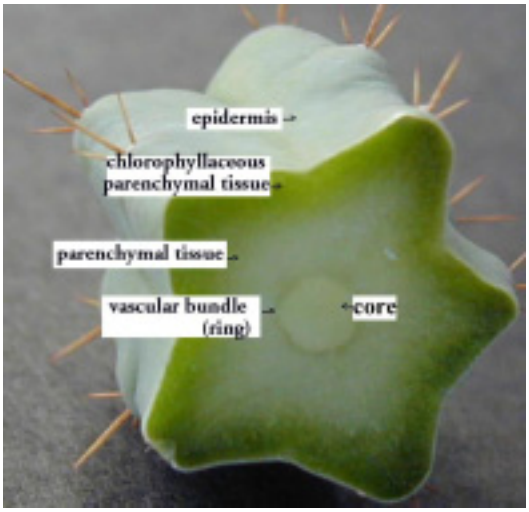
Distribution of alkaloids within cacti

Surprisingly there has been very little serious work published on this topic.

Alkaloids in "*pellote*" (i.e. peyote) were reported by JANOT & BERNIER 1933 to be almost exclusively in the internal cells of the cortical parenchyma at top of plant. (See TLC results by Todd elsewhere here.)

In *Trichocereus candicans* alkaloids were found by Niedfeld to be mainly in the chlorophyllaceous cortical parenchyma. (Niedfeld used microchemical methods to determine this) RETI 1950 cited NIEDFELD 1931.

In *T. terscheckii*; alkaloids are primarily in the parenchymal tissues, 29% were found to be in the green epidermis (dry), while the central parts (dry) including cortical parenchyma contained 45% of the total alkaloid content [please note that this included the vast majority of the parenchymal tissues and the total weight of that portion of the plant is much higher than that of the green epidermis. This indicates a lower concentration for the central parts than in the green portion but potentially useful concentrations nonetheless.] RETI & CASTRILLÓN 1951



Anderson cited TODD 1969 as finding little difference [qualitative] between the alkaloids of root and top in peyote except for hordenine which was only present in the root **[Note 87]**. While true in most aspects, this is a little misleading as concentrations in the roots are far lower than in the tops. Please see more details under the *Lophophora williamsii* entry. [In ***Sacred Cacti* 3rd ed. Part A** or in ***Sacred Cacti* 2nd ed**.]

This is also in at least partial conflict with the reports of other workers.

Todd collected his samples during June. Curiously, lophophorine was apparently observed as the major alkaloid in *L. williamsii*. [See also comments on the seasonal fluctuations of alkaloids in peyote.]

GUTTIERREZ-NORIEGA 1950 (citing CRUZ SÁNCHEZ 1948) claimed that the alkaloids are primarily in the "bark" of *T. pachanoi*. His word, *corteza*, translated in the English summary as *bark*, also means 'cortex' or 'skin' in Spanish.

Apparently CRUZ SANCHEZ worked with the outer layer due to the slime resulting from use of the whole stem interfering with his extraction procedure. He reported 5% in the dried outer layer.

Parenchymal tissues are highly specialized thin-walled storage cells that exist within in the thick outer layer on the plant. They are the site of many metabolic processes and also store such things as water, calcium oxalate crystals and often alkaloids. Calcium oxalate crystals are said to be stored in abundance in some peyote specimens.

As far as I can determine, the parenchymal tissues extend from near the skin to the vascular bundle; including most of the tissues other than vascular, structural or connective.

Cortical parenchymal tissues are those towards the outside. Chlorophyllaceous just means that they have chlorophyll (are green.)

Obviously, when a peyote button is sliced into two horizontal portions, they will be slightly more prevalent in the top half of the button than the bottom half of the above ground portion due to the relative percentage of tissue which is occupied by the central vascular tissues and by the outer layer. Published analytical work reflects this (see under *Lophophora williamsii* chemistry.)

A similar picture was reported for triterpene glycoside distribution within the flesh of the organ pipe cactus *Lemaireocereus thurberi*.

Tissue	**% of total Methanol soluble product**
Epidermis	4
Photosynthetic layer	42
Transition zone	28
Cortex	12
Pith	10
Wood	3

From KIRCHER 1972

Since there is considerably more weight to the central parts than the green portion, RETI & CASTRILLÓN 1951 gives some support to the idea that the highest mescaline concentration is on the green periphery of the plant.

"*Less*" does not mean that there is no alkaloid in the whitish tissues beneath it. All evidence suggests that there is ample alkaloid contained in these parts. It is also likely there is even less in the central vascular bundle and core itself.

Another interesting result was noted among SMOLENSKI and coworker's multitude of general alkaloid screenings. When testing *Pachycereus pecten-aboriginum* they reported **Roots: ++**, **Stems: –** and **Ribs: +++.** As slicing off the ribs would remove most of the cortical tissues this is in line with the above observations. Their account provides no further information on tissues evaluated (samples provided to them as a previously prepared extract).

There is additional support for this; DJERASSI *et al.* 1953b determined that the majority of the alkaloid content in *Lophocereus schottii* was in the green epidermis (6.7% crude alkaloid); only a minor portion in the cortex (1.1% crude alkaloid) and almost no alkaloid in the core & pith (0.2% crude alkaloid).

By *cortex* Djerassi means the epidermis, by *green epidermis* Djerassi refers to the chlorophyllaceous parenchyma. Djerassi was a natural products chemist not a botanist.

The casual and nonconsistent use of the words *epidermis* and *cortex* has caused confusion for many readers who did not stop and ask what was being actually meant by the user of those particular words and instead translated them based on what they themselves would have meant by those words.]

This area needs further work. While many alkaloids may indeed be higher towards the outside of the plant there are known exceptions. Hordenine being observed in the root rather than the top (in peyote) is a good example. Its highest concentrations being in the root was reported again in *Mammillaria microcarpa* by KNOX and coworkers.

It is noteworthy also that **all** of the alkaloids measured by KNOX were much higher in the cortex itself as compared to the chlorophyll rich tubercles and several were higher in the vascular tissues than in the tubercles.

We were informed by an *Entheogen Review* reader that they had found an unspecified amount of the cores of San Pedro to be active but they provided inadequate information for us to understand HOW they actually determined this or how much they observed.

This should not be any surprise should a person ingest a large enough amount.

PUMMANGURA *et al*. 1982 reported that mescaline did not transmigrate between grafted *T. pachanoi* and *T. spachianus* regardless of which was used as stock and scion. Their conclusion was that mescaline was locally produced and noncirculating.

While it may or may not be true that transmigration of alkaloids does not occur, SINISCALCO 1983 reported that the normally mescaline-free *Myrtillocactus geometrizans* was found to contain 0.3% mescaline by dry weight after having previously been grafted with *Lophophora williamsii*.

Many questions immediately arise.

None are presently answered.

A flowering *Trichocereus peruvianus* KK242
Photo by Flip

In an e-mail we received in 2004, Karel Knize commented
"*Some flowers are used (cont ca 4%) plant itself 2-3.5%*"
"*the strongest type are 9-12 ribs or 3-4 ribs*"

He did not elaborate further.

A friend claimed to have had good results from flower masses from *peruvianoids* and *terscheckii* but preserved no details.

In more recent years, additional friends ingesting *pachanoi* and *peruvianus* flowers and ovary could discern no effects whatsoever..

Clearly some analytical work seems in order to know what to believe.

***Trichocereus scopulicola* FR991**
(NMCR)
from Ritter's seed

It is almost unbelievable that no one has looked into the matter of alkaloid distribution within cacti more thoroughly.

Analysis of only outer green layers looking at only mescaline has become the predominate analytical approach.

Trichocereus pachanot
Variant growth