Animal Poisoning by *Amanita pantherina* and *Amanita muscaria:* A Commentary

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WHEN DOGS get sick and mushroom poisoning is suspected, it is often difficult to determine whether or not mushrooms were consumed, which species was the culprit, or how long it was between consumption and poisoning effects. When the mushroom is determined to be *Amanita pantherina* or *Amanita muscaria,* two additional challenges arise. The first problem is that some sources advise treatment with atropine, a specific antidote for muscarine. However, muscarine levels are quite low in these species in which the two most important toxins are ibotenic acid and muscimol. Atropine, a powerful drug extracted from *Atropa belladonna, Datura stramonium,* and other *Solonaceae*, exacerbates the effects of ibotenic acid and muscimol. Nevertheless, other symptoms at times indicate that the use of some atropine might be beneficial. The second problem is that the toxins ibotenic acid and muscimol induce a deep comatose sleep. At this point, the vet will frequently consult with the owner, who will choose to euthanize the animal. But would the animal have recovered in a day or two? Some colleagues have long argued that with patience, dogs will recover. But will dogs always recover?

It is clear that, barring exceptional complications from other medical conditions, these toxins do not lead to death in humans from ingestion of either *Amanita muscaria* or *Amanita pantherina.* In two *Amanita muscaria* cases I was involved with in the 1970s, cat deaths occurred when the pet owner had saved a stash of dried mushrooms for hallucinogenic use. Are cats more susceptible to the toxins than humans or dogs?

In 2008 one case of the death of two puppies from *Amanita pantherina* was presented to me in such clarity, that by the end, I was convinced of the potential lethality of *Amanita pantherina* for dogs. Some of what was going on was the fact that these were puppies, with immune systems not yet fully functioning and thus at greater susceptibility to toxins. Another issue was size. Toxicity is measured in terms of amount of toxin per kg of body weight; thus a small dog that eats one mushroom winds up with a much, much higher concentration of toxin than a human who eats one mushroom. Each species (and even different individuals within a species) vary in susceptibility to toxins. Also, from work that I did years ago I know that the amount of toxins in *Amanita pantherina* (and *Amanita muscaria*) can be quite variable from one collection to the next. Similarly, it has been found that some collections of *Amanita phalloides* or of Destroying Angels, like *Amanita bisporigera,* are far more toxic than other collections. Furthermore, I have also always been curious about the fact that the poisonings that we see from *Amanita pantherina* in the Pacific Northwest sometimes seem more severe than poisonings by *Amanita muscaria.* Nearly 30 years ago, on my first Sabbatical, I was working with Dr. Scott Chilton on extracting a mystery toxin from *Amanita pantherina* that we do not see in *Amanita muscaria.* While we failed in our attempts to identify this other toxin, we did observe that the dark-capped collections of *Amanita pantherina* had a lot more muscimol and ibotenic acid than the light-capped collections of *Amanita pantherina.* Had these puppies ingested particularly potent mushrooms?

Anne Leathem who lives in British Columbia, only a few hours from where the puppy incident occurred reported:

> A few years ago we had a case of two seven-week-old puppies eating *Amanita pantherina.* We were contacted by a vet. At 1730 hours one puppy was found with a decreased level of consciousness, increased tone in tail and jaw, muscle rigidity and tetanic spasms in the back. Pupils and temperature were normal. At 1900 h the other puppy was found to have the same symptoms but greater CNS depression and less muscle rigidity. This second puppy died suddenly at 2100 h, and on autopsy,

> medium-brown cap and white stem mushroom fragments were found in the stomach. The first puppy was then given gastric lavage, and mushroom fragments were retrieved. He still had increased muscle tone and worsening CNS depression. We recommended giving oral-activated charcoal and, if needed, IV diazepam for seizures. By the next morning this puppy had improved and was discharged the following day. Both of the puppies had eaten the mushrooms before 1630 h.

I think how much mushroom was consumed is likely different in these cases. Also, there are individual variations in susceptibility and in toxin concentrations. Some puppies survive and others don't. I think they are certainly more likely to die than older dogs, but as you say the dose/body weight is important. In human children, we don't see this degree of CNS depression; breathing does not stop, but perhaps they consume less generally than a gobbling puppy. The mysteries of fungi continue.

Marilyn Shaw has more experience with dogs that have eaten *Amanita pantherina* or *Amanita muscaria* than any other person in the country. Marilyn's accounts follow:

> I still wonder about the dog deaths from muscimol/ibotenic acid in general. As Michael knows, I have handled numerous cases going back 20 to 25 years, and had only two which ended in death. One dog aspirated vomit while comatose, during the 30 min. drive to the emergency vet clinic, and its lungs could not be cleared. The other, just a couple of years ago, involved a dog that was euthanized within three hours of onset of symptoms, due to a comatose state and muscle spasms ("seizures"). The vet had proceeded without consultation with the PC. It was the owner who called me later. In all of my other cases (with one possible exception last year) all the dogs came out of it just fine, though recovery can take 10–12 hours or more.

I always stress that over-treatment of the hyper state ("seizures") must be avoided because of the vacillations between hyper and lethargic (comatose) states. Tranquilizers can unduly suppress the central nervous system. It is also strongly recommended that atropine be avoided, unless there are unequivocal indications for its use. Because of the species name of *Amanita muscaria*, a toxin which was isolated in this mushroom was named "muscarine." This toxin causes cholinergic symptoms (over stimulation of the parasympathetic nervous system). These symptoms are rarely seen in muscimol/ibotenic acid poisonings (see "muscarine" case below). Atropine is a specific antidote for muscarine poisonings, but will typically increase the effects of muscimol/ibotenic acid. The symptoms in these poisonings are very alarming and confusing. They typically eventually progress from a hyperactive state, to staggering, collapse, and coma with muscle spasms. The supposition is that the dog is suffering, and this is the point at which the decision to euthanize is generally made. However, if we can judge by what happens in human cases (I'm not saying we necessarily can), there *may* be fear but not physical suffering. It is recommended that euthanasia be avoided for several hours since, in my experience, most dogs will survive if the poisoning is allowed to run its course. Close observation should be given to avoid aspiration if vomiting should occur. It should be remembered that these mushrooms are widely used intentionally by humans, and have been for thousands of years, for their inebriating effects. They are, in fact, sold on the internet for this purpose.

Marilyn also pointed out that cats can survive eating *Amanita muscaria*. In the two cases I had dealt with, death of the cat had been the outcome, so I had concluded that cats always die from these mushrooms. Marilyn reported:

> I had a case several years ago, which involved three seven-week old kittens. Their owner said she had picked an *Amanita muscaria,* the day before, and was keeping it "to try to identify." The following day at 8:30 a.m. the kittens got hold of the mushroom and were eating it. They protested vehemently when it was taken away. Soon they were tearing around the house as if possessed (hyper state). Finally, two abruptly fell fast asleep, remaining comatose (lethargic state) for several hours. The third was in much worse shape. He was vomiting, having diarrhea, and was convulsed with muscular spasms. The owner couldn't afford a

vet. I advised her to at least try to get one to help. She called three, but none would agree to see them without payment. I mentioned in passing that the treatment vets would give for the seizures would be some kind of tranquilizer. She described to me, in great distress, #3 writhing at her feet. Later—about 4 p.m.—without my knowledge, she decided to give #3 a quarter of a Valium she had on hand. (This is *not* recommended. I'm surprised it didn't kill him.) That evening about 7:30 p.m. while she was eating dinner with #3 on the sofa beside her, he/she raised his/her head briefly and meowed, but fell back into the coma-like sleep. In the middle of the night, about 12: 30 a.m., the owner heard loud crunching. She got up, thinking it was an older, overweight cat eating, but to her surprise, it was #3, fully recovered and making up for the missed meals. So I have to disagree that cats always die. These three tiny kittens made it even without veterinary care.

Returning to the topic of dogs, Marilyn Shaw illustrated her feelings about the general non-lethality of *Amanita pantherina* and *Amanita muscaria* in dogs with another one of her case reports:

> I am reminded of a call from a veterinarian that was referred to me at 1:30 a..m. by RMPDC several years ago. The vet said he had a dog that had been poisoned by a muscarine mushroom. As I developed the facts about symptoms, I was confused. They certainly did not sound like muscarine symptoms. Then ,as I got the description of the mushroom, it became clear that it was an *Amanita muscaria* case. The dog was comatose with muscle spasms. "He's dying," the vet said. I advised that, given a few hours, I was sure the dog would survive. It did. There are no lasting effects from these poisonings.
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> Rocky Mountain Poison and Drug Center is the largest and busiest of all the poison centers in the country. It serves Colorado; Idaho; Montana; La Vegas and Reno, Nevada; and Hawaii. I have had cases involving these amanitas from all of these areas with the possible exception of Nevada, and often receive calls from other parts of the country as well."

Dr. Denis Benjamin, MD and author of *Mushrooms: Poisons and Panaceas* (W. H. Freeman and Company, New York 1995) on reading these accounts emailed us these comments:

> I tend to agree with Marilyn's comments that over-treatment (of *Amanita pantherina* and *Amanita muscaria* poisonings) generally causes far more problems in both humans and animals. The intense desire on the part of physicians, vets, and pet owners to "don't just stand there, do something" is always stronger than "don't do something, just stand there." Following recovery, everyone tends to believe that the treatment did something useful. Most often the recovery is in spite of the treatment. Managing the seizures may be reasonable, but anticonvulsants can themselves cause considerable CNS depression, so doses have to be carefully calculated. I would definitely avoid the use of atropine if the mushroom is identified as *Amanita pantherina* or *A. muscaria*.
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> Thank goodness for Marilyn's extraordinary memory, careful note-taking and persistence in following up all her cases. I suspect that she has contributed more to our knowledge in the last few decades than the medical/veterinary professions combined. I have had no experience with cats, so I value her observations.