

Mushroom Poisoning in North America  
Summary of Voluntary Reporting and News Articles for 2015 and 2016  
By Michael W. Beug  
Chair NAMA Toxicology Committee

A combination of patient confidentiality laws and expanded use of the internet for mushroom poisoning information has led to a decrease in the reporting of mushroom poisoning cases. As an organization, NAMA is engaged in discussions with Poison Centers across North America and with the Centers for Disease Control in an effort to improve reporting. Our hope is that all poison centers, doctors, veterinarians, and NAMA members will encourage anyone involved in a mushroom poisoning to file a report with NAMA. I believe that in the past NAMA has received reports on about 10% of all mushroom poisoning cases but feel that current reporting has fallen well below that 10% level. Never the less, we can gather some useful information from the data we have at hand. I have divided the material into three groups – poisoning by known toxic mushrooms, adverse reactions to commonly edible species and poisoning of animals (only dogs these past two years). Incidents are placed in alphabetical order by species of mushroom.

Human poisoning from known toxic species

Some *Agaricus* species can cause mild flu-like symptoms including vomiting and diarrhea. Many *Agaricus* species are hard to identify even for an expert. In one case a child vomited after consuming part of an unidentified *Agaricus*. What may have been *Agaricus hondensis* caused vomiting and nausea in an adult. Consumption of *Agaricus xanthoderma* (= *xanthodermus*) led to nausea, vomiting, diarrhea and elevated liver function tests (as well as a bill for a Hospital Emergency Room visit).

*Amanita phalloides*, *Amanita bisporigera* and other members of *Amanita* section *Phalloideae* claimed a number of victims (20 in 2016 alone, with at least one death and at least three liver transplants needed). Since we received no full reports, details are sketchy. These species are covered extensively in a separate article. The important things to know here are that these mushrooms are large, beautiful, delicious and deadly, with toxins that are not destroyed by cooking. If you wish to collect wild mushrooms for the table, it is important to learn to recognize *Amanita* species before consuming any gilled mushroom.

In 2016 we had the first ever report of the effects of consuming *Amanita magniverrucata*. A man consumed roughly one pound (cooked) and after a three hour delay suffered chills, sweating, vomiting and diarrhea. Other *Amanita* cases included one where a man suffered a rash after simply handling *Amanita phalloides*. Another man consumed an *Amanita* in the *pantherina* group and then felt strange, became agitated, and then vomited and had diarrhea. A couple consumed *Amanita alpinicola*. Both became dizzy and nauseated. One became confused and vomited. A child who suffered a seizure was thought to have eaten *Amanita gemmata*, but no mushroom had been eaten. *Amanita smithiana* was involved in three cases reported by the Oregon Poison Center and two incidents reported by NAMA mushroom poisoning identifiers. The poisonings were very serious, resulting in hospitalization and kidney damage that resolved after several days. In at least four of the cases, the victims reported that they thought that they were picking *Tricholoma magnivelare*, “matsutake”. We have the most detail about one of the Washington cases. A midlife man collecting by Mount Rainier had picked what he thought was matsutake. About 10 hours after cooking a meal of the mushrooms, he was not feeling well. He reported to the hospital with gastro intestinal upset. A NAMA identifier recognized *Amanita*

*smithiana* from the photos. Two toxins associated with *Amanita smithiana* are chlorocrotylglycine and allenic norleucine, though more research is needed to determine precisely the toxic components of this mushroom. The hospital was most appreciative to learn that they should treat for a kidney toxin. Photographs and the ways to tell the *Amanita smithiana* and *Tricholoma magnivelare* apart appeared in the first 2017 issue of *The Mycophile*.

*Chlorophyllum molybdites* always claims numerous victims and the past two years were no exception. At least two individuals mistook *Chlorophyllum molybdites* for *Coprinus comatus*. If you ignore the over-all shape (broad and squat versus tall and slender), ignore the gill color (white becoming greenish versus pinkish becoming black) and a few other differences (moderately spaced versus crowded gills, meaty versus soft textured, etc.), you too can enjoy a few days of vomiting and diarrhea with the added bonus of chills, headache, salivation and excessive perspiration. Of course other people who consumed this mushroom consumed it because it was growing in their yard and they assumed that anything so delicious looking in their own yard (or sometimes on their golf course) must be there for them to enjoy raw. After all, they are delicious that way. For an hour or two you can be proud of yourself for making such a meaty find. Those people learned that consumed raw, these mushrooms are even more vicious than when consumed cooked. Their vomit and diarrhea was quite bloody. Some mistook *Chlorophyllum molybdites* (gills white but eventually greenish from spores that are initially white but turn green when fully mature) for the highly similar *Chlorophyllum rachodes* (gills white and remaining white since the mature spores remain white). Unless I spore-printed every specimen, I would not eat any of the edible *Chlorophyllum* species except in climates where *C. molybdites* does not grow (e.g. the Pacific Northwest).

*Boletus huronensis* was consumed by one person who suffered vomiting and nausea. We do not know why the mistake was made in this case but do know that *Boletus huronensis*, an eastern species, is sometimes mistaken for the “king bolete”.

*Caloboletus marshii*, “the bitter bolete” was consumed by one California woman who had gone to a mushroom field day and returned to her ranch to pick a wide range of mushrooms she found growing there. She had identified the “bitter bolete” as a “butter bolete” and suffered chills, flushing and nausea. I made a similar mistake myself this summer when I collected a sack of blue-staining *Caloboletus marshii* fungi from my oak grove. I sampled a tiny bit raw (and spit it out). I found them to be very sweet and tasty, not at all bitter. I concluded that I might have found a new “butter bolete” species, one that did not have a netted stipe apex. I proceeded to write up a description as well as to cook a small sample batch. I only cook and sample unknown mushrooms from groups where the known similar species are edible or thought to be relatively harmless. After all, the only way to tell whether an unnamed species is edible is to eat some. If a little bit is OK, then try more a day or two later. If still OK, serve them to a few daring individuals. While I would never do this with an unknown mushroom where similar species are toxic, I have done it a few times in the past where I had good reason to anticipate a good outcome. WARNING: DO NOT DO THIS YOURSELF, MY PRACTICE IS ONLY FOR EXPERTS! In this case, after the first extremely bitter taste, I immediately identified my find as *C. marshii*. A few months later, under those same oak trees, I found a blue staining “butter bolete”. Since I had never before eaten a “butter bolete” or any other strongly blue-staining bolete (most are extremely bitter), I cooked up my collection. I was already positive it was *Butyriboletus querciregius*. That collection was delicious!

Consumption of an unidentified *Clitocybe* species led to vomiting. Many *Clitocybe* species have considerable quantities of the toxin muscarine and many are difficult to identify.

Clearly individuals were regularly seeking to get high on hallucinogenic mushrooms, though we rarely hear about it, even when things go badly. When we do get a report, the reason why the mushroom was consumed is rarely in the report. I only uncover it when I contact the individual(s). One couple reported explosive and burning diarrhea after consuming a *Gymnopilus* species. From photos, it appeared to be in the *G. sapineus* group. When I asked why they would even eat such a very bitter mushroom, they admitted that they had hoped to get high. Indeed, several *Gymnopilus* species are hallucinogenic, notably *Gymnopilus spectabilis*, “big laughing gym”. However, one poor soul from the Pacific Northwest discovered that mistaking that for what appeared to me from pictures to be a *Pholiota*, led to days of vomiting. Had he paid more attention, he would have noted that “big laughing gym” should indeed be big and should bruise blue. His mushroom had not stained blue and was not very big. To add insult to injury, our PNW look-alike to *Gymnopilus spectabilis*, *Gymnopilus ventricosus*, is not even hallucinogenic! In another PNW case, a man suffered gastro-intestinal distress after consuming a non-staining *Cortinarius* species thinking it was “big laughing gym”. Consumption of what was identified as *Cortinarius vanduzerensis* by yet another individual also resulted in an inquiry, but we do not know what the effects were or why the individual consumed this particular slimy *Cortinarius*.

*Lactarius c.f. luculentus* produced vomiting in one individual.

Consumption of a *Lepiota* similar to *Lepiota cristata* produced a case of gastrointestinal upset. I am particularly concerned about consumption of smallish *Lepiota* species because some contain amatoxins and are thus deadly poisonous.

Consumption of cooked *Leucopaxillus gentianeus* produced a case of stomach cramps and paranoia.

There were four incidents of poisoning by Jack-O-Lantern fungi (*Omphalotus* species) including one incident involving *Omphalotus olearius* and three incidents (six individuals) involving *Omphalotus illudens*. In all cases it appears that they were mistaken for *Chanterelles* and the price was severe gastro-intestinal distress. When your “Chanterelles” are growing in a large clump, and especially if you note that at night you can read by the light of your “Chanterelles”, it is best to assume that you have made a mistake in your identification and consuming the mushrooms will be an enormous mistake, but one from which you will recover – eventually.

Consumption of *Psilocybe* mushrooms as hallucinogens is popular but sometimes can go very wrong. In one case, police were called to an apartment building to deal with a man who was destroying the apartment in his hallucinatory state. He fell to his death from the third floor window while trying to elude the police. In the past, there have been reports of individuals high on psilocybin jumping to their death from tall buildings. In a visit in October of 2016, Paul Stamets told me of reports he has received of individuals suffering temporary paralysis after consuming some of the very potent wood-chip *Psilocybe* species and the beach-grass *Psilocybe*, *P. azurescens*. The concern here is that someone might consume these mushrooms out in the field on a cold, rainy day and suffer hypothermia before they can walk again.

Consumption of a batch of red *Russula* species led to gastro-intestinal distress for two individuals in Colorado. In the South, one person suffered chills, diarrhea and sweating from consumption of a white *Russula*.

*Scleroderma* species were involved in a number of cases. One case involved a child grazing in the yard. In some cases sclerodermas were consumed by people thinking that they were eating a puffball and in other cases people thought that they had found a truffle. In all cases the result was diarrhea and vomiting, often exceptionally severe. One elderly woman who I later met nearly died from the severity of the poisoning. She was one of the people who thought that she had consumed a puffball. Puffballs, when in the edible stage, are uniform pure white inside and are soft like a marshmallow. *Scleroderma* species may be whitish when very young but soon turn purple to black inside and are hard, not soft like a marshmallow. The choice edible truffles are marbled inside. Truffles are tasteless and of no culinary interest until mature. At maturity, the choice species develop an amazing aroma, often of ripe cheese and garlic. *Scleroderma* species are not marbled inside and have either no odor or a disgusting odor depending on species and maturity. In the case of the woman who nearly died from a *Scleroderma*, we collected fresh material from her site as well as a similar *Scleroderma* from my garden and sent material off for DNA analysis. We learned that the DNA data on *Scleroderma* species is confused and that species concepts will need to be straightened out before names can accurately be applied.

Handling of *Suillus pungens* caused a rash in one individual.

#### Adverse reactions to normally edible species

Gastrointestinal distress was experienced by one person who consumed each of the following species: *Amanita calyptroderma* (old), *Boletus edulis*, *Cantharellus formosus*, *Coprinus micaceus* (raw), *Hydnum repandum* (left in trunk for one week before consumption, victim also passed out), *Laccaria ochropurpurea*, *Leccinum insigne*, *Leucocoprinus americanus* (also hallucinations and impaired motor function), *Pleurocybella porrigens*, *Pleurotus c.f. ostreatus*, *Ramaria* species (western fall, yellow), *Ramaria* species (western spring, yellow, three victims in one incident), *Sparassis crispa*, *Sparassis radicata* (old), *Sparassis spathulata*, *Suillus* species (frozen when raw and later cooked, patient also experienced low blood pressure) .

Five cases of gastro-intestinal distress resulted from consumption of various *Armillaria* species in the *A. mellea* complex ("honey mushrooms"). Two were definitely *Armillaria solidipes* (= *ostoyae*), a mostly western species that has a record of causing a significant number of adverse reactions. One was definitely *Desarmillaria tabescens* R.A. Koch and Aime 2017 (= *Armillaria tabescens*), an eastern species. One adverse set of symptoms was the result of eating raw honey mushrooms and another was the result of eating old honey mushrooms. Looking back over years of poisoning reports, I find that it is very rare for adverse effects to occur upon consumption of honey mushrooms collected in eastern North America, where they are one of the more popular edible species. However, it is very common for adverse effects from honey mushrooms collected in western North America (where we have different species of honey mushrooms).

One case of consumption of alcohol with a meal of cooked *Coprinus comatus* led to flushing. Since the flushing reaction is normally associated with *Coprinopsis atramentaria* and alcohol rather than *Coprinus comatus*, there is a chance that there is an error either in the filing of the report or in the original identification.

"Hen of the woods", *Grifola frondosa*, was implicated in one case where the person suffered chills, dizziness, sweating, weakness, numb tongue and throat.

*Hypomyces lactiflorum* may have been involved in one hallucinatory event reported to Dr. Joe Ammirati and provides a detailed example of the kind of puzzles the NAMA toxicologists can get involved in unraveling:

Hi Joe. Here is everything I can remember about when I ate the lobster mushrooms...

My friends and I were staying at a cabin outside Mount Rainier. I had been feeling a bit sick for several days, so I had been taking a lot of Ibuprofen. At dinner, we had cooked lobster mushrooms and a bit of chanterelles mixed in with our food that we had harvested earlier that day. I had only a few sips of beer that night, and some of our food had been cooked with wine. I was also drinking the tap water.

All of a sudden when I was eating, I felt a rush go through my body from my feet to my head. This rush happened a couple of times. Then, I started to have hallucinations similar to what marijuana would cause. I began to have intense anxiety and paranoia and went into a panic attack and eventual vomiting. It took a couple of hours for me to feel more or less back to normal.

While everything was happening, I thought maybe the mushrooms were causing the effects, but my friends and I could not find any information about lobster mushrooms having any side effects. I eventually wrote it off as being caused by the possibility of having too much ibuprofen. It's possible it was a mix of those different factors.

One of four people in Florida who jointly consumed a meal of *Laetiporus sulphureus*, "chicken of the woods", experienced chills, hallucinations, dizziness, spasms, vomiting and diarrhea. This suite of symptoms is often associated with the two western chicken of the woods species, *Laetiporus conifericola* and *Laetiporus gilbertsonii*. *Laetiporus gilbertsonii* caused bloody vomiting in one individual. It is worthy of note that the two eastern species, *Laetiporus sulphureus* and *Laetiporus cincinnatus* (currently considered a synonym of *L. sulphureus*), are much tastier edibles than western chicken of the woods.

*Lentinula edodes*, "shiitake", was identified in eight reports. Raw shiitake caused a severe flagellate rash in three individuals, one of whom also suffered chills and flushing. One of the reports mentioned that 10 people shared the raw mushrooms but only one developed the rash, which is consistent with Japanese research that found that fewer than 5% of people who consume raw shiitake develop a rash. The rash is caused by the lentinin in the mushrooms. Lentinin is used in cancer therapy (mainly in Asia). Lentinin is destroyed by cooking and so the rash is rarely seen in people who consumed well-cooked mushrooms. However, light cooking, a practice often seen in restaurants, does not destroy all of the lentinin. Three individuals reported a rash from cooked shiitake. In one case, the rash was accompanied by fever. In another case, the rash was accompanied by diarrhea. Rash onset is usually 2-3 days post ingestion. One restaurant poisoning involved flushing, dizziness, cramps, drowsiness and gastro intestinal distress. In a second restaurant case, the female victim suffered flushing, salivation, dizziness,

sweating, disorientation, and muscle spasms. A follow-up revealed that the restaurant had frequently been cited for listeria in the previous five years.

In Hawaii there were two separate cases of purchased *Macrocybe spectabilis*, cooked, causing vomiting. This species, while generally considered edible, contains traces of cyanide that are dissipated on cooking.

As has frequently been the case in the past, *Morchella* species were cited in so many cases that were they not so delicious and so commonly eaten, I would be tempted to call morels poisonous (and have everyone send their morels to me for proper disposal). For most people, morels are definitely poisonous raw or only lightly cooked. In one case, two of five people who consumed some raw morels had chills and diarrhea. In separate incidents, two other people who consumed morels raw experienced vomiting and diarrhea. Two people shared one large cooked morel and suffered gas, stomach upset, and severe diarrhea. Another person cooked a batch of morels, had abdominal cramping, and vomited. Consumption of a meal of cooked “burn morels” produced gastro intestinal distress, hallucinations and dizziness. A Washington State woman who had eaten morels before with no problems had a stomachache three hours after her meal. She went to a hospital. Consumption of a meal reported to be of morels, helvellas and gyromitras led to the person vomiting fifteen times. Another person who consumed “morels and gyromitras” vomited and had abdominal pain.

A couple who consumed an unidentified *Suillus* species suffered gastrointestinal distress, dizziness, weakness and headache.

Five people who consumed *Verpa bohemica*, thinking they were consuming morels suffered adverse effects. I consider *Verpa bohemica* to be an edible species when thoroughly cooked, but one of the edible species where a significant number of people have adverse reactions. It should be consumed with caution and only if well cooked. Like true morels, it is definitely poisonous raw. The toxins in *Verpa bohemica* are unknown (as is also the case with true morels). In my own case, I do not find *Verpa bohemica* to be very tasty, so I stick with morels.

#### Animal poisonings

During 2015 and 2016, all actual animal poisoning reports involved dogs. One 2015 case involving a cat death had Dr. P. Brandon Matheny and me puzzled for weeks. The very unusual cat had a penchant for consuming anything and everything (something common for dogs, but rare in normally discerning cats). Brandon even did DNA work to identify the mushroom involved because neither of us was sure what species we were looking at but neither of us thought that it was likely that the mushroom was toxic either. To add to the puzzle, the reported symptoms did not match any toxic mushroom syndromes. Finally, the owner was able to attribute the poisoning to a non-mushroom toxin. A second cat was thought to have possibly consumed a *Galerina* but we have no idea what happened or whether a mushroom was even involved.

*Agaricus c.f. meleagris* was consumed by one dog. The dog experienced vomiting and diarrhea.

*Amanita* mushrooms in section *Phalloideae* (including *A. phalloides*, *A. bisporigera*, and *A. ocreata*) claimed the lives of several dogs. Dogs can rarely be saved when they consume one of these species. In one case, a dog owner contacted Debbie Viess thirty minutes after the dog consumed the mushroom and she identified the mushroom (*Amanita phalloides*). The dog was rushed to a vet

experienced with treating amatoxin cases and the dog was saved. One report mentions a dog saved using IV fluids and milk thistle. Another dog survived what appears to have been a possible *Amanita bisporigera* ingestion after experiencing 32 hours of chills, diarrhea, salivation, vomiting and drowsiness.

*Amanita pantherina* and *Amanita muscaria* are frequently eaten by dogs. In one reported case, a dog consumed *Amanita pantherina* and then vomited, became ataxic and could not stand. At least one other dog could not stand after consuming *Amanita pantherina* and another dog vomited. Several other dogs were sickened by *Amanita pantherina*, but we have no details. There was also a case of poisoning from *Amanita gemmata* and one from *Amanita aprica*, but again no details. Of two dogs (two incidents) that consumed *Amanita muscaria*, one died and the other experienced salivation and disorientation. Another dog consumed a mixture of a *Russula* species and *Amanita* species and experienced classical ibotenic acid poisoning symptoms of vomiting, diarrhea, ataxia and disorientation.

A *Calvatia* species was for the first time implicated in a dog poisoning. The dog vomited. In a first report for a *Conocybe albipes* ingestion, a dog experienced vomiting and diarrhea.

A bite or two of *Chlorophyllum molybdites* produced seizure and a drooping head in a dog. In another case, the dog vomited, had diarrhea and appeared weak, disoriented and drowsy.

*Clitocybe* species, many of which contain significant levels of muscarine, caused significant problems for at least three dogs. One suffered violent vomiting, diarrhea and was unable to stand. Another had diarrhea and excessive drooling. A third had what were described as classical muscarinic (PSL) poisoning symptoms. PSL standing for perspiration (though dogs pant and do not perspire), salivation and lachrymation.

Some *Entoloma* mushrooms are notorious for their toxicity, though I have never before had a specific report of a dog poisoning from them. This first case involved a dog with muscarinic syndrome poisoning (PSL) that appeared disoriented and seemed to be hallucinating.

*Inocybe* species, most of which have significant levels of muscarine, were involved in several dog poisonings. NAMA is often contacted to identify the mushroom, but we are rarely informed of the symptoms or the outcome. That was certainly the case for some of the *Inocybe* poisonings. One dog had classic muscarine PSL symptoms – panting, salivation and lachrymation accompanied by vomiting and diarrhea. Another simply vomited. However, one dog consumed *Inocybe c.f. fibrosa*, showed classic PSL symptoms, vomited, developed bloody stool, and liver failure and died.

We had a first ever report of a dog consuming *Lysurus cruciatus*. The dog was found vomiting afterwards. Consumption of a *Leucoagaricus* caused another dog to vomit. *Phyllotopsis nidulans*, another mushroom never before implicated in a dog poisoning, caused neurologic problems and liver damage in one dog. Another first ever report involved *Polyporus squamosus*. The dog experienced vomiting and profuse diarrhea, exhibited small pupils, elevated liver enzymes and was unresponsive.

Consumption of *Panaeolina foenicicii* produced nausea and fatigue in one dog.

*Scleroderma* species were involved in several dog-poisoning reports. One dog consumed 1/5 of one mushroom, vomited and was weak. Another dog vomited. A third dog was found drooling, vomited, experienced diarrhea and had an elevated heart rate. We have no details on a fourth and fifth dog (two

different cases) at a vet after consuming a *Scleroderma*. *Scleroderma citrinum* produced vomiting and diarrhea in another dog. *Scleroderma* species in the past have led to deaths for both dogs and pigs.

A dog found to have consumed *Stropharia coronaria* vomited and was ataxic.

A dog took bites from a *Suillus* and was found with PSL symptoms and unable to stand. Another dog consumed a *Suillus* and vomited.

Consumption of a *Xerocomellus* species (identified as *Boletus chrysenteron*) caused vomiting in a dog. The vet treated the animal with activated charcoal.

### Summary

While we have fewer cases and fewer details than ever, we have learned about some new toxic mushrooms. I hope that we can find ways to encourage more reporting so that we can both minimize ingestion of toxic species and improve treatments.

Of interest to some, the species of *Armillaria* that lack an annulus are now in a new genus, *Desarmillaria* [Koch, R.A., A.W. Wilson, O. Séné, T.W. Henkel, and M.C. Aime. 2017. Resolved phylogeny and biogeography of the root pathogen *Armillaria* and its gasteroid relative, *Guyanagaster*. *BMC Evolutionary Biology*, **17:33** (16 pages)]. Other new genera appear in this report because, for example, the genus *Boletus* has proven to contain diverse lineages of mushrooms. Furthermore, we are learning both about more cryptic species and about more misapplied names. *Boletus chrysenteron* is a misapplied name for a group of at least three different cryptic species.