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# The significance of pharmacological and biological indicators in identifying historical uses of *Amanita muscaria*

By Kevin Feeney

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[\*280]

## INTRODUCTION

Since the publication of R. Gordon Wasson's *Soma: Divine Mushroom of Immortality* theories have abounded regarding potential historical mushroom cults involving the use of *Amanita muscaria* (Allegro 1971; Arthur 2003; Heinrich 2002; Irvin 2009; Irvin & Rutajit 2009). Subsequent researchers have relied largely upon studies of art, linguistics, and mythology, and have offered varying levels of support for their theories, drawing parallels between color schemes, mushroom shapes, and mushroom biology, however, Wasson's 1968 opus remains unparalleled in terms of depth and comprehensiveness. One of the fundamental contributions of Wasson's work was the proposition that Soma was an entheogen, a point driven home through detailed comparisons of the known effects of entheogenic substances and descriptions of Soma inebriation in the *Rig Veda*. In addition to Wasson's discussion of the ecstasies that can be produced by hallucinogenic mushrooms, he also argued that the Soma cult involved ritual ingestion of *Amanita muscaria* infused urine. Both of these factors provided a groundbreaking pharmacological depth to Wasson's theory.

Despite Wasson's pioneering efforts, however, he never adequately addressed how preparation, as described in the *Rig Veda*, affects the pharmacology of *Amanita muscaria*, and also overlooked possible indicators of historical knowledge regarding the muscarinic properties of this mushroom. Another examination of the evidence for historical uses of this mushroom, which seeks to identify cultural knowledge of *Amanita muscaria*'s peculiar pharmacology, may further bolster theories identifying its use. In order to demonstrate the significance of such an investigation, evidence for use of this mushroom in India, Mesoamerica, and among Germanic and Celtic groups will be examined with an eye to uncovering both pharmacological and biological evidence supporting a finding of historical *Amanita muscaria* use.

[\*281]

### **UNDERSTANDING *AMANITA MUSCARIA***

*Amanita muscaria* is a cosmopolitan mushroom that can be found throughout the globe. While it occurs in both tropic and temperate climates, its potential habitats are limited due to the symbiotic nature of the mushroom. *Amanita muscaria* is a mycorrhizal mushroom, meaning that it only grows in association with certain trees, including birch, fir, pine, spruce, aspen and oak, and therefore can only be found in environments that support these arboreal species. This is an important property of *Amanita muscaria* because it helps us determine whether historical groups with suspected entheogen use may have had access to this mushroom.

While *Amanita muscaria* shares some effects with the *Psilocybe* mushrooms, including hallucinations and size distortions, the properties and effects of *Amanita muscaria* are easily distinguishable from those caused by the *Psilocybes*. *Amanita muscaria* inebriation is typically characterized by confusion, delirium, hallucinations (often taking the form of size-distortion), muscle spasms, and alternating periods of excitation and lethargy or sleep. Although the

pharmacology of *Amanita muscaria* is not entirely understood, there are three chemical constituents of which we are primarily concerned; these are ibotenic acid, muscimol, and muscarine.

The principal inebriating agents of *Amanita muscaria* are the isoxazole derivatives ibotenic acid and its decarboxylation product, muscimol. Ibotenic acid, a glutamate agonist, is the most abundant of the two principal compounds, although it readily decarboxylates into the more potent muscimol. Dehydration of the mushroom is the easiest way to promote decarboxylation of ibotenic acid to muscimol, which is five to ten times more potent than its precursor. It has been suggested that heating or cooking may also promote degradation of ibotenic acid to muscimol (Catalfomo & Eugster 1970), a suggestion which appears to be verified by more recent research (Tsunoda et al 1993a). Muscimol, a potent GABA agonist, is believed to be an artifact of ibotenic acid, rather than a biogenic feature of *Amanita muscaria* (Tsujikawa et al 2006). Both compounds are water [\*282] soluble, and muscimol is thermostable, meaning it will not degrade with cooking or boiling. The effects of these compounds have been shown to include: unsteadiness, dizziness, narrowed field of vision, mild visual spasms, altered auditory and visual perception, visual disturbances, loss of equilibrium, muscular twitches, and sleep (Chilton 1975; Waser 1979). Interestingly, the highest concentrations of ibotenic acid and muscimol in *Amanita muscaria* appear to occur in the skin of the cap and the yellow tissue immediately beneath it, while the lowest concentrations occur in the stipe, or stem (Michelot & Melendez-Howell 2003; Tsujikawa et al 2006; Tsunoda et al 1993b). The difference in potency between cap and stipe is an additional feature of *Amanita muscaria* that may be used to distinguish historical uses of this mushroom from use of *Psilocybes*.

Another notable constituent of *Amanita muscaria* is muscarine, a cholinergic agonist, which primarily affects the peripheral parasympathetic nervous system, instead of acting on the

central nervous system as hallucinogens do. The effects of muscarine poisoning are generally marked by excessive perspiration and salivation, blurring of vision, abdominal pain, nausea, vomiting, and diarrhea. While the muscarine content of *Amanita muscaria* is generally considered insufficient to produce muscarinic effects (Catalfomo & Eugster 1970), recent research suggests that muscarine may in fact play an important role in the pharmacological effects of this mushroom (Feeney & Stijve 2011; Stijve 1982; Stijve 1981), a role that has apparently not gone unnoticed by cultures familiar with the mushroom's properties. In the following pages I will outline how these idiosyncratic features of *Amanita muscaria*'s pharmacology and biology can be used to help identify potential historical uses of this mushroom.

### **SALIVA & THE GIFT OF INTOXICATION**

The folklore surrounding the use of *Amanita muscaria* in Europe and Asia seems to suggest that cultures familiar with this mushroom [\*283] recognized its muscarinic effects and considered them important components of *Amanita muscaria* inebriation. In several folk-stories the muscarinic effects of *Amanita muscaria* appear to play an important role in the mushroom's origins. In Siberia, Koryak legend tells us that *Amanita muscaria* was created by the spittle of Vahiyinin, the God of Existence (Schultes & Hofmann 1992). Similarly, a Croatian variation on the myth of Wotan's wild hunt describes how *Amanita muscaria* was formed by the bloody spittle that fell from the mouth of Wotan's horse (Morgan 1995). The connection between salivation and the creation of *Amanita muscaria* strongly suggests a cultural familiarity with the muscarinic effects produced by the mushroom, and provides a basis for further investigating stories that connect muscarinic effects, like salivation, with sacred inebriants and magical objects.

While there is no direct evidence of *Amanita muscaria* use amongst the Germanic tribes, the above account of Wotan's wild hunt combined with stories describing the origins of the famed Mead of Inspiration are highly suggestive that the early Germanics were familiar with, and revered, the properties of this mushroom. According to myth, as recorded in Snorri Sturluson's *Skaldskaparmal*, the rival gods of the Aesir and Vanir sealed a truce by spitting into a cauldron. From the spittle a being known as Kvasir was created. Kvasir, came to be celebrated for his wisdom and teachings, but was subsequently killed by two dwarfs who mixed his blood with honey to create the Mead of Inspiration. It was said that anyone who drank of this mead would become a wise poet. The Mead, which later came into the possession of Suttung the Giant, was eventually recovered by Wotan (Odin) who convinced Suttung's daughter to let him have a taste of the Mead. Wotan slyly consumed the entirety of the mead and escaped to Asgard in the form of an eagle. On Wotan's journey some of the Mead was "dropped," making the Mead available to mortals. Upon arrival at Asgard the Mead was spit into containers and provided to the Gods.

The importance of this story lies in the repeated connections between saliva and the creation of the Mead of Inspiration. First, [\*284] saliva is used in the formation of Kvasir, who can be seen as an embodiment of the sacrament, as suggested by Eliade (1982). In order to gain the wisdom of the sacrament, Kvasir must be sacrificed so that he may be consumed in the form of the Mead of Inspiration. After Wotan steals the Mead we are told that some of the Mead is lost on his journey, and what remains is spit up again when he returns to Asgard. In this account saliva is connected twice with the creation of the Mead, first through the creation of Kvasir, and second through regurgitation of the Mead in Asgard. The way the Mead is lost, however, is equally important. The account of Wotan "dropping" some of the Mead on his journey is ambiguous at best, but since Wotan consumed the Mead there are a limited number of ways that it could have

been lost. Presumably the Mead was lost through salivation, urination, or defecation. While diarrhea is a potential effect of muscarine, the properties of *Amanita muscaria* are known to be preserved in the urine, which is collected amongst some Siberian tribes for repeated use. Knowledge of either of these properties could be indicated here, in addition to the obvious connections between saliva and the creation of the inebriant, which are clearly paralleled in the Koryak and Croation myths mentioned earlier.

A similar creation story is recounted in the *Popol Vuh* of the Quiche Maya, recorded shortly after the Spanish Conquest, although the connection to ritual inebriant use is less clear. In this story two youth, Hun Hunahpú and Xbalanqué, find themselves in the underworld, Xibalba, where they are challenged to a life or death ball game by the Lords of Xibalba. The two youth are overcome by the Lords of Xibalba, and are sacrificed in their defeat. Hun Hunahpú's decapitated head is hung in a tree where he is visited by Xpuic, a daughter of the Xibalbans. Hun Hunahpú spits in the maiden's hand, impregnating her. Xpuic eventually gives birth to the Hero Twins, who will later defeat the Lords of Xibalba.

Although the above story does not appear directly connected to inebriant use, the story remains striking for several reasons. First and [\*285] foremost is the act of creation through expectoration, a clear parallel with the Koryak and Croation myths recounting the origins of *Amanita muscaria*. Second, *Psilocybe* mushrooms are still used among certain Mexican indigenous groups, although no modern use has been confirmed among any Mayan groups. Psychoactive mushroom use was documented at the time of the conquest, around the same time that the *Popol Vuh* was recorded, and earlier archaeological artifacts depicting mushrooms have been found throughout Mesoamerica. Some of these artifacts clearly appear to be representations

of *Amanita muscaria* (Figure 1; Figure 2), although modern uses of *Amanita muscaria* in Mesoamerica remain unconfirmed (Schultes & Hofmann 1992).



**Figure 1.** The above statuette comes from Nayarit, Mexico, and is believed to date back to 100 CE. Here a man, perhaps a *curandero*, is seated beneath a giant *Amanita muscaria*. (Illustration by Laura Boergadine Sapp ©).

Third, and finally, is a parallel story among the Aztecs which identifies the Hero Twins as the god Quetzalcóatl and his twin aspect Xólotl. Quetzalcóatl, which may be translated as either “plumed serpent” or “precious twin,” is a god with a variety of attributes, who is known by different names depending on what feature is emphasized. His appearance as Xólotl, the twin, and Ehecatl, the wind god, are the most significant to our discussion.

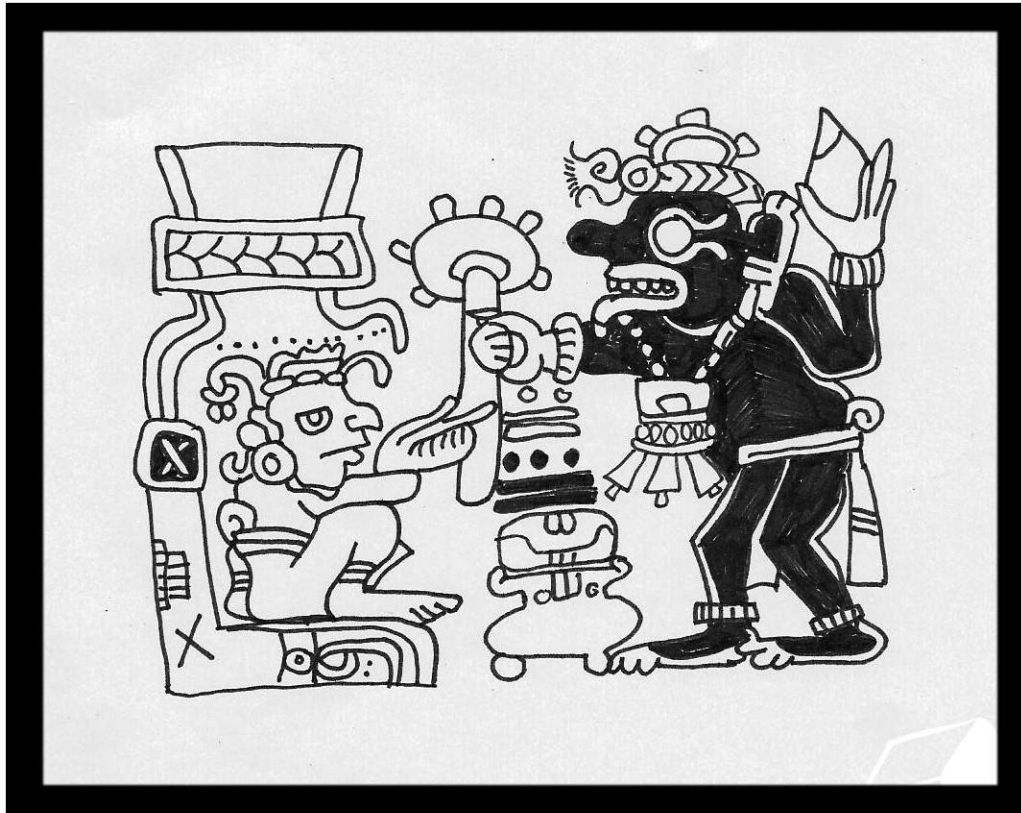
Quetzalcóatl, in his form of the Wind God, is often depicted with fangs and dangling eyeballs. The appearance of dangling eyeballs has been interpreted as representing a type of



remorseful weeping, or perhaps some pervasive type of eye disease (Vankirk & Bassett-Vankirk 1997), but it has recently been suggested by Carl de Borhegyi (2010), son of the renowned archaeologist Stephan de Borhegyi, that the dangling eyeball represents a mushroom. This is most clearly illustrated by a stone bust of Ehecatl, found on the south coast of Guatemala, which features both the fanged teeth and dangling eyeballs (Figure 3) Upon closer inspection, a clear picture of an *Amanita* mushroom emerges. The eyelids of the bust appear to represent mushroom caps, while the eyeballs can be seen as representations of the typical bulbous base of an *Amanita*. The only prominent features missing are the distinctive warts that typically decorate the cap of the mushroom and the characteristic ring left by remnants of the universal veil. Further supporting [\*286] Borhegyi's observation is the fact that one of the effects of muscarine is lacrimation, or tear production. As a result, Ehecatl's dangling eyes may double as both representations of the mushroom and of tears, perhaps an acknowledgment of this peculiar property of the mushroom.

Xólotl, the God of Twins, and twin of Quetzalcóatl, is also occasionally depicted with a dangling eyeball. In the *Codex Borgia* (C.B.), a pre-Columbian religious manuscript believed to originate in either the state of Puebla or Oaxaca, Mexico, Xólotl is frequently depicted with this strange feature (Figure 4; C.B. Plate 10). The dangling eyeball also appears in connection with a solar deity (Xólotl, perhaps) depicted in a birthing pose (C.B. Plate 43) as well as in representations of women who died during childbirth (C.B. Plates 47, 48). The *Codex Borgia*, however, also features images of individuals having their eyes ritually gouged (C.B. Plates 15, 16), as well a figure who can be seen gauging his own eye out (C.B. Plate 10). Ultimately, the purpose of this feature remains unclear. It has been suggested that it may represent penitent weeping, a form of eye affliction, or perhaps may represent the results of some type of ritual sacrifice. Nevertheless,

the similarity between the stylized “dangling eyeball” and a mushroom is remarkable, particularly when one recognizes the pharmacological connection between muscarine and tear production.



**Figure 2.** This panel taken from the Madrid Codex features God M (right) presenting what appears to be an *Amanita muscaria* to a seated figure. Alternatively, it has been speculated that the object represents an incense burner. (Illustration by Laura Boergadine Sapp ©).

## OTHER MUSCARINIC INDICATORS

Aside from creation stories, there may be other indicators that a particular culture is familiar with the muscarinic properties of *Amanita muscaria*. A passage from the *Rig Veda*, known as the Frog Hymn, may suggest such knowledge among the Indo-Aryans. In this passage frogs are compared to perspiring Brahmins gathered around the Soma bowl:

[\*287]

Like Brahmins at the overnight Soma-sacrifice speaking around as it were a full lake, ye celebrate that day of the year which, O Frogs, has begun the rain.

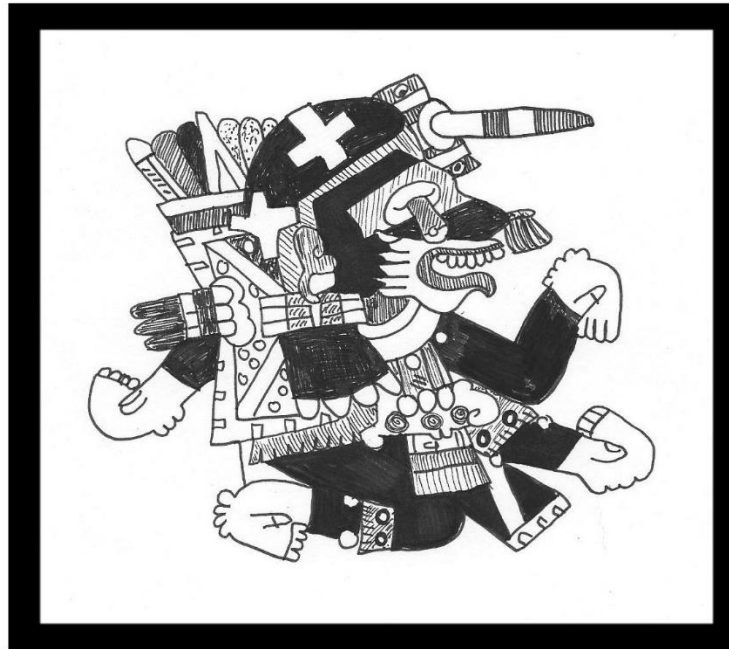
Soma-pressing Brahmins, they have raised their voice offering their yearly prayer, Adharvu priests, heated, sweating, they appear; none of them are hidden (MacDonell 2006, p. 145).

While it has been asserted that the Brahmins in this passage are sweating because they are gathered around a heated cauldron of milk (Doniger 2005), a new possibility arises if Soma is the *Amanita muscaria* mushroom, as suggested by Wasson.



**Figure 3.** This stone sculpture represents the Wind God, Ehecatl, and prominently features his dangling eyeballs, generally considered to be tears. Upon closer inspection, however, the tears can easily be seen as the stalk and bulbous base of an *Amanita*, with the eyelids providing the cap of the mushroom. Only the characteristic warts are missing. (Photo by Jacques VanKirk ©).

Another suggestive account of Soma intoxication comes from Phillipe de Félice. Referencing a story from the *Satapatha Brahmana* in 1936, de Félice provided the following description of Soma inebriation, “It happens sometimes that the inebriation is accompanied by organic disturbances, which are in reality symptoms of an acute intoxication. Men know and fear the baleful effects of the drug, and, though he was a god, Indra himself did not escape them, since one day the Soma came forth from every opening in his body” (Wasson 1968, p. 135, *citing* Félice 1936). The experience of the god Indra, as described above, suggests typical muscarinic symptoms, which include: salivation, perspiration, vomiting and diarrhea. There are few orifices that are left unaffected by the properties of muscarine.



**Figure 4.** This panel taken from the Codex Borgia features the God of Twins, Xólotl. Here, and elsewhere in the Codex, he is featured with a dangling eyeball, or what appears to be a mushroom. The similarities between this stylized “eye” in the Codex and those in the sculpture of Ehecatl are noteworthy. (Illustration by Laura Boergadine Sapp ©).

## IMPORTANCE OF PREPARATION

Historical accounts of how long-lost inebriants were prepared, as well as archaeological artifacts that evidence particular preparation techniques can provide important clues in identifying these enigmatic substances. Wasson, in his attempt to identify the three filters used in the preparation of Soma, clearly recognized the importance of preparation in unearthing the hidden identity of this sacred inebriant. Wasson (1968) identified these three filters as: (1) a [\*288] celestial filter, or filter of sunlight; (2) a filter of woolen cloth; and (3) the human body, and relied on a combination of relevant passages from the *Rig Veda*, and on explanations of *Amanita muscaria*'s pharmacology, in making his case. Wasson focused heavily on the first and third filters in his theory but placed little emphasis on the second, a weakness pounced upon by several critics. Vedic scholar John Brough (1971: 338) argued that "if the Soma-plant had been a mushroom, it would be strange that the elaborate Vedic process of pounding out and filtering the juice should have been necessary. Why should the plant not have been simply eaten?" Others have similarly argued that the elaborate process of preparation for Soma, as outlined in the *Rig Veda*, would be unnecessary and inexplicable if the same effects could be obtained by simply chewing and swallowing the mushroom (Flattery & Schwartz 1989; Greene 1992).

While some have argued that these objections are nonsensical (ie: who would make this argument about Japanese use of tea: Ott 1998: 25-26), evidence of complex preparations are often examples of a sophisticated understanding of plant properties and toxicities (Johns & Kubo 1988). However, the idea that the Aryans may have had an advanced understanding of plant properties and preparations was also rejected by Brough (1971: 336), who definitively stated that "there are no grounds for believing that the Indo-Iranians were sufficiently skilled herbalists to have made such discoveries."

Methods of detoxifying and processing plants for human use are known throughout the world, and include a variety of techniques, including: dehydration, application of heat, leaching, and fermentation, among others (Johns & Kubo 1988). While it is difficult to trace the origins of these methods, or to answer the question of how certain groups learned to detoxify and process useful plants in their environment, to make a blanket claim that certain cultures were incapable of discovering plant properties, and the methods necessary for rendering them safe and useful, seems naïve at best. Regarding the processing of fungus specifically, the Chinese have long made use of various polypore mushrooms for [\*289] medicinal purposes, most of which require a hot water extraction in order to render the medicinal properties available for human use. Similarly, methods of parboiling are used among the Karelians in Northern Europe to render certain mushrooms edible, including *Gyromitra esculenta* and certain species of *Lactarius* (Härkönen 1998). In Nagano, Japan, as another example, villagers are known to pickle *Amanita muscaria*, a process which removes both hallucinogenic and toxic components of the mushroom, thereby making them edible (Phipps 2000). Nevertheless, while preparations of foods and inebriants may employ arbitrary methods that merely reflect cultural preference, rather than serving a practical function, it would be a mistake to simply make such an assumption. As a result, a closer look at Wasson's three filters is warranted.

Wasson's first filter, a celestial filter of sunlight, represents the process of dehydration. As mentioned earlier dehydration of *Amanita muscaria* causes ibotenic acid to degrade into the more potent compound muscimol. Additionally, recent investigations have indicated that the process of dehydration significantly reduces the incidence of vomiting following *Amanita muscaria* ingestion (Feeney 2010). These pharmacological features of *Amanita muscaria* are recognized by Siberian tribes familiar with the mushroom, many of whom have taboos against consumption of the fresh

mushroom, which is considered toxic and potentially deadly (Jochelson 1905, 1908; Maydell 1893). Wasson, relying on ethnographic accounts of the disparate attitudes towards fresh and dried mushrooms among these Siberian tribes, makes a strong argument that dehydration, or a “filter of sunlight” was the first of three filters applied in the preparation of Soma, as described in the *Rig Veda*.

Wasson’s second filter, a filter of woolen cloth, is based on numerous verses from the *Rig Veda* describing the mixture of Soma with water, being pressed with stones, and finally filtered through a woolen cloth. The term Soma can be translated as meaning “the pressed one,” with the prefix “su-“ signifying “to press,” indicating the import of this procedural step (Nichols 2000). While clear pharmacological information is lacking, my [\*290] own research has demonstrated that extractions of *Amanita muscaria* in water significantly reduce the frequency of toxic effects (nausea and vomiting) caused by fresh or dried specimens of the mushroom (Feeney 2010). These findings are significant in that they counter one of the major criticisms of Wasson’s theory, that the elaborate process of preparation for Soma, as outlined in the *Rig Veda*, would be unnecessary and inexplicable if the same effects could be obtained by simply chewing and swallowing the mushroom (Brough 1971; Flattery & Schwartz 1989; Greene 1992).

While water extractions are not necessarily conducted for functional purposes, the fact that such an extraction method significantly alters the effects of *Amanita muscaria* makes such preparatory techniques, when combined with corroborating evidence, potential indicators that the Indo-Aryans were familiar with the pharmacological properties of this mushroom. Notably, the creation of the Mead of Inspiration in Germanic mythology shares some significant parallels with Soma and its preparation. According to the *Skaldskaparmal*, the Mead of Inspiration was created by two Dwarfs who captured and killed Kvasir the Wise. The Mead was produced by mixing

Kvasir's blood with honey, and any who drank of the potion would become "poetically" inspired. Interestingly, Kvasir's name begins with the prefix "kvas," which can be translated as "wort of" (Nichols 2000). Here we have several peculiar parallels: first, both the god Soma and the supernaturally born Kvasir can be seen as divine embodiments of a sacred inebriant; and secondly, each name suggests a particular type of preparation associated with the embodied inebriant, specifically that the inebriant should be extracted as an infusion or decoction.

One rebuttal offered by Wasson to Brough, and others, was that indigenous groups in Mexico are known to make aqueous extractions of *Psilocybes* for use in curing ceremonies, a point meant to undermine the argument that preparation of mushrooms is unnecessary (Wasson 1972; Ott 1998). While the point is well taken, and as Jonathan Ott pointed out, no one would question the Japanese preference for infusions of tea over consuming whole tea leaves (Ott 1998); it does not obviate [\*291] the potential that preparation serves a particular pharmacological function. While evidence supporting the historical use of *Amanita muscaria* in Mesoamerica is tentative (Schultes & Hofmann 1992), an argument can be made that the extraction methods used with *Psilocybes* may be a remnant of earlier practices involving the use of *Amanita muscaria*.

In Mexico, the Mixtec are known to prepare aqueous extractions of *Psilocybes*, generally grinding the mushrooms on a metate and mixing them with water (Borhegyi 1961). Interestingly, sets of metates and manos (grinding stones) have been found in association with mushroom stones in Guatemala, artifacts which are thought to date back to the Early or Late Preclassic Mesoamerican periods (1000 BCE – 200 CE) (Borhegyi 1961). While the mushroom stones remain an enigmatic feature of Mesoamerican archaeology, the association of metates with mushroom stones tends to support the prevailing theory that the mushroom stones are connected with the ritual use of hallucinogenic mushrooms (Borhegyi 1961; Wasson & Wasson 1957). The



grinding of mushrooms on a metate also recalls the Vedic descriptions of “pressing stones” used in the preparation of Soma.

While my own investigations suggest that aqueous extractions of *Amanita muscaria* produce effects that are significantly less toxic than when the mushroom is consumed fresh or dried (Feeney 2010), there does not appear to be any clear preference for aqueous extractions among Siberian groups with traditional uses of this mushroom. While there are general taboos against consumption of fresh mushrooms, which are considered toxic and potentially lethal (Jochelson 1905, 1908), the mushrooms are consumed in a variety of manners, including dried, cooked in soups, and both aqueous and alcohol extractions (Saar 1991). Although there is no ethnographic evidence suggesting a preference for aqueous solutions among Siberians with traditional uses of *Amanita muscaria*, evidence suggesting this extra step of processing by the Mixtec remains significant, particularly given the adeptness of traditional cultures at identifying and eliminating toxins from food sources (Johns & Kubo 1988). [\*292]

Wasson proposed that the third filter was represented by the human body, which would filter and emit the purest variety of Soma in the form of urine. This conjecture was based upon several key passages in the Rig Veda combined with evidence of urine-recycling practices in Siberia, where the urine of intoxicated individuals would be consumed to produce additional bouts of intoxication. In support of his theory Wasson pointed to several passages in the Rig Veda, suggestive of an association between Soma and urine, including the following:

9.74.4: The swollen men piss the flowing [Soma] (Wasson 1968: 29).

8.80.3: In the belly of Indra the inebriating Soma clarifies itself (Wasson 1968: 56).

Wasson’s assertion that the third filter mentioned in the *Rig Veda* is the human body, and that mushroom-infused urine is the purest form of Soma, has perhaps been the most contentious

component of his theory. Daniel Ingalls, a Harvard Professor of Sanskrit, raised several significant challenges to Wasson's position that merit mention. First, Ingalls took issue with Wasson's assertion that "priests appointed to impersonate Indra and Vayu" urinate the divine inebriant (Wasson 1968: 30), pointing out that there is no evidence in the *Rig Veda* "that priests ever impersonate the gods in any capacity" (Ingalls 1971: 189). Ingalls second point of contention is based on both the scarcity and ambiguity of passages connecting Soma and urine, of which he notes "the verb to urinate is used in connection with the word soma only twice in the *Rig Veda*" (Ingalls 1971: 189).

Most important to our present considerations, however, is a point raised by Jonathan Ott (1998) that *Amanita muscaria* is not the only substance where substantial amounts of inebriating compounds are discharged in the urine. Consumption of both *Psilocybe* mushrooms and mescaline-containing cacti are both followed by significant amounts of the inebriating compounds psilocin and mescaline being eliminated in the urine (Grieshaber et al. 2001; Kalberer et al. 1962; Ott 1998). As a result, consumers of either of these drugs could theoretically consume their own urine in order to prolong the effects of inebriation. In part, it was the distinctiveness of this feature of *Amanita muscaria* that made the mushroom so compelling to Wasson as a candidate for Soma, though the strength of his theory does not rise or fall depending on the validity of this part of his argument, as some critics have argued (Letcher 2008). While Ott's observation clearly calls into question the significance of this component of Wasson's theory, his assessment is not entirely satisfactory. First, there is no ethnographic record of cultures that ingest urine in order to prolong the effects of *Psilocybe* mushrooms or mescaline-containing cacti, while the historical record clearly shows this practice among the Siberians with regards to the use of *Amanita muscaria*. Secondly, Wasson's argument goes beyond mere recognition of this odd property of *Amanita*

*muscaria* by additionally arguing that the process of filtering Soma through the human body is a process with pharmacological significance. This assertion is clearly outlined by Wasson in the following speculation:

In modern experience the fly-agaric causes nausea. If the agent that provokes vomiting is not the same as the one that leads to ecstasy, the former might be eliminated in the digestive track and urine be thus freed from this inconvenience (Wasson 1968: 31).

Wasson goes even further, claiming that “the Soma juice that is drunk by ‘Indra’ and ‘Vayu’ in the course of the liturgy is filtered in their organisms and issues forth as sparkling yellow urine, retaining its inebriating virtue but having been purged of its nauseating properties” (Wasson 1968: 55).

From a pharmacological perspective Wasson may indeed be correct. While ibotenic acid, one of the mushrooms active constituents, passes in the urine unmetabolized, it is likely that other components of *Amanita muscaria* that contribute to nausea and vomiting, such as muscarine, have been metabolized (filtered) into inactive by-products. This biological process would leave a fairly [\*294] pure extraction of ibotenic acid in the consumer’s urine. This filtering effect also appears to be supported by ethnographic accounts from Siberia, including the following observation from Carl von Dittmar:

People generally claim that the effect of the mushroom poison becomes more intense and more beautiful when it has already passed through another organism. Thus an intoxicated man will often be followed by someone else who wants to collect his urine, which is supposed to possess this effect to a particularly high degree (Wasson 1968: 257, reprinting Dittmar 1900).

While it is important to realize that *Amanita muscaria* is not unique in the sense that its properties can be recycled through urine-consumption, the more important question is why does this practice come about? And why is this practice not observed among indigenous groups in Mexico with traditional uses of *Psilocybe* mushrooms? There are two possible answers to these questions, the first being scarcity. If a resource is scarce, which has been suggested by accounts that a single mushroom might be exchanged for a reindeer in Siberia (Erman 1833-1848), then we are likely to see cultures maximizing the use of particular resources. Wasson's theory suggests that Soma was only available in the mountains, and would have been scarce in the Indus Valley, where the Indo-Aryans came to reside. Recycling urine, as Wasson asserts is described in the *Vedas*, makes sense in an environment where the principal intoxicant is scarce and highly-valued.

The second possible answer is that the urine of *Amanita muscaria* consumers has been relieved of toxic qualities that are evident in fresh or dried specimens of the mushroom, thus making the urine a purer and more desirable drug. More information is needed about the pharmacology of *Amanita muscaria* before such an answer can be given with confidence, but an answer in the affirmative would provide a clear reason why *Amanita muscaria* infused urine is valued and used, whereas *Psilocybe*-infused urine is not so valued. I have not, as of yet, uncovered other examples of urine being associated with a divine inebriant, but the two above stated reasons provide [\*295] a potential basis for drawing a connection between ritual urine consumption and use of *Amanita muscaria*, as opposed to *Psilocybes* or other inebriants.

## **THE POTENT HEAD**

The concentration of ibotenic acid and muscimol in the cap of *Amanita muscaria* is another unique pharmacological feature of this mushroom. While the pharmacology of *Amanita muscaria*

is not completely understood, if the distribution of muscarine, and other toxic compounds that may be present, are uniformly distributed throughout the mushroom, then removal of the stem could be seen as a method of preparation that decreases the mushrooms overall toxicity. Among the Khanty, of Western Siberia, only the cap of the *Amanita muscaria* is consumed, though the reasons for this practice are unknown (Saar 1991). Another example of this type of preparation can be found among the Mixe of Oaxaca, Mexico, who prepare *Psilocybe* mushrooms in this way (Wasson & Wasson 1957). The Mixe consume the caps of the mushroom only, the stems are saved and later left in front of a cross as an offering. While the stem retains a ceremonial purpose, there is no clear pharmacological reason for the stem of a *Psilocybe* mushroom to be discarded. This practice could signify an earlier use of *Amanita muscaria*, where the practice of discarding the stem would have potentially decreased the negative effects of the mushroom. While this is largely speculative, it seems certain that the scarlet cap of *Amanita muscaria* would have caught the eye of indigenous peoples before the generally drab appearance of the *Psilocybes*, and that its properties would similarly have been discovered much earlier. Although *Amanita muscaria* is equally as effective an inebriant as *Psilocybe* mushrooms, the potency and resulting effects of the mushroom are more highly variable, both factors that may have contributed to a subsequent preference for *Psilocybe* varieties and an eventual discontinuance of *Amanita muscaria* use. [\*296]

Aside from clues we might garner from preparation techniques that favor mushroom caps, there are recurring themes regarding decapitation and the spiritual potency of the head in the Vedic, Germanic, Celtic and Mesoamerican cultures. In the *Brahmanas*, an ancient Indian text that follows the *Vedas*, one of the cups of Soma is referred to as the head of Gayatri, Gayatri being the eagle who bore Indra down from the heavens after beheading the dragon Vrtra and obtaining the holy Soma. Here, not only is Soma represented by the image of a head, but it is procured only after

beheading Vrtra. Similarly, the giant Mimir, who guards the Well of Wisdom in Germanic mythology, is beheaded by the Vanir gods who wish to gain access to the sacred Well. The Well of Wisdom is generally considered a permutation of the Mead of Inspiration, from which Odin drinks. The close association of Mimir with the Well, and the subsequent preservation and use of his head as an oracle by Odin, suggests that Mimir's head may itself be a representation of an inebriant.

The Celts believed that the head was the container of the soul, as well as a source of truth, wisdom, and healing (Cowan 1993). In this view, the head is essentially a source of spiritual potency, much like the cap of the *Amanita muscaria* is the source of the mushroom's mind altering properties. In Celtic myth, a faery tree bearing scarlet berries that "cheer like wine" is guarded by a giant (Wilson 2001). The giant was slain by Diarmuid, a Fenian warrior, who took refuge in the tree in order to hide from Finn McCool, leader of the Fianna, whom he had betrayed. Finn sent nine men into the tree after Diarmuid, and each was beheaded, their heads falling from the tree like "ripe berries." The berries appear to be frequently equated with the head (Wilson 2001), a connection that again combines the symbolism of the head with a divine inebriant. Interestingly, both Celtic and Germanic myth have examples of giants guarding divine inebriants, with Odin beheading nine thralls of the giant Suttung in his pursuit of the Mead of Inspiration.

Ritual decapitation, as a form of sacrifice, was practiced by the Aztecs in Mesoamerica (Baquedano & Graulich 1993). As described [\*297] earlier, Hun Hunahpa, the father of the Hero Twins in the *Popol Vuh*, was decapitated after losing a ball game with the underworld Xibalbans. His head was hung in a tree and became like fruit, also a potential embodiment of the sacred inebriant.

The persistent connection between spiritually potent decapitated heads and inebriating fruits and beverages is striking, however, it is important to note that symbols are often multivocalic, representing a multiplicity of meanings, including ideas that may appear contrary from an outside perspective (Turner 1965). It is not asserted here that the practice of decapitation is directly related to, or even results from, the use of psychotropic mushrooms, but rather that the particular pharmacology of *Amanita muscaria* is highly compatible with the symbolism implicit in “cults of the head.” When addressing historical uses of psychoactive mushrooms this peculiar feature of *Amanita muscaria*, and related symbolism, could be an important factor in distinguishing ritual use of *Amanita muscaria* from ritual uses of *Psilocybes*.

### FEATS OF STRENGTH

As mentioned earlier, the Koryak believe that *Amanita muscaria* was created by the god of existence, Vahiyinin, but some further elaboration is required. The origin story begins with Big Raven who encounters a beached whale. Big Raven sought to help the whale return to the sea, but was unable to lift the large creature. Big Raven pleaded with Vahiyinin for assistance, and Vahiyinin responded by spitting upon the ground, causing *Amanita muscaria* to grow. The deity told Big Raven to “go to a level place near the sea: there thou wilt find white soft stalks with spotted hats. These are the spirits wa’paq. Eat some of them and they will help thee” (Wasson 1968: 268, reprinting Jochelson, W. 1905, 1908). Big Raven ate the mushrooms and was imbued with great strength, whereupon he returned the whale to the sea and proclaimed “Let the Agaric (*Amanita muscaria*) remain on earth, and let my children see what it will show them” (Wasson 1968: 268, reprinting Jochelson, W. 1905, 1908). *Amanita muscaria* [\*298] mushrooms have been used for both strength and endurance among Siberians, and reportedly keep hunters nimble when

pursuing prey. According to Georg Heinrich von Langsdorf (1809), who spent time among the Kamchadal in the early 19<sup>th</sup> century, a man was reported to have carried a 120lb sack of flour for 10 miles after consuming *Amanita muscaria*, a feat he would normally have been incapable of. Similarly, a woman from Kamchatka proclaimed, “under the influence of the fungus it is a trifle to walk 50km” (Saar 1991: 164). A more recent account describes how Koryak women will chew small pieces of *Amanita muscaria* while tanning fur, or attending other tasks, in order to relieve muscle soreness and provide endurance (Irimoto 2004).

The connection between *Amanita muscaria* and feats of strength led to the proposal by Samuel Odman in 1784 that *Amanita muscaria* was the intoxicant of the Viking Berserkers (Fabing 1956). The Berserkers were warriors, associated with the cult of Odin, known for their ecstatic battle frenzy and seeming imperviousness to pain (Buchholz 1984). The Berserkers have been described as warriors who rode into “battle without coats of mail and acted like mad dogs or wolves. They bit their shields and were as strong as bears or bulls. They killed people, and neither fire nor iron affected them” (Hollander 2002: 10). This theory was later supported by F.C. Schuber, a Norwegian physician and botanist, who noted that the symptoms of Berserker rage are consistent throughout different accounts (Fabing 1956), and also by Rolf Nordhagen who, in 1930, uncovered an 1814 report from the Varmland regiment (Swedish Army) where an officer had taken note of troops that were raving and foaming at the mouth (Morgan 1995: 116). Upon inquiry the officer was informed that the soldiers had taken *Amanita muscaria* in order to prepare for battle (Morgan 1995: 116). Other accounts suggest that the Berserker rage begins with particular symptoms, including shivering, chattering of teeth, chills in the body, and flushing in the face (Fabing 1956). Such symptoms suggest that some sort of substance was ingested which would regularly cause such effects, effects which are often associated with the beginning [\*299] stages of *Amanita*



*muscaria* inebriation. Laws were passed outlawing Berserkers and robbers in 1015 CE in Norway, and later in 1123 CE in Iceland (Fabing 1956). The practice ceased in Iceland shortly after its outlawing (Fabing 1956), a fact that may have more to do with ecological changes in Iceland rather than a respect for law.

Interestingly, Wasson dismissed the Berserker theory out of hand, claiming that symptoms caused by *Amanita muscaria* were opposite of those associated with the Berserker rage (Wasson 1968: 176-178). Perhaps Wasson had concerns about linking *Amanita muscaria* with such a violent tradition, however, the known symptoms of the Berserker rage appear to be compatible with ethnographic accounts of the mushroom's use in Siberia, including a report that the mushrooms are eaten among the Koryak when one is "resolved toward murder" (Morgan 1995: 103). It is also worth noting that Soma is most commonly associated with Indra, a god of war, who consumes Soma prior to his great battle with Vrtra.

A parallel to the Berserker tradition can also be found among Celtic myths detailing the deeds of the hero CuChulaind (Riedlinger 1999). CuChulaind was known for his ferociousness in battle, and parallels have been drawn between descriptions of his battle-fury and symptoms caused by *Amanita muscaria* (Riedlinger 1999). As CuChulaind's fury builds his behavior becomes manic, his hair bristles and his heart booms, symptoms which Thomas Riedlinger has connected with the agitation and tachycardia caused by *Amanita muscaria*. More curiously, however, are descriptions of CuChulaind's fury in which one eye is described as protruding while the other recedes into the back of his head, a description that Riedlinger argues is indicative of the visual distortions caused by *Amanita muscaria* inebriation.

The accounts of the Berserkers and of CuChulaind are certainly suggestive of the effects of *Amanita muscaria*, which makes it surprising that Wasson so readily denied any connections

between the Berserkers and this mushroom. The Berserker rage also has a counterpart, as the rage is generally described as being followed by a period of lassitude, which brings us to the next topic: mushroom-induced sleep. [\*300]

### **THE MUSCARIA SLUMBER**

One of the noted properties of *Amanita muscaria* is the inducement to sleep. Waldemar Bogoras, a Russian anthropologist exiled to Siberia in the late 19<sup>th</sup> century, observed the use of *Amanita muscaria* among the Chuckchee, and noted that many users of the mushroom would succumb to a period of sleep (Bogoras 1904-1909). Bogoras noted that some individuals would fall asleep immediately after consuming the mushroom, only to wake up a few hours later while fully inebriated. Others would pass through three stages of inebriation, including stimulation, hallucination, and stupor, before succumbing to a heavy slumber (Bogoras 1904-1909). This experience was also noted by other early explorers, including Joseph Kopec who was given mushrooms by a medicine man to treat his illness and to provide sleep. Kopec reported that a long restful sleep followed, one filled with vivid dreams which he described thus:

Flowers of different colours and shapes and odours appeared before my eyes; a group of most beautiful women dressed in white going to and fro seemed to be occupied with the hospitality of this earthly paradise. As if pleased with my coming, they offered me different fruits, berries, and flowers. This delight lasted during my whole sleep, which was a couple of hours longer than my usual rest (Wasson 1968: 244).

Gordon Wasson himself reported a tendency towards sleep in his own experiments with *Amanita muscaria*, and periods of sleep have been reported elsewhere as a consistent symptom of *Amanita muscaria* ingestion (Cosack 1998; Irimoto 2004; Saar 1991).

According to Snorri Sturlson, Odin could change shape and send his spirit out on errands “while his body lay as if asleep or dead” (MacCulloch 1930: 47). This sort of spirit travel is a common feature of shamanism, yet the description of Odin appearing as if asleep or dead, while having a supposedly “ecstatic” experience, is particularly suggestive given his close association with the inebriating Mead of Inspiration. Interestingly, shamanic practices among the Saami [\*301] share similarities with this description of Odin’s spiritual travel. The practices of the Saami are of particular interest since they are reported to have used *Amanita muscaria* as a shamanic inebriant (Itkonen 1946), and because they are linguistically related, as members of the Uralic language family, to Siberian tribes that continue to use *Amanita muscaria* today. During shamanizing it is reported that the Saami shaman “falls down dead” (Backman & Hultkrantz 1978: 45). As the shaman lays “as if asleep or dead” he completes his shamanic tasks and afterwards wakes up in a sweat, as if he had been involved in some strenuous activity (Backman & Hultkrantz 1978: 102), perhaps suggesting the muscarinic effects of *Amanita muscaria*. It is plausible that shamanic practices, and perhaps use of *Amanita muscaria*, were introduced to the Germanic peoples by the Saami.

Another example of mystical slumber is provided by a Pahlavi translation of the *Avesta*, which describes an event where Zoroaster falls into a seven day slumber after consuming a substance described as “liquid omniscient wisdom” (Flattery & Schwartz 1989: 21). Flattery and Schwartz (1989: 23) proposed that this liquid represents Soma, and maintained that “the Pahlavi accounts show that sauma (Soma) brought about a condition outwardly resembling sleep in which visions of what was believed to be a spirit existence were seen.” While the original identity of Soma was almost certainly lost by the time the Pahlavi texts were written, it is possible that

Zoroaster's sleep following consumption of Soma is a remnant of earlier accounts of Soma's properties.

The infamous Berserker rage, detailed above, is also described as being followed by a period of feebleness and lassitude, a state which was said to persist for a day or more (Fabing 1956). A similar description of the Celtic warrior CuChulaind is provided by Thomas Riedlinger (1999) who recounts an episode where CuChulaind's battle-fury is followed by a year-long torpor filled with visionary and prophetic dreams. The combination of agitation and feats of strength with periods of lassitude and sleep in accounts of the Berserkers and tales of CuChulaind are clearly suggestive of *Amanita muscaria* use. [\*302]

While little is known about the pharmacological mechanisms that induce these periods of sleep, the ethnographic record and accumulated anecdotal reports appear to suggest that a period of slumber is a common symptom produced by *Amanita muscaria* inebriation. This "sleep effect" provides us another tool which can be used to further bolster theories regarding use of *Amanita muscaria* in the historical record.

## **THE SACRED TREE & THE MUSHROOM**

The *Amanita muscaria*, as a mycorrhizal mushroom, only grows in association with particular trees, a feature that may have become apparent to cultures with traditional uses of the mushroom. In Siberia, the *Amanita muscaria* grows in association with birch, which figures as the world-tree within the cosmology of several Siberian tribes. Dried *Amanita muscaria* are often kept wrapped in birch cloth or birch containers. In certain Siberian myths, an eagle is described as perched in the tree, while a serpent dwells at its base, an image which is paralleled in Germanic myths of the world tree. Interestingly, the name for the Germanic World Tree, Yggdrasil,

translates as Ygg=Wotan (Odin), drasil=horse, or Wotan's horse (Leto 2000). This dual identity of Yggdrasil, as both the World Tree and as Wotan's horse, suggests that the horse's saliva, which gives birth to *Amanita muscaria*, fell to the base of the World Tree, perhaps demonstrating recognition of the symbiotic relationship between *Amanita muscaria* and the sacred tree.

While mushrooms are never clearly discussed in relation to the World Tree, Mimir's Well of Wisdom is described as residing under one of its roots. It is from this well that Odin receives the gift of poetic inspiration. Another interesting story is provided in the *Havamal*, where Odin is described as sacrificing himself on a tree (presumably the World Tree). Odin hangs on the tree for nine days without food or water, before discovering the sacred runes at the base of the tree. The story contains clear shamanic implications, [\*303] suggesting a period of fasting before receiving a vision, and is also suggestive of the first stage of preparing the mushroom, dehydration. The lack of food and water can potentially be seen as having the dual meaning of shamanic fasting, as well as desiccation of the sacrament, as personified by Odin. Each of these stories suggests that something important may be found at the base of the World Tree, and when taken together the implication that a sacred inebriant will be found growing at the base of the tree is powerful. That *Amanita muscaria* is clearly specified in one of these stories is a further indicator that the properties of this mushroom were understood, and held in high esteem, perhaps representing both the contents of Mimir's Well as well as the runes themselves.

Celtic mythology also associates intoxicating "berries" with trees. In "The Voyage of Maelduin," a tree with magical berries is encountered on a mystical island (Laurie & White 1997). The berries, which produce intoxication and sleep, are described as large as an apple with a tough rind, a description which fails to bring to mind any known fruit trees in Ireland, or the British Isles more generally (Laurie & White 1997). The fact that these berries are found on an island has

potentially important implications. With most of Ireland's forests depleted over a thousand years ago, the last remnants of Irish forests would be found on islands (Laurie & White 1997). Because *Amanita muscaria* requires a symbiotic relationship with trees to grow, the mushroom would have been rare on the Irish mainland.

The issue of deforestation is also significant in the case of Iceland and the disappearance of the Berserkers. Iceland had dense forests when it was first settled in 870 CE, but most of these forests had disappeared by 1123 CE when the Berserker rage was outlawed (Laurie & White 1997). Accounts that the Berserkers disappeared around this time perhaps have less to do with the outlawing of "going berserk," and more to do with the lack of forests. Without forests, *Amanita muscaria* would have become unavailable, and cases of *Amanita muscaria* intoxication would have disappeared. [\*304]

In Mexico there also appears to be a connection between trees and some mushrooms. In the *Annals of the Cakchiquels* there is reference to use of "mushrooms [which grow at the foot] of the trees" as a sacrifice to one of the gods (Recinos & Goetz 1953: 83). In the *Vocabulario Castellano-Zapoteco*, a Zapotec lexicon compiled by Fray Juan de Cordoba, there is a reference to an intoxicating mushroom, *nocuana peneeche*, which apparently grew in trees (Wasson & Wasson 1957: 228). There is also, of course, the story of Hun Hunahpú whose head is hung in a tree, and whose expectoration later results in the birth of the Hero Twins. In this case, Hun Hunahpú's head could potentially be seen as an embodiment of the mushroom.

More convincing, however, is a myth that comes from the Tzutuhil, telling the creation story of the god Maximon. In this story the Nahuales, gods of the Tzutuhil, were looking for a tree that could rule over the men of earth, and learned of a tree surrounded by mushrooms that grew at the base of a volcano (Lowy 1981). Upon approaching the tree, a great wind arose and the tree was

struck by a bolt of lightning, splitting the tree. Inside the tree an ambiguous countenance was encountered which was then carved into the figure of Maximon. When Maximon was fully formed he was imbued with special powers by the Nahuales. A deaf mute was brought from the village to test Maximon's healing powers. Maximon gave the man a piece of a mushroom found growing at the base of the tree, thereby curing the man of his condition (Lowy 1981). Again, we find a connection between a sacred tree, which gives birth to a god, and healing mushrooms that appear to grow in association with the tree. Interestingly, *Amanita muscaria* is known among the nearby Quiche Maya as Kakuljá, or lightning bolt (Lowy 1974; Lowy 1981), which provides another potential connection between *Amanita muscaria* and the legend of Maximon.

### **MUSHROOMS & MYSTICAL BIRTH**

The growth patterns of mushrooms are difficult to view since they come and go so quickly, appearing and disappearing overnight as if [\*305] by magic. Their apparent lack of seed is another feature that was likely observed by early peoples who encountered them, perhaps providing further mystery as to the origin of these strange organisms. Wasson asserted that the lack of any mention of roots, leaves, blossoms or seeds in association with descriptions of Soma was highly suggestive of a non-plant fungal candidate. Regarding seed specifically, Wasson pointed out that “there is positive evidence that Soma was thought to lack seed: Soma was procreated from on high, the Somic germ having been placed by the gods” (Wasson 1968: 18). Wasson later went on to discuss Aja Ekapād, a deity connected with Soma, whose name roughly translates as “un-born single-foot” (Wasson 1971). The name suggests both a type of miraculous birth or origin, and can also be seen as an anthropomorphism of a mushroom, which has only “one foot.”

Among the Mazatec in Oaxaca, Mexico, mushrooms are referred to as *si to*, or “that which springs forth” (Wasson & Wasson 1957: 251). A similar idea, of “springing-forth,” also occurs in Germanic mythology in descriptions of how the world was born. According to myth, Odin and his brothers slayed the giant Ymir, and from his body the world was created. Dwarfs, who would later create the Mead of Inspiration, spontaneously appeared “like maggots from the flesh of Ymir” (Leto 2000: 61). This story is noteworthy not only because of the connection between dwarfs and the Mead of Inspiration, but because the miraculous appearance of the dwarfs parallels the miraculous appearance of mushrooms. It is not insignificant that the dwarfs are compared to maggots, organisms that occur abundantly in mature specimens of *Amanita muscaria*, and other mushrooms. The apparent embodiment of the mushroom in the dwarfs is also significant because of the characteristic hallucinations [\*306] of size distortion caused by both *Amanita muscaria* and *Psilocybe* mushrooms.

### **SIZE DISTORTION**

The effect of mushrooms on perceptions of size was most famously illustrated by Lewis Carroll in his classic book “Alice in Wonderland.” It is generally believed that Carroll’s description of a mushroom that could make one either large or small was inspired by accounts of *Amanita muscaria* use in Siberia. One such account may have come from Stepan Krasheninnikov (1755), who described how a man under the influence of *Amanita muscaria* “might deem a small crack to be as wide as a door, and a tub of water as deep as the sea.” While perceptions of space are clearly affected, another interesting feature is the prevalence of diminutive beings in *Amanita muscaria* visions.



In Siberia both the Chukchee and Yurak report visions of “Fly Agaric Men,” dwarf like creatures that look like mushrooms, with no neck or legs, that sometimes guide bemushroomed individuals on journeys, and other times are the source of mischief (Bogoras 1904-1909; Lehtisalo 1924). It is believed that the number of these mushroom spirits one encounters depends on the number of mushrooms consumed. As a result, it has become practice among Yurak shamans to eat only two and one-half mushrooms, and in this way they can keep up with the half-man while on their journey (Lehtisalo 1924). Similar mushroom spirits are recognized by the Khanty, and other Siberian tribes (Saar 1991).

In Japan, the *Amanita muscaria* is known as beni-tengu-take, or long-nosed goblin mushroom. The Tengu, or goblins, are considered trickster spirits in Japan. While pickled *Amanita muscaria*'s are consumed in Japan without effect, no traditional uses of the mushroom for its psychoactive properties are known. Nonetheless, the name of the mushroom suggests a level of familiarity with its peculiar properties.

As mentioned previously, Dwarfs are responsible for the creation of the Mead of Inspiration, which was made by mixing honey [\*307] with the blood of Kvasir. Dwarfs are strongly associated with the underworld and appear as anthropomorphized mushrooms in the myth describing the creation of the world. Interestingly, giants are also closely associated with the Mead of Inspiration. The giant Suttung extorts the Mead of Inspiration from the Dwarfs, and keeps it hidden within his mountain home where it is eventually retrieved by Odin. More recent Germanic folklore connects mushrooms with elves, specifically with the elf-king who is commonly depicted as resting under a toadstool. According to folklore, it is said that “whoever carries a toadstool about him grows small and light as an elf” (Nichols 2000: 114; *citing* Grimm 1966: 1412).

## MUSHROOMS & LANGUAGE

With Soma, the Mead of Inspiration, and among other implied sacraments, there is a strong connection between inebriation and the production of language. Indeed, the ninth book of the *Rig Veda* is full of hymns dedicated principally to the god and sacrament Soma. Soma, in the *Rig Veda*, is connected with exalted speech and with the origins of poetry. The Mead of Inspiration, sometimes referred to as the Mead of Poetry, is said to provide “poetic inspiration” to those who consume it (MacCulloch 1930). A connection between language and the Germanic sacrament is also apparent in the myth of Odin’s self-sacrifice on the World Tree, where he hangs for nine days and nights without food and water before discovering the Runes, an early Germanic form of written language.

Among the Celts there is also clear mythology that connects the ideas of poetic inspiration with sacred inebriation. In Celtic mythology there is a story of a tree that drops “hazelnuts” of knowledge into a nearby spring, producing what the Celts referred to as either *bolg fis*, or *bol imbais*, which respectively translate as “bubbles of wisdom” and “bubbles of poetic inspiration” (Laurie & White 1997: 57). According to Laurie and White (1997), the term *bolg* is often found in Irish and Scots Gaelic names of mushrooms, suggesting a possible link between mushrooms and bubbles of wisdom. In a related story, [\*308] “The Boyhood Exploits of Finn,” Finn MacCool travels to learn poetry from Finn Éices. The boy is asked to catch and cook the salmon of Féc’s pool, but told not to eat any part of it. Unbeknownst to the boy, the salmon has fed on the “bubbles of wisdom,” and will transfer knowledge to anyone who consumes it. While cooking the fish Finn accidentally burns his thumb, in response the boy places his thumb in his mouth and inadvertently absorbs the power and knowledge of the fish. In this way, Finn becomes a poet, and master of language.

Notably, a direct connection between mushrooms and language can be found among Siberian groups with traditional uses of *Amanita muscaria* and also among Mexican groups who use *Psilocybes* in divinatory and healing rituals. Among the Khanty of Siberia, *Amanita muscaria* plays an important role in the recitation of heroic epics and in the production of ritual song. Storytellers will consume several mushrooms in order to inspire their performances and to “sing heroic epics in a ferocious voice all the night long” (Saar 1991: 164). The *chirta-ko*, a specific type of Khanty shaman, will sing and drum as part of traditional divination rites. Each *chirta-ko* has his own mushroom song, which is understood to be spontaneously bestowed by the mushroom. It is believed that “each fly agaric (*Amanita muscaria*) song is different because it is that particular fly agaric that gives the words to the shaman’s song” (Wiget and Balalaeva 2001: 87).

In Mexico, the Mazatec believe that “he who eats these mushrooms (*Psilocybes*), if he is a man of language, becomes endowed with an inspired capacity to speak” (Munn 1973: 88). In interviews with Álvaro Estrada (1981), María Sabina recounted how she received a book of wisdom from the mushrooms, and how she cured “using the language of the children,” as the mushrooms are called by the Mazatec (Estrada 1981: 49).

Unlike many of the other traits discussed in this chapter, which are distinctive of *Amanita muscaria*, the connection between mushrooms and language production does not appear to be entirely unique. The use of song and percussive instruments are prevalent in psychedelic forms of shamanism, and also prevalent in religious uses [\*309] of related inebriants. Song plays an important role in ceremonies of the Native American Church, which uses peyote as a sacrament, and both song and chanting play an important role in the Brazilian ayahuasca religions. Additionally, the apparent miraculous birth of mushrooms also extends to *Psilocybes*, as well as the visual impacts on perceptions of size. While some of the discussed traits can be extended to

other psychedelic candidates, I propose that the above traits, when considered as a complex, can ultimately provide an increasingly compelling basis for theories identifying historical uses of *Amanita muscaria*.

## CONCLUSION

Due to their soft bodies and ephemeral nature, it is unlikely that biological evidence of mushrooms will ever be discovered in the archaeological record. This fact poses certain difficulties in determining the antiquity of modern cultural uses of psychoactive mushrooms, like those in Mexico and Siberia, and makes it even more difficult to determine whether psychoactive mushrooms were recognized and used by historical culture groups that are now extinct. These limitations, however, should not discourage investigations into promising lines of inquiry. While the true identity of sacred and long-lost inebriants might never be determined to a 100% degree, reasonable theories can be developed through a holistic approach that investigates not only visual, cultural, geographic, archaeological and textual components, but which also take into accounts peculiarities of biology and pharmacology, and how these features might have been understood or perceived by historical cultures.

Even though Wasson was not an anthropologist, or a historian, his approach to his investigations were generally measured and thoughtful, combining data from historical texts, and both the ethnographic and archaeological record, in addition to his own on-the-ground data collection. While Wasson's investigations into the identity of the *Vedic Soma* were groundbreaking, his line of argumentation was limited by an incomplete understanding of the pharmacological properties of *Amanita muscaria*. In the preceding pages I have endeavored to detail the variety of unique pharmacological and biological properties of *Amanita muscaria* and,

through examples based on historical cultures in India, Mesoamerica and Europe, to illustrate how the idiosyncratic properties of *Amanita muscaria* can be used as tools to help flesh out theories attempting to identify historical and ritual [\*310] uses of this mushroom. While many of the examples provided are speculative, they all suggest that a more comprehensive examination of these historical cultures may bear *fruit*. New investigations with an eye to *Amanita muscaria*'s unique properties, including evidence of appropriate detoxification methods, muscarinic symptoms, and variations between feats of strength and slumber, may help to bolster existing theories regarding historical uses of *Amanita muscaria*, as well as to develop promising new lines of inquiry.

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