysis 109
image 690
seedling 103
Echinocactus hystrix 109
Echinocactus ingens 105, 106
See as Echinocactus platyacanthus 109
Echinocactus jourdaniana 206
Echinocactus lewinii 109
Echinocactus lewinii var. jourdaniana 206
Echinocactus platyacanthus 102, 109
Echinocactus polyccephalus
analysis 109
var. xeranthioides
analysis 109
Echinocactus pruinosus 109
Echinocactus ritteri 109
Echinocactus texensis 107, 108, 109
Echinocactus visnaga 106
analysis 109
Echinocactus williamsii 109
Echinocereus acifer
analysis 109
Echinocereus blanckii
analysis 109
water content 109
Echinocereus chilanthus
analysis 109
Echinocereus chrysocentrus 543
Echinocereus cinerascens
analysis 109
Echinocereus coccineus  543
Activity Endnotes  541
activity note  541
flower  542
paucispinus
flower  6
var. gurneyi
flower  542
var. paucispinus  543
var. rosei  542, 543
Echinocereus enneacanthus
activity note  540
enneacanthus
flower  110
var. stramineus  111
analysis  111
flower  111
Echinocereus fendleri  543
eaten  543
Echinocereus gonacanthus
eaten  543
Echinocereus horizonthalonius
Calcium oxalate  687
Echinocereus leeanus  543
Echinocereus mamillosus
activity note  546
Echinocereus merkerii  111
analysis  111
Echinocereus pectinatus  112
Echinocereus reichenbachii
activity note  546
image  627
Echinocereus rigidissimus  543
Echinocereus salm-dyckianus  542
Activity Endnotes  541
activity note  541
Echinocereus stramineus
Calcium oxalate  687
Echinocereus triglochidiatus
Activity Endnotes  541
activity note  541
eaten  543
flower  112
tryptamines purported  112
var. arizonicus
activity note  543
DMT purported  543
var. gurneyi
analysis  112
var. neomexicanus  113
analysis  112
var. paucispinus
analysis  112
Echinocereus triglochidiatus var. neomexicanus  112
Echinocereus viridiflorus  112
Echinofossulocactus multicostatus
analysis  112
Echinomastus dasyacanthus  115
Echinomastus intertextus  259
var. dasyacanthus  115
Echinopsis ancistrophora
arachnacantha
analysis  118
cardenasiana
analysis  118
pojoensis
analysis  119
ssp. ancistrophora
analysis  115, 116, 117, 118
ssp. arachnacantha
analysis  118
ssp. cardenasiana
analysis  118
ssp. pojoensis
analysis  119
Echinopsis bridgesii  119, 120
flower  119, 120
Echinopsis camarguensis  119
Echinopsis candidans  119
Echinopsis chiloensis  119
Echinopsis eyriesii
analysis  119
water content  119
Echinopsis fulvilana  119
Echinopsis gigantea  119
Echinopsis huascha  119, 383
synonyms  383
Echinopsis kermesina  119
Argentina 68.0681  321
Echinopsis lageniformis  119
Echinopsis lamprochloara  119
Echinopsis lobivioides  383
Echinopsis macrogona  119
Echinopsis mamillosa  668
image  668
Echinopsis manuiana  121
Bolivia 68.0679  121
Echinopsis manguinii  119
Echinopsis multiplex  121, 545
activity note  545
cristate  545
Echinopsis obrepana
analysis  121
image  121
Echinopsis oxyptetalum
analysis  123
image  123, 124
Echinopsis pachanoi  121
<table>
<thead>
<tr>
<th>Chemical Compound</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Echinopsis pasacana</td>
<td>121</td>
</tr>
<tr>
<td>Echinopsis pecheretiana</td>
<td>383</td>
</tr>
<tr>
<td>Echinopsis peruviana</td>
<td>121</td>
</tr>
<tr>
<td>ssp. puquiensis</td>
<td>121</td>
</tr>
<tr>
<td>Echinopsis rhodotricha</td>
<td>121</td>
</tr>
<tr>
<td>analysis</td>
<td></td>
</tr>
<tr>
<td>Echinopsis rowleyi</td>
<td>383</td>
</tr>
<tr>
<td>Echinopsis schickendantzii</td>
<td>121</td>
</tr>
<tr>
<td>Echinopsis scopulicola</td>
<td>121</td>
</tr>
<tr>
<td>Echinopsis spachiana</td>
<td>121</td>
</tr>
<tr>
<td>Echinopsis strigosa</td>
<td>121</td>
</tr>
<tr>
<td>Echinopsis taquimbalensis</td>
<td>121</td>
</tr>
<tr>
<td>Echinopsis terschekii</td>
<td>121</td>
</tr>
<tr>
<td>Echinopsis thelegona</td>
<td>121</td>
</tr>
<tr>
<td>Echinopsis thelegonoides</td>
<td>121</td>
</tr>
<tr>
<td>Echinopsis triumphans</td>
<td>121</td>
</tr>
<tr>
<td>analysis</td>
<td></td>
</tr>
<tr>
<td>Echinopsis tubiflora</td>
<td>121</td>
</tr>
<tr>
<td>analysis</td>
<td></td>
</tr>
<tr>
<td>eclampsia</td>
<td>524</td>
</tr>
<tr>
<td>E,E-2,4-Heptadienal</td>
<td>274</td>
</tr>
<tr>
<td>E.F.A. 4950</td>
<td>66</td>
</tr>
<tr>
<td>Eicosane</td>
<td>123</td>
</tr>
<tr>
<td>2-Methyl-</td>
<td></td>
</tr>
<tr>
<td>Eicosanol</td>
<td>73</td>
</tr>
<tr>
<td>Eisacol</td>
<td>343</td>
</tr>
<tr>
<td>elephant cactus</td>
<td>301</td>
</tr>
<tr>
<td>emetic</td>
<td>559, 594</td>
</tr>
<tr>
<td>emission rates variable</td>
<td>324</td>
</tr>
<tr>
<td>emollient</td>
<td>569</td>
</tr>
<tr>
<td>Enchanted Rock</td>
<td>230, 231, 232, 233</td>
</tr>
<tr>
<td>endophytic fungi</td>
<td>569</td>
</tr>
<tr>
<td>endophytic fungus</td>
<td>273</td>
</tr>
<tr>
<td>enteritis</td>
<td>594</td>
</tr>
<tr>
<td>enterrhagia</td>
<td>534</td>
</tr>
<tr>
<td>entheogen</td>
<td>559, 594</td>
</tr>
<tr>
<td>Epicatechin</td>
<td>280, 292</td>
</tr>
<tr>
<td>Epinephrine</td>
<td>70</td>
</tr>
<tr>
<td>structure</td>
<td>670</td>
</tr>
<tr>
<td>Epinine</td>
<td>210, 670</td>
</tr>
<tr>
<td>Epiphyllum hybrid</td>
<td>125</td>
</tr>
<tr>
<td>flower</td>
<td>125</td>
</tr>
<tr>
<td>Epiphyllum</td>
<td>545</td>
</tr>
<tr>
<td>cv</td>
<td></td>
</tr>
<tr>
<td>Epiphyllum oxypetalum</td>
<td>546</td>
</tr>
<tr>
<td>activity note</td>
<td></td>
</tr>
<tr>
<td>analysis</td>
<td></td>
</tr>
<tr>
<td>floral aroma</td>
<td>123</td>
</tr>
<tr>
<td>leaves</td>
<td>123</td>
</tr>
<tr>
<td>image</td>
<td>547</td>
</tr>
<tr>
<td>Epiphyllum sp</td>
<td>125</td>
</tr>
<tr>
<td>activity note</td>
<td>546</td>
</tr>
<tr>
<td>Epiphyllum truncatum</td>
<td></td>
</tr>
<tr>
<td>See as Schlumbergera truncata</td>
<td>122, 125</td>
</tr>
<tr>
<td>Epithelantha micromeris</td>
<td></td>
</tr>
<tr>
<td>activity note</td>
<td>548</td>
</tr>
<tr>
<td>analysis</td>
<td>127</td>
</tr>
<tr>
<td>var. bokei</td>
<td>126, 127</td>
</tr>
<tr>
<td>var. greggii</td>
<td>125</td>
</tr>
<tr>
<td>var. micromeris</td>
<td>127</td>
</tr>
<tr>
<td>cristate</td>
<td>125</td>
</tr>
<tr>
<td>var. unguispina</td>
<td>127</td>
</tr>
<tr>
<td>Epithelanthate</td>
<td></td>
</tr>
<tr>
<td>structure</td>
<td>680</td>
</tr>
<tr>
<td>Epithelanthic acid</td>
<td>127</td>
</tr>
<tr>
<td>Epoxy geraniol</td>
<td>123</td>
</tr>
<tr>
<td>Epoxy linalool</td>
<td>50</td>
</tr>
<tr>
<td>equine herpes virus</td>
<td>575</td>
</tr>
<tr>
<td>Eriocereus guelichii</td>
<td></td>
</tr>
<tr>
<td>analysis</td>
<td>130</td>
</tr>
<tr>
<td>Eriocereus sp</td>
<td>130</td>
</tr>
<tr>
<td>Eriodictyol</td>
<td>272, 273</td>
</tr>
<tr>
<td>Erucasaponin A</td>
<td>333</td>
</tr>
<tr>
<td>Erynginol A</td>
<td></td>
</tr>
<tr>
<td>structure</td>
<td>680</td>
</tr>
<tr>
<td>erysipelas</td>
<td>568</td>
</tr>
<tr>
<td>Erythrodioi</td>
<td>98, 177, 180, 181, 317</td>
</tr>
<tr>
<td>structure</td>
<td>680</td>
</tr>
<tr>
<td>Escontria chiotilla</td>
<td>128, 129, 130</td>
</tr>
<tr>
<td>analysis</td>
<td>130</td>
</tr>
<tr>
<td>water content</td>
<td>130</td>
</tr>
<tr>
<td>Escontria gaumeri</td>
<td>130</td>
</tr>
<tr>
<td>Espostoa huanucensis</td>
<td></td>
</tr>
<tr>
<td>analysis</td>
<td>130</td>
</tr>
<tr>
<td>Espostoa lanata</td>
<td>130</td>
</tr>
<tr>
<td>analysis</td>
<td>130</td>
</tr>
<tr>
<td>Ethanol</td>
<td>599</td>
</tr>
<tr>
<td>Ethanone</td>
<td></td>
</tr>
<tr>
<td>1-(2-Hydroxy-5-methylphenyl)-</td>
<td>123</td>
</tr>
<tr>
<td>Ethyl 3,4-dihydroxybenzoate</td>
<td>292</td>
</tr>
<tr>
<td>Ethyl benzoate</td>
<td>123</td>
</tr>
<tr>
<td>Eucomic acid</td>
<td>292</td>
</tr>
<tr>
<td>Eudesman-3,7-dien</td>
<td>139</td>
</tr>
<tr>
<td>Eugenol</td>
<td>123</td>
</tr>
<tr>
<td>evil-eye</td>
<td>594</td>
</tr>
<tr>
<td>excrescence</td>
<td>561</td>
</tr>
<tr>
<td>expectorant</td>
<td>569, 571, 581</td>
</tr>
<tr>
<td>extraction artifact</td>
<td>98</td>
</tr>
<tr>
<td>eye</td>
<td>571</td>
</tr>
<tr>
<td>eyes large</td>
<td>548</td>
</tr>
<tr>
<td>E, Z-2,6-Nonadienal</td>
<td>274</td>
</tr>
<tr>
<td>E, Z-2,6-Nonadienol</td>
<td>274</td>
</tr>
<tr>
<td>E,Z-2,6-Nonadienol</td>
<td>273</td>
</tr>
</tbody>
</table>

**F**

Farnesene 139, 144
Farnesol 123
fatty acids 98
Trouts Notes on Cactus Chemistry

febrifuge 559
Ferocactus
brew 599
Ferocactus covillei
activity note 549
flower 549
image 549
Ferocactus emoryi
activity note 549
Ferocactus hamatocanthus
analysis 132
flower 130
spine details 131
Ferocactus latispinus
analysis 132
Ferocactus recurvus 133
Ferocactus sp
activity note 549
Ferocactus stainesii
analysis 132
Ferocactus wislizeni 132
analysis 132
cristate 132
flower 135
var. herrerae 133, 134
Ferulic acid 40, 292
glycoside 40
fever 526, 529, 559, 581, 582, 585
Firecracker 326
fire-crown cactus 324
FK 873 456
Flavone 268
Flavonoids 93, 267, 268, 278, 285, 290
Flavonol-3-glycoside 278, 327
flavonols 358, 469
Flavonols 227, 274, 290, 309, 313
fleshy roots 570
floral scent 306
floral scent 94, 102, 306, 324, 508
emission rates variable 324
flor del cuerno 11, 524
flor del látilgo 11
floricuerno 11
FR 856 453
FR 991 463
fractures 559, 570
fragrance 273
free radical scavenging 569, 575
Friedelan-3a-ol 293
structure 680
Friedelin 292, 293
structure 680
frightening 548
frog 540
Fructose 50, 273
Fusarium oxysporum 569

G

GABA 168
Gadoleic acid 266
Galactose 37, 40, 73, 84, 102, 263, 264, 272, 273, 292, 341, 519
Galacturonic 519
Galacturonic acid 37, 84, 264, 272, 273, 341
Gallic acid 280, 292
garambullo 195, 249, 251
Garambullo 195
garambullos 567
garumbulo 539
gastric pain 581
gastric ulcer 575, 578
gastritis 594
gastrointestinal problems 539, 559, 581
Gennaro et al. 1996 399
Geraniol 123, 274
Geranyl acetate 123
Geranyl acetone 123
geranilyl isobutyrate 123
gigante 327
Giganteine 40
structure 674
giganton 375, 399
Ginkangyoku 204
Glandulicactus crassihamatus
analysis 132
Globosuxanthone A 88
Globosuxanthone B 88
Globosuxanthone C 88
Globosuxanthone D 88
glochids 690
glory of Texas 343
Glucaric acid 40, 109, 203, 212, 294, 301, 304
Glucose 40, 50, 272, 273, 310
Glucuronic acid 272, 273, 310
Glushinskite 268
golden spined strawberry 543
golondrina 572
gonorrhea 575
Gonzales Huerta 1960 399
good luck fetish 528
Gorman 565
gorondilla 572
GR 1086 203, 204
Grave's disease 585
grosellero 309
Grusonia bradtiana
analysis 136
image 135
see as Grusonia bradtiana 268
Grusonia clavata
   see as Corynopuntia clavata 136
guinea-pig ileum 546
guinea-pig lungs 546
guinea-pig tracheal chain 546
guineaworms 569, 575
Gummosogenin 220, 328, 680
Gummososide A 328
Gummososide A methyl ester 328, 587
   activity note 587
Gymnocalycium bruchii
   analysis 144
   flower 144
   image 143, 144
Gymnocalycium calochlorum
   analysis 144
   flower 146
   fruit 146
   image 145, 146
   seedling 145
Gymnocalycium cardenasianum 147
   analysis 147
Gymnocalycium carminanthum
   analysis 147
Gymnocalycium chubutense
   analysis 147
Gymnocalycium comarapense
   analysis 147
Gymnocalycium curvispinum
   analysis 147
Gymnocalycium delaetii
   analysis 147
Gymnocalycium denudatum 147, 148
   analysis 148
Gymnocalycium eytianum 147
Gymnocalycium fleischerianum 148
   analysis 148
   flower 148
Gymnocalycium friedrichii 149
   analysis 148
Gymnocalycium gibbosum 150, 151
   analysis 148, 150, 151
   pH of juice 148
   water content 148, 150, 151
Gymnocalycium horridispinum
   analysis 150
Gymnocalycium lagunillasense
   image 157
Gymnocalycium leeanum 150
   analysis 150
Gymnocalycium marsoneri 150, 151, 152
   analysis 150, 151
Gymnocalycium mazanense 150, 152
   analysis 150, 152
Gymnocalycium megalothelae
   analysis 153
Gymnocalycium mesopotamicum 153
   analysis 153
Gymnocalycium mihanovichii 153, 154
   analysis 153
   cristate 153, 154
Gymnocalycium monvillei 153, 154
   analysis 153
Gymnocalycium moserianum
   analysis 155
Gymnocalycium multiflorum 155
analysis 155
flower 157
Gymnocalycium netrelianum
analysis 155
Gymnocalycium nigriareolatum
analysis 155
Gymnocalycium oenanthemum 155
analysis 155
Gymnocalycium paraguayense
analysis 155
Gymnocalycium pflanzii 156
analysis 156, 157
flower 158
var. albopulpa 157
Gymnocalycium platense 156
Gymnocalycium pungens
analysis 157
Gymnocalycium quehlianum
analysis 157
Gymnocalycium ragonesii
analysis 157
Gymnocalycium riograndense 160
analysis 160
Gymnocalycium riojense
analysis 159
ssp. kozelskyanum 159
ssp. paucispinum 159
Gymnocalycium saglione 160
analysis 160
Gymnocalycium schickendantzii
analysis 160
Gymnocalycium stellatum 161, 163
analysis 160, 161, 163
Gymnocalycium strigilianum
analysis 163
Gymnocalycium tillianum 161, 163
analysis 161, 162, 163
Gymnocalycium triacanthum 162, 163
analysis 163
Gymnocalycium uebelmannianum
analysis 163
Gymnocalycium valnicekianum
analysis 163
Gymnocalycium vatteri 165
analysis 165
Gymnocereus altissima
image 164

H
H 296 199, 200
H 811 171
H 6816 57
H 10526 179

Trouts Notes on Cactus Chemistry
Helianthocereus andalgalensis 165, 383
Helianthocereus atacamensis 165
Helianthocereus grandiflorus 383
Helianthocereus huascha 165, 383
Helianthocereus hyalacanthus 383
Helianthocereus pasacana 165
Helianthocereus pecheretianus 383
Helianthocereus poco 165
Helianthocereus speciosus 165
Helmlin & Brenneisen 1992 399
hemorrhoids 575
Helium 123
Heptacosane 123
Heptadecene 139
Heptadienal 274
Heptan-2-one 325
Hepten-1-ol 274
herpes simplex virus type 2 575
Hentrichocereus beneckei 165
Hexadecane 123
Hexalactone 274
Hexanal 123, 274
Hexanoic acid 274
Hexenal 274
Hexyl acetate 274
hierba de la alferecía 11
high blood pressure 581
hikora rosapara 560
hikuri 541, 563
HIV-1 575
hombre viejo 195
Homopiperonylamine 212, 403
ho' o'kiva 581
ho' o'kiwa 581
Hordenine 11, 13, 17, 22, 23, 35, 45, 46, 48, 49, 59, 60, 63, 65, 67, 69, 70, 73, 77, 80, 93, 1
02, 111, 119, 121, 127, 130, 137, 139, 143,
144, 147, 148, 150, 153, 155, 157, 159, 160, 163, 165, 169, 192, 193, 203, 204, 206, 208,
210, 227, 241, 243, 264, 265, 280, 293,
306, 327, 341, 383, 424, 449, 461, 465, 469,
473, 476, 479, 489, 497, 504, 506, 508, 509,
511, 512, 515, 516, 517, 518, 519, 585, 600, 601
structure 669
horned toad cactus 560
horse crippler 107
huallanca 592
Huamanga 588
Huancabamba 410, 555
huayanca 592
huevo de venado 581
human bioassay 358
Hutchison 3279 178
Hydrocotarnine
structure 674
Hydrohydrastinine
structure 674
Hylocerenin 167, 168, 169
Hylocereus costaricensis
analysis 167
image 167, 552
Hylocereus costaricensis X purpusii
analysis 167
Hylocereus hybrid 1
analysis 167
Hylocereus Hybrid 35
analysis 167
Hylocereus Hybrid 95
analysis 167
Hylocereus monacanthus
See as Hylocereus polyrhizus 168
Hylocereus ocamponis
analysis 168
Hylocereus polyrhizus
analysis 168
image 552
Hylocereus polyrhizus X sp. 487
analysis 167
Hylocereus polyrhizus X undatus
analysis 168
Hylocereus purpusii
analysis 168
Hylocereus sp. 487
analysis 168
Hylocereus sp. 487 X polyrhizus
analysis 167
Hylocereus undatus 552
activity note 552
analysis 169
Hylocereus undatus X sp. 487
analysis 167
Hyperin 278
hypnotic 594
hypotensive 575
hystrix lactone 177, 180, 187
I
image 42
Incilius alvarius 8
Indicaxanthin 168, 273
Indole 123
infection 559
inflammation 569, 570, 571, 575, 581
influenza 559, 575
inhibits viral replication 575
inhibit XO activity 569
inotropic 546, 586
insanity 548
insect growth regulation 567
insecticidal 560, 567
insomnia 571
internulcer 569
intestinal disorders 559
intestine 546
intoxicant 528, 530, 559
intoxicating beverage 599
introduction 7
invigorates blood 575
Inyo County 286
Iron 273
ISI 97-37 456
ISI 98-20 480
Islaya minor
analysis 169
Iso-2'-apiosyl-betanin 326
Isoanhalamine 210
structure 674
Isoanhalidine 210
structure 674
Isoanhalonidine 210
structure 674
Isobackebergine 36, 304
structure 673
Isobetanadin 168, 285
Isocitral 123
Isocitric acid 40, 67, 121, 294, 296, 301, 304, 326, 340
Isoeugenol 123
Isohylocerenin 167, 168, 169
Isolatocereus dumortieri 169
Isonortehuanine 304
structure 675
Isonorweberine 304
structure 676
Isopachycereine 304
structure 676
Isopellotine 210
structure 674
3-O-glucoside 292
3-O-rutinoside 292
3-O-α-L-rhamopyranosyl-(1→6)-β-D-galactopyranoside 169
3-O-β-D-glucopyranoside 169
3-O-β-D-rutinoside 169
Isorhamnetin-
3-O-galactoside 292
3-O-glucoside 292
Isorhamnetin-3-galactoside 278
Isorhamnetin-3-glucoside 267, 268, 278, 285
Isorhamnetin-3-O-rutinoside 292
Isorhamnetin-3-rhamnogalactoside 278
Isorhamnetin 3-hamnosylgalactoside 278
Isorhamnetin-3-rhamnosylgalactoside 267, 268, 278, 285
Isorhamnetin-3-rutinoside 278
Isorhamnetin-3-rutinoside 267, 268, 278, 285
Isorhamnetin-3-β-galactoside 327
Isorhamnetin-3-β-rutinoside 327
Isosalsolidine 304
structure 674
Issosalsoline 298
structure 673
Itesmol 343
J
jackrabbits 528
Jahuackollai 375
Jamaica 553
jarramatraca 581
Jarum Tujuh Bilah 581
J.Bauml et al. 1002 61
JD 687 195, 196
Jikuri 578
joconostle 334
Johnson
Harry, Sr. 379
joint pain 559
joints 559
juco tapatio 169
junco 11, 169
junquillo 11
Juul’s Giant 419
K
Kaempferide 292
Kaempferol 122, 169, 227, 272, 273, 274, 290, 292, 309, 313, 358, 469
3-methyl ether 273
3-O-a-arabinoside 292
3-O-a-L-rhamopyranosyl-(1→6)-β-D-galactopyranoside 169
Trouts Notes on Cactus Chemistry

7-O-β-D-glucopyranoside 292
7-O-β-D-glucopyranosyl-(1→4)-β-D-glucopyranoside 292
Kaempferol-3-methyl ether 272
Kaempferol 3-galactoside 268, 278, 285
Kaempferol 3-glucoside 81, 84, 93, 112, 290
Kaempferol 3-O-rhamnosylglucoside 112
Kaempferol 3-O-α-L-arabinofuranoside 169
Kaempferol 3-O-β-D-galactopyranoside 169
Kaempferol 3-O-β-D-glucopyranoside 169
Kaempferol 3-O-β-D-rutinoside 169
kakwari 599
Kattermann 873 456
kaya 599
ketones 272
key to structural tables 676
kidney 569, 581
kidney toxicity 570
KK242 442
Rio Chillon 444
KK339 409
KK340 375
KK591 408
knowledge 559
koubo 50
Krebs acid conjugates 5
Krebs cycle conjugates structure 678

L
lactogogue 559, 564, 571
Lathosterol 195, 558
Lauric acid 272
 laxative 570
lectins 331
Leguminosae 600
Lemaireocereine 36, 301, 304
structure 673
Lemaireocereus aragonii 170
analysis 169
MK2423 169
water content 169
Lemaireocereus beneckei 170
Lemaireocereus chende 170
Lemaireocereus chichipe 170
Lemaireocereus deficiens 170, 171
analysis 170
Lemaireocereus dumortieri
analysis 172
Lemaireocereus dumortii 172, 174
Lemaireocereus eruca 177
Lemaireocereus euphorbioides 177
Lemaireocereus griseus
analysis 177
Lemaireocereus gummosus 177
Lemaireocereus hollianus
analysis 178
Lemaireocereus humilis 178
Lemaireocereus hystrix 553, 554, 597
Activity Endnotes 553
activity note 553
analysis 180
Ethnogardens 553, 554
H 49153 180, 554
water content 180
Lemaireocereus laetus 180, 181, 523
activity note 555
analysis 180
water content 180
Lemaireocereus longispinus 181
analysis 181
water content 181
Lemaireocereus marginatus 181
Lemaireocereus matucanense 523, 555
activity note 555
in habitat 556
Lemaireocereus mixtecensis 181
Lemaireocereus montanus 182, 183
analysis 183
Lemaireocereus pruinulosus 184, 185
analysis 184
water content 184
Lemaireocereus queretaroensis 186
activity note 558
analysis 186, 558
Lemaireocereus quevedonis 187
analysis 187
water content 187
Lemaireocereus stellatus 187
Lemaireocereus thurberi 188, 189, 190, 191
analysis 188
brew 599
monstrosus 191
water content 188
Lemaireocereus thurberii
activity note 558
Lemaireocereus treleasei 188
Lemaireocereus weberi 188
Lemaireocereus weberi
analysis 191
Leucogardens 191
analysis 191
Lepidocoryphantha macromeris 191
Lepidocoryphantha runyonii 191
leprosy 569
Leuchtenbergia principis 192
activity note 556
analysis 191
Lewis pulmonary carcinoma 545

647
lime stick 265
Limonene 123, 272, 325
linalool 50
Linalool 50, 273, 274, 325
R-(-)-Linalool 273
S-(+)-Linalool 50
linament 559
Linoleic acid 195, 266, 273
Linolenic acid 195, 197, 266
lipid peroxidation 569
lipoprotein oxidation inhibition 569
Lobivia allegriana analysis 192
Lobivia andalgalensis 192
Lobivia aurea analysis 192
Lobivia backebergii analysis 192
Lobivia binghamiana analysis 192
Lobivia chlorogona analysis 192
Lobivia famatimensis analysis 192
Lobivia formosa analysis 193
Lobivia huascha 193
Lobivia huashua 193
Lobivia pentlandii analysis 193
Lobivine 212, 403
Locereol 195
longevity 546
Longimammamine 98 structure 673
Longimammatine 98, 102 structure 673
Longimammidine 98 structure 673
Longimammine 102, 669
Longimammosine 98 structure 673
Longispinogenin 98, 130, 177, 180, 181, 187, 188, 220, 247, 249, 321, 328, 680
Lophenol 193, 195 structure 680
Lophoceneine 197, 296 structure 674
Lophocereus australis analysis 193
Lophocereus gatesii 193, 194 analysis 193
Lophocereus marginatus 295
Lophocereus mieckleyanus 193
Lophocereus sargentianus 193
Lophocereus schottii 195, 196, 211, 558 activity note 558
analysis 195
Australis 193, 197 analysis 193
ccephalium 558
f. spiralis 676
image 521
mieckleyanus 199, 200 analysis 197
monstrosus 197, 198 analysis 197
schottii analysis 197
spination 558
spine detail 558
tenuis analysis 197
water content 195
Lophocerine 195
Lophocine 195
Lophophine 212, 403
Lophophora diffusa 202, 203 analysis 203
var Koehresii analysis 203
Lophophora echinata 216
Lophophora fricii 204, 205 activity note 558
analysis 204
Lophophora jordani 206 activity note 558
analysis 206
flower 206
Lophophora koehresii 204 analysis 203
Lophophora lutea 206
Lophophora sp var. Viesca analysis 208
Lophophora sp. Viesca image 208
Lophophora williamsii 10, 563 activity note 559
analysis 208, 210, 212
caeaspitosa 208 analysis 214
cristate 212
decipiens analysis 216
echinata 214, 216
cristate 9, 219
image 202, 206, 209, 210, 212
pentagona 217, 218
Trouts Notes on Cactus Chemistry

typica
  analysis 210, 212
  water content 208
Lophophorine 139, 143, 144, 147, 148, 150, 153,
  155, 157, 160, 163, 165, 203, 204, 206, 208,
  210, 214
  structure 674
Lophotine 210
  structure 675
lung abscess 575
lung inflammation 581
lungs 581
Lupene 188
Lupenetriol 188
  structure 680
Lupenone 330
Lupeol 168, 188, 195, 330
  structure 680
Lupeone 168
Lutein 274
Luteolin 272
Luteolin 8-C-glucoside 292
Lycorine 327

M

Macdougallin 188, 249, 567
  structure 680
Machaeric acid 220, 328
  structure 680
Machaerinic acid 220, 328
  structure 680
Machaerocereus eruca
  image 587
Machaerocereus gummosus 220, 221
  activity note 560
  cristate 220
Machaeroceric acid 331, 333
Machaerogenic acid
  activity note 587
Machaerogenin 334
Macromerine 67, 69, 70, 73, 537
  human bio assay 538
Pharmacology 538
  structure 671
Magnesium oxalate 268
Malhueniopsis clavaroides 223
Malhueniopsis darwinii 222
Makino 273
Maleic 273
Malic acid 50, 273, 292
Malonic acid 273
MAM 1219 264
MAM 1307 341
MAM 1308 37
Mamillopsis senilis 222
  activity note 560
  ethnobotanical 222
  flower 222
Mammillaria arietina
  activity endnote 560
Mammillaria centricirrha
  activity endnote 560
  illustration 560
Mammillaria coronata
  analysis 224
Mammillaria craigii 224, 225
  activity note 561
  flower 225, 562
Mammillaria crinita 224
Mammillaria dactylitele 224
Mammillaria dioica 224, 225
  flowering 223
Mammillaria disciformis 224
Mammillaria donatii
  analysis 224
Mammillaria elongata
  analysis 227
  cristate 227
  var. echinaria 227
  var. rufro crocea
  analysis 227
Mammillaria geminispina
  activity note 561
  image 561
Mammillaria gracilis 227
  fragilis 227, 228
Mammillaria grahamii 227, 560
  cristate
    images 561
  fruit 562
  illustration 521
  images 563
  var. olivae 227, 560
    activity note 563
Mammillaria gummifera
  analysis 227
Mammillaria heyderi 3, 230, 231, 232, 233
  activity note 563
  analysis 233
  Enchanted Rock 230, 231, 232, 233
  flower 233
  with Lophophora williamsii 563
Mammillaria hidalgensis
  analysis 233
Mammillaria karwinskiana
  analysis 235
Mammillaria karwinskiana
  analysis 235
  flowering 234, 236
Mammillaria lenta
analysis 237
flowering 236, 237
Mammillaria lewinii 235
Mammillaria longimamma 238
Mammillaria longimamma sphaerica 238
Mammillaria longimamma uberiformis 238
Mammillaria macromeris 238
Mammillaria magnimamma 238, 240
activity note 564
flowering 238, 240
var. divergens
analysis 238
Mammillaria mainae 560
Mammillaria meiacantha
analysis 238
fruit 233
Mammillaria melanocentra
analysis 238
Mammillaria microcarpa
activity note 564
analysis 241, 242
Mammillaria multiceps
analysis 241
Mammillaria neumanniana
analysis 241
Mammillaria pilcayensis 241
Mammillaria polythele
activity endnote 564
Mammillaria pulchra
activity endnote 564
Mammillaria pusilla 241
Mammillaria rhodantha 241
analysis 241
Mammillaria roseo-alba
analysis 243
Mammillaria runyonii 238, 243
Mammillaria saffordii
analysis 243
Mammillaria seitziana
analysis 243
Mammillaria senilis 222
Mammillaria setigera
analysis 243
Mammillaria sphaerica 243
Mammillaria surculosa
see as Dolichothele surculosa 102
Mammillaria tetrancistra
analysis 243
Mammillaria wildii
analysis 243
Mammillaria williamsii 243
Mammillaria woodsii
analysis 243
Mammillaria zeilmanniana
analysis 243
flower 245
flowering 243
Mammillaria zucchinianiana 243, 244
analysis 243
Mammillarina 224, 227, 235, 243
Mammillarol 238
mandacaru 48
Manganese 273
Manghaslin 292
Maniladiol 98, 130, 249
Marshallocereus aragonii 245
Marshallocereus thurberi 245
mastitis 575
Matucana puipati 565
Matucana 556
Matucana madisoniorum 245, 564, 565
activity note 565
flower 564, 565
white variant 564
images 564, 565
MEAI 331
MEAI 331
measles 569
medicinal 525
Megastigmatrienone 123
Melocactus bellavistensis 245
activity note 565
Melocactus delesertianus
analysis 245
Melocactus depressus
activity note 565
image 566
Melocactus maxonii
analysis 245
Melocactus obtusipetalis 245
Melocactus peruvianus 565, 566
activity note 565
analysis 245
images 565, 566
Melonal 123
Mentha-1(7),2,8-triene 123
Mescaline 32, 35, 40, 43, 53, 70, 73, 80, 81, 84,
86, 93, 109, 137, 139, 143, 144, 147, 148,
150, 153, 155, 157, 159, 160, 163, 165,
169, 203, 204, 206, 208, 210, 214, 216, 217,
245, 249, 266, 272, 306, 309, 313, 317, 322,
330, 331, 334, 335, 337, 352, 358, 366, 378,
379, 399, 418, 421, 423, 429, 442, 451, 458,
462, 463, 469, 475, 476, 479, 486, 489, 495,
501, 506, 508, 512, 517, 534, 537, 550, 553,
565, 594, 600
citrimide 212
structure 678
<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Page Numbers</th>
<th>Structure Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methyl queretaroate</td>
<td>681</td>
<td></td>
</tr>
<tr>
<td>Methyl salicylate</td>
<td>123, 325</td>
<td></td>
</tr>
<tr>
<td>Methyl undecenone</td>
<td>325</td>
<td></td>
</tr>
<tr>
<td>Mexican organ pipe</td>
<td>177</td>
<td></td>
</tr>
<tr>
<td>Mexico 59.0652</td>
<td>313</td>
<td></td>
</tr>
<tr>
<td>mice</td>
<td>548</td>
<td></td>
</tr>
<tr>
<td>Mimosine, methyl ester</td>
<td>600</td>
<td></td>
</tr>
<tr>
<td>mitra</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>MK2423</td>
<td>169</td>
<td></td>
</tr>
<tr>
<td>moles</td>
<td>571</td>
<td></td>
</tr>
<tr>
<td>Monvillea spegazzinii</td>
<td>246</td>
<td></td>
</tr>
<tr>
<td>analysis</td>
<td>246</td>
<td></td>
</tr>
<tr>
<td>moon cactus</td>
<td>565</td>
<td></td>
</tr>
<tr>
<td>Morolic acid</td>
<td>331, 333</td>
<td></td>
</tr>
<tr>
<td>mucilage</td>
<td>37, 264, 272, 341, 393, 519</td>
<td>548</td>
</tr>
<tr>
<td>mulato</td>
<td>548</td>
<td></td>
</tr>
<tr>
<td>mumps</td>
<td>570</td>
<td></td>
</tr>
<tr>
<td>Musk ambrette</td>
<td>600</td>
<td></td>
</tr>
<tr>
<td>Myrcene</td>
<td>123, 272</td>
<td></td>
</tr>
<tr>
<td>Myristic acid</td>
<td>272, 273</td>
<td></td>
</tr>
<tr>
<td>Myrtillocactus cochal</td>
<td>247, 248</td>
<td></td>
</tr>
<tr>
<td>analysis</td>
<td>247</td>
<td></td>
</tr>
<tr>
<td>fruit</td>
<td>247</td>
<td></td>
</tr>
<tr>
<td>water content</td>
<td>247</td>
<td></td>
</tr>
<tr>
<td>Myrtillocactus eichlamii</td>
<td>249</td>
<td></td>
</tr>
<tr>
<td>analysis</td>
<td>249</td>
<td></td>
</tr>
<tr>
<td>Myrtillocactus geometrizans</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>activity note</td>
<td>567</td>
<td></td>
</tr>
<tr>
<td>analysis</td>
<td>249</td>
<td></td>
</tr>
<tr>
<td>cristate</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>flowering</td>
<td>249, 567</td>
<td></td>
</tr>
<tr>
<td>var. grandiareolatus</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>Myrtillocactus grandiareolatus</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>analysis</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>Myrtillocactus schenckii</td>
<td>251</td>
<td></td>
</tr>
<tr>
<td>analysis</td>
<td>251</td>
<td></td>
</tr>
<tr>
<td>flowering</td>
<td>251</td>
<td></td>
</tr>
<tr>
<td>Myrtilligenic acid</td>
<td>247, 249</td>
<td></td>
</tr>
<tr>
<td>structure</td>
<td>681</td>
<td></td>
</tr>
</tbody>
</table>

**N**

N-2-Cyclohexylethyl-N-methylamine 600
N-[3,4,5-Trimethoxyphenethyl]-alanine 208
N-[3,4,5-Trimethoxyphenethyl]-glycine 208
N-Acetyl-3,4-dimethoxyphenethylamine 39
N-Acetyl-3-hydroxy-4,5-dimethoxyphenethylamine 212
structure 671
N-Acetylanhalamine 212
N-Acetylanhalonine 212
N-Acetyl DMPEA
structure 670
N-Acetylmescaline 212
structure 672
NAMT
structure 670
n-Amyl salicylate 123
Naphthalene 325
napiosa 43, 599
Narcissin 268, 272, 273, 278, 327
narcotic 538, 539, 546, 548, 559, 578
navaí 599
N.Chile 475
n-Decanal 123
Neobuxbaumia euphorbioides 251, 252, 253
analysis 251
Neobuxbaumia multiareolata 253
Neobuxbaumia scoparia 257
flower 257
image 254, 255, 256, 257
Neobuxbaumia tetetzo 257, 258
analysis 43
image 257
Neogomesia agavioides 257
Neolloydia intertexta
var. dasyacantha
analysis 261
image 261
Neolloydia intertextus 259
flower 259
spine detail 260
Neolloydia odorata
analysis 261
Neomammillaria runyonii 261
Neoperteria ebenacantha
analysis 262
Neoraimondia arequipensis 262
var. roseiflora
analysis 262
Neoraimondia gigantea 262
Neoraimondia macrostibas
activity note 567
analysis 262
roseiflora
image 567
water content 262
Neral 123
Nerol 123
Nerolidol 121, 139, 144
nervousness 575
Neryl acetate 123
neuroprotective 569
Neverland gene 558
N-Formyl-3-hydroxy-4,5-dimethoxyphenethylamine 212
structure 671
N-Formylanhalamine 212
N-Formylanhalinamine 212
N-Formylanhalonidine 212
N-Formylanhalonine 212
N-Formylmescaline 212
structure 671
N-Formylormacromerine 70
N-Formyl-O-methylanhalonidine 212
N-Glycans 227
n-Hexadecanoic acid 123
n-Hexanal 123
Nicotine 600, 601
nictating membrane 546
night-blooming cereus 11
Night-blooming cereus 581
N-Isovalerylhistamine 98
NMCR 589
N-Methyl-3,4,5-trihydroxy-phenethylamine 600
N-Methyl-3,4-dimethoxy-phenethylamine 127, 203, 208, 306, 314, 315, 486, 504, 600
N-Methyl-3-hydroxy-4,5-dimethoxyphenethylamine 212
structure 671
N-Methyl-3-hydroxy-4-methoxyphenethylamine 600
N-Methyl-3-methoxytyramine 17, 65, 67, 70, 73, 102
N-Methyl-4-methoxy-b-hydroxyphenethylamine 36, 195, 296, 298, 301, 304, 3
14
structure 669
N-Methyl-6,7-dimethoxy-isoquinolinium chloride
structure 675
N-Methylanhalamine 600, 601
N-Methylleuropeine
N-Methylheliamine 36, 195, 296, 298, 301, 304, 3
14
structure 674
N-Methylisosalsoline
structure 674
N-Methylleuropeine 36
structure 671
N-Methylmethanephrine 70
structure 670
N-Methylpachycereine
structure 676
N-Methylpachycereine 298, 304
N-Methylphenethylamine 98, 102, 137, 600, 601
structure 669
N-Methyltryptamine 601
N,N-Dimethyl-3,4-dimethoxyphenethylamine 35, 39, 314, 486
N,N-dimethyl-3,4-methyleneoxyphenethylamine 403
N,N-Dimethyl-3,4-methylenedioxyphenethylamine 212
N,N-Dimethyl-3-hydroxy-4,5-dimethoxyphenethylamine 306
structure 671
N,N-Dimethyl-3-methoxy-4-hydroxyphenethylamine 208
N,N-Dimethyl-3-methoxytyramine 11, 212, 315
structure 670
N,N-Dimethyl-4-methoxy-b-hydroxyphenethylamine 669
N,N-Dimethyl-4-methoxyphenethylamine 39, 669
N,N-Dimethyl-a-methyl-phenethylamine 600
N,N-Dimethylidopamine 600
N,N-Dimethylhistamine 109, 112
N,N-Dimethylmescaline 137, 139, 147, 148, 153, 155, 157, 160, 163, 486, 506, 508, 509, 511, 517
N,N-Dimethyl-phenethylamine 600
structure 669
N,N-Dimethyltryptamine 112, 379, 486, 601
N,N,N-Trimethyl-phenethyl-ammonium hydroxide 600
n-Nonacosan-10-ol 370
no alkaloid 262
nocheznopalli 568
nochote 599
n-Octyl-alcohol 195
no detectable alkaloid 17, 28, 43, 45, 63, 73, 81, 102, 109, 112, 130, 132, 169, 172, 177, 178, 180, 181, 184, 188, 243, 249, 251, 261, 274, 285, 314, 321, 328, 343, 569, 570
no detectable alkaloids 88
no detectable triterpenes 304
Nonadecane 123
2-Methyl- 123
Nonadienal 274
Nonadienol 274
Nonalactone 274
Nonanal 274, 325
Nonanoic acid 274
Nonanol 274
Nonanone-2 325
Nonanol 274
nopal 568
nopal de San Gabriel 568
Nopalea cochenillifera activity note 568
analysis 263
flower 557, 568
image 557, 568
Nopalea karwinskiana activity note 568
nopalillo 568
nopalillo de flor 568
Nopalexochia ackermannii 263
analysis 263
flower 263
Nopalexochia phyllanthoides 264
analysis 264
Norcarnegine 40
Norcarine 70, 670
Normacromerine 67, 69, 70, 98, 102
structure 670
Norcarpine 70
Norebeberine 70
Norepinephrine 70, 670
Nortriptyline 600
Nortriptiline 600
Norweberine 304
structure 676
Notocactus concinnus
analysis 264
Notocactus mammulosus
analysis 264
Notocactus ottonis
analysis 264
Notocactus scopa
analysis 265
Notocactus sp
flowering 264
Notocactus uebelmannianus
flowering 264
N-trimethyl cation of 3-Methoxytyramine 601
N-trimethyl cation of Dopamine 601
Nyctocereus guatemalensis
analysis 264
Obregonia denegrii 265
activity note 568
analysis 265
flower 265
Trouts Notes on Cactus Chemistry

Ochoterene 296
Ocimene 123, 139, 144
Oct-1-en-3-ol 325
Octadecanoic acid 123
Octan-2-one 325
Octanal 325
Octanoic acid 249, 274
Octanal 274, 325
Oct-1-en-3-ol 325
Octopamine 
structure 669
ointments 559
Olean-12-ene-3b,16b,28-triol-3-palmitate 370
Oleane 188
Oleanolic acid 127, 177, 180, 181, 183, 184, 186, 
187, 188, 247, 249, 250, 251, 317, 321, 328, 
330, 331, 333, 334, 335
structure 681
Oleanolic acid 3-O-a-L-rhamnopyranosyl- 
(1→3)-β-D-glucuronopyranosyl 28-O-alpha-D-glucopyranoside 334
Oleanolic aldehyde 98, 188, 317 
structure 681
Oleanonate 98
Oleic acid 195, 266, 272, 273
Ollotis alvaria 8
O-Methyladrenaline 
structure 670
O-Methylcandicine 69, 669
O-Methylcorypalline 304, 314
structure 674
O-Methylpellotine 203, 208, 212, 304
structure 675
O-Methylpeyorovic acid 212 
structure 675
O-Methylpeoxylic acid 212 
structure 675
O-Methylsynephrine 98
Ooctic acid  
2-Methyl- 123
Opal 268
opening comments 7
ophthalmia 568, 569, 575
Opuntia 
ayahuasca admixture 529
brew 599
Opuntia basilaria 266
Opuntia basilaris 266
Opuntia bergeriana 
analysis 266
Opuntia boldinghii 
analysis 266
Opuntia brasiliensis 529
Opuntia chlorotica 
analysis 267
image 267
Opuntia clavata 
see as Corynopuntia clavata 268
Opuntia comonduensis 
analysis 268
Opuntia compressa 570 
activity note 570
image 275
Opuntia curvispina 268
Opuntia cylindrica 
analysis 28
illustration 28
image 28
Opuntia decumbens 
analysis 268
Opuntia dejecta 
analysis 268
Opuntia diademata 
analysis 268
Opuntia dillenii 268 
activity note 575
image 292, 575
reticulata 571
Opuntia elator 268, 568 
activity note 569
analysis 268
Opuntia ellisiana 
analysis 268
image 269
Opuntia engelmanii 268, 270, 271 
activity note 569
analysis 268
brew 599
fruit 599 
var. linguiformis 271
Opuntia erinaceae 
var. hystricina 
analysis 272
var. ursina 271
Opuntia ficus-indica 272 
activity note 569
flower 272
fruit 272 
fragrance 273
water content 272
Opuntia fragilis 
activity note 569
Opuntia fulgida
activity note 569

Opuntia guatemalensis
analysis 274

Opuntia hernandezii 568

Opuntia hickenii
analysis 274

Opuntia horrida 568

Opuntia humifusa 274
activity note 570
analysis 274, 570
image 275, 570

Opuntia imbricata
activity note 570

Opuntia invicta
image 60

Opuntia leuchotricha
analysis 274

Opuntia lindheimeri
activity note 570
analysis 278

Opuntia littoralis 278
image 275, 276
var. austrocalifornica 279
var. littoralis 278, 279
analysis 278
var. martiniana
analysis 278

Opuntia longispina
analysis 278

Opuntia macrocentra 280, 281
flower 280, 281

Opuntia macrocentra
analysis 278, 280

Opuntia maldonadensis
analysis 280

Opuntia matudae 280

Opuntia megacanthus
activity note 570

Opuntia megarrhiza
activity note 570
image 570

Opuntia monacantha 285
image 286

Opuntia moniliformis
activity note 571

Opuntia nopalilla 568

Opuntia pachypus 285
see as Australocylindropuntia pachypus 285

Opuntia paraguayensis
analysis 285

Opuntia penicilligera 285

Opuntia phaeacantha
activity note 571

analysis 285
image 289, 571
var. discata
analysis 285
var. major
analysis 285

Opuntia pilifera 285

Opuntia plumbea
activity note 571

Opuntia polycanatha
activity note 571
analysis 287

Opuntia erinacea
image 286

Opuntia pseudo-tuna
activity note 571

Opuntia pubescens 572, 573
image 572, 573
use 572, 573

Opuntia reflexispina
activity note 535, 571

Opuntia ritteri
analysis 288

Opuntia robusta 290
analysis 290
flower 290
fruit 290

Opuntia sp
activity note 571
fruit 684

Opuntia spinosior 5

Opuntia spp. hybrids
analysis 290

Opuntia streptacantha
activity note 574
analysis 290

Opuntia stricta 342
analysis 290
var. dillenii
activity note 575
analysis 292
image 575

Opuntia tomentella
analysis 292

Opuntia tomentosa
analysis 293

Opuntia tuna 568
activity note 575

Opuntia violacea
var. macrocentra 293

Opuntia violaceae 280

Opuntia vulgaris 293
analysis 293

Opuntia zebrina 571

Opuntia B 293
Trouts Notes on Cactus Chemistry

Opuntiol 268, 287, 292
Opuntioside I 292
Opuntioside-1 575
Opuntisterol 292
Opuntisteroside 292
organillo 327
organo 11, 296
organ pipe 188
Orientin 292
Oroya peruviana
flower 684
orthopedic ailments 559
OST 92701 455, 458
Ostolaza #8428 30
Oxalate druses 212
Oxalic acid 273
Oxallobetulin 335
Oxycandicine 337

P

Pachanane 172
Pachanol A 401
structure 681
Pachanol B 401
Pachanol C
revised structure 393
Pachanol D 172
Pachanoside C1 393
Pachanoside D1 172
Pachanoside E1 393
Pachanoside F1 393
Pachanoside G1 393
Pachanoside I1 172
Pachycereine 296, 304, 676
Pachycereus calvus 294
Pachycereus chrysomallus
analysis 294
Pachycereus gaumeri 294
Pachycereus gigas 294
Pachycereus grandis
analysis 294
Pachycereus hollianus 294
Pachycereus marginatus 294, 295, 296, 297, 298
activity note 575
analysis 296
flowering 294, 295, 296, 297, 298
Pachycereus pecten-aboriginum 298, 299, 300
activity note 578
analysis 298
brew 599
flowering 298, 299, 300
image 521, 578
Pachycereus pringlei 301, 302, 303, 577
activity note 579
analysis 301
Peniocereus greggii 308, 309
activity note 581
Peniocereus hirschtianus 264
Peniocereus striatus
activity note 581
Peniocerol 188, 249, 308, 567
structure 681
Pentene-1-ol 274
Pereskia aculeata 309
activity note 581
analysis 309
image 583
Pereskia autumnalis
analysis 309
Pereskia bleo 568
activity note 581
acute toxicity 581
analysis 309
LD50 581
Pereskia corrugata
analysis 309
Pereskia cubensis
analysis 309
Pereskia godseffiana
analysis 309
Pereskia grandiflora 310
analysis 309
flower 310
seeds 310
Pereskia grandifolia 310
activity note 581
acute toxicity 581
analysis 309
fruit 309, 310, 311, 312
LD50 581
seeds 310
Pereskia guamacho
activity note 581
Pereskia pititache 313
analysis 310, 581
Pereskia tampicana
analysis 313
Mexico 59.0652 313
flower 313
Pereskia weberiana 576
Pereskiopsis chapistle
analysis 313
Pereskiopsis porteri 313
analysis 313
Pereskiopsis scandens 313
Perillalcohol 274
pertussis 569
Peru 48.1540 431
Peru 49.1579 429

Trouts Notes on Cactus Chemistry

Peru 52.0752 431
Peru 52.0762 429
Peru 56.1153 379
Peru 64.0762 416
Peru 64.0903 30
Peru 65.0715 474
Peru 68.0235 52
Peruvian torch 429
Peyoglunal 212
structure 678
Peyoglutam 212
structure 675, 678
Peyonine 212
structure 678
Peyophorine 212, 601
structure 675
Peyorvic acid 212
structure 675
peyote 13, 17, 24, 208, 306, 528, 563, 581
peyote cimarron 526
peyote cimarrón 13, 24, 528
peyote mulato 548
peyotillo 306, 581
Peyotine 212, 214
structure 675
Peyoxylic acid 212
structure 675
pezuña de venado 17
pH 119, 273
phagocytosis 565
Phellandrene 123
Phenethylamine 36, 98, 169, 309, 313, 506, 508, 509, 511, 512, 517, 600, 601
structure 669
phenethylamines
key to structural table 672
structure table 669
Phenol 123
Phenoxyethanol 325
Phentolamine 546
Phenylethanol 274
Phenylethyl alcohol 123
Phenylethyl benzoate 123
Phillyriside A 333
Phrynoidis alvarius 8
p-Hydroxyamphetamine 600
p-Hydroxybenzaldehyde 40
p-Hydroxybenzoic acid 40, 292
p-Hydroxynepeicolamide 601
Phyllocactus ackermannii 313
Phyllocactus hybridus 314

657
Physcion 273
Phytol 123
Phytosterols 188
piles 569
Piloceridine 195
Pilocereine 193, 195, 197, 296
structure 676
Pilocereus chryscanthus 314
analysis 314
Pilocereus chrysomallus 314
Pilocereus euphorbioides 314
Pilocereus gaumeri 314
Pilocereus giganteus 314
Pilocereus glaucescens 314
Pilocereus gounellei
analysis 314
Pilocereus guerreronis
analysis 314
Pilocereus leucocephalus
See as Cephalocereus leucocephalus 315
Pilocereus maxonii 315
analysis 315
Pilocereus nobilis 315
Pilocereus pasacana 315
Pilocereus sargentianus 315
Pilocereus schottii 315
Pilocereus senilis 315
Pilocereus thurberi 315
Pilosocereus chryscanthus 315
Pilosocereus gaumeri 315
Pilosocereus glaucescens 315
Pilosocereus guerronis
analysis 315
Pilosocereus leucocephalus 315
Pilosocereus maxonii 315
Pilosocereus nobilis 315
Pilosocereus pasacana 315
Pilosocereus sargentianus 315
Pilosocereus thurberi 315
Pyrrocactus strausianus 323
Quadrone 93
Quercetin 40, 122, 169, 227, 272, 273, 274, 278, 290, 292, 309, 358, 469, 569, 570
3-methyl ether 273
3-O-β-D-galactopyranoside 169
Quercetin-3-galactoside 278
Quercetin-3-glucoside 81, 84, 93, 112, 267, 268, 278, 285, 289
Quercetin 3-methyl ether 272, 569
Quercetin-3-O-rhamnoside 292
Quercetin 3-O-rhamnosylglucoside 112
Quercetin-3-O-rhamnopyranoside 169
queretin-3-glucoside 81, 84, 93, 112, 267, 268, 278, 285, 290
Quercetin 3-methyl ether 272, 569
Quercetin-3-O-rhamnoside 292
Quercetin 3-O-rhamnosylglucoside 112

Trouts Notes on Cactus Chemistry
Quercetin 3-O-β-D-glucopyranoside 169
Quercetin-3-rutinoside 81, 84, 93, 267, 268, 278, 285, 290
Quercetin 7-O-glucoside 112
Quercitrin 272
Queretarioic acid 183, 186, 188, 330, 331, 333
Queretarol structure 681
Quiabentia chacoensis flower 322, 323
images 322, 323
Quinic acid 40, 203, 265, 296, 306, 314

Rabies 581
Rabo de raposa 165
Racamatraca 581
Radiation burn 569
Radical scavengers 570
Rainbow cactus 543
Randia echinocarpa 599
Randia laevigata 599
Randia watsoni 599
rat auricles 546
Rat basophilic leukemia 587
Rathbunia alamosensis 323
rat hearts 546
rat invasion 556
rat-tail cactus 11
RBL-2H3 587
Reactions of mescaline 148
Rebutia arenacea analysis 324
Rebutia fabrisii analysis 324
Rebutia krainziana analysis 324
Rebutia margarethae 324 analysis 324
Rebutia marsoneri analysis 324
Rebutia miniscula analysis 324
Rebutia pseudodeminuta analysis 324
Rebutia senilis analysis 324
Rebutia sp flowering 324
Recreational inebrient 526
reduces plasma glucose 570
red urine 558, 599
References 602

Trouts Notes on Cactus Chemistry

Quinic acid 40, 203, 265, 296, 306, 314

Rabies 581
reduces plasma glucose 570
refreshing 529
refreshing tea 568
refrigerant 581
regurgitation 585
reina de noche 581
religious 559
removes toxin 575
respiratory depression 546
respiratory stimulant 559
respiratory syncitial disease virus 575
Retusin 17
revitalizing 581
Rhamnose 37, 84, 102, 263, 264, 272, 273, 341, 519
rheumatism 559, 568, 575, 581, 585
Rhipsalis baccifera analysis 325
fruit 324
ssp. mauritiana 324
fruit 324, 325
Rhipsalis capilliformis analysis 325
Rhipsalis cassytha activity note 582
analysis 325
Rhipsalis conferta
Activity note 325, 582
Rhipsalis gaertneria analysis 325
Rhipsalis juengeri analysis 325
Rhipsalis mesembranthyemoides analysis 325
Rhipsalis pachyptera activity note 582
Rhipsalis paradoxa analysis 325
Rhipsalis regnellii analysis 325
Rhipsalis rhombea analysis 326
Rhipsalis teres analysis 326
Rhipsalis virgata analysis 326
Rhipsalis warmingiana analysis 326
Rhizosphere 88, 93, 540
Rhodocactus grandifolius see as Pereskia grandifolia 309
Rhodocactus sp 326
Rhodoxanthin 274
Rhyrcose 273
Rio Chillon 444
Trouts Notes on Cactus Chemistry

Ritterocereus griseus 326
Ritterocereus hystrix 326
Ritterocereus montanus 326
Ritterocereus pruinosus 326
Ritterocereus queretaroensis 326
Ritterocereus weberi 326
Riverside Co 286
robbers 526, 548
Rooksbya euphorbioides 326
rosapara 548, 560
Rose 1899
Sacred Cactus
   image 560
Rose 20063 57
Roseocactus fissuratus 326
Roseocereus tephractionus 326
RS 404 208
rubber 293
Rules of Nomenclature
   loopholes 501
runners 548
Rutin 272, 292
Sacamatraca 581
Saccharose 73
Sacred Cacti cover 520
Sacred Cactus 222
   image 560
saguro 39
saguesa 301
sahuarro 39
Salado 543
Salicifoline 601
   structure 670
Salm-Dyck
   image 396
salmon-flowered hedgehog 543
Salsolidine 40, 253, 257, 296, 298, 304, 601
   structure 673
Salsoline 111, 298
   structure 673
Salsolinol
   structure 673
salve 581
San Pedro 352, 399, 429, 594
   Amsterdam 353
   Macho 429
   Trichocereus peruvianus 429
San Pedro book 520
San Pedro de Atacama 10
San Pedros
   5 523
San Pedro substitute 555
Santa Poli 536
Santa Rosa Mountains 286
sarcoma 45 578
scald 569
Schelle
   macrogonus 396
Schlumbergera bridgesii
   analysis 326
Schlumbergera russelliana
   analysis 326
Schlumbergera truncata
   analysis 326
flower 326
flowering 686
   images 326
Schlumbergera x buckleyi 326
Schottenol 195
Schumann
   image 396
sciatica 529
scorpion sting 559
scurvy 529
Selenicereus coniflorus 326
   activity note 585
Selenicereus grandiflorus 327
   activity note 585
   analysis 327
   flower 327
   image 586
   inexcusable substitute 570
Selenicereus pteranthus
   analysis 327
Selinene 325
senita 195, 558
Seri 530, 558, 579
Serotonin 212
Sesquiterpene alcohol 94, 98, 102, 119, 121, 139, 144, 153, 306, 324, 508
Sesquiterpene alcohol 1 306
sexual exhaustion 585
Shortwindedness 569
silver cholla 84
sina 328
Sinapinic acid 292
Siniscalco 1983 210, 249
sinita 195
Sitosterol 17, 40, 48, 73, 102, 121, 169, 183, 268, 274, 292, 309, 326
   structure 679
skin ailments 569, 570, 571
sleep 559
smoked 526
snake bite 559, 571, 575, 581
snake repellent 560
snowball pincushion 560
Soehrensia bruchii 327
solid tumour S180 545
Solisia pectinata analysis 327
Solisia pseudopectinata 327
Some Simple Tryptamines book 691
sorcerers 548
sores 549, 569, 575, 581
sore throat 575
Spanish
  Gooseberry 309
spasms 559, 569
speed 548
Spinasterol
  structure 679
Spinasterone 123
Spiroketal 273
SS01 397
SS02 355
standard peruvianus 358
star cactus 24
Stearic acid 266, 272, 273
Stellatogenin 251, 331, 333, 334, 335
  structure 681
Stellatogenin 3-O-α-L-rhamnopyranosyl-(1→4)-α-L-rhamnopyranosyl-
  (1→2)-β-D-glucuronopyranoside 334
Stellatoside 334
Stellatoside B 333
Stellatoside B methyl ester 333
Stellatoside C 333
Stellatoside C methyl ester 333
Stellatoside D 333
Stellatoside E 333
Stenocactus multicostatus 327
Stenocereol 188
  structure 681
Stenocereus alamosensis 327, 328, 329
  activity note 587
  analysis 328
  image 587
Stenocereus beneckei 330
  analysis 330
Stenocereus chende
  See as Polaskia chende 331
Stenocereus chichipe 331
Stenocereus dumortieri 331
Stenocereus eruca 331, 332, 333
  activity note 587
  analysis 331
  image 587
Stenocereus griseus 333
Stenocereus gummosus 333
Stenocereus hystrix 333, 553, 554
  activity note 553
Stenocereus longispinus 333
Stenocereus marginatus 333
Stenocereus montanus 333
Stenocereus pruinosus 333
Stenocereus queretaroensis 333
Stenocereus quevedonis 333
Stenocereus stellatus 334
  analysis 334
  fruit 334
  water content 334
Stenocereus thurberi 334
Stenocereus treleasei 335, 336
  analysis 335
Stenocereus weberi 335
sterility 594
steroid 102
sterol 40
Stetsonia coryne 337, 338, 339, 340
Stigmast-4-en-3-one 123
Stigmasterol 121, 123, 309
structure 681
stimulant 548, 588
stimulant activity 424
strawberry cactus 110, 540
Strombocactus disciformis 340
  analysis 340
monstrose 340
Structural formula key
  Isoquinoline
    generic diagram 676
    key 676
  Isoquinolines 673
  alphabetical 677
  Phenethylamines 669
    generic diagram 672
    key 672
  Triterpenoids 679
    generic diagram 682
    key 682
structure table
  isoquinolines 673
  phenethylamines 669
  triterpenoids 679
Stuart 529
stupefy fish 560
Strycne 325
suaharo 39
Succinic acid 273, 292
Sucrose 50
sugaro 530
sugaru 39
Sulfurous acid
  Cyclohexylmethyl hexyl ester 123
sunami 526
sunburn 569
sunset cactus 560
sunstroke 559
suppurative 581
suwarro 39
suwarrow 39
swelling 559, 561, 570, 571, 581
reduce 581
swelling of eyelids 529
sympathomimetic 568
Synephrine 67, 69, 70, 73, 98, 102, 227
structure 669
syphilis 575, 581
Syringaldehyde 40

Tajuá 560
Taraxanol 292, 293
Taraxerone 293
Tartaric acid 273
tasajillo 88
tasajo 169
tasajulla 539
Taxifolin 272, 273
tchá 529
Tehuanine 301, 303, 304
structure 674
Tehuanine-N-oxide 301
structure 674
Tepinene 303
structure 674
Tephrocactus articulatus
analysis 341
Tephrocactus aurantiaca
analysis 341
Tephrocactus glomeratus
analysis 341
Tephrocactus soehrensii 342
analysis 342
terpeneid summary
by species 7
Terpinene 123, 272
Terpinolene 123
Terrecyclic acid A 93, 540
tesgüino 526, 534, 558, 559, 599
Testosterone cypionate 123
tetanic convulsions 546
Tetracosane 123
tetracyclic triterpenoid 73
Tetradecane 123, 325
tetramethylated quercetrine 17
Tetrol 102
Thelocactus bicolor 342, 343, 345, 346
analysis 343
flower 342, 343, 345, 346

Thelocactus lophothele 343
Thelocactus pseudopectinatus 343
Thelocactus rinconensis 343, 346
Thelocactus sausseri
image 346
Thelocactus sp
analysis 343
thirst 571
throat ailments 569
throw down precipice 548
Thurberin 188
Thurberogenin 188, 331, 333, 334, 335
structure 682
Thurberol 188
structure 682
Thurberoside A 333, 587
activity note 587
tobacco toxemia 585
Toco 480
Todd 1969 210
Toluene 272
Tom Juul 418
tonic 546, 585
too strong 529
toothache 568
Toothache 569
Torres & Torres 475
bioassay 475
totem pole cactus 197
toxemia 585
toxicity 548
trans-Nerolidol 121, 139, 144
trans-Ocimene 123
trans-β-Ocimene 139, 144
Treleasegenic acid 331, 333, 335
structure 682
Treleaseside A 333
Trichocereine 486, 600
structure 672
Trichocereus
Huanuco 590, 591
San Pedro 594
Trichocereus aff. huanucoensis 347
Trichocereus aff. pachanoi 416, 417
Trichocereus andalgalensis 348
analysis 348
flower 348
Trichocereus argentinensis 52, 348
Trichocereus atacamensis 10
activity note 588
bioassay 349
Trichocereus bridgesii 353
activity note 588
analysis 352
Bolivia 349
Bolivia 53.0162 351, 352, 353, 357, 358
flower 352, 357, 358
H70760 356
Huanuco 588
monstrose 358
long form 360
short form 359, 360
San Pedro 588
Trichocereus bruchii
analysis 361
Argentina 74.0146 361, 362
flower 362
Trichocereus camaraguensis 363
analysis 363
flower 363, 364
Trichocereus candidans 366, 368, 682
analysis 366
flower 367
fruit 369
Trichocereus cephalomacrostibas 365, 366, 550
activity note 550
flowering 550
Trichocereus chalaensis 366, 370
Trichocereus chilensis
analysis 370
Chile 52.0568 371, 372
Chile 52.1507 370, 371
Chile 55.0643 373, 374
flower 370
H 20932 371
Trichocereus chiloensis 370
activity note 588
Trichocereus courantii
analysis 375
Trichocereus crassicostata 375
Trichocereus cuzcoensis 375, 377, 378
activity note 588
analysis 375
fruit 375
not 588
Trichocereus cv
Juulís Giant 418
Trichocereus escayachensis 377
Trichocereus fulvilanus 378
analysis 378
Trichocereus giganteus 46, 626
Trichocereus grandiflorus 378, 379
activity report 589
analysis 378
Argentina 74.0151 379
flower 378
misidentified 589
 purported activity 589
tryptamine question 378
white-flower 589
Trichocereus halianca
activity note 592
cutting 592
dried 592
Trichocereus huanucoensis
bioassay 379
flower 380
flowering 381
HBG 382, 668
UC 380, 381
weird growth 382
Trichocereus huancha 383, 384
analysis 383
flower 383
Trichocereus huayanca 592
Trichocereus knuthianus 385, 386
analysis 386
Trichocereus lamprochlorus 386, 387, 388
analysis 390
Trichocereus litoralis 389
flowering 389
Trichocereus lobivioides grandiflorus 383
Trichocereus macrogonus 354, 391, 392, 393, 394,
395, 592, 672
analysis 390
associated names 396
RS0004 390
bioassay 390
Schelle
image 396
subsp. pachanoi 404
Trichocereus manguinii
analysis 399
Trichocereus pachanoi 403, 407, 412, 414, 416
activity note 594
analysis 399
areoles compared to
Trichocereus scopulicola 671
Arequipa 401
black hair purported 406
cristate 594
Ecuador
Oz 415
flower 400, 406, 410
fruit 406
hair color 406
KK339 409, 410
KK591 408
Matucana 398, 399, 402
peruvianus compared 403
water content 399
Xperuvianus 446, 447
Trichocereus pachanoid
Peru 593
short-spined 593
Trichocereus pallarensis 420, 421, 422, 423
flowering 421
Trichocereus pasacana 692
analysis 424
Argentina 32.3056 424, 426
Argentina 90.0989 425
Argentina 90.0989 425
bioassay 424
Bolivia 55.0259 425
flower 424
HBG 427
Trichocereus peruvianoids 429
Trichocereus peruvianus
analysis 429
Chavin de Huantar 442
cv Blue form 439
f. Ancash 440
flower 8, 432, 433, 435, 436, 437, 438
fruit 434
GF
flowering 8, 433, 435, 436, 437, 438
fruit 434
Huancabamba 410, 411
KK242 442, 443
analysis 442
Rio Chillon 444
KK242 Matucana 442
KK338 441
Matucana 432
Oz 430
Peru 48.1540 431
flower 432
Peru 49.1579 429
Peru 52.0752 431
Peru 52.0762 429
rosei #1 8
rosei #2 8
Trujilloensis 430
var. knuthianus 386
water content 429
XJuul's Giant
cristate 448
Trichocereus poco 450
analysis 449
Trichocereus puquiensis 451, 452
flower 451
fruit 451
monstrose
bioassay 452
Trichocereus purpureopilosus 453
analysis 453
flower 453
fruit 453
Trichocereus riomisquiensis 455
Trichocereus riomizquiensis
images 455
Trichocereus rosei
#1 8
#2 8
Trichocereus santaensis 455, 456, 457, 458
FK 873
image 456
H 76747
image 456
OST 92701
image 457
images 455
Trichocereus santiaguensis 458, 459, 460, 461
analysis 461
images 458, 459
Trichocereus schickendantzii 461, 462
analysis 461
images 462
Trichocereus schoenii 462
activity note 594
analysis 462
image 462
Trichocereus scopulicola 462, 463, 464, 465, 466, 468, 595
activity note 594
areoles 466
areoles compared to
Trichocereus pachanoid 671
flower 462, 463
fruit 678
images 463, 464, 465, 466, 468
NMCR
image 467
skin detail 462, 463
Trichocereus scopulicolus 463, 468
Trichocereus skottsbegii
analysis 469
image 470
Trichocereus smrzianus 469
bioassay 469
Trichocereus sp
Bolivia 55.0261 449
Juulis Giant 419
N. Chile
bioassay 475
N.Chile 475
Peru 65.0715 474
SS01 397
SS02 355
bioassay 475
Standard 358
bioassay 358
<table>
<thead>
<tr>
<th>Species</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trichocereus spachianus</td>
<td>469, 471, 472</td>
</tr>
<tr>
<td>activity note</td>
<td>596</td>
</tr>
<tr>
<td>analysis</td>
<td>469</td>
</tr>
<tr>
<td>flower</td>
<td>471, 472</td>
</tr>
<tr>
<td>fruit</td>
<td>471, 472</td>
</tr>
<tr>
<td>image</td>
<td>596</td>
</tr>
<tr>
<td>Trichocereus sp. SS03</td>
<td></td>
</tr>
<tr>
<td>image</td>
<td>445</td>
</tr>
<tr>
<td>Trichocereus strigosus</td>
<td>476</td>
</tr>
<tr>
<td>Trichocereus tacaquirensis</td>
<td>478</td>
</tr>
<tr>
<td>Bolivia</td>
<td>65.0839 477</td>
</tr>
<tr>
<td>Trichocereus taquimbalesiens</td>
<td>470, 477, 478, 479, 480, 481</td>
</tr>
<tr>
<td>activity note</td>
<td>596</td>
</tr>
<tr>
<td>analysis</td>
<td>479</td>
</tr>
<tr>
<td>image</td>
<td>482</td>
</tr>
<tr>
<td>Trichocereus tarmaensis</td>
<td>483, 484</td>
</tr>
<tr>
<td>flowering</td>
<td></td>
</tr>
<tr>
<td>fruit</td>
<td>483</td>
</tr>
<tr>
<td>Trichocereus terscheckii</td>
<td>486, 487, 488</td>
</tr>
<tr>
<td>analysis</td>
<td>486</td>
</tr>
<tr>
<td>fig.</td>
<td>486, 487, 488</td>
</tr>
<tr>
<td>flower</td>
<td>486, 596</td>
</tr>
<tr>
<td>Trichocereus theletonoides</td>
<td>489</td>
</tr>
<tr>
<td>analysis</td>
<td>489</td>
</tr>
<tr>
<td>Trichocereus thelegenus</td>
<td>489, 490, 491, 492</td>
</tr>
<tr>
<td>analysis</td>
<td>489</td>
</tr>
<tr>
<td>Trichocereus torataensis</td>
<td>489</td>
</tr>
<tr>
<td>Trichocereus tulhuayacensis</td>
<td>489, 597</td>
</tr>
<tr>
<td>activity note</td>
<td>597</td>
</tr>
<tr>
<td>Trichocereus tunariensis</td>
<td>489</td>
</tr>
<tr>
<td>analysis</td>
<td>489</td>
</tr>
<tr>
<td>Trichocereus unidentified</td>
<td></td>
</tr>
<tr>
<td>San Pedro</td>
<td>594</td>
</tr>
<tr>
<td>Trichocereus uyupampensis</td>
<td>493, 491</td>
</tr>
<tr>
<td>flowering</td>
<td></td>
</tr>
<tr>
<td>fruit</td>
<td>494</td>
</tr>
<tr>
<td>Trichocereus validus</td>
<td>493, 495, 496, 497, 498</td>
</tr>
<tr>
<td>analysis</td>
<td>495</td>
</tr>
<tr>
<td>Trichocereus volcanensis</td>
<td>501</td>
</tr>
<tr>
<td>Arg. 56.0508</td>
<td>501</td>
</tr>
<tr>
<td>Trichocereus vollanus</td>
<td>499, 500, 501</td>
</tr>
<tr>
<td>analysis</td>
<td>495</td>
</tr>
<tr>
<td>flower</td>
<td>499, 500, 501</td>
</tr>
<tr>
<td>fruit</td>
<td>499, 500</td>
</tr>
<tr>
<td>Trichocereus werdermannianus</td>
<td></td>
</tr>
<tr>
<td>analysis</td>
<td>501</td>
</tr>
<tr>
<td>Bolivia 50.1998</td>
<td>501</td>
</tr>
<tr>
<td>Bolivia 71.0083</td>
<td>502, 503</td>
</tr>
<tr>
<td>Tridecan-2-one</td>
<td>325</td>
</tr>
<tr>
<td>Trimethyl benzene</td>
<td>123</td>
</tr>
<tr>
<td>Trimethylcitrate</td>
<td>273</td>
</tr>
<tr>
<td>triterpene summary</td>
<td></td>
</tr>
<tr>
<td>by species</td>
<td>7</td>
</tr>
<tr>
<td>triterpenoids</td>
<td></td>
</tr>
<tr>
<td>key to structure table</td>
<td>682</td>
</tr>
<tr>
<td>structural table</td>
<td>679</td>
</tr>
<tr>
<td>structure table</td>
<td>679</td>
</tr>
<tr>
<td>Triterpenol</td>
<td>73</td>
</tr>
<tr>
<td>Tryptamine</td>
<td>112, 212, 601</td>
</tr>
<tr>
<td>tsuwiri</td>
<td>526</td>
</tr>
<tr>
<td>tuberculosis</td>
<td>559, 571</td>
</tr>
<tr>
<td>Tulip prickly pear</td>
<td>571</td>
</tr>
<tr>
<td>tumor growth inhibition</td>
<td>545</td>
</tr>
<tr>
<td>tumors</td>
<td>569, 571, 581, 588</td>
</tr>
<tr>
<td>tuna</td>
<td>334, 568</td>
</tr>
<tr>
<td>tuna mansa</td>
<td>568</td>
</tr>
<tr>
<td>Tunilla soehrensii</td>
<td>503</td>
</tr>
<tr>
<td>tunillo</td>
<td>335</td>
</tr>
<tr>
<td>Turbinicarpus</td>
<td></td>
</tr>
<tr>
<td>comments</td>
<td>504</td>
</tr>
<tr>
<td>Turbinicarpus alsonoi</td>
<td>504</td>
</tr>
<tr>
<td>analysis</td>
<td>504</td>
</tr>
<tr>
<td>flower</td>
<td>504</td>
</tr>
<tr>
<td>Turbinicarpus bonatzii</td>
<td>504</td>
</tr>
<tr>
<td>Turbinicarpus dickisoniae</td>
<td>504</td>
</tr>
<tr>
<td>analysis</td>
<td>512</td>
</tr>
<tr>
<td>Turbinicarpus flaviflorus</td>
<td>504</td>
</tr>
<tr>
<td>analysis</td>
<td>512</td>
</tr>
<tr>
<td>Turbinicarpus gracilis</td>
<td>504</td>
</tr>
<tr>
<td>analysis</td>
<td>515</td>
</tr>
<tr>
<td>Turbinicarpus hoferi</td>
<td>505</td>
</tr>
<tr>
<td>cristate</td>
<td>505</td>
</tr>
<tr>
<td>Turbinicarpus jauernigii</td>
<td>505</td>
</tr>
<tr>
<td>flower</td>
<td>505</td>
</tr>
<tr>
<td>Turbinicarpus klinkerianus</td>
<td>505</td>
</tr>
<tr>
<td>analysis</td>
<td>515</td>
</tr>
<tr>
<td>Turbinicarpus krainzianus</td>
<td>505</td>
</tr>
<tr>
<td>var. minimus</td>
<td>505</td>
</tr>
<tr>
<td>Turbinicarpus laui</td>
<td>505</td>
</tr>
<tr>
<td>Turbinicarpus lauii</td>
<td>505</td>
</tr>
<tr>
<td>Turbinicarpus lausseri</td>
<td>506</td>
</tr>
<tr>
<td>flower</td>
<td>506</td>
</tr>
<tr>
<td>Turbinicarpus lilinkeudus</td>
<td>506</td>
</tr>
<tr>
<td>flower</td>
<td>506</td>
</tr>
<tr>
<td>Turbinicarpus lophophoroides</td>
<td>506</td>
</tr>
<tr>
<td>analysis</td>
<td>506</td>
</tr>
<tr>
<td>flower</td>
<td>506</td>
</tr>
<tr>
<td>ssp. jauernigii</td>
<td>508</td>
</tr>
<tr>
<td>Turbinicarpus macrochele</td>
<td>508</td>
</tr>
<tr>
<td>analysis</td>
<td>516</td>
</tr>
<tr>
<td>ssp. macrochele</td>
<td></td>
</tr>
<tr>
<td>var. polaskii</td>
<td>508</td>
</tr>
<tr>
<td>var. schwarzii</td>
<td></td>
</tr>
<tr>
<td>f. polaskii</td>
<td>508</td>
</tr>
<tr>
<td>Turbinicarpus panarito</td>
<td>508</td>
</tr>
</tbody>
</table>
Trouts Notes on Cactus Chemistry

Turbinicarpus polaskii 508
analysis 516
Turbinicarpus pseudomacrochele 507, 508, 510
analysis 508
ssp. krainzianus 509
analysis 508
flower 508
f. minimus 508
Turbinicarpus pseudopectinatus 509
analysis 509
var. roseiflorus 509
Turbinicarpus roseiflorus 509
flowering 677
Turbinicarpus schmiedickeanus 510
analysis 511
f. polaskii 516, 518
analysis 516
ssp. dickisoniae 512, 513
analysis 512
ssp. flaviflorus 510, 512, 514
analysis 512
ssp. gracilis 515
ssp. klinkeranus
f. schwarzii 515
ssp. klinkerianus 515
analysis 515
ssp. macrochele 516
analysis 516
flower 516
ssp. rubriflorus 516
ssp. schwarzii 517, 518
analysis 517
cristate 517
flower 517, 518
f. rubriflorus 518
ssp. schwarzii f. rubriflorus
analysis 518
Turbinicarpus schwarzii 519
analysis 517
f. rubriflorus
analysis 518
Turbinicarpus swobodae 519
Turbinicarpus valdezianus 519
structure 669
Tyrosine 48, 293

U
Uberine 102
structure 673
Ubine 98, 102
structure 669
ulcers 569, 575, 581
Undatuside A 169
Undatuside B 169
Undatuside C 169
Undecan-2-one 325
unidentified
alcohol 376
amine 326
bases 56, 160
Chiclayo, Peru 597, 598
imidazole 102
lactone 177, 180
lactone-forming acid 272
quaternary alkaloid 80, 107
terpene 170, 178
triterpene 294, 429
triterpene lactone 127
waxy solid 429
unidentified alkaloid 263, 272
urinary tract 572
urine
red like blood 558, 599
useful trivia 10
UV 280

V
valvular disease 585
Van Geest 430
Vanillic acid 40, 280, 292
Vanillin 40, 280
venereal ailments 559
vermicide 552
vermifuge 524, 540, 551
veterinary 556, 570
vichishovo 251
Viesca 208
Vieska 208
Vitalis 530
Vitexin 292
viznaga 107
volatile compounds 118, 119, 118
volatiles 50
Vulgaxanthin I 326
Trouts Notes on Cactus Chemistry

W

wallflower-crown 324
wamapanako 546
warts 560, 569, 571
water content 17, 56, 119, 148, 178, 180, 181, 184,
188, 193, 195, 208, 247, 262, 272, 287, 306,
334, 335, 399, 429, 486
water purification 581
W. Baker 5452 358
bioassay 358
weakness 585
Weberbaueroereus acranthus 550
activity note 550
Weberbaueroereus cephalomacrostabas
activity note 550
flowering 550
Weberidine 298, 301, 304
structure 673
Weberine 301, 304
structure 676
Weddellite 56, 109, 147, 259, 323, 324, 519
formula 687
Whewellite 86, 268, 278, 285, 322
formula 687
White Mountains 286
white torch 469
wichowaka 578
wichowåka 578
wichuri 536, 541
Wigginsia arechavaletai
analysis 519
Wigginsia erinacea
analysis 519
Wigginsia macrocantha
analysis 519
Wigginsia teprhacantha 519
analysis 519
flower 519
Wilcoxia striata
activity note 581
see as Peniocereus striatus 581
women's ailments 549, 569, 571
wounds 526, 546, 556, 559, 569, 571, 581

X

Xanthophyll 274
Xian Ren Zhang 292
XO activity
inhibits 569
xocconostle 280
Xylose 37, 40, 84, 263, 264, 272, 273, 341, 519

Y

Yacovleff & Herrera 1934
fig 39 265
yellow fever 581

Z

Z-2-Hexen-1-ol 274
Z-2-Pentene-1-ol 274
Z-3-Hexen-1-ol 274
Z-3-Hexenal 274
zacoub 169
Zeylmaker #8504 266
Zeylmaker #8508 81
zina 195
Zinc 273
Zygocactus truncatus 326
### Cactus Phenethylamines: A Tabular Key to their Structural Formulas

<table>
<thead>
<tr>
<th>Compound</th>
<th>Position:</th>
<th>Phenyl</th>
<th>Ethyl β</th>
<th>Ethyl α</th>
<th>Amine N1</th>
<th>Amine N2</th>
<th>Amine N3+</th>
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<td>na na</td>
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</tr>
<tr>
<td>N-Methylphenethylamine</td>
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<td>na na</td>
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<tr>
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<td>Me na</td>
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<td>Me H na</td>
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* Not reported as a cactus alkaloid; included for structural comparison
### Trouts Notes on Cactus Chemistry

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<th>Compound</th>
<th>Position:</th>
<th>Phenyl</th>
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<td>3-Hydroxy-4-methoxyphenethylamine</td>
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<td>na na Me H na</td>
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<td>Normacromerine</td>
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<td>Calipamine</td>
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<td>N-Acetyl DMPEA</td>
<td>H MeO MeO H H</td>
<td>na na C(O)Me H na</td>
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* Not reported as a cactus alkaloid; included for structural comparison
### Structural tables: Phenethylamines

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<th>PEA cont.</th>
<th>Position:</th>
<th>Phenyl</th>
<th>Ethyl</th>
<th>Amine</th>
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<tr>
<td>Compound</td>
<td>2 3 4 5 6</td>
<td>β  α N1 N2 N3+</td>
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<td></td>
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<td>3,4-Dimethoxy-N,N-dimethylphenethylamine</td>
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<td>na na Me Me na</td>
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<td></td>
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<tr>
<td>Macromerine</td>
<td>H MeO MeO H H</td>
<td>HO na Me Me na</td>
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<td>β-Methoxy-3,4-dimethoxy-N,N-dimethylphenethylamine</td>
<td>H MeO MeO H H</td>
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<tr>
<td>3-Nitrotyramine</td>
<td>H NO2 HO H H</td>
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<tr>
<td>3,4,5-Trihydroxyphenethylamine*</td>
<td>H OH OH OH H H</td>
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<td>na na H H na</td>
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<tr>
<td>3-Hydroxy-4,5-dimethoxyphenethylamine</td>
<td>H HO MeO MeO H H</td>
<td>na na H H na</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-Methyl-3-hydroxy-4,5-dimethoxyphenethylamine</td>
<td>H HO MeO MeO H H</td>
<td>na na Me H na</td>
<td></td>
<td></td>
</tr>
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<td>N-Formyl-3-hydroxy-4,5-dimethoxyphenethylamine</td>
<td>H HO MeO MeO H H</td>
<td>na na C(O)H H na</td>
<td></td>
<td></td>
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<td>N-Acetyl-3-hydroxy-4,5-dimethoxyphenethylamine</td>
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<td>N,N-Dimethyl-3-hydroxy-4,5-dimethoxyphenethylamine</td>
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</tr>
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<td>4-Hydroxy-3,5-dimethoxyphenethylamine</td>
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<td></td>
</tr>
<tr>
<td>Mescaline</td>
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<td>na na H H na</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N-Methylmescaline</td>
<td>H MeO MeO MeO H H</td>
<td>na na Me H na</td>
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<td>N-Formylmescaline</td>
<td>H MeO MeO MeO H H</td>
<td>na na C(O)H H na</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Not reported as a cactus alkaloid; included for structural comparison

---

**Trichocereus pachanoi (VIC)**

**Trichocereus scopulicola (VIC)**

Images not to scale
### Generic structural diagram for phenethylamine table

#### Phenethylamine Key:

**Abbreviations**

- α: Carbon adjacent to the nitrogen.
- β: Carbon adjacent to the phenyl ring.
- Cl: Chlorine
- C(O)H: Formyl
- C(O)Me: Acetyl
- CO₂H: COOH: Carbonyl
- EtO: Ethoxy
- H: Hydrogen
- HO: Hydroxy
- Me: Methyl
- Me+: Methyl cation
- MeO: Methoxy
- na: Not applicable.
- NO₂: Nitrate
- PEA: Phenethylamine

---

**Trouts Notes on Cactus Chemistry**

<table>
<thead>
<tr>
<th>Compound</th>
<th>Phenyl</th>
<th>Ethyl</th>
<th>Amine</th>
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<tr>
<td>N-Acetylmescaline</td>
<td>MeO</td>
<td>H</td>
<td>C(O)Me</td>
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<td>β-Hydroxy-mescaline</td>
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<td>H</td>
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<td>Trichocereine</td>
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<td>Me</td>
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<td>-CO₂H</td>
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<td>2-Chloro-mescaline**</td>
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<td>2,6-Dichloro-mescaline*</td>
<td>Cl</td>
<td>na</td>
<td>H</td>
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</table>

* Not reported as a cactus alkaloid; included for structural comparison
** Believed to be extraction artifact
Cactus Isoquinolines: A Tabular Key to their Structural Formulas
(The following includes related isoquinolines that do not occur in cacti; these are included for comparative purposes)

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<th>Compound</th>
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<th>R7</th>
<th>R8</th>
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<td>Me</td>
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**Generic structural diagram for isoquinoline table**

![Generic structural diagram for isoquinoline](image)

**Isoquinoline key:**

**Abbreviations**

- **1,2:** 1,2-Dehydro
- **3,4:** 3,4-Dehydro
- **CO₂H:** COOH: Carbonyl
- **H:** Hydrogen
- **Me:** Methyl
- **MeO:** Methoxy
- **na:** Not applicable
- **OH:** Hydroxy
- **-O-Me-O-:** Methyleneedioxy
- **X:** Point of attachment (X-X)
- **Y:** Point of attachment (Y-Y)

**Lophocereus schottii forma spiralis**

(UC)
### Structural tables: Isoquinolines

#### Structural table Isoquinolines in alphabetical order

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**Turbinicarpus roseiflorus**

(SS)
Mescaline Krebs acid conjugates & other compounds:

Peyonine and Peyoglunal are pyrrole derivatives rather than Krebs cycle conjugates; they are included on this page only for convenience.

The remaining Krebs acid conjugates include Peyoxylic acid, O-Methylpeyoxylic acid, Peyoruvic acid & O-Methylpeyoruvic acid. These are included in the tables above.
**Some Cactus Triterpenoids, Sterols & Similar Molecules**

**A Tabular Key to their Structural Formulas**
(The following includes several related compounds that do not occur in cacti; these are included for comparative purposes)

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<th>Compound</th>
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<th>R2</th>
<th>R3</th>
<th>R4</th>
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<th>R6</th>
<th>R7</th>
<th>R8</th>
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679
### Trouts Notes on Cactus Chemistry

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*Structural tables: Triterpenes & sterols*
**Triterpenoids Key:**

**Abbreviations:**
- Stereochemistry is not reflected in table unless indicated in structural diagram

- **=:** Indicates position of a double bond
- **COOMe:** Methyl ester
- **-O-:** Epoxy
- **Et:** Ethyl: C₂H₅
- **OH:** Hydroxy
- **H:** Hydrogen
- **“to R#”:** Indicates the place it is bonded
- **“from R#”:** Indicates where it is linked
- **CHO:** Formyl
- **Me:** Methyl
- **CO₂H:** COOH: Carbonyl
- **na:** Not applicable

<table>
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<tr>
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<th>Ring</th>
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**Trouts Notes on Cactus Chemistry**

*Trichocereus candicans*  
*(HBG)*
Generic Ring Skeletons to accompany the key to Triterpenoid & Sterol structural tables

Some other nonalkaloidal molecules
Betalains

Betalains are water soluble pigments that are typically associated with cacti and other members of the Caryophyllae. Betacyanins are red-violet and are the immonium conjugates of betalamic acid with cyclodopa. They are often glycosides. Betaxanthins are yellow and are the non-glycosidic immonium conjugates of betalamic acid with various amino acids or amines. These are the pigments in cactus fruit & flowers rather than anthocyanins.

Oroya peruviana (CCC) right

Opuntia sp. (Grant Co., NM) below
Biominerals

Remnants of a couple of dead ‘eagle’s claw cactus’ (right), AKA *Echinocactus horizonthalonius*, in Hudspeth County, Texas visibly show abundant biominerals deposited in the form of hydrated calcium oxalate. This material is the most important way that cacti sequester atmospheric carbon dioxide. Stored in the form of the oxalate they slowly decompose to calcium carbonate. The cortex of older regions within the stem was found to contain up to 50% of its dry weight as the oxalate (in the form of druses of Weddellite) *Rivera & Smith* 1979.

A similar picture is true for *Echinocereus stramineus* (see the carcass below, also in Hudspeth County.)

There are many species of minerals which can form and some of them have taxonomic value. There may be dynamic biotransformations during both the life and decay of the plant.

Two trends may interest readers: *Trichocereus* species produce druses of Weddellite (Calcium oxalate dihydrate CaC_{2}O_{4}·(2+x) H_{2}O [with x ≤ 0.5]). These look like small white drusy crystalline spheroids (this is the white ‘sand’ in the bottom of San Pedro tea). It can be ‘readily’ biotransformed into Whewellite.

*Opuntia* species mainly produce Whewellite (Calcium oxalate monohydrate CaC_{2}O_{4}·H_{2}O) Commonly forms acutely pointed radiating druses. These look like jagged 3-D stars.

The reported occurrences of biominerals are scattered through the text.
This used to be inside of a cactus!
In *Opuntia ficus-indica* the mucilage consists of alternating rhamnose and galacturonic acid residues to which are side chains composed of three galactose residues. Arabinose and xylose residues branch from the galactose. It is believed that arabinose is attached to the galactose and the xylose is attached to the arabinose. Some galactose side chains have only arabinose and some others have two arabinose residues and one xylose. Other *Opuntia* species were found to have different ratios of these sugar residues.

In *Opuntia* they were found to act as a calcium storage reservoir. As much as 20% of the plant’s calcium may be associated with its mucilage. This is due to the carboxylic acid moiety of galacturonic acid creating a strongly negative charge (causing the whole molecule to have a net negative charge).

**Mucilage**

![Chemical structure of mucilage](image)

**Composition of Mucilage**

A Mucilage subunits

B Tentative proposal for repeating units in *Opuntia ficus-indica* mucilage.

The 20 side chains (R) contain around 15 xylose and 25 arabinose residues in total.

Adapted from McGarvie & Parolis 1981a-c

Mucilage is often used to describe an aqueous solution of gums.

Mucilages are different from gums however in that gums are usually produced in response to injury and are secreted into cavities whereas mucilage is produced inside of highly specialized cells that accumulate it between the cell wall and the cell membrane.

Mucilages are water soluble complex acidic or neutral polysaccharides of high molecular weight. Some components are related to cell wall components such as galactose, arabinose, xylose, rhamnose and galacturonic acid.

Mucilages are highly branched and fibrous. This makes them not just large but very sticky and troublesome to handle.

Most cactus mucilages have not been studied except for some of the *Opuntias*.

In *Opuntia ficus-indica* the mucilage consists of alternating rhamnose and galacturonic acid residues to which are attached side chains composed of three galactose residues. Arabinose and xylose residues branch from the galactose. It is believed that arabinose is attached to the galactose and xylose is attached to the arabinose. Some galactose side chains have only arabinose and some others have two arabinose residues and one xylose.

Other *Opuntia* species were found to have different ratios of these sugar residues.

In *Opuntia* they were found to act as a calcium storage reservoir. As much as 20% of the plant’s calcium may be associated with its mucilage. This is due to the carboxylic acid moiety of galacturonic acid creating a strongly negative charge (causing the whole molecule to have a net negative charge).

See:

- Amin *et al.* 1970
- McGarvie & Parolis 1979
- Medina-Torres 2000
- Mindt *et al.* 1975
- Techtenberg & Mayer 1981

689
Spines

The glochids of at least two species were said to be composed of pure crystalline cellulose.


Spines consist of an “intimate composite” of a compact arrangement of slender cellulosic microfibrils (0.4mm x 6-10μm) embedded in a matrix of arabinan.

Vignon et al. 2004

Spines were described as a nanofiber composite that consists of roughly 50% cellulose and 50% arabinan.

The strength values of Opuntia ficus-indica under three point bending stress was greater than several composite materials (more than double carbon fiber reinforced polycarbonate (13 GPa) but less than half an individual E-glass fiber (72 GPa)).

Also measured % of crystallinity and found there was no correlation between percent crystallinity of the spines and flexural stress.

Pilosocereus pachycladus had the strongest spines of the species they examined.

Cooper et al 2013

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Cooper et al 2013

Echinocactus horizonthalonius
(Presidio County, Texas)
Thanks to Erowid
The ayahuasca book is online with copyright free text
http://erowid.org/library/books_online/ayahuasca_apa/

Want some more Trout?

Some Simple Tryptamines
http://troutsnotes.com/PDF/SST.html

The Genus Desmodium

Some Other Succulents
Acknowledgements

Our thanks to all of the botanical garden staff members, cactus growers & cactus collectors who shared their knowledge, opinions, collections, literature and/or photos with us and to the botanical gardens the collections of which enabled the acquisition of many of the images that grace this work.