

The same experiments were carried out on Pale Rose with the result that a small quantity of a crystalline substance apparently the same as that from Red Rose was directly extracted by ether; while a less amount was obtained in the experiment with mildew.

These experiments will be repeated to determine whether the crystals will develop in the mush without the appearance of mildew.

It is within the bounds of probability that this crystalline substance is related to the astringent principle.

The solubility of this crystalline principle in chloroform distinguishes it completely from the substance which forms the burr-like aggregates when the solution of the astringent principle is treated with acid.

The burr-like aggregates melt when heated and sublime in the same crystalline form, tending to assume this peculiar manner of association.

PEYOTE, THE NARCOTIC MESCAL BUTTON OF THE INDIANS.

BY W. E. SAFFORD, PH.D.*

Peyote is a small, fleshy, spineless cactus which has been used for centuries by aboriginal Americans in connection with their religious rituals and as a magic plant believed to have the power of inducing supernatural visions. By most laymen the name cactus is loosely applied to almost any spiny plant of the arid regions of our Southwest. Indeed, the Greek *κακτος*, from which Linnaeus adopted the name cactus, was the spiny wild artichoke, or cardoon (*Cynara cardunculus*) not at all related to the botanical family Cactaceae, which is essentially American and had no representatives in the Old World until after the discovery of America. Plants are classified by the structure of their flowers and fruit, not by their general appearance or their habit of growth; the peyote, though quite devoid of spines, is a true cactus. It was first referred to the genus *Echinocactus*, afterward to *Anhalonium*, and finally was made the type of a new genus, *Lophophora*. The various generic names are probably the cause of the erroneous idea that a number of species of narcotic cacti are used by the Indians. As a matter of fact there is but one species, *Lophophora williamsii*, so used. This species varies in the arrangement of its tubercles. One form of it was called *Anhalonium lewini* by Hennings in 1888; but the latter was shown by Professor Coulter to be only a variety of *Lophophora williamsii*, a species first described under the name *Echinocactus williamsii* in 1845 by Lemaire, the distinguished authority on Cactaceae.

Dr. Thomas S. Blair,¹ chief of the Bureau of Drug Control, Pennsylvania Department of Health, recently published a paper in *The Journal A. M. A.* in which he states that he has not succeeded in finding a botanic description of the narcotic peyote plant in any of our American works on botany. For a description of this plant, of both the typical form *Lophophora williamsii* and its variety *lewini*, I would refer the reader to a paper by John M. Coulter.² In this paper Dr. Coulter

* Economic Botanist, Bureau of Plant Industry, United States Department of Agriculture. Reprinted from *Journal A. M. A.*, Oct. 15, 1921.

¹ T. S. Blair, "Habit Indulgence in Certain Cactaceous Plants among the Indians," *J. A. M. A.*, 76, 1033, April 9, 1921.

² J. M. Coulter, "Preliminary Revision of the North American Species of Cactus, *Anhalonium*, and *Lophophora*," *Contributions from the United States National Herbarium* 3, 91-132, June 10, 1894.

states that he found the form with irregularly arranged tubercles, named in honor of the chemist Dr. Lewin of Berlin, to be connected with the typical *Lophophora williamsii* by such complete intergradation that it was impossible to separate the two forms as distinct species. This intergradation was shown by a great number of living specimens in the Missouri Botanical Garden. Dr. Coulter's observations have since been confirmed by Dr. J. N. Rose of the Carnegie Foundation. I shall not here quote the botanic descriptions of the type and its variety. The intergradation between the typical forms *Lophophora williamsii* and the variety *lewinii* may be seen at a glance. The flowers of these two forms are indistinguishable.

The earliest description we have of the peyote plant is that of Hernandez, a learned Spanish physician sent in the sixteenth century by his sovereign, Philip II, to make a study of the resources of New Spain. He characterizes it as a root "of nearly medium size sending forth no branches or leaves above ground, but with a certain woolliness adhering to it;" and he adds: "Marvelous virtues are attributed to it by the Indians (if any faith can be given to what is commonly said among them on this point). It enables those eating it to foresee and prophesy such things, for instance, as whether on the following day the enemy will make an attack upon them, or whether the weather will continue favorable; or to discern who has stolen from them missing objects, and other things of like nature which the Chichimecas really believe they have the power of divining. On this account the plant scarcely issues above the surface of the ground, but hides itself as though unwilling to harm those who may discover and eat of it."¹

Peyote grew, and still grows, in northern Mexico in what is now the state of Zacatecas, and also in Chihuahua and on both sides of the Rio Grande not far from Laredo, Texas. Its collection was formerly accompanied by ceremonies recalling those observed by early herbalists of the Old World in collecting certain medicinal plants. It was dried and preserved either in longitudinal strips called *raiz diabolica* (devil's root) or in disks resembling mushrooms called *teonanacalli* (god's flesh, or sacred mushrooms). Padre Sahagun,² writing in 1575, states that it was commonly eaten by the wild Indians of the north called Chichimecas, giving them courage to fight and rendering them insensible to the pangs of hunger and thirst, as well as protecting them, as they believed, from all danger. Padre José Ortega, writing before 1700, described the ceremonial of the peyote, accompanied by singing and dancing throughout the entire night and resulting in the intoxication of those who partook of the drug.

The early Catholic missionaries were opposed to peyote, not so much on account of its physical effects on the Indians as because it was connected with the rituals of their religion, and kept them from embracing Christianity. It was forbidden by law, and to partake of it was regarded almost as great a crime as cannibalism. In one of the early manuals for the administration of the sacraments of the Indians, the following questions were asked: "Hast thou eaten flesh of man? Hast thou eaten peyote?"

¹ Hernandez, *De Historia Plantarum Novae Hispaniae, Francisco Hernando Medico atque Historico Philippi II. Hispaniae et Indiarum Regis; et totius Novi Orbis Medico Primario, Auctore*, Madrid, 3, 70, 1790.

² Bernardino Sahagun, *Historia general de las cosas de Nueva España, Edición Bustamente*, 3, 70.

NARCOTICS AND INTOXICANTS USED BY INDIANS.

In my investigation of the narcotics and intoxicants used by the American Indians, I have found that alcoholic drinks have been their greatest curse. The principal sources of these have been the Mexican maguey or century plant, and the sotol of the southwestern United States and Northern Mexico. In addition to those intoxicants, certain drinks called *tizwin* (from the Aztec *tehuino*, intoxicating) were formerly brewed in the Southwest from malted maize or other grain, and in South America fermented drinks were prepared from maize and the roots of *mandioca*. The effects of all these drinks were sometimes strengthened by the addition of narcotics. The use of the dried disks of *peyote* for strengthening the distilled liquor called *mescal* has given to them the name "mescal buttons," and has led to the erroneous belief that these disks are obtained from the *mescal* plant, or perhaps that the *mescal* plant is a species of cactus. In inquiries relating both to maguey and to sotol, the plants so called are frequently characterized as cactuses. As a matter of fact, the magueys are species of *Agave*, belonging to the botanic family *Amaryllidaceae*, and the sotols are species of *Dasyliirion*, belonging to the *Lilliaceae*. From both sources a sweet sap is obtained (the *nequatl*, or "honey-water," of the Aztecs), as harmless as sweet cider when fresh, but intoxicating like hard cider when fermented. This fermented sap, variously doctored with spices or perhaps with narcotics, is the well-known *pulque* of Mexico. The sap, in addition to sugar, contains albuminous substances, which after fermentation become ill smelling. These substances may be precipitated by the introduction of certain roots or barks containing tannin, after which the clarified liquor is decanted. The action of the tannic acid on the proteins in the *pulque* may be compared to that of hops in the manufacture of beer. In addition to precipitating the albuminous material, the barks or roots used for the purpose impart a pleasant aromatic flavor to the drink.¹

The first to study the chemical properties of *peyote* was Dr. I. Lewin, who in 1888 used in his investigation dried plants furnished by Parke, Davis & Co. of Detroit. A chemical analysis was also made by Erwin E. Ewell,² who announced his results in a paper entitled "The Chemistry of the Cactaceae."

EFFECTS OF PEYOTE.

Various accounts of the effects of *peyote* have been published. In some of these the drug is said to produce beautiful color visions; in others, no such sensation is recorded. From the testimony of Indians, the effects seem to be of a hypnotic character. *Peyote* has been called a habit-forming drug, and some writers have likened it to hashish or Indian hemp. The latter, which has been introduced into Mexico and our Southwest under the name *marihuana*, is a most dangerous drug. Introduced clandestinely into prisons, it has been the cause of riots. Its use is now forbidden by the Mexican government. *Peyote* is never used habitually by the Indians, but is now used, as it was used four centuries ago in old Mexico, in certain ceremonials. It causes hallucinations, but its effect is quieting and there is no tendency to commit acts of violence by those who partake of it. More than this

¹ W. E. Safford, "The Use of Timbe Barks by the Mexicans in the Preparation of Alcoholic Drinks," *Science*, 29, 160, 1909.

²E. E. Ewell, "The Chemistry of the Cactaceae," *J. Am. Chem. Soc.*, 18, 624-643, 1896.

testimony was given by many of those who use it ceremonially in the so-called Peyote Church, that since joining the latter they have not only discontinued the use of all alcoholic stimulants but they do not even crave them. The greatest harm caused by peyote is its use as a medicinal remedy by the Indians, who regard it as a sacred plant possessing magic curative properties. By the unwise administration of it to little children and to invalids it has in all probability been harmful and even fatal.

Its physiologic and therapeutic properties were investigated by Drs. D. W. Prentiss and Francis P. Morgan¹ of the department of materia medica and therapeutics in Columbia University. Illustrations of the mushroom-like mescal buttons and of blooming specimens of both the typical form of *Lophophora williamsii*, with its tubercles in regularly radiating rows, and its variety *lewinii*, with the tubercles alternating or arranged diagonally, are included in an article² of mine published in 1915.

PHYTOCHEMICAL NOTES.*

No. 88. Oil of Catnip.

BY RALPH M. HIXON.³

Thanks to the kindness of Dr. E. R. Miller, there was available more than a liter of catnip oil which he had distilled during the seasons of 1915 and 1916 while he was chemist of the Wisconsin Pharmaceutical Experiment Station. A preliminary determination of the saponification value, which turned out very high, caused him to suspect the presence of a lactone. Hence, while working on lactones from plants in a general way, it seemed desirable to become further acquainted with the lactone possibly present in this oil. This naturally led to a study of the oil as such. It is with the general study of the oil that this report is concerned. The study of the lactone will be made the subject of a separate report.

The oils so kindly placed at our disposal by Professor Miller were several hundred cc of 1915 oil, about a liter of 1916 oil and approximately one hundred cc of cohobated oil of 1916. The physical and chemical constants so far as determined for these oils are herewith tabulated.

	1915 oil.	Original.	1916 oil.	Cohobated.
d_{23}° ⁴	1.058	1.047		1.076
α_{D23}°	+5.59°		+2.55°
S. V.	319		379
Soluble in 90 p. c. alcohol	miscible in all proportions ⁵			
Soluble in 80 p. c. alcohol	1 : 1		1 : 1
Soluble in 70 p. c. alcohol	1 : 2.5 ⁵		1 : 2 ⁵

It becomes apparent that with the increase in density and of the saponification value, in other words, with the increase of the lactone content, the angle of rotation diminishes.

¹ The results of their experiments were published in Volumes 19 and 20 of the *Therapeutic Gazette*, 1895 and 1896.

² W. E. Safford, "An Aztec Narcotic," *J. Heredity*, 6, July, 1915.

³ From the Laboratory of Edward Kremers.

⁴ Fritzsche Brothers Fellow.

⁵ Schimmel & Co. report a density of 1.041, *Bericht von S. & Co.*, Oct. 1891, p. 40.

⁶ Upon dilution 1:9 the solution becomes opalescent.