

TEONANACATL: THE NARCOTIC MUSHROOM  
OF THE AZTECS<sup>1</sup>

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I

BECAUSE of the important roles which they played in ceremonial and in daily life, the narcotic plants of ancient Mexico are of especial interest to the anthropologist. Mexico possessed and still possesses many plant narcotics and intoxicants, of which a few are outstanding in their uses and are extremely interesting because of their great antiquity as well as because of the important bearing their use, distribution, and history may have on questions of a theoretical nature. Of these, the most notable are the *toleselo* or *coral-berry* (*Sophora secundiflora* (Ort.) Lag. ex DC.), *ololiuqui* or *piule* (*Rivea corymbosa* (L.) Hall. f.), *peyote* (*Lophophora Williamsii* (Lem.) Coult.), and *teonanacatl* (*Paneolus campanulatus* L. var. *sphinctrinus* (Fr.) Bresadola).

Long the center of confusion and ambiguity, *teonanacatl* was not known botanically until very recently. Therefore, a thorough discussion of the ethnobotanical history of this narcotic mushroom should be made available to anthropologists in order that the erroneous interpretations now rather widespread in anthropological literature concerning *teonanacatl* may be corrected.

II

In his *Historia de las cosas de Nueva España*, Sahagun<sup>2</sup> recorded the earliest description of *teonanacatl* and discussed its narcotic and medicinal uses among the Mexican Indians of the period of the Spanish conquest. One of these references, in a general consideration of useful plants, states that

. . . they (the Chichimecas) possessed a great knowledge of plants and roots, and they were acquainted with properties and virtues of them; these same people were the first to discover and use the root which they called *peioll*, and those who are accustomed to eat and drink them used them in place of wine; and they did the same with those which they call *nanacatl*, which are harmful mushrooms which intoxicate in the same way as wine . . . <sup>3</sup>

<sup>1</sup> It is with pleasure that I express my appreciation of the constant interest which Professor Oakes Ames, Director of the Botanical Museum of Harvard University, has shown in the ethnobotanical work which has led, among other things, to the rediscovery of *teonanacatl*. I wish also to thank the several workers whom I mention in this article for making available to me unpublished information in their possession.

<sup>2</sup> B. de Sahagun, *Histoire generale des choses de la Nouvelle Espagne*.

<sup>3</sup> The translations which appear in this paper are free translations made by the writer from the original sources.

A more detailed description of the plant and its uses occurs in a chapter which deals specifically with narcotic plants:

There are some small mushrooms in that region which are called *teonanacatl*; these grow under the grass (hay) of the fields and pastures. They are round, having a rather high stipe, slender and terete. When eaten, they have a bad taste, hurting the throat, and they cause intoxication. They are medicinal for fevers and for rheumatism. Only two or three need to be eaten. Those who eat them see visions and feel a faintness of the heart. And they provoke to lust those who eat a number, or even a few, of them.

From Sahagun's reports (as well as from other early reports which are quoted below), it is absolutely clear that the narcotic which the Aztecs called *teonanacatl* was a mushroom. *Teonanacatl* has been identified with the dried tops of the peyote-cactus, *Lophophora Williamsii* (mescal buttons), and this misidentification has been widely accepted in botanical and anthropological literature. For this reason, it is necessary to examine closely and evaluate all of the early reports concerning *teonanacatl* and its uses.

In the first of the excerpts quoted above, Sahagun clearly distinguished between "the root which they call *peiottl*" and "*nanacatl*, which are harmful mushrooms." Likewise, in the chapter on plant narcotics, from which the second excerpt is taken, Sahagun discusses, in one paragraph, the "small mushrooms . . . which are called *teonanacatl*" and, in another paragraph, *peiottl*, the "earth-cactus."

There is another herb like the earth-tunas which is called *peiottl*. It is white and grows in the north. Those who eat it see terrifying and amusing visions. The intoxication persists for two or three days and then stops . . .

Still further assurance that *teonanacatl* was a fungus is found in a third reference to the narcotic in Sahagun's *Historia*:

The first thing which they ate at the gathering was small, black mushrooms which they called *nanacatl*. These are intoxicating and cause visions to be seen and even provoke sensuousness. They ate these (mushrooms) before dawn, and they also drank chocolate before daylight. They ate these little mushrooms with honey, and when they began to be excited by them, they began to dance, some singing, others weeping, for they were already intoxicated by the mushrooms. Some did not want to sing but sat down in their quarters and remained there as if in a meditative mood. Some saw themselves dying in a vision and wept; others saw themselves being eaten by a wild beast; others imagined that they were capturing prisoners in battle, that they were rich, that they possessed many slaves, that they had committed adultery and were to have their heads crushed for the offense, that they were guilty of a theft for which they were to be killed, and many other visions which they saw. When the intoxication from the little mushrooms had passed, they talked over among themselves the visions which they had seen.

In a chapter on mushrooms (*De las setas*) Sahagun used the term *nanacatl* to refer to mushrooms:

The cone-shaped mushrooms (*nanacatl*) *genus campos agrorum* in the mountains are good to eat. They are cooked for this purpose . . .

Sahagun not only described teonanacatl as a mushroom, but the plant is figured in (Plate CI; Fig. 453a) the Paso y Troncoso edition of Sahagun's writings as a small mushroom growing in a grassy field.

In addition to Sahagun's direct statements that teonanacatl was a mushroom, it is obvious from linguistic evidence that the term *nanacatl* refers to mushroom. *Teonanacatl* probably was the specific word for the intoxicating mushrooms, for it appears that *nanacatl* referred to mushrooms in general. In Mexico at the present time, mushrooms are called *nanacates*.

In his *Dictionnaire de la langue Nahuatl ou Mexicaine* Siméon analyzed several words which include the root *nanacatl* and clearly indicated the meaning of the term:

*Nanacatl*, Champignon: *quauhlla-nanacatl*, champignon des bois; au. fig. *nana-catl nicté-ittilinemi* (Olm.), rendre quelqu'un pervers, lui donner de mauvais conseils. En comp: *nonanac* ou *nonanacauh* (Olm.) mon champignon, R. *nacatl*?

*Nacatl*, Chair, viande; . . . nonac, ma viande, la chair que je mange.

*Teonanacatl*, Espèce de petit champignon qui a mauvais goût, enivre, et cause des hallucinations; il est médicinal contre les fièvres et la goutte (Sah.) RR. *teotl*, *nanacatl*.

*Teyhuinti*, Qui enivre quelqu'un, enivrant; *teyhuinti nanacatl*, champignon enivrant.

Further evidence can be derived from a definition of *teonanacatl* offered by Jourdanet and Siméon in their translation of Sahagun's *Historia*.

(*Teonanacatl*) c'est a dire: champignon dangereux. Later me générique est *nanacatl*, qui se met en composition avec d'autres mots pour designer les diverses espèces de champignons.

As further corroboration, the compounds used by Hernandez may be cited. By adding adjectival prefixes to a modification of the term *nanacatl*, Hernandez<sup>4</sup> described several types of mushrooms under the heading "*De nanacatl seu Fungorum genere*": *iztacnanacame* (white mushroom), *tlapal-nanacame* (reddish mushroom), and *chimalnanacame* (yellow-orbicular mushroom). He described teonanacatl as *teyhuinti* or "intoxicating."

<sup>4</sup> Francisco Hernandez (1790), p. 357.

In his *Catálogo*, Garcida<sup>5</sup> called eleven species of *Agaricus*, one species of *Hypophyllum*, and two species of *Boletus*, all Oaxacan *Fungi*, by the common name *nanacatl*. This is certainly convincing evidence that the word still refers to mushrooms in modern Mexico.

In the works of Serna,<sup>6</sup> a very complete description of the use of "coloured mushrooms," *quatlannamacatl*, as a narcotic for divination is found:

And it so happened that an Indian had come . . . bringing some of the coloured mushrooms which are gathered in the hills, and, with these, he had performed a great idolatry. But before explaining this (idolatry), I wish to explain the nature of the said mushrooms which, in the Mexican language, are called *quatlannamacatl* . . . these mushrooms were small and yellowish, and to collect them, the priests and all men, appointed as ministers for these impostures, went to the hills and remained almost the whole night in sermonizing and in superstitious praying. At dawn, when a certain little breeze which they know began to blow, they would gather them (the mushrooms), attributing to them deity. They have the same effect as ololiuqui and peyote, for when they are eaten or drunk, they intoxicate, depriving those who partake of them of their senses and making them believe a thousand absurdities.

A further description of the use of narcotic mushrooms, *teunamacatlth*, is given by Benvento in Kingsborough<sup>7</sup> and by Orozco y Berra:<sup>8</sup>

They had another kind of intoxication . . . which was induced by small toadstools or mushrooms . . . which are eaten raw. Because of the bitter taste of these mushrooms, they drink after them or eat with them a little honey after which they shortly see a thousand visions, especially snakes. They went raving mad, and they ran about the streets wildly . . . In their language they called these mushrooms *teunamacatlth*, a word which means "bread of the gods" . . .

The meaning of the word *teonanacatl* has been questioned recently by LaBarre,<sup>9</sup> who states that Benvento's etymology ("bread of the gods") is wrong. The acceptance of this etymology or a similar one ("flesh of the gods") is wide. Safford<sup>10</sup> accepted "flesh of the gods" as a correct translation of *teonanacatl*. Bancroft,<sup>11</sup> furthermore, writing of Nahuatl intoxicants, said:

Among the ingredients used to make their drinks more intoxicating, the most powerful was the *teonanacatl*, "flesh of the gods," a kind of mushroom which excited the passions and caused the partaker to see snakes and divers other visions.

<sup>5</sup> Manuel Martínez Gardica (1891), p. 21.

<sup>6</sup> Jacinto de la Serna (1892), pp. 61-63.

<sup>7</sup> Lord, Kingsborough (1848), p. 17.

<sup>8</sup> Manuel Orozco y Berra (1880), p. 437.

<sup>9</sup> Weston LaBarre, *The Peyote Cult* (1938), pp. 128-130.

<sup>10</sup> William Safford, *An Aztec Narcotic* (1915), p. 291.

<sup>11</sup> Hubert Hugh Bancroft (1882), p. 360.

In an unpublished manuscript,<sup>12</sup> V. A. Reko applies the meaning of "divine food of a soft or fleshy nature" to *teonanacatl*. According to usage and to Siméon,<sup>13</sup> *nanacatl* refers to mushrooms in general, but Simeon suggests, with reservations, that the root of *nanacatl* may be *nacatl*, the word for "meat" or "flesh." According to Siméon, therefore, *teonanacatl* may mean "flesh of the gods."

In early Mexican literature, other references to the uses of mushrooms for intoxication are less detailed but nevertheless of interest and of importance.<sup>14</sup> Usually, they lack common names or descriptions which might make it possible to identify the actual plant which was used.

Kingsborough reports that "wild mushrooms" were given to visitors at Montezuma's coronation, and that the mushrooms intoxicated the visitors and caused them to dance.<sup>15</sup>

Motolinia<sup>16</sup> described a religious feast held by Montezuma at which intoxicating wild mushrooms were eaten; the visions which accompanied the intoxication were believed to constitute divine advice concerning the future.

Duran, quoted by Bourke,<sup>17</sup> states that, after the sacrifices of human beings at the coronation of Montezuma II, the multitude ate raw mushrooms which induced an intoxication which was much stronger than alcoholic-intoxication; many committed suicide at the height of the intoxication; some received visions and were, in this way, enabled to prophesy the future. Although it is difficult to identify the plant which served as the narcotic in these cases, the symptoms of the intoxications induced are the same as those induced by the *teonanacatl* of the ancient Aztecs and are the symptoms of the intoxication induced only (among the mushrooms) by members of the genus *Paneolus*, the genus with which *teonanacatl* has been identified.

Thompson<sup>18</sup> reports Saville as saying that Tizoc, an Aztec ruler, who was poisoned after a five year reign, may have been killed by the substitution of poisonous mushrooms for the intoxicating kinds which were normally eaten at ceremonies. The deadly *Amanita phalloides* (Fr.) QuéL. may possibly have been the instrument of death, but this species never could have been secretly substituted, in a fresh condition especially, for the entirely different *Paneolus* spp. *Paneolus* spp., while slightly poisonous, are not known to cause sudden death by poisoning.

<sup>12</sup> Victor A. Reko (undated).      <sup>13</sup> Remi, Siméon (1885).

<sup>14</sup> Kingsborough (1848), Fr. Motolinia (1858), p. 23; Orozco y Berra (1880).

<sup>15</sup> Kingsborough, *Antiquities of Mexico* (Cronica Mexicana), p. 153.

<sup>16</sup> Motolinia (1858), p. 23.      <sup>17</sup> John G. Bourke (1891).

<sup>18</sup> J. Eric Thompson (1933), pp. 31, 74.

## III

The many references to the general use of narcotic mushrooms among Mexican Indians of four hundred years ago suggests to the ethnobotanist of the present time that these plants may still be used in parts of Mexico in a similar way.

Curiously enough, the actual utilization of mushrooms as intoxicants in modern Mexico was unobserved until very recently. In 1923, Doctor Blas Pablo Reko wrote, in a letter to Doctor J. N. Rose of the United States National Herbarium,<sup>19</sup> that the *teonanacatl* is a "fungus . . . which is still used under the same old name by the Indians of the Sierra Juárez in Oaxaca in their religious feasts."

In 1936, Mr Robert J. Weitlaner of Mexico City visited the capital of the Mazatec region of Oaxaca, Huautla de Jiménez, and learned of the use of certain mushrooms in witchcraft and divination among these primitive peoples. He secured a few samples of the narcotic plants and sent them to Reko who forwarded several pieces to the Botanical Museum of Harvard University for identification.<sup>20</sup> These specimens were insufficiently preserved upon arrival to make possible a definite specific identification; they belonged to the genus *Paneolus*, and were possibly referable to a species which is closely allied to *P. campanulatus* var. *sphinctrinus*.

While I was engaged in ethnobotanical investigations among the little known Mazatec Indians of the District of Teotitlán, Oaxaca, with Dr. B. P. Reko in the summer of 1938, samples of the narcotic mushrooms and information concerning their use were collected in Huautla de Jiménez.<sup>21</sup> These mushrooms are referable to *Paneolus campanulatus* L. var. *sphinctrinus* (Fries) Bresadola.<sup>22</sup> Though apparently used rather frequently, the plant does not appear to be common in the Mazatec country. It is valued highly. Growing in boggy spots in pastures and open fields, it is easily available only during the rainy season from June to September. Those who search for the plant gather and dry the specimens for use during the rest of the year. Because of the belief that the mushroom is semi-sacred, it is

<sup>19</sup> Letter preserved on herbarium sheet number 1745713, United States National Herbarium, Washington, D. C.

<sup>20</sup> In an earlier article (32, p. 39), I stated that these mushrooms were collected among the Otomis of Puebla. This is an error which was caused by a misunderstanding in correspondence. In the article I gave no credit to Mr Weitlaner for his work on *teonanacatl* in the Mazatec country, since this information has only recently been communicated to me by Mr Jean B. Johnson.

<sup>21</sup> Schultes and Reko 231, *Collections of Economic Botany No. 5548* (Botanical Museum, Harvard University, July 27, 1938).

<sup>22</sup> Schultes (February, 1939).

not offered for sale in the markets of the Mazatec towns, although the *yashun* paper (made from the bark of *Heliocarpus appendiculatus* Turcz.) and other articles for *brujería* (withcraft) are important articles of sale in the markets of Huautla.

The native Mazatec names by which *Paneolus campanulatus* var. *sphinctrinus* is known in Huautla de Jiménez and San Antonio Eloxochitlán are: *t-ha-na-sa* (meaning unknown), *she-to* ("pasture mushroom"), and *to-shka* ("intoxicating mushroom").

Among the Mazatec Indians there are professional diviners who earn a livelihood locating stolen property, discovering secrets, and giving advice through *Paneolus*-intoxication. It is impossible to state whether or not these diviners practice their art exclusively with *Paneolus*; it is probable that they are general *curanderos* (herb-doctors) as well. Due probably to the frequent ingestion of the slightly poisonous *Paneolus*, they are said to age rapidly, signs of approaching senility being apparent at the age of thirty-five.

The narcotic is taken to induce a semi-conscious state which is accompanied by a mild delirium. The incoherent utterances which are made during the intoxication are interpreted as prophetic or admonitory.<sup>23</sup> The doses which the Mazatec Indians prescribe vary with the size and the age of the individual. Usually fifteen mushrooms are considered sufficient to induce the desired effect, but larger doses are reported. Overdoses of fifty to sixty mushrooms result in severe poisonings, while continued use of excessive quantities is said to produce permanent insanity. While this might be an expected physiological result of the type of intoxication induced by species of *Paneolus*, it was not possible to verify this with actual cases in the field. According to a number of descriptions from the Indians, the intoxication lasts about three hours. Shortly after ingestion of the mushrooms, the subject experiences a general feeling of levity and well-being. This exhilaration is followed within an hour by hilarity, incoherent talking, uncontrolled emotional outbursts, and, in the later stages of intoxication, by fantastic visions in brilliant colours, similar to the visions so often reported for the narcotic peyote (*Lophophora Williamsii*).

Johnson,<sup>24</sup> engaged in ethnological work among the Mazatec Indians in 1938, was informed that *brujos* (witch-doctors) use several kinds of

<sup>23</sup> This, interestingly, parallels the use of ololiuqui or piule (*Rivea corymbosa*) which is also used as a narcotic for divination in parts of Oaxaca. Investigation revealed that this narcotic convolvulaceous plant, the seeds of which are used, is known in the Mazatec region but is no longer utilized. It is used, however, by the Chinantec and Zapotec Indians to the south and east. (Schultes, ined.)

<sup>24</sup> Jean Bassett Johnson (1939).

mushrooms. He reports the names of these as *steyi* and *tsami-ye*, *tsamikishu*, and *tsamikindi*. Unfortunately, it was not possible to procure specimens, photographs, or descriptions, and botanical identification is thus precluded. It is not improbable, however, that one or more of these is a *Paneolus*. Although in my two visits to the Mazatec country narcotic mushrooms other than *Paneolus campanulatus* var. *sphinctrinus* were not found in use in divination, it is possible that poisonous mushrooms of the same or of other genera may be utilized. As emphasized below, the intoxication which has symptoms making it valuable to the Indians for divination is especially, but not exclusively, typical of the entire genus *Paneolus*.

Mr Bernard Bevan of Mexico City, who has carried out ethnological studies among the Chinantec Indians and who has visited the Mazatec tribe, writes, in a letter to me, that he was informed of the use of mushrooms for intoxication among the Mazatecs.

Extending my ethnobotanical investigations in northeastern Oaxaca in the spring and summer of 1939, I learned that *Paneolus campanulatus* var. *sphinctrinus* is used as a narcotic for divination among the western Chinantec Indians. The consumption of the narcotic is not uncommon in the western Chinantla<sup>25</sup> where the fungus grows in the high mountain pastures during the torrential rains of July. In the *pueblitos* of Santa Cruz Tepetotutla and San Pedro Sochiapam in the District of Cuicatlán, aged men were seen gathering this mushroom in fields, and in San Juan Zautla, District of Cuicatlán, information as to the use of the plant was obtained from two sources. In Tepetotutla five mushrooms (*Schultes* 722) were obtained from one of the gatherers in exchange for several quinine pills. In these Chinantec villages, the *Paneolus* has the name *nañ-tau-ga*. The information as to the utilization of the plant and descriptions concerning the intoxication were identical with those obtained from the neighbouring Mazatec Indians. Furthermore, in Tepetotutla, I was informed that small doses of from five to eight of these mushrooms are prescribed for several consecutive days for severe attacks of rheumatism. No medical uses were reported in the Mazatec region, but, according to Sahagun, teonanacatl in small doses of two or three was "medicinal for fevers and for rheumatism" among the Aztecs.

Further evidence of the use of narcotic mushrooms was obtained among

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<sup>25</sup> The term *Chinantla* is extremely ambiguous, having been used in a number of different senses by historical, anthropological, and botanical writers. It is a term which, as Bevan points out (Instituto Panamericano de Geografía e Historia, publ. No. 24, Mexico, 1938) should be used only in its widest sense: "a synonym for the region where any dialect of Chinantec is spoken." It is used here in this sense.

the Chinantec and Zapotec Indians who together inhabit the small town of Latani, near Santiago Choapam, District of Choapam, in the southeasternmost corner of the Chinantec area. Since my visit to Latani was made before the advent of the late June and July rains, it was impossible to collect specimens of the fungus which, according to the inhabitants, is eaten as a narcotic for divination. Very detailed descriptions of the fungus and a full account of the type of intoxication which it induces indicate that the intoxicating mushroom of Latani is also a species of *Paneolus*. The possibility that it is *Paneolus campanulatus* var. *sphinctrinus* is not remote. The Chinantec name is *a-ni* ("medicinal mushroom") or *a-mo-kyá* ("medicine for divination").

It is interesting to note here that *ololiuqui* or *piule* (the seeds of *Rivea corymbosa* (L.) Hall. f., often mistakenly identified as a *Datura*), another divinatory-narcotic of ancient usage in Mexico, is found growing in door-yards in Latani and is used, in the same way as the mushrooms, as an aid in divination.<sup>26</sup>

There can be little doubt that *Paneolus campanulatus* var. *sphinctrinus* is used among other Indian groups in Oaxaca and possibly in other states as well. Johnson writes in a letter to me that the mushrooms are known to the Cuicatec Indians of the District of Cuicatlán, Oaxaca, but that these people do not use them. Reko has learned by correspondence that the Zapotecs of Santiago Yaveo, District of Choapam, Oaxaca, use this narcotic, but when Reko and I visited this pueblo in 1939, no specimens could be obtained. Search for its use among the Zapotec Indians of Santa Maria Tonagua, San Ildefonso Villa Alta, Santa Maria Temascalapa, San Juan Yatsona, and San Juan Yaée produced no results. Likewise, during a very short stay in the Mije country, I could not learn of its use among the inhabitants of Santa Maria Chisme, San Juan Metlattepec, and Santiago Zacatepec (at the base of Cerro Zempoaltepetl). I think that it is highly probable that the narcotic properties of the *Paneolus* mushrooms are employed in divination among these peoples, however, and that when intensive investigation is carried out among the Mijes, the use of *Paneolus* will be discovered in this poorly studied tribe.

The names under which *Paneolus campanulatus* var. *sphinctrinus* is or has been known may be summarized as follows:

Aztecs: *nanacatl* (mushroom); *teonanacatl* (sacred mushroom); *quauh-tlanacatl* (wild mushroom); *teunamacatlth* (probably an erroneous rendition of *teonanacatl*).

Chichimecas: name unknown.

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<sup>26</sup> Richard Evans Schultes, *Plantae Mexicanae VI*.

Chinantecs: *nañ-tau-ga*; *a-ni*; *a-mo-kyá*.

Mazatecs: *t-ha-na-sa* (meaning unknown); *she-to* (pasture mushroom); *to-shka* ("intoxicating mushroom"). Although the names for the narcotic mushrooms reported by Johnson cannot definitely be applied to this species, it is probable that the mushrooms are species of *Paneolus*: *steyi*; *tsami-ye*; *tsamikishu*; *tsamikindi*.

#### IV

*Paneolatus campanulatus* L. var. *sphinctrinus* (Fr.) Bresadola is a small mushroom of boggy spots in meadows during the rainy seasons. This species and its closest relatives are found on all the major continents. The mushroom is about ten centimeters high, with a slender, terete, dark brown stipe from one to two centimeters in diameter. The dark colour of the stipe serves to separate this variety from its close relative, *R. papilionaceus* Fries. The pileus, three centimeters in diameter and one half centimeter high, is either parabolical, conical, or nearly hemispherical, often slightly cuspidate or obtusely acuminate, smooth, light yellowish-brown. The gills are spotted and are dark brownish-black. The spores, varying from 12-18 times 7.5-12  $\mu$ s, are black, sublimoniform. When dried, the entire mushroom assumes a brownish-black colour.

An excellent coloured illustration of *Paneolus campanulatus* var. *sphinctrinus* is to be found in Bresadola's *Iconographia Mycologica*.<sup>27</sup> Technical Latin diagnoses of the characters of the plant may be found in Bresadola's *Iconographia Mycologica* and in Fries' *Epicrasis*,<sup>28</sup> Bresadola's Latin diagnosis is republished in Schultes' *Plantae Mexicanae II*.

#### V

Species of the genus *Paneolus* have long been known to be poisonous,<sup>29</sup> but the use of *Paneolus campanulatus* var. *sphinctrinus* as an intoxicant in Mexico is the only instance in which its properties have been employed for narcotization, so far as I have been able to learn from the anthropological and botanical literature.

Ford<sup>30</sup> divides mushroom-poisoning into five categories, according to the physiological action of the poisonous constituents of the plants: 1) the choleric type (caused by the deadly *Amanita phalloides* (Fr.) Quél.); 2) the nerve-affecting type which is marked by convulsions, coma, and occasional deaths (caused by *Amanita muscaria* (L.) Pers., which is used in Kamchatka as a narcotic); 3) the gastrointestinal type; 4) the blood-

<sup>27</sup> J. Bresadola (1931), p. 894.

<sup>28</sup> Elias Fries (1838), pp. 235-236.

<sup>29</sup> Louis C. C. Krieger (1935).

<sup>30</sup> W. W. Ford (1923), pp. 225-229.

dissolving type; 5) and the cerebral type. *Paneolus*-intoxication belongs to the fifth category of poisonings. The narcotic action is mainly cerebral and is characterized by exhilaration, a feeling of ease and well-being, muscular incoordination, drowsiness, a staggering gait or difficulty in walking, emotional excesses, laughter and hilarity, incoherent and delirious speech, mydriasis, and fantastically coloured visions.

Most of the full descriptions of the use of teonanacatl among the ancient Aztecs indicate, by the peculiar type of intoxication, that the mushroom was a species of *Paneolus*. It is indeed significant that these early descriptions and the notes obtained from the Mazatec, Chinantec, and Zapotec Indians agree completely with the description of a typical *Paneolus*-intoxication by Douglas<sup>31</sup> and Krieger.<sup>32</sup>

Knowing that *Paneolus* was a poisonous genus, the late Professor Santesson<sup>33</sup> carried out a series of pharmacological studies with specimens of *Paneolus campanulatus* var. *sphinctrinus* which were collected in the Mazatec country.<sup>34</sup> The results of experiments with frogs indicated that a principle was present which induced a kind of narcosis very similar to that which is induced by ololiuqui (*Rivea corymbosa* (L.) Hall. f.) another Mexican oracular narcotic. Santesson called this state "eine Art Halb-narkose." Chemical tests convinced Santesson that a glucoside, but no alkaloid, was present. This is rather unexpected, since in *Amanita muscaria* (L.) Pers., the Kamchatkan narcotic mushroom, the active principle is an alkaloid—muscarine.

## VI

The identity of teonanacatl was unknown for three centuries. During this time doubt has been expressed concerning the accuracy of all of the earlier writers in describing the narcotic as a "mushroom." As a result, considerable confusion and uncertainty arose and a serious error has been accepted and widely spread in the botanical and anthropological literature.

The first attempt to identify teonanacatl botanically was made in 1915, when Safford<sup>35</sup> published his conclusion that the so-called "mushroom" was, in reality, the dried tops of the cactus *Lophophora Williamsii* (Lem.) Coulter and, notwithstanding all of the numerous early reports, was not a fungus. "Three centuries of investigation," wrote Safford, "have failed to reveal an endemic fungus used as an intoxicant in Mexico, nor is such a fungus mentioned either in works on mycology or pharmacography;

<sup>31</sup> B. Douglas (1917), p. 209-221.

<sup>32</sup> Kreiger (1935).

<sup>33</sup> C. G. Santesson (1939), pp. 1-9.

<sup>34</sup> Schultes and Reko, *op. cit.*

<sup>35</sup> Safford, *An Aztec Narcotic* (1915).

yet the belief prevails even now that there is a narcotic Mexican fungus . . ." On the basis of this argument, Safford concluded that the dried, brown, discoidal head ("mescal button") of the spineless peyote-cactus (*Lophophora Williamsii*) resembled a "dried mushroom so remarkably that, at first glance, it will even deceive a mycologist." When this "remarkable" resemblance is analyzed with actual specimens, however, it is found not to exist. There is actually very little similarity in appearance between the dried pilei of *Basidiomycetes* and mescal buttons. The shrivelled crowns of the cactus have a heavy cushion of closely packed areolate tufts of silky hairs on the upper surface and a conspicuous fibrovascular region on the lower surface. It seems highly improbable that either the early writers or the Indians were likely to confuse dried peyote with dried mushrooms. But Safford concluded that those same people who gathered peyote and teonanacatl (one of which inhabits dry, calcareous deserts; the other, wet, soggy, mountain pastures) failed to recognize the hard wrinkled, brown mescal-buttons (which Safford stated were teonanacatl) as a part of the soft, succulent, green peyote-plant. The former he assumed the Aztecs called *teonanacatl*, the latter, *peiotl*.

Much of Safford's ethnobotanical investigation of Mexican plants was brilliant. It is not surprising, therefore, that his conclusions on this mysterious "narcotic mushroom," which was known only in the literature, were accepted and became firmly established in both botanical<sup>36</sup> and anthropological literature.<sup>37</sup> This identification was repeated several times by Safford and early gained a wide audience.<sup>38</sup> Some of the recent writers on the subject of narcotics, however, have not accepted Safford's conclusions.<sup>39</sup> Prior to 1915, when Safford made his identification of teonanacatl, a number of authors had occasion to mention the narcotic and accepted the statements which all of the early writers had made concerning the fact that teonanacatl was a mushroom.<sup>40</sup>

The first published objection to Safford's identification appeared in 1936 in a popular book by V. A. Reko<sup>41</sup>: "*Dem* (the Safford identification) *muss*

<sup>36</sup> N. L. Britton and J. N. Rose (1922) p. 84; William E. Safford *Narcotic Plants and Stimulants of the Ancient Americans* (1917) pp. 398-405.

<sup>37</sup> Herbert J. Spinden (1917), p. 36; Eric Stone (1932), p. 55; J. Eric Thompson (1932), p. 31, 74. See E. W. Emmart: *The Badianus Manuscript* (Baltimore, 1940), p. 66.

<sup>38</sup> William E. Stafford (1917).

<sup>39</sup> Jean Bassett Johnson (1939); Weston-LaBarre, *Native American Beers* (1938); *Ibid.*, *The Peyote Cult* (1938); Blas Pablo Reko (1919); Victor A. Reko (undated); *Ibid.* (1936); Sahagun (1938); Schultes (April, 1937); *Ibid.* (November, 1937); Spinden (1917).

<sup>40</sup> Bancroft (1882), p. 360; Thomas A. Joyce (1914), p. 156; Siméon (1885); Manuel Urbina (1900), p. 25; *Ibid.* (1912), p. 131.

<sup>41</sup> V. A. Reko (1936).

widersprochen werden. Die Nanacates sind Giftpilze, die mit Peyote nichts zu tun haben . . ." He suggested, but apparently without any basis, that nanacatl might be a species of *Amanita*.

From the first appearance of Safford's identification, however, Dr B. P. Reko has opposed the opinion that teonanacatl was a form of peyote. In 1923, he wrote to Dr J. N. Rose of the United States National Herbarium:<sup>42</sup> ". . . I see in your description of *Lophophora* that Dr Safford believes this plant to be the 'teonanacatl' of Sahagun which is surely wrong. It is actually as Sahagun states, a fungus which grows on dung-heaps and which is still used under the same old name by the Indians of the Sierra Juárez in Oaxaca in their religious feasts . . ." In 1919, he had stated<sup>43</sup> that teonanacatl was "*div. géneros de hongos, especialmente un hongo negro que crece sobre estiércol y produce efectos narcóticos.*"

In 1939, specimens of *Paneolus campanulatus* L. var. *sphinctrinus* (Fr.) Bresadola which were collected in the Mazatec country of northeastern Oaxaca were identified as teonanacatl<sup>44</sup>. Later, the same plant was found to be used among the neighbouring Chinantecs and Zapotecs. There is, therefore, no longer any reason for the retention of Safford's misidentification of teonanacatl with *Lophophora Williamsii*.

The entire genus *Paneolus* is known to be poisonous. Differences between species are often very slight and extremely technical. Different species, having the same intoxicating properties and being so similar in gross appearance, are without doubt utilized along with *P. campanulatus* var. *sphinctrinus*. Although I have found no other mushroom used as teonanacatl in Oaxaca, numerous reports that there are several kinds of teonanacatl must be interpreted to mean that other species are actually used. Although the identification of "teonanacatl" was made on the basis of specimens of *P. campanulatus* var. *sphinctrinus*, it is probable that this vernacular name refers to several or numerous species of *Paneolus* and that further ethnobotanical research will result in the discovery of other species which serve as divination-narcotics in southern Mexico.

## VII

In summary, it may be stated that:

1) *Paneolus campanulatus* L. var. *sphinctrinus* (Fr.) Bresadola (and possibly other species of *Paneolus*) is used as a narcotic in witchcraft and

<sup>42</sup> Letter preserved on herbarium sheet number 1745713, United States National Herbarium, Washington, D. C.

<sup>43</sup> Blas Pablo Reko (1919).

<sup>44</sup> Schultes (February, 1939).

divination among the Chinantecs, Mazatecs, and Zapotecs of southern Mexico.

2) The size, colour, form, growth habits, uses, and narcotic effects of *Paneolus campanulatus* var. *sphinctrinus* correspond so closely to the descriptions of the same aspects of the teonanacatl of the Chichimecas and early Aztecs that there can be no doubt that this species represents the intoxicating mushroom which was described by many of the early writers as one of the chief narcotics of Mexico at the time of the Spanish Conquest.

3) The discovery of the use of *Paneolus* in three Mexican Indian tribes and its identification with *teonanacatl* should dispel the confusion which has resulted in the literature from Safford's misidentification of teonanacatl with peyote.

4) Although it seems to have been and to be widely used in southern Mexico as a narcotic, *Paneolus* is not known to be utilized as an intoxicant by any other group of primitive peoples.

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