

Further Reflections on *Amanita muscaria* as an Edible Species

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Over twenty five years ago, a tiny perfect grisette seduced me into the world of mushrooms. Barely three inches tall, it glowed pearly gray and grew from the middle of my favorite Bay Area hiking trail. The sight of it drew me to my knees. It was too beautiful to disturb, so I sketched it on a bank deposit slip, the only scrap of paper that I had with me. I carried that paper in my wallet for years and eventually identified it as a grisette, a member of the *Amanita vaginata* group, one of the many edible amanita species found here in California.

The hook was set, and amanitas in the wild continued to intrigue me. I obsessively read mushroom field guides, paying particular attention to the amanitas. A desire to eat what I had tentatively identified as a "Coccora" (*Amanita calyptroderma*), a locally popular edible amanita, coupled with a strong sense of self-preservation, caused me to join a local mycological society and begin my mushroom studies in earnest.

Since then, I have become a proponent of the safe and mindful collection and consumption of various edible California amanita species, as well as a mushroom poison identifier and mushroom educator, and I continue to have an abiding passion for all of the members of the genus *Amanita*. It was therefore with great interest that I first learned of the paper discussing *Amanita muscaria* and its use as food by William Rubel and David Arora, in the October 2008 special mushroom issue of the journal *Economic Botany*.

For as long as I have known him, David Arora has recounted the story of the modern day treatment of *muscaria* as an edible species in the Nagano Prefecture of Japan. Along with many others who attended his lectures and forays, I was fascinated by the concept. I was also aware of the many instances of serious *muscaria* poisonings that have occurred both through the ages and in modern times, so I was curious how their argument in the *Economic Botany* paper would proceed.

The title of the article was "A Study of Cultural Bias in Field Guide Determinations of Mushroom Edibility Using the Iconic Mushroom, *Amanita muscaria*, as an Example." The authors start by noting that there is a

broad scientific acceptance that *muscaria* toxins are water soluble, and that there are a few isolated practices of people around the world detoxifying and eating *Amanita muscaria*. From this they conclude that somehow "cultural bias" causes North American field guide authors to continue to list *muscaria* as a poisonous rather than edible species (Rubel, Arora, 2008).

But is this really a case of "cultural bias," or is it just good, common sense?

The basic hypothesis of field guide authors' mushroom edibility bias is sound. Any mushroom book that deals with edibility preferences is subject to the whims of its author: their culinary experience, personal judgment, and prevailing opinions all help to determine poisonous and edible designations. Since no one wants to recommend a mushroom that might be harmful to others, it is in everyone's best interest for field guide authors to err on the side of caution, even if you might be aware of exceptions to the rule.

As I read Rubel's arguments and selected quotes in his *muscaria* paper, my uneasiness grew. His several attempts to redefine the word "poisonous" so that it didn't apply to *muscaria* were disturbing. His suggestion that future mushroom book authors should list *muscaria* as an edible species, and that it would be perfectly unremarkable to do so, was also troubling. Do we really want to encourage folks to use less caution about known poisonous species, even if, as mycophagists of long standing, we may know of ways to circumvent these poisons? And finally, I wasn't buying the premise that *muscaria* was commonly accepted as a perfectly safe edible species anywhere in the world.

Amanita muscaria is one of the most beautiful and eye-catching mushrooms found any where. Although *muscaria* is a seriously toxic mushroom, its most abundant toxins - ibotenic acid and its decarboxylation by-product muscimol - are water soluble, and can be leached from the mushroom flesh through careful and prolonged boiling.

Let us note in passing that this method of preparation of course does not work for the deadly, amatoxin-containing, world-spanning amanitas collectively called "Death Caps" and "Destroying Angels." The highly stable and supremely toxic amatoxin molecule is impervious to heat, cold, or acid bath. Amatoxins cannot be removed from mushroom flesh through par-boiling or any other sort of heat or cooking process. Certainly, no one would want to have novice amanita mycophagists generalizing the *muscaria* parboiling detoxification process to these sorts of unequivocally deadly, albeit also delicious tasting, amanita species.

As for *muscaria*, it is true that very small numbers of people around the world have indeed discovered that it can be made edible through careful and sometimes elaborate preparation; but it is also imperative to remember to throw out the water into which the toxins were leached. One American couple who forgot to do so became seriously intoxicated, to the point of damaging both themselves and their household (Beug, 2010)!

Field Guide Bias Si! *Muscaria* as a Safe Edible Species No!

On these basic points (water soluble toxins in *muscaria*, field guide bias) I think that we can all agree. But rather than going on to demonstrate how most field guide authors show bias in all of their edibles' designations, the Rubel/Arora paper chose to present an elaborate justification for the treatment of *muscaria* as a perfectly safe edible species. The authors based this hypothesis upon the evidence that they selected, but I will show that this evidence is incomplete and therefore insufficient for declaring *muscaria* to be a perfectly safe edible species.

As an intellectual exercise, digging through dusty tomes to find a few scattered references to folks who ate *muscaria* as food in the course of history can make interesting reading. Conjecture can be strengthened by selective examples to support a hypothesis. However, it is difficult to prove a hypothesis beyond the shadow of doubt through the fog of centuries. What becomes troubling is when this conjecture and conflation of anecdotal evidence gets stamped with the imprimatur of someone of David Arora's stature, a man to whom many look for answers to mycological questions, especially in terms of mushroom edibility.

The authors' central hypothesis of the purported safe edibility of *Amanita muscaria* soon left the relative obscurity of subscribers to *Economic Botany*, and traveled to the boundless territory of the Internet, with links to the paper on both Rubel's and Arora's websites, in addition to many other places online, such as Wikipedia,

Springerlink.com, Ingentaconnect.com, Discoverlife.org, Tititudorancea.org, etc.. Now the paper, with what I believe to be major misconceptions, was being referenced by a wide variety of mushroom enthusiasts worldwide as "common knowledge," and a recipe for the "safe" preparation of *muscaria* was freely shared.

"Edible" *Amanita muscaria*: A Recipe for Disaster?

As public educators, on a topic that is mostly unknown here in North America, I believe that we must consider the impact of our words. Although many experienced mushroomers are aware of the fact that it is possible to remove the toxins from *Amanita muscaria*, it is naïve at best to assume that people will always carefully follow a recipe, especially one that includes a potentially dangerous mushroom. Ironically enough, even the original *muscaria* detoxification recipe that Rubel and Arora provided in the *Economic Botany* article had important numerical conversion errors, listing 250 gm. of *muscaria* as the equivalent of 4 ounces. In the online version of this paper, linked to from his website, Arora changed the amount of *muscaria* in the recipe to the correct weight of 110 gm. (Arora, 2009).

Yet even a perfectly reasonable recipe can have unreasonable translation into a real-time meal. If many folks have difficulties following any recipe, why start with a troublesome and sometimes even dangerous ingredient? I know of at least four folks who had unpleasant experiences after attempting to detoxify *muscaria* at home. One told me of her experiences directly, another wrote it up in great and glorious detail online (Konecney, 2009), and two others published their story in *Mushroom, the Journal of Wild Mushrooming* (Millman, Haff, 2004). Even the recent book *Mycophilia* by Eugenia Bone describes a less than ideal experience (waking up in a chair not remembering anything) after eating *muscaria* as an "edible" species, with two well known Western amateur mycologists who brought the *muscaria* to her vacation home in Colorado (Bone, 2011). Do you think they got the recipe wrong, too, or perhaps didn't care if it ended with the diners in a *muscaria* dream state?

What seems to be a fairly obvious factor that the authors failed to consider was this: the vast majority of folks who would even want to try *muscaria* as an edible are undoubtedly already primed for eating *muscaria* as an entheogen (in layperson's terms: to get high). In other words, they would have even less reason to want to follow exactly the elaborate procedures necessary to make this mushroom wholly non-toxic. For these "psychonauts," a nice, neurotoxic poisoning could be looked upon as a bonus. Pity those poor folks who just want a nice mushroom meal for their families, though, and not a trip to the emergency room. Wouldn't a bit of warning be in order for them?

Redefining Poisonous to Exempt *Muscaria*

According to Rubel, one shouldn't even consider *muscaria* to be poisonous, at least in the strict sense. After all, a small piece won't kill you (Rubel, Arora, 2008). But in fact, although seldom fatal (its deadly designation in many older field guides does indeed seem like "overkill" to most) *muscaria* can certainly be dangerously toxic.

I botenic acid-containing mushrooms (*Amanita pantherina* and *A. muscaria* and their close relatives) are a major cause of serious mushroom poisonings, especially in the Pacific Northwest, often resulting in hospitalizations (Benjamin, 1995; Beug, 2006; Spoerke *et al*, 1994). Usually, these poisonings are self-limiting. The folks who were poisoned, regardless of the reason the mushroom was eaten, have no wish to repeat the experience.

Recent North American Deaths Linked to *Amanita Muscaria* Ingestions

Sometimes the unforeseen results of eating *muscaria* are more serious than "merely" an unpleasant poisoning and hospital stay. The National Poison Data System for 2004, established by the American Association of Poison Control Centers (AAPCC), listed a fatal outcome for a young man who ate 6-10 freeze-dried *muscaria* caps (Watson, 2004). He was discovered in cardiac arrest, and died 10 days later from anoxic brain injury. Another fatal *muscaria* poisoning case from 2007, recounted in a NAMA Toxicology Committee Report in the 2009 issue of *McIlvainea*, tells of an otherwise healthy young man who died twelve hours after ingesting 6 or 7

muscaria caps. After falling into a *muscaria*-induced swoon the night before, he was found dead in bed the next morning. The medical examiner who autopsied the corpse labeled it death by mushroom poisoning, since he could find no other contributing cause of death (Beug, 2009), although since there were other drugs involved, the exact cause of death remained unclear (Beug, 2012).

Blithe assurances of the safe and unremarkable edibility of *muscaria* would be cold comfort indeed to the families of the two separate cases of young men who ate *muscaria* and then fell into comas. While in this helpless state, one froze to death while camping, and the other died after aspirating vomitus (Beug, 2006).

In a more recent case, recounted to me by Marilyn Shaw, toxicology expert and poison identifier for the Rocky Mountain Poison Control, a young man in Aurora, Colorado narrowly escaped death when he was discovered naked and unconscious, with a severely lowered body temperature and in cardiac arrest, after the recreational ingestion of *muscaria* (Shaw, 2012).

Who knows how many other incidental deaths after *muscaria* ingestion there may have been? Testing for muscimol levels is hardly part of a coroner's normal toxicology panel (Benjamin, 2012).

Recent *Muscaria* Deaths in the Southern Hemisphere

Documented deaths from the ingestion of *Amanita muscaria* are not restricted to North America. Formerly found only in the Northern hemisphere, *Amanita muscaria* has been inadvertently introduced to the Southern hemisphere in *Pinus* tree farms, producing a novel, toxic species of red amanita in places where no ibotenic acid-containing amanitas have been found before. This has had tragic consequences in Tanzania, where locals had safely gathered a number of choice, edible amanita species for many generations, without a thought to careful identifications. Often only the amanita caps were gathered, leaving the bases buried. A *muscaria* cap in age, with its warts removed and with a striate margin, can closely resemble local edible species in Amanita section *Caesarea*.

While Finnish mycologists were in Tanzania describing some of these local, edible amanita species for science, they consulted on a *muscaria* poisoning case, where two women and a child were poisoned and in hospital. After reassuring doctors that the poisonings would resolve on their own, since that was indeed their experience with *muscaria* poisonings in Scandinavia, they were horrified to learn that one of the women died from her meal the next day. Upon further interviews with other Tanzanian locals gathering amanitas, they discovered even more recent *muscaria* deaths (Harkonen, 1994).

Our Most Famous North American *Muscaria* Fatality

If one is willing to go back a little over a hundred years ago, you discover the unfortunate death of Italian diplomat Count de Vecchj, who requested amanita mushrooms from the Virginia countryside for his breakfast, believing them to be local examples of *Amanita caesarea*. Unfortunately, the mushrooms that were brought to and consumed by the Count were not the choice, edible *caesarea* of Italy, but the toxic *muscaria*, and the Count ate a gluttonous meal of somewhere between a dozen and two dozen caps, which resulted in convulsions so great that he broke his hotel bed (Rose, 2006).

The Count, who prided himself upon his mushroom identification skills, died from his meal. Out of his death and its ensuing lurid and widespread publicity, sprang a renewed North American interest in mushroom societies, especially in the Northeast, to provide much needed public education about edible and poisonous wild mushrooms (Rose, 2006).

On the face of all of this evidence to the contrary, it is disingenuous at best to consider *muscaria* to not be a poisonous mushroom. But poisonous is an off-putting word, pleads Rubel, a fan of *muscaria* eating to be sure.

Evidence for *Amanita muscaria* as a Poisonous Mushroom

In his *muscaria* paper, Rubel states: "Listing *A. muscaria* as edible rather than poisonous is a completely unremarkable judgment in a culinary context." Here is how Rubel describes the effects of *muscaria* ingestion on his website:

"*Amanita muscaria* is not poisonous in the sense that it can kill you. It is poisonous in the sense that if not parboiled in plentiful water (the "toxins" are water soluble), then raw or undercooked mushrooms eaten (in moderation) will cause you to become inebriated and possibly nauseous" (Rubel, 2011).

The above statement assumes that future *muscaria* eaters, perhaps lulled into complacency by assurances that *muscaria* isn't *really* poisonous, will use moderation and carefully follow a recipe. But wouldn't a stronger emphasis on its very real toxicity be a better way to get any future *muscaria* mycophagists to be cautious in its preparation and consumption? Or maybe reject the idea of eating *muscaria* as an edible species altogether?

Here's what the *Emergency Physicians Monthly* website had to say about *Amanita muscaria* and the many ibotenic acid poisonings that they have collectively observed:

A toxic dose in adults is approximately 6 mg. muscimol or 60 mg. ibotenic acid - the amount found in one cap of *Amanita muscaria*. However, the amount and ratio of chemical compounds per mushroom varies widely from region to region and season to season. Spring and summer mushrooms have been reported to contain up to 10 times as much ibotenic acid and muscimol compared to autumn specimens. Toxic components are not distributed uniformly in the mushroom. Most of the muscimol and ibotenic are contained in the cap or pileus. A fatal dose has been calculated at approximately 15 caps.

Fly agarics are known for unpredictable clinical effects which can be highly variable between individuals exposed to similar doses. Symptoms typically appear after 30 to 90 minutes and peak within three hours. Certain effects can last for days, but the majority of cases completely recover within 12 to 24 hours. Unlike other toxic mushroom ingestions, vomiting is uncommon. Patients may exhibit ataxia, auditory and visual hallucinations (described as sliding vision and "the ability to see through walls"), as well as hysteria. Central nervous system depression, coma, myoclonic jerking, hyperkinetic behavior, and seizures have been described in larger doses. Retrograde amnesia and somnolence can result following recovery. (Erickson, 2010)

Whoa, that sounds rather more unpleasant than "inebriation" and "mild nausea," doesn't it?

Let's take the informed opinion of another North American mycologist and toxicologist, Michael Beug, PhD. Beug fields poisoning calls in the Pacific Northwest, where muscimol poisonings account for the majority of all serious mushroom poisonings. He had also heard that some Russians living outside Moscow eat detoxified *muscaria* as an edible species (through the work of R. Gordon Wasson and later from Dr. Daniel Stuntz), but he doesn't know how many do so, nor to what degree this is practiced. Here is what Beug had to say about eating *Amanita muscaria*:

Both *Amanita muscaria* and *Amanita pantherina* are large, showy, and delicious, though poisonous mushrooms (unless cooked by boiling them and then discarding the water, but if you don't get rid of *all* the water, look out!). Though some people in Russia apparently parboil and eat *Amanita muscaria*, it is not a practice I recommend. *Amanita muscaria* and *Amanita pantherina* are frequently eaten intentionally by people seeking to get high and are also frequently eaten by mistake (believe it or not, often from people thinking they had an *Agaricus*). The "trip" from *Amanita muscaria* and *Amanita pantherina* is generally not pleasant and involves hospitals more predominately than hallucinations. (Beug, 2004)

Attitudes about Eating *Amanita muscaria* from Outside of North America

A very different viewpoint of Russian fungal proclivities is provided by Gary Lincoff, mycologist and author of *The Audubon Society Field Guide to North American Mushrooms*. Lincoff and a group of 15 or so others traveled to the Kamchatka Peninsula of Russia in 2004 and 2005. Their purpose was to investigate firsthand the statements made by Gordon Wasson about *Amanita muscaria* use in Siberia, taken from his 1968 book, *Soma: Divine Mushroom of Immortality*. Here is what Lincoff had to say about local attitudes towards *muscaria*:

The hunter-gatherer peoples differ from the Russians in many ways but none more dramatic than in their use of mushrooms. The Russians hunt many kinds of edible mushrooms but avoid one mushroom in particular, the fly-agaric, *Amanita muscaria*, which they regard as very poisonous. In fact, it is used in Russia and Europe as a fly-killer: the mushroom is placed in a cup of milk to which flies are attracted and become numbed. The hunter-gatherers, on the other hand, collect and eat just one single mushroom, the same fly-agaric that the Russians avoid. (Lincoff, 2005)

The Eastern Siberian Koryak and Even (or Evensk) tribes, the hunter-gatherers to which Lincoff refers, eat their *muscaria* sun-dried and uncooked, for maximum mind-altering potency. It is used as a sort of tonic within that traditional society, especially by the elderly. It is not eaten as a food species, but as medicine.

Russian mycologist Tatiana Bulyankova, a scientist from Western Siberia who has been contributing field observations to the popular website Mushroomobserver.org, sent me a long letter about firsthand Russian mushroom eating practices. She also spoke laughingly about how in Russia, American field guide authors were roundly ignored, and warned me that it was pretty impossible to generalize anything about a country the size of Russia, or as she put it, 1/7 of all land mass. Point taken, Tatiana!

Here is what she had to say about *Amanita muscaria*:

The Fly Agaric, predictably, is very common here (and everywhere else in cold to temperate-climate Russia, I guess). It is the symbol of all toxic mushrooms here, I'd even say it's the symbol of poison. It's featured in countless books, cartoons, artworks... everyone knows that it's poisonous. Of course there are young idiots who try it as a recreational drug but that's a bad influence of the Internet, I guess. It's also consumed by tribe shamans of Yugra, Yakutia and other Northern territories but it's something I've only read in the books. (Bulyankova, 2011)

I think we may safely draw the conclusion that even in obsessively fungiphilic Russia, the commonsense cultural bias is *against* eating *Amanita muscaria* as an edible.

A quick survey of various field guides and online sources where the eating of *muscaria* as an edible species is mentioned shows very little empirical or even local evidence to bolster the claims - most *muscaria* eating was reported from elsewhere. A modern Lithuanian field guide stated that *muscaria* was poisonous, but also: "eaten in mountainous France and Austria." No word about Lithuanian edibility practices, though, despite an apparent historical tradition of *muscaria* inebriation.

The main market for *muscaria* in Eastern Europe seems to be in high potency, dried *muscaria* caps, harvested in Latvia and Bulgaria, and then sold online for "scientific purposes." Beware of what is sometimes deadly home research.

George Atkinson, in his 1900 mushroom book *Studies in American Fungi*, claimed that *muscaria* was: "eaten as food in parts of France and Russia, and sometimes in North America," but again, this is repeating information drawn from other sources without explicit verification of facts.

Bruno Cetto's more recent Italian mushroom guide, *I Funghi dal Vero*, Vol. 1, claims that *muscaria* was "eaten cooked and pickled in Russia, France and the Lake Garda region" of Italy. Again, there is no verification of these claims; and the information appears to be merely copied from one source to another without citation. There may well be a very few folks in Russia that eat *muscaria* as an edible species, and perhaps Pouchet

(detailed later in this essay) managed to convince some of the poor to do so in France as well, but these are hardly widespread practices.

A Food of Desperation in Italy

Attempting to track down some of the Italian *muscaria* eating references from the Lake La Garda region, (prior to WWII), I came up with the following, from Pierluigi Cornacchia's online article, "*L'Amanita muscaria in Italia*". This modern day writer remarks upon the difficulty of tracking down these old references, even within Italy, and lists many local variations of common names for *muscaria*, all of which refer to its poisonous properties. Here are two quoted instances where locals in the past had detoxified and eaten *muscaria* (Cornacchia, 2006):

F. Cavara (1897) confirmed that in Vallombrosa (Firenze) *Amanita muscaria* was commonly consumed and stated, "I can assure you that many report, in some countries of Tuscany, for example above Pontassieve, in late autumn, this agaric is harvested in quantity and put to soak in basins where water is changed every day, for 10 or 12 days, after that is treated like other edible fungi and found excellent. It helps [in the preservation] that the season is cold."

This information has been verified directly in the field. I have been collecting testimonies of elderly inhabitants of the villages of Reggello, Saltino, Pian di Melosa and Vallombrosa. The ovolo malefic ["evil egg"],¹ as it is called in those parts, was usually consumed after appropriate preparations (boiling with vinegar, salting, rinsing with running water). According to the testimonies, the use of this fungus as food, which lasted until the beginning of World War II, was due solely to the economic problems.

¹ Presumably the good mushroom eggs in that part of the country would be caesarea or the Coccora. - LS

In other words, the *ovolo malefic* was a food of desperation, and the preparation needed to make it edible was hardly trivial.

Pouchet's Place in History

Another country for which the historical and "culturally accepted" practice of eating *muscaria* has been claimed is France. Although I could find zero evidence of current *muscaria* eating practices, and in fact a respected French mycologist of my acquaintance scoffed at the very idea (Wuilbaut, 2012), in his *muscaria* paper Rubel devoted a good bit of ink to the work of a Frenchman and scientist who apparently tried to popularize *muscaria* eating amongst the poor in the 1800s: Félix Archimède Pouchet.

Pouchet in his time - like Rubel in ours - equated the preparation of and eating of poisonous *muscaria* to poisonous manioc, a staple food across Africa. Manioc starts out deadly poisonous and is made edible through careful preparation. But this is a poor analogy. Nobody in modern day North America *needs* to eat *muscaria* to survive. Fresh or dried, dangerously poisonous, cyanide containing manioc is often the only high quality starch available to millions, mostly across Africa, where it can be grown in poor soil and under drought conditions. Its deadly toxins also discourage crop predation. But it can have faulty preparation as well, and can cause some very serious illnesses.

Perhaps, like me, you had never heard of Pouchet? He was indeed a respected scientist of his time, and a popular science writer, but also one of the strongest proponents of the theory of spontaneous generation. Would it be safe to hold the rest of his science up to a modern light?

To prove that *muscaria* was a safe edible species, he fed dogs both *muscaria*-infused broth (to show that *muscaria* toxins were water soluble; the dogs died) and boiled and drained *muscaria* (the dogs survived) (Pouchet, 1839). He also claimed to have "fattened dogs" on boiled *muscaria*, but experimental details for that experiment were not available and fortunately for local dogs, none of these experiments were repeated, to my knowledge, by any other researchers. Pouchet's work was widely cited by others at the time (Rubel, Arora, 2008). But do a few dog studies really translate to human safety?

If *muscaria* was such a wonderful and safe edible species, why would Pouchet limit its use to the poor?

Pouchet is best known today for being a fierce public critic of Louis Pasteur, another scientist of the day who publicly disputed the commonly held theory of spontaneous generation. Pasteur was, of course, the French scientist who managed to keep lots of folks from dying in various horrible ways, by creating the process of pasteurization that prevented formerly widespread milk fevers (typhoid and scarlet fever, septic sore throat, diphtheria, and diarrheal diseases) and for creating life-saving vaccines against the scourges of rabies and anthrax (Swayze and Reed, 1978).

Pasteur gave a public demonstration, to which Pouchet was formally invited, to prove once and for all that it was in fact microorganisms, not spontaneous generation, that created life where there was apparently none before. Pasteur gave birth to the science of microbiology.

Pouchet was a no-show at this triumphant exhibition by Pasteur, but he did give us boiled *muscaria* for the poor as *his* legacy.

Sketchy historical evidence, couched in terms of "it is said" and "it is reported that" of *muscaria* eating around the world should not be used to bolster claims of its safety. There is no evidence that it was ever a commonly accepted edible species anywhere in the world, and for good reason.

***Amanita muscaria* Consumption in Japan: Exception not the Rule**

What about in Japan, specifically the Nagano Prefecture, where the consumption of *muscaria* as an edible species is often cited?

I first learned about the unusual practice of mundane (as opposed to ritual) *muscaria* munching in David Arora's annual Mendocino Thanksgiving Foray, an event that I attended, both as a participant and as staff, for over a dozen years running. The story that he told was both fascinating and charming: he claimed to have passed local mushroom hunters along a Nagano mountainside, whose baskets were filled with *muscaria*. Arora's basket brimmed with *Boletus edulis*, and they both looked at each others' finds in horror! Great theatre, but what is the deeper reality?

While visiting the Nagano Prefecture, Arora tried the *muscaria* pickles that are a traditional but in fact seldom eaten food. Nagano Prefecture is the only Japanese province wholly cut off from the sea. The practice of pickling *muscaria* began after "salt roads" were built from the coast into the mountains over a hundred years ago.

In addition to Arora's experiences there, a young man by the name of Allan Phipps, who spoke and understood the Japanese language, spent a good bit of time researching the localized treatment of *muscaria* as an edible species for his Master's Thesis at Florida International University. His results were quite interesting, and showed that eating *muscaria* is hardly typical for the Japanese culture as a whole (Phipps, 2000).

Phipps' thesis showed that local consumption of *muscaria* as an edible species is severely restricted, in both amounts of *muscaria* eaten as well as in general acceptance of the practice. *Muscaria* eating takes place not in the already limited Nagano Prefecture as a whole, but merely as a subset of people in one town: Sanada Town, with a population around 10,000. Within that subset, Phipps located 123 *muscaria*-favorable individuals, and from them he winnowed out ten most likely subjects for interviews (Phipps, 2000, p. 29).

Even more telling, he discovered these interview subjects by attending local mushroom fairs (three per year in Sanada Town), of a similar style to our North American mushroom fairs, with general collecting on one day, identification by local experts on the next, and then public displays with labeled mushrooms. At all of these fairs, within ground zero of *muscaria* eating in Japan, displays of *muscaria* were clearly labeled as poisonous mushrooms! These fairs were sponsored by the Japanese government and local insurance companies in hopes of preventing *mushroom poisonings* (my emphasis). Phipps found his interview subjects by hanging out at the *muscaria* display table and targeting those that scoffed at the poison label (Phipps, 2000, p. 29).

Indeed, within Sanada Town only (adjoining towns within the Nagano Prefecture treat *muscaria* as a wholly

poisonous mushroom) *muscaria* is made into pickles, which have been shown through careful lab analysis to contain zero amounts of toxins. These pickles are then eaten in small amounts, for special occasions such as the New Year.

The process of making them is extremely involved (Phipps, 2000, p. 62). There are four steps to pickling *muscaria*, as relayed to Phipps by Sanada Town *muscaria* pickle devotees: boiling for ten minutes, or five minutes three times, washing, salting and soaking. Mushrooms are often initially boiled until all color is removed; the water is always tossed. After boiling, the mushrooms are rinsed under running water for 1-3 minutes. Mushrooms are then packed in salt and compressed, and left for at least one month. Prior to consumption, pickles were soaked for several hours or overnight to remove the salt (and any remaining traces of the toxins). These *muscaria* pickles were then used as culinary accents, not meals. They were and still are eaten for special occasions only, or served to special guests (Phipps. 2000, p. 37).

But frankly, the above method to prepare a wholly non-toxic snack does not sound like a reasonable recipe for today's modern-day, want-it-now cooks. In fact, the tradition is dying in Sanada Town, because modern Japanese youth can't be bothered to go through all the preparation steps to make a toxic mushroom edible (Phipps, 2000).

Phipps' thesis that unboiled *muscaria* is also grilled and eaten in *small* quantities (Phipps' emphasis) by certain local men. Here is what a subject told Phipps:

"He compared the experience of eating a known poisonous mushroom like *muscaria* to eating fugu, the poisonous blowfish. The combined thrill of eating something poisonous and the outstanding taste makes this mushroom worth the risk."

But only small amounts are ever eaten, and there remains a good bit of paranoia attached to the process, with the men fearful of possible accumulative effects in addition to directly toxic ones. In other words, despite the limited local tradition of eating *muscaria* as an edible species, they are still uneasy about actually eating it (Phipps, 2000, pg. 41).

It is safe to say that *muscaria* eating in Japan is by no means a culturally accepted practice - and as even Rubel pointed out, in apparent disbelief, even Japanese field guides list *muscaria* as an unambiguously toxic mushroom.

Limited Historical Evidence of *muscaria* Consumption in North America

Rubel and Arora were "intrigued" by unsubstantiated reports of African-Americans in the southern states in the 1800s that may have eaten *muscaria*, but convincing evidence is lacking. Even if it were true, what reasons might an enslaved people have for eating *muscaria*? Was it another food of desperation? Or perhaps it was even eaten unboiled for its entheogenic strengthening effects, qualities a desperate slave could surely use. This is of course mere conjecture on my part, but so is any other imagined historical scenario.

A single verified example of historical *muscaria* eating in the Washington, D.C. area was also cited by Rubel, in hopes, I believe, of showing that it was at one time an accepted practice here in North America, so why not now? But even here in North America the evidence is not only flimsy but rather conjectural. Yes, there was apparently one black woman mushroom vendor who prepared *muscaria* for her table, discovered at a mushroom market outside of Washington, D.C. in the late 1800s, and of course that famous fatal encounter with *muscaria* by the late Count de Vecchj.

Even more telling to me than one individual with out-of-the-norm eating habits was this quote by Frederick Vernon Coville - a botanist who in 1898 investigated the recent, sensational *muscaria* poisoning of Count de Vecchj for the U.S. Department of Agriculture. Coville searched for potential sources of *muscaria* at the Washington, D.C., K Street Market:

Though *most* [my emphasis] of the colored women of the markets look upon the species [*Amanita muscaria*] with horror *one* [my emphasis] of them recited in detail how she was in the habit of

cooking it. (Coville, 1898)

Oddly, in his *muscaria* paper Rubel also showed the entire quote, but somehow didn't derive the same meaning that I did: that eating *muscaria* was *not* a common practice, but one observed by a single individual among many others who rightly feared it. Rubel went on to seemingly conjecture that because this one woman's recipe (again, an anomaly among the rest of the mushroom sellers) for *muscaria* was printed in a USDA publication (Coville, 1898), and then cited by others, it was therefore a locally acceptable practice.

I drew a very different conclusion from these same facts: that the behavior of one woman does not a trend make, and that in fact, the publication of these recipes and the quotes about the market seller were widely cited and published for the very same reason that this topic gets press today: its shock value.

The *muscaria* prep by the African American market woman was quite elaborate, and the mushroom hardly resembled a *muscaria* when it was done: the cap was peeled, the stipe was peeled and the gills were removed. The remaining mushroom bits were then parboiled and the boiling water tossed before cooking. Coville went on to suggest that since, as was believed at the time, most of the toxins were contained in the gills and the cap cuticle, parboiling would have most certainly removed any remaining toxins, and he praised her ability to be able to detoxify a known poisonous mushroom without a scientific background. But he was hardly advocating its use.

It is possible that at some misconstrued Coville's remarks as a recommendation that *muscaria* be treated as an edible species. A few months later, in a revised version of the original USDA Circular 13, Coville firmly recommended that no one eat this mushroom, as did physicians during the same time period who were writing for the medical rather than the botanical community. Here is his quote:

this process (of *muscaria* preparation) is cited not to recommend its wider use, but as a matter of general interest. The writer's recommendation is that a mushroom containing such a deadly poison should not be used for food in any form. (Coville, 1898, revised)

Coville also noted in the revision of USDA Circular 13 that the *muscaria* that poisoned the Count was not purchased at the K Street Market, but rather was brought to him from the Virginia countryside by a countryman who delivered it "under protest" to the Count.

As an added public safety precaution, *muscaria* selling was banned at local, Washington, D.C. markets, shortly after Coville's original article appeared (Chestnut, V.K, 1898). But there is no evidence that it was ever for sale in these markets to begin with.

Lacking in many of these historical, eating-*muscaria*-as-an-edible accounts are first hand reports of the effects, or lack thereof, post-ingestion, but there is certainly a broadly based fear of eating *muscaria*, here and across the world. This is reflected in the universal treatment of *muscaria* as a poisonous mushroom by mushroom field guides worldwide, including those countries with a strong mycophilic and mycophagic history, like Europe (Courtecuisse, 1994) and Japan (Hongo, Izawa, 1994).

***Amanita muscaria* Fed to Participants in Arora Forays**

What about modern day use of *muscaria* here in North America? In his paper, Rubel states that David Arora has served *muscaria* to hundreds as a justification for its safety as an edible, and those numbers are probably true. But I would lay wager, based on my first hand evidence, that none of them ate a full meal of it; and the kitchen preparation for their *muscaria* tastings included thin slicing, several boilings, carefully measured waters (thrown out between batches) and a good splash of vinegar at the end. That last seems more for good measure than for any real benefit.

I was at the first Mendocino California foray, back in the 90s, when Arora served about 70 of us boiled *muscaria*, and I participated in about a dozen forays after that one. Most folks, with a bit of peer pressure and the reassurances of the "god of mushrooms" would try a piece or two - though, according to one of the people who passed the mushrooms around, at least a third of the group declined. Several folks that I have talked to who attended those forays did not wish to repeat the experience of eating parboiled *muscaria*, and who knows

how many others, over the years, felt the same way? Like the Japanese gentlemen in Nagano Prefecture, they were thrilled by their daring, but still uneasy about eating a mushroom widely believed to be poisonous.

Peer Reviewed is not the Same as Peer Approved

In correspondence with me, Rubel apparently attempted to bolster his claims about the safety of *muscaria* as an edible species by informing me that he and Arora had published their paper in a peer-reviewed journal (Rubel, 2009). But since only two of his reviewers were actual toxicologists (Michael Beug, PhD and Denis Benjamin, MD) and they both had issues with the paper as originally presented to them (neither read the final version), I was hardly reassured (Beug, 2009; Benjamin, 2009). Dr. Benjamin informed me that his opinions upon this topic were undergoing some evolution and he asked to not be quoted here, but Dr. Beug had no such qualms. Here is what he told me, and I quote:

"I did not review the final version of the [*muscaria*] paper but was highly critical of the draft and recommended that it not be published" (Beug, 2012).

Does it count as much if the peers who review your work and are intimately familiar with toxic mushrooms pan it?

Evaluate All of the Evidence and Decide for Yourselves

I will not go through a point by point rebuttal of the Rubel/Arora paper, although I have certainly been doing so in my mind and in various forums online, ever since I first read it over five years ago. I would hope by now that you the reader are starting to see the bigger picture on your own: that despite the fact that a few people, here and there around the world, have indeed eaten *Amanita muscaria* after elaborate detoxification preparations, it is hardly a broadly accepted practice to eat *muscaria* as an edible species anywhere, nor has it ever been so. And it is preposterous to pretend that it is sometimes not a dangerously poisonous mushroom, when there is a wealth of evidence to the contrary.

When field guides both here and abroad list *Amanita muscaria* as a toxic mushroom they are representing both the universal cultural and common sense norm. Perhaps these various American field guide authors, scoffed at by Rubel, who list *muscaria* as a poisonous mushroom, were more concerned with the safety of innocent foragers rather than presenting all of the possible ways that one might circumvent the poisons?

As new mycophagists delve deeper into the study of mushrooms in their readings of other places and times, perhaps they will be tempted to try a piece or two of *muscaria*, boiled or unboiled. But to recommend its safe practice as an edible species, with the justification that it was ever commonly eaten in other places and has little toxic downside, is a highly implausible parsing of history.

In edible *Amanita* lectures that I have given around the country, I often cite the official United Nations Food and Agricultural Organization (FAO) document on edible fungi, where dozens of species of edible amanitas, among many, many other species of edible mushrooms, are listed by name. These are all amanitas, from *caesarea* to *zambiana*, commonly eaten or sold in markets around the world. This list even includes some *Amanita* species that might reasonably give us the willies, like *Amanita manginiana*, an edible, market amanita from China that is related to and even resembles *Amanita phalloides* (Boa, 2004). But even in this very even-handed, strongly fungiphilic international document, *muscaria* is listed not as an edible but as a medicinal mushroom. Even more emphatically, the U.N. actually proposed a *resolution* against its sale and use as an edible species:

Article 622 - None of the genera of poisonous mushrooms listed hereinafter may be used as food, even if they have undergone special treatments to deprive them of their toxic principles [italics mine]:

Amanita: Mushrooms with fleshy caps colored green (Green *Amanita* or *Amanita phalloides*), or red with white warts (Fly Agaric or *Amanita muscaria*)...

Has it started to sink in yet? That maybe, just maybe, more than a little caution is called for when considering

Amanita muscaria as an edible species?

In the interest of full disclosure, I admit that I have personally eaten very small amounts of *Amanita muscaria* as an edible three times: once, at a long-ago Arora foray, where it was first par-boiled (slimy, tasteless, but still thrilling in a naughty way), once at a camping foray at Salt Point State Park, on the California Coast, where it was grilled by a master Japanese chef (delicious; the best *amanita* that I ever ate), and once atop pizza, after rehydrating dried *muscaria* mushrooms and throwing out the pretty red water. And yet, I believe that to encourage folks to eat *muscaria* is a bad idea, and I feel safe in saying that the vast majority of the rational, mushroom-loving world agrees with me.

Ironically, perhaps Den is Benjamin's recent satirical piece on *muscaria* eating in FUNGI magazine (Winter, 2011), really does hold the answer: if you must recommend the eating of *muscaria*, treat it as a poisonous mushroom that can be presented as a daring culinary adventure - the land-based American fugu experience, if you will. Go ahead, flirt with danger and have a *muscaria* snack at some future foray or in the privacy of your own home; certainly a piece or two of *muscaria* with the crap boiled out of it won't kill you, and then you'll have those bragging rights (Benjamin, 2011).

But please, gentlemen, don't tout *Amanita muscaria* as a perfectly reasonable edible species with a long history of safe usage and cultural acceptance both here and overseas, when the evidence clearly refutes your claim. And if you do someday revise *Mushrooms Demystified*, Mr. Arora, please, err on the side of caution. The many people who look to you for personal safety as well as honest answers will appreciate it.

***Muscaria* Treatment in American Mushroom Field Guides**

Just to see what all the fuss was about in the treatment of *muscaria* by American mushroom field guide authors, I read the *muscaria* edibility descriptions in over a dozen modern guides that I own. All authors, reasonably enough, cited *muscaria* as a toxic mushroom. None, other than McIlvaine's *One Thousand American Fungi*, cited it as deadly. Some mentioned its potential hallucinogenic properties. Some talked about its historic use as an inebriant. The most recent mushroom field guide from California, *A Field Guide to Mushrooms of Western North America* (Davis *et al*, 2012), touched upon some of this recent edibility controversy by expanding a bit upon the usual dismissive toxicity statements. They stated that *muscaria* was:

Poisonous and hallucinogenic; the toxins are water soluble, but given the preparation required to remove the toxins, this is not a good mushroom for the table.

The strongest argument against its use, however, was this one, from a mushroom field guide published in 1986:

Poisonous and hallucinogenic. Fatalities are extremely rare, but it is undoubtedly dangerous in large or even moderate doses. Too many people have had unpleasant experiences for me to recommend it.

The author? David Arora, in *Mushrooms Demystified* (Arora, 1986).

Those wise words still ring true today.

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