Psycho-Mycological Studies Of Amanita - From Ancient Sacrament To Modern Phobia

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INTRODUCTION

The fly-agaric, *Amanita muscaria* (Fr. ex L.) Hooker, is certainly one of the most poorly understood of the known psychoactive plants. Despite the fact that there exists a record of more than a century of chemical and toxicological studies of this mushroom, its chemistry has not been fully delineated. Moreover, the chemical literature concerning *A. muscaria* is fraught with errors and misleading data.

Much recent work has been devoted to the history of the use of this mushroom. Because of this work, and the attention it has drawn to the psychotropic properties of *A. muscaria,* this mushroom has come, during recent years, to be widely used as a recreational drug in the United States. However, persons who routinely use psilocybin-containing mushrooms (*Psilocybe, Panaeolus, Conocybe, Stropharia* spp.) as recreational drugs often display a curious fear of *A. muscaria.* This fear can tell us a great deal about the ancient and modern roles of mushrooms in our culture.

In this paper, I will review the history, chemistry and pharmacology of *A. muscaria* and its chemotaxonomic relatives, and discuss various theories regarding a sacramental role of the fly-agaric in ancient religious cults. Further, I will contrast modern intentional and accidental use of the psychotropic *Amanita* species in the United States, and describe the subjective effects of *Amanita* intoxication. Finally, I will discuss the phobia, so frequently manifested by members of the psychedelic subculture, which surrounds modern recreational use of *Amanita* species.

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HISTORY OF *AMANITA MUSCARIA*

During the seventeenth, eighteenth and nineteenth centuries, there were a number of reports by explorers and anthropologists of the ritual use of *A. muscaria* in Siberia. This use was attributed to shamans of the Koryak tribe of the Kamchatka penninsula, the Irtysh-Ostyak tribe of northern Siberia and others (Dittmar & Patkanov 1968). Use of the fly-agaric as a recreational drug by the Koryak, Yukagir, Chukchi and Kamchadal tribes of Siberia was also commonly reported (Steller *et al.* 1968). As are all mushrooms in the genus, *A. muscaria* is mycorrhizal, that is, it grows in a symbiotic relationship with the rhizomes of certain trees. Owing to the scarcity of trees in parts of Siberia, *A. muscaria* was rare and expensive. This fact combined with the lack of any other indigenous psychotropic plants to produce a curious practice: the ingestion of the urine of a person intoxicated by the mushrooms, either to prolong the intoxication in the same person or to produce intoxication from a single dose of mushrooms in more than one person! This bizarre practice was reported by Steller (Steller *et al.* 1968):

> Those who cannot afford the fairly high price [of *A. muscaria]* drink the urine of those who have eaten it, whereupon they become as intoxicated, if not more so. The urine seems to

...more powerful than the mushroom, and its ...ts may last through the fourth or the fifth

...therefore been supposed that the toxins of *A. ...ria* pass into the urine of the user. Pharmacology, of course, this is not unique. Psilocin, an active ...nciple of "teonanáctl," the hallucinogenic mushrooms used as ritual sacraments in ancient and modern Mexico (Heim *et al.* 1958) and as recreational drugs in modern cultures (Pollock 1974; Pollock 1975; Ott 1975; Ott in publication—a; Ott in publication—b), also passes into the urine of the user (Kalberer, Kreis & Rutschmann 1962). The Siberian practice of urine recycling, however, represents the only documented use of urine as an inebriating substance.

Some of the Siberian reports attributed effects of macropsia to the ingestion of *A. muscaria.* It is said that Lewis Carroll had read of the reports of the use of *A. muscaria* in Siberia, and that these served as an inspiration for his classic tale, *Alice's Adventures in Wonderland* (Wasson & Wasson 1957). Consequently, the mushroom motif in this book as well as Alice's macropsia may represent the first major inprint of the Siberian use of *A. muscaria* on modern cultures.

Siberian use of the fly-agaric was to have no further impact on Western cultures until 1953, when Ramsbottom (1953) reviewed some accounts of the Siberian practices. A much more detailed and careful study of the Siberian history of *A. muscaria* was presented by Wasson (1968). Wasson published a thorough review of the literature on Siberian use of *A. muscaria,* in support of his theory that this mushroom represented the plant-god "Soma" of ancient Indian literature. The Rig Veda, the earliest known holy book of India and the foundation of modern Hinduism, consists of 1028 hymns, many of which are devoted to descriptions and praises of Soma. The identity of Soma, which is no longer used in India, has long been a point of ethnobotanical controversy. Wasson's theory is certainly the most plausible thus far advanced. The principle arguments in favor of Wasson's identification are: 1) the Soma plant is described in the Rig Veda as growing in the mountains, as does *A. muscaria* in the area in question; 2) although there are vivid descriptions of Soma in the Rig Veda, there is no mention of leaves, roots, bark, seeds or flowers — being a mushroom, *A. muscaria* of course does not have these anatomical features; and 3) the Rig Veda seems to describe Soma both as a plant and as the urine of priests who have ingested the plant (Wasson 1968):

> Acting in full concert, those charged with the Office, richly gifted, do full honor to Soma. The swollen men piss the flowing [Soma].
>
> Mandala IX 74[4] — Rig Veda

The arguments in favor of Wasson's hypothesis are therefore strong, and it is Wasson's book that is primarily responsible for modern awareness of the psychoactive effects of *A. muscaria.*

The publication of Allegro's theories (1970) probably had an even greater impact on public awareness of the psychotropic properties of the fly-agaric. Allegro theorized that the New Testament was written in a code designed to conceal the activities of a cult surrounding the ingestion of *A. muscaria.* This argument was linguistic, and there exists no ethnobotanical evidence to support it. Another theory which may have had some influence on modern awareness of the effects of *A. muscaria* is that of Lowy (1972; 1974), who postulated that certain motifs in the ancient Mayan Madrid and Dresden codices represented carpophores of *A. muscaria,* drawn in relation to other figures and glyphs so as to suggest ritual use of this mushroom. Although Lowy's theory was published in the mycological literature, it has seemingly appeared, in distorted form, in popular literature. A poor pamphlet on hallucinogenic mushrooms, published in Louisiana (where Lowy works), falsely alleged that *A. muscaria* was the "sacred mushroom of Mexico" (Ghouled 1972).

Public consciousness of the hallucinogenic potential of *A. muscaria* has been expanded by several popular publications, describing its use as an ancient sacrament, and as a recreational and sacramental drug in the United States (Puharich 1959; Mann 1971; Coyote Man 1972; Sandford 1973; *High Times* 1975). Recently published data suggest an awareness of the inebriating properties of *A. muscaria* in Japan (Wasson 1973; Imazeki 1973); there may well exist modern recreational use of the fly-agaric in parts of Japan. My forthcoming book documents modern use of *A. muscaria* in the United States, and I shall discuss such use in this paper. It will be, however, necessary to first review the chemistry and pharmacology of psychoactive *Amanita* species in order to place this use in a proper perspective.

CHEMISTRY AND PHARMACOLOGY OF PSYCHOACTIVE *AMANITA* SPECIES

The main active principles of *A. muscaria* are probably ibotenic acid (α-amino-3-hydroxy-5-isoxazole acetic acid) and its decarboxylation product, muscimol (3-hydroxy-5-aminomethyl isoxazole). Ibotenic acid was isolated at about the same time by three laboratories (Takemoto, Nakajima & Sakuma 1964; Bowden & Drysdale 1965; Eugster, Müller & Good 1965). These

toxins also occur in *A. pantherina* (DC ex Fr.) Krombh. (Takemoto, Yokabe & Nakajima 1964; Chilton & Ott in publication; Benedict, Tyler & Brady 1966), *A. cothurnata* Atkinson (Chilton & Ott in publication), and hybrids between *A. pantherina* and *A. gemmata* (Fr.) Gill (Benedict, Tyler & Brady 1966). These species are placed in section *Muscaria* of the genus. Ibotenic acid has been reportedly isolated from *A. strobiliformis* (Paul.) Quélet in Japan (Takemoto, Yokabe & Nakajima 1964). This compound, in fact, gets its name from the vulgar Japanese name for *A. strobiliformis*, "Ibotengu-take." Subsequent work has failed to detect ibotenic acid in *A. strobiliformis* from Japan, or in *A. solitaria* (Fr.) Secretan or *A. chlorinosma* (Peck) Saccardo, its relatives in section *Lepidella* of the genus *Amanita* (Chilton & Ott in publication; Benedict, Tyler & Brady 1966; Chilton *et al.* 1973).

In 1869, muscarine was isolated from European *A. muscaria*, and was for decades believed to be the main active principle. Actually, muscarine appears to be a trace constituent (at least in European specimens), and the muscarinic symptoms (salivation, lachrymation and perspiration), common to poisoning with mushrooms which contain high concentrations of muscarine (*Inocybe, Clitocybe* spp.), are not generally reported in *A. muscaria* poisoning (Eugster 1956; Committee on Toxicology 1972). I have, however, experienced and observed muscarinic effects following ingestion of *A. muscaria* from the state of Washington – this will be considered in detail later. Atropine, a psychoactive alkaloid derived from several genera of *Solanaceae* (*Atropa, Datura, Hyoscyamus* spp.) has become standard treatment for muscarinic poisonings (it is an effective antidote for toxic effects of muscarine), and is routinely administered to *A. muscaria* and *A. pantherina* poisoning victims. Atropine, however, potentiates the effects of ibotenic acid and muscimol. This fact resulted in the application of the name "pilzatropine" to the then unknown toxin of *A. muscaria*, and it has even been wrongly reported that atropine itself occurs in *A. muscaria* (Lewis 1955). Bufotenine (dimethyl serotonin, an isomer of psilocin) has also been reported as a toxic principle of *A. muscaria* (Wieland & Motzel 1953). Several studies have shown the above reports to be in error (Brady & Tyler 1959; Talbot & Vining 1963; Saleminck 1963), although the presence of bufotenine has been verified in *A. citrina* S.F. Gray and *A. porphyria* (Fr.) Secretan, species not known to possess oral toxicity (Wieland & Motzel 1953; Tyler & Groeger 1964).

Ibotenic acid and muscimol have both been shown to produce hallucinosis, delirium, muscular spasms and sleep in human volunteers (Waser 1967). The oral threshold dose of muscimol in human subjects is approximately 6 mg, the oral threshold dose of ibotenic acid being 5-10 times that amount. LD_{50} for muscimol in rats ranges from 4.5 mg/kg (intravenous) to 45 mg/kg (oral) (Theobald *et al.* 1968). When administered intraperitoneally to rats, both compounds were observed to effect brain levels of DOPAmine, serotonin and norepinephrine, in a manner analogous to LSD (Koenig-Bersin *et al.* 1970).

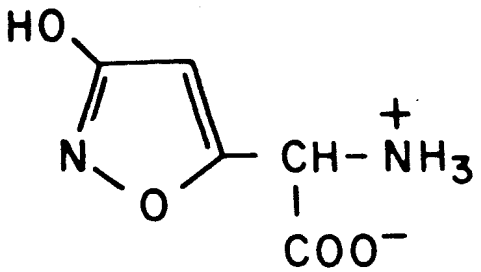
A structural analog of GABA, muscimol is, like GABA, an inhibitor of CNS neurotransmission (Johnston 1971). A structural analog of glutamate, ibotenic acid is, like the sodium salt of glutamate, a taste enhancer, and has been patented for this use in Japan (Takeda Chemical Industries 1966). (See Figure 1.)

Recent work has been done on the urinary excretion of ibotenic acid and muscimol. Both toxins have been detected in human urine following ingestion of *A. muscaria*. Labeled muscimol injected intraperitoneally into mice resulted in the excretion of only 5-10 percent of the label as muscimol within 48 hours (Ott, Wheaton & Chilton 1975). Further studies with human subjects demonstrated the excretion of substantial amounts of orally ingested ibotenic acid in urine collected within 90 minutes of ingestion (Chilton 1975).

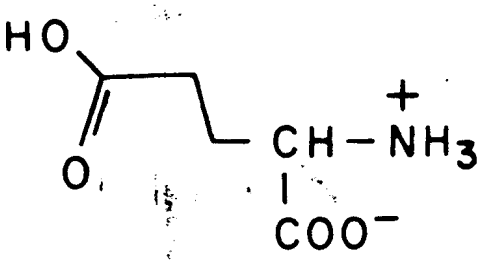
We may then postulate a mechanism for the observed practice of urine ingestion in Siberia. On ingesting *A. muscaria*, the subject would receive a substantial dose of ibotenic acid. During digestion and absorption some of the ibotenic acid would be converted to muscimol by decarboxylation in the mild acidic conditions of the stomach (complete degradation of ibotenic acid in 0.01 N formic acid takes 2-3 hours over a steam bath), the remainder being excreted as free ibotenic acid. When the urine containing ibotenic acid was drunk, the process could be repeated, until there was an insufficient amount of ibotenic acid in the urine to generate a threshold dose of muscimol by decarboxylation. It must be remembered that an oral threshold dose of ibotenic acid represents 5-10 oral threshold doses of muscimol. This mechanism may be an oversimplification. The ibotenic acid degradation reaction is complex, producing both muscimol and a yet-unidentified compound, panthimol, which may be an isomer of muscimol, and may have pharmacological activity (Chilton 1975).

The above mechanism is directly analogous to the toxic mechanism of the psilocybin-containing mushrooms. In this case, the mushrooms generally contain a large amount of psilocybin and trace amounts of psilocin. Psilocybin, following ingestion, is dephosphory-

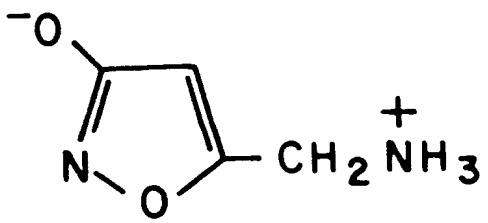
FIGURE 1



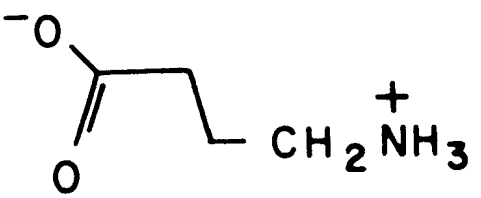
IBOTENIC ACID



GLUTAMATE



MUSCIMOL



GABA

lated to psilocin by an intestinal phosphorylase (Horita & Weber 1961). It is evidently psilocin which reaches the brain and produces hallucinogenic effects (Horita & Weber 1962). Substantial amounts of psilocin are then excreted in the urine (Kalberer, Kreis & Rutschmann 1962). Psilocin is observed to be more potent than psilocybin, suggesting that the dephosphorylation is only partial (Heim *et al.* 1958).

MODERN USE OF PSYCHOACTIVE *AMANITA* SPECIES

Following publication of the various studies of the history of *A. muscaria,* the fly-agaric began to be used in the United States as a recreational drug, as did *A. pantherina* (Ott in publication–a; Ott in publication–b). Recent studies have shown that North American *A. pantherina* contains a higher concentration of ibotenic acid and muscimol than does North American *A. muscaria* (Benedict, Tyler & Brady 1966; Chilton 1974). I have observed the use of both of these species in Washington, Oregon and California. Given the cosmopolitan distribution of these mushrooms, it is likely that they are used in other parts of the United States as well.

The use of *A. pantherina* as a food source has been observed in Washington (Chilton 1974). Users, who are unaware of the toxicity of fresh specimens, will peel and discard the skins from the caps of the mushrooms, parboil the mushrooms, and discard the water prior to canning the mushrooms for future use. This treatment will render the mushrooms non-toxic, as the toxins are water-soluble, and the mushrooms so prepared are said to be delicious. A similar culinary use of *A. muscaria* has been reported from Japan. In certain areas, *A. muscaria,* called "Beni-tengu-take" (scarlet long-nosed goblin mushroom), is collected and dried, pickled in brine for about 12-13 weeks, and repeatedly rinsed prior to ingestion as a food (Imazeki 1973).

Recreational users of *A. muscaria* in the United States have been observed to peel the skins from the caps of the mushrooms and dry these, to smoke them

later for their psychoactive properties (Ott in publication b). This produces a very mild effect, and I have detected muscimol in the smoke of combusted skins of *A. muscaria*. It has recently been shown that the toxins of *A. muscaria* are more concentrated in the skin of the cap than in any other part of the mushroom (Bowden 1965; Catafolmo & Eugster 1970), and that these toxins exist in chemical combination with the pigments of this skin (Doepp & Musso 1973). It is interesting to note that both recreational and culinary users of *Amanita* seem to recognize the skin as the most toxic portion of the mushroom.

A. muscaria and *A. pantherina* are more often eaten for their psychoactive effects. Sometimes only the caps of the mushrooms are ingested. The mushrooms may be eaten fresh, cooked by themselves or with foods, or dried. However ingested, these mushrooms are quite tasty. There is some loss of potency with age in dried specimens. Dried mushrooms more than seven years old have been shown to contain no detectable ibotenic acid or muscimol (Benedict, Tyler & Brady 1966).

ACCIDENTAL VERSUS INTENTIONAL USE OF PSYCHOACTIVE *AMANITA* SPECIES

A. pantherina and *A. muscaria* are more commonly implicated in accidental mushroom poisoning cases in the Pacific Northwest than are any other species (Committee on Toxicology 1972). There is a great deal of difference between the experiences of accidental and intentional users. I have recently conducted a survey of some accidental and intentional users of *Amanita* in Washington. Nine accidental and nine intentional users were interviewed. The intentional users averaged 30 experiences per person, while the accidental users had had but one experience each. All experiences described involved oral ingestion.

Seven of the accidental users found the experience to be highly unpleasant, and four of these feared death. Three experienced nausea, seven drowsiness (of whom five lost consciousness), three muscle spasms, two muscle weakness, three loss of balance and coordination, and seven experienced hallucinations. Most of these victims developed (or, perhaps more to the point, *reaffirmed*) negative attitudes toward mushrooms, and couldn't conceive of intentional ingestion of these mushrooms.

All nine of the intentional users found the experience to be pleasurable, many highly so. Three members of this group experienced nausea, only two felt drowsiness (with no reports of loss of consciousness), one reported loss of balance and coordination, and one reported muscle weakness and muscle spasms. All of the persons in this group experienced some form of hallucinations. All had had prior experiences with hallucinogenic drugs. In some cases, intentional users ingested a higher quantity of mushrooms than did the accidental victims (one of whom allegedly ate only about one gram fresh weight of *A. muscaria* and subsequently lost consciousness!).

It is significant to note that all of the intentional users enjoyed the experience, while only two accidental users found it to have some pleasant aspects (both of these users had had prior experiences with hallucinogenic drugs). The intentional users, by virtue of the fact that they were actively seeking the experience, had a much more positive attitude toward the effects than did the users in the accidental group. Moreover, based on their past experiences, the intentional users were no doubt exercising some control over set and setting.

Wasson and Wasson (1957) have taken great pains to document and study the "mycophobia" or fear of mushrooms which pervades our culture. This will be considered in greater detail later. Based on my personal experiences with psychotropic *Amanita* species, and my conversations with accidental *Amanita* poisoning victims, I am convinced that the negative effects which accidental users experienced were a result of their mycophobic attitudes. On first experiencing subjective effects of *Amanita* intoxication, the accidental users typically believed that they had eaten deadly poisonous mushrooms, and hence were facing death. One person even contacted a lawyer, to ensure that her will was in order, before seeking medical aid! Medical aid, in some of the cases I reviewed, consisted of injections of atropine sulfate, the result being a prolonged period of suffering and hospitalization for the unfortunate victims. These data, then, underscore the importance of set and setting on the quality of psychedelic experience (Weil 1972), and testify to the importance of mycophobia in our culture.

SUBJECTIVE EFFECTS OF *AMANITA* INTOXICATION

In the spring of 1975, after completing the above survey, I collected some early specimens of *A. pantherina* near Tenino, Washington. I sliced and sautéed the mushrooms, and divided them into six portions, consisting of about one half cup of material each. The six portions were ingested by myself and five friends, one of whom ingested only one half of a dose, the remaining half being ingested, along with a full portion, by another of my friends. All of us enjoyed the taste of the mushrooms.

After an hour had elapsed, I had concluded that the dose level was too low, and had retired to my house to build a fire and study. About 90 minutes after ingestion, however, while hyperventilating into my wood stove in an attempt to start the fire, I noticed that I was experiencing changes in visual perception. These effects became stronger over the next hour or so, and were characterized by sensing an "alive quality" in inanimate objects, wavy motion in the visual field like a Van Gogh canvas (no color perception was associated with this motion, however, as is so commonly experienced following ingestion of LSD, psilocybin or mescaline), and mild distortion of size, distance and depth perception. Auditory hallucinations were also prominent – especially the effect, called "anahata sounds" of yoga, of hearing fine high-pitched sounds like bells and violin strings. I experienced only slight impairment of motor coordination and balance, such as would be produced by a small amount of ethanol, equivalent to two or three bottles of beer. In contrast to the effects of ethanol, however, there was no slurring of speech or clouding of consciousness. While I felt as though my consciousness was somehow removed and distant from the surroundings, I experienced a great sense of clarity, as I often experience following ingestion of psilocybin-containing mushrooms. It seemed to me that the psychic effects were emanating from the "ajna chakra," the so-called "third eye" – a locus above and between the eyes. I experienced no muscular spasms, cramps, vomiting, or nausea of any kind. The experience was totally pleasureable, and lasted about seven hours. I was struck by the unique quality of the effects whereas I find the psychic effects of LSD, psilocybin-containing mushrooms, and peyote to be similar, to be, as it were, on a continuum of related experience, I felt that *A. pantherina* was distinctly different.

Of my five friends, two experienced slight nausea, and only one felt drowsy. This person slept for about an hour, and awoke feeling refreshed. Two of my friends alleged that they had never been so high on hallucinogenic drugs before. One of these friends, the person who ingested half again as much of the fried msuhrooms as I, experienced a complete dissociative reaction, and was unable to communicate with the rest of the group for about five hours. While in this state, he was periodically attempting to articulate his thoughts, but was totally incapable of communication. During this phase of his intoxication, we were talking about this history of *A. muscaria* and urine ingestion in Siberia. The subject in the dissociated state later reported the experience of vivid waking dreams which were related, through bizarre imagery, to the topics of the conversations we had been conducting around him. After about five hours of dissociative experience, this subject began to reestablish contact with the rest of us, and within 90 minutes was fully rational, although shaken and frightened. None of us experienced any after-effects.

On two occasions in the fall of 1975, I ingested dried caps of *A. muscaria* from Washington. The mushroom caps were eaten as "Amanita chips," and were tasty. On the first occasion, I ingested the caps along with several grams of *Psilocybe cyanescens* Wakefield from Washington which had been estimated to contain at least 1 percent psilocin dry weight. The effects experienced therefore have no bearing on *Amanita* toxicity. On the second occasion, I ingested about 30 grams of the dried caps, and after an hour began to experience a very pleasant opium-like sedation with slight visual phenomena, similar to those described for *A. pantherina* intoxication, although of lower intensity. I experienced distinct muscarinic effects, characterized by profuse salivation and mild perspiration. Three friends who ingested the mushrooms with me reported similar effects. The muscarinic symptoms were not at all unpleasant. Either these effects were due to muscarine in the carpophores (in which case *A. muscaria* from Washington must contain a much higher concentration of muscarine than is reported for European specimens), or they were produced by some yet-unidentified compound with muscarinic activity.

Again, I experienced no nausea or other adverse effect. The intoxication was experienced for about five hours, after which I went to sleep and awoke the next morning with no after-effects. During the experience, I noticed a rather profound diminution of coordination and balance, effects similar to advanced stages of ethanol intoxication. There were, however, no effects of clouding of consciousness or slurring of speech. One of the friends who ingested the mushrooms with me experienced slight nausea, but no other adverse effects were reported.

It would seem, based on my limited experience, that there are more somatic effects associated with the ingestion of *A. muscaria* than *A. pantherina*. While the psychic effects were similar, they were much less prominent in the *A. muscaria* experience, despite the fact that this experience was characterized by a much higher level of somatic effects. *A. muscaria* from Washington must contain fairly high concentrations of some compound with muscarinic activity. *A. pantherina* seemed indeed to be more potent, at least with respect to psychic effects. Stizolobic and stizolobinic acids have been isolated from *A. pantherina*, and are of unknown

pharmacological activity (Chilton, Hsu & Zdybak 1974). These compounds occur, however, in edible beans (*Stizolobium* spp.), and it is unlikely that they contribute to the toxicity of *A. pantherina*. The dissociative experience provoked in my friend by the ingestion of *A. pantherina* indicates that users should experiment with dose levels of this mushroom, starting with small amounts. My friend entered a dissociative state having ingested only 50 percent more of the mushrooms than I, and my dose produced a pleasant state of hallucinosis.

AMANITAPHOBIA

I have already discussed mycophobia in relation to the adverse effects experienced by accidental users of *Amanita*. I have decided to coin the term "amanitaphobia" to explain the special type of mycophobia displayed by recreational users of hallucinogenic mushrooms in the United States. I have seen persons eagerly eat wild mushrooms out of a bag, without the most cursory examination, after having been told that the mushrooms contained psilocybin. Is this mycophobia? These same persons were seen to balk, however, at the ingestion of *A. muscaria*. Some were even observed to separate carefully the psilocybin-containing mushrooms from a mixture of these and *A. muscaria*, to avoid ingesting the dreaded red fly-agarics. Furthermore, I know many regular users of psilocybin-containing mushrooms, some of whom have written articles and even a book about these mushrooms, who have expressed no desire to experiment with the hallucinogenic *Amanita* species; who have, in fact, expressed open animosity toward the idea. In one case, I recommended that such a person try *A. pantherina* – he later enthusiastically endorsed the effects, and no longer suffers from amanitaphobia.

There are undoubtedly several factors responsible for this phenomenon. It is obvious that *A. muscaria* represents a strong archetype in our culture. No other species of mushroom is so widely depicted in art associated with fairy tales – it is truly the archetypal "toadstool." Indeed, it has been suggested, based on linguistic evidence, that the original toadstool (this being a stigmatizing label attached to certain fungi) was *A. muscaria* (Wasson & Wasson 1957; Wasson 1968). The fly-agaric is depicted on the cover of the bulk of the popular mushroom books which have appeared over the years, and is so strong a visual symbol that most people instantly can conceive a visual image of this colorful mushroom, despite the fact that they may know nothing whatever about fungi. No other species of mushroom is so clearly represented in art motifs, clothing and household items. It may also be significant that no other species of mushroom has been so widely implicated in the various theories advanced, as pure conjecture, to explain the religious practices of ancient times, and which are not based on ethnobotanical evidence (Allegro 1970; Lowy 1972; Puharich 1959).

This plethora of imagery associated with *A. muscaria* testifies to the ancient role of this mushroom as a sacred plant. This thesis has been expounded at length by Wasson and Wasson (1957) and Wasson (1968). I have reviewed some of the evidence to support this contention, at least with respect to Oriental cultures. Modern amanitaphobic attitudes probably derive from ancient tabus surrounding the use of *A. muscaria* in religious cults.

Wasson and Wasson (1957) and Wasson (1968) have carefully dissected the phenomenon of mycophobia, demonstrated its derivation from tabus surrounding the use of the fly-agaric, and documented the expansion of this phobia, which in some cultures eventually came to encompass all species of fungi. The modern recreational use of hallucinogenic mushrooms seems to be destroying mycophobic attitudes, however, and the place of *A. muscaria* in this use further underscores the Wassons' thesis and my point about amanitaphobia. Although users will indiscriminately ingest alleged psilocybin-containing mushrooms, displaying no mycophobia whatever, they are often afraid to ingest *A. muscaria*. Amanitaphobia, therefore, is nothing new – it represents an atavistic trend in mycophobia; it is, so to speak, mycophobia stripped to its bare essentials – to the ancient fear of the tabu fly-agaric.

There is no evidence for any role of the psilocybin-containing mushrooms as archetypes in our culture, as ancient use of these mushrooms is known directly only from Mexico and, by inference and extrapolation, from other parts of Meso-America. There exists no great body of folklore in Indo-European cultures concerning mushrooms of the genera *Psilocybe, Panaeolus, Conocybe* and *Stropharia;* in fact, these mushrooms had been almost completely ignored until they were implicated as sacred plants in Mexico. Obviously, our "cultural consciousness" is neutral, if not downright indifferent, toward these "little brown crud mushrooms." It seems that the use of psilocybin-containing mushrooms has come to this country riding on the wave of interest in LSD, and that the vast populatity of these mushrooms threatens to destroy mycophobia in our culture. The much-maligned fly-agaric, however, because of its archetypal nature, continues to have problems of acceptance among members of the psychedelic generation. This fact

confirms the "bold surmise" brilliantly advanced by Wasson and Wasson (1957) almost 20 years ago, concerning the tabu nature of the fly-agaric. Little did the world expect, in 1957, that a modern demonstration of the Wassons' thesis was forthcoming.

Another probable source of amanitaphobia is the fact that the genus *Amanita* possesses at least five potentially deadly species which contain α-amanitin and other amatoxins (Hatfield & Brady 1975). The whole genus is considered to be poisonous by some, despite the fact that in mycophilic Mexico, one of the most popular food mushrooms, sold in markets all over the country, is *A. caesarea*. Most of the mushroom manuals referred to above list *A. muscaria* and *A. pantherina* as poisonous, with the implication that they are quite as dangerous as *A. phalloides* or *A. verna*, species which contain the amatoxins (Miller 1971). This probably represents a combination of mycophobia, scientific zeal and poor research on the part of the writers concerned. It would not be easy to confuse the hallucinogenic *Amanita* species with those species known to contain the amatoxins, particularly if photographs were consulted. It is more probable, in fact, that a recreational user of psilocybin-containing mushrooms may confuse some species of *Psilocybe* with *Galerina autumnalis*, or another of the *Galerina* species which, like the deadly *Amanita* species, contains the amatoxins (Hatfield & Brady 1975; Miller 1971). I have observed species of *Galerina* growing in close proximity to similar-looking species of *Psilocybe* which are used as recreational drugs in Washington. I am afraid that it is only a matter of time before someone dies as a result of confusing the two.

CONCLUDING REMARKS

It is obvious that further chemical work will be necessary to delineate fully the toxicology of the hallucinogenic *Amanita* species. There may well be unidentified toxic principles, and there may be significant differences, other than the concentration of ibotenic acid/muscimol, between the toxicity of North American *A. muscaria* and *A. pantherina*. The muscarine content of North American *A. muscaria* must be investigated, to determine whether in fact content of this metabolite shows intercontinental variation.

Extreme attitudes toward the use of *Amanita* species as recreational drugs seemingly reflect the importance of *A. muscaria* as a sacred plant of ancient cultures. We can learn a great deal from the study of amanitaphobia, and the study of the dissolution of mycophobia in general, as the mushroom revolution sweeps the United States. Hallucinogenic mushrooms are becoming so popular that I recently witnessed, during a mushroom show in Washington, the theft of a huge specimen of *A. muscaria*. Despite the fact that this mushroom was displayed under a large sign saying "Dangerous Mushrooms" (not a single species present under the sign was dangerous), and the fact that a nearby poster depicted *A. pantherina* as the prototypic "Poisonous Mushroom," this fine specimen was stolen by a youth (obviously acquainted with amanitaphobia) who subsequently streaked out the back door of the hall in which the show was held, pursued by a contingent of shouting amanitaphobes, who did not want him to "poison" himself.

Meanwhile, in the midst of all this sound and fury, we confirmed amanitaphiles continue to enjoy *A. muscaria* and *A. pantherina* which are, at the time of this writing, perfectly legal. It appears that amanitaphobia runs so strong in our culture that it has not even seemed worthwhile or expedient (to our normally over-zealous legislators) to enact laws against these loathsome plants. It is my hope that the hallucinogenic species of *Amanita* will continue to be legal, and that more persons will establish good relationships with these delightful fungi.

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