# A Rare *Cortinarius rubellus* Poisoning in North America and some Thoughts about our Attitudes towards *Cortinarius* in General

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**Abstract:** Only the second orellanine poisoning from North America is reported from Québec. The victim's own story, as well as poisoning symptoms of delayed minor GI distress, fatigue and eventual kidney failure are chronicled, and attending physician's remarks provided. Specimen identification was collaborative, starting with the Facebook POISONS group; *Cortinarius rubellus*, an orellanine containing *Cortinarius*, was confirmed in hand by Patrice Dauzet, an identifier with Le Cercle des Mycologues de Montreal. *Cortinarius rubellus* and *Cortinarius orellanosus*, the only North America species found in *Cortinarius* section *Orellani,* are medium sized mushrooms, distinctive in having dry, umbonate to peaked, matted fibrillose, uniformly colored reddish to red-orange caps and similarly colored stipes. These two species are restricted to temperate (*C. orellanosus*) to boreal to subalpine (*C. rubellus*) forests in northern latitudes. Poisonings with orellanine containing *Cortinarius* are extremely rare in North America, but less rare in Europe. There are several non-toxic lookalike species such as *C. gentilis, C. limoneus, C. kroegeri, C. callisteus* and similarly colored *Dermocybes.* Outside of these two distinctive, geographically restricted orellanine containing *Cortinarius*, there is little to no evidence of *Cortinarius* toxicity in North America. Evidence of the edibility of several North American *Cortinarius* species (*C. caperatus, C. armillatus*, *C. violaceus*, among others) is presented, with corroborating evidence from an international document on edible wild fungi found around the world.

**Key Words:** orellanine poisoning, orellanic syndrome, *Cortinarius rubellus, Cortinarius orellanosus,* cortinarius edibility, cortinarius toxicity.

In early August 2020, a Québécois forest firefighter and mushroom hunter went searching for his supper in a black spruce woods. With his basket already full of his favorite lobster mushrooms, he continued to search a bit more, hoping to find something new to "complement his meal."

Detouring into a sphagnum bog, he spied five beautiful and appetizing looking, reddish-capped mushrooms. These he picked and brought home. His dinner that night contained both lobster mushrooms and those lovely, albeit unknown, reddish fungi.

The next day, and in ensuing days, he experienced mild abdominal issues and noticed that some foods, especially green beans and eggs, had an oddly sulfurous flavor. Despite persistent symptoms, he was reluctant to go to the hospital due to COVID restrictions. After 18 days of suffering at home, his condition worsened to the point where he had no choice but to seek medical attention. He was admitted to a local hospital in Abitibi, Québec on August 28, and treated for acute kidney failure.

On August 31, feeling a bit better after intravenous rehydration, he requested to go home briefly to take care of his animals. Before returning to the hospital, he stopped by that same bog and collected more of those unknown mushrooms, which he showed to his attending physician, Dr. Marilyn T. Duravage.

Unfamiliar with fungi, Dr. Duravage contacted a medical colleague who is also an amateur mycologist. He recommended that she post photos of those mushrooms to the Facebook POISONS group, “Poisons help; Emergency Identification for Mushrooms and Plants”(Marilyn TD, 2020).
This group, co-founded and managed by highly skilled British forager Kerry Woodfield, has almost 200 expert identifiers of both plants and fungi. Its international scope allows at least a few people to be on call at any time of day. Free and timely photo identifications of readily recognized species are often made in minutes via consensus ID. This case, however, took a bit more time and effort.

With the mushroom photos posted to POISONS, and the case history of delayed kidney failure, Kerry immediately recognized its potential as a very serious orellanine poisoning. *Cortinarius* is a difficult group to ID, especially from a mere photo, so she requested further ID help from the POISONS’ *Cortinarius* experts. She and others pinged folks like Dimitar Bojantchev, who has spent the past fifteen plus years studying *Cortinarius*, and Irene Andersson, a well-respected Swedish mycologist, who specializes in high latitude fungi and *Cortinarius* (unfortunately, she was not available to consult on this case).

Meanwhile, other non-specialist mycologists on POISONS were proposing various specific IDs of *Cortinarius* section *Orellani*, since the fruit body, despite its rather poor condition, resembled an orellanine containing *Cortinarius* and of course, the symptoms fit, too. Surprisingly, two *Cortinarius* experts, one North American and one European, got it wrong, both saying it most likely wasn't something toxic in section *Orellani,* suggesting *Dermocybe* and the non-toxic *Cortinarius gentilis* (section *Telamonia*) as an ID. This underlines the point that sometimes a photo ID is insufficient, no matter who is doing that identification. But most of us persisted in our belief that it was an orellanine poisoning. All IDs on POISONS are done by consensus, so no single voice holds sway.

I sent the photos to Michael Beug, Professor Emeritus, The Evergreen State College, and Chair of the NAMA Toxicology Committee, and he sent them to Joe Ammirati, Professor, Department of Biology, University of Washington, and Pacific North West *Cortinarius* expert. They both identified the mushroom as *Cortinarius rubellus*. POISONS identifiers encouraged Dr. Duravage to treat it as an orellanine poisoning while she confirmed the ID in hand with members of a local NAMA affiliated mushroom club, Le Cercle des Mycologues de Montreal. Patrice Dauzet, an experienced microscopist with that club, received the specimens and determined them to be *Cortinarius rubellus* via macroscopic, microscopic and chemical analysis, confirming only the second known orellanine poisoning in North America.

This case was truly a collaborative effort!

Here is a synopsis of the case history as presented by Dr. Duravage on the Mycoquebec Blog:

On August 28, the patient, a healthy 61 year old man, presented to the emergency room of a hospital in Abitibi with lower abdominal pain, weight loss with loss of appetite, and severe fatigue. Blood tests clearly showed acute renal failure and some related lab abnormalities. Creatinine tests were sky high, 8 times the normal value, demonstrating that the kidneys were no longer working. Mushroom consumption was estimated to have taken place around August 10, but due to the lengthy period between consumption of mushrooms and severe symptoms, a mushroom poisoning was not initially suspected. Blood, urine and radiological investigations were begun to discover the cause of the patient's renal failure. At first, prolonged dehydration due to diarrhea and lack of fluid intake was suspected to be the cause of the latter, but this renal

insufficiency was too severe to be explained away by mere dehydration. Intravenous rehydration improved kidney function within days at hospital, but did not normalize it, due to probable damage to the kidneys from the orellanine toxin. High blood pressure, presumably also caused by kidney damage, also appeared during hospitalization. The patient's symptoms gradually subsided, but even after about 6 weeks post ingestion he still experienced mild headaches, low abdominal discomfort and mild fatigue. As renal function normally takes a few months to stabilize, it is not possible at this time to say that it will return to normal in the medium term, although its improvement is encouraging to date.

The patient says: "I was told that I had consumed a very toxic mushroom responsible for my hospitalization. Before my poisoning I was in great shape, and could go about my business all day. Since my hospitalization, I have lost energy, some foods still taste like sulfur and the doctor does not know if I can hope for a full recovery."

Dr. Duravage continues to treat this patient and is in process of writing up her own account (Duravage, 2021).

**Distribution of *Cortinarius section Orellani* in North America**

*Cortinarius* section *Orellani* are found in temperate to boreal to subalpine forests in the northern latitudes. We currently believe that there are only two species of orellanine containing *Cortinarius* found here: *Cortinarius orellanosus*, with oaks, and *Cortinarius rubellus* (synonyms: *C. speciosissimus*, *C. orellanoides* and C. *rainierensis*), with conifers (Figures 1a,b). *C. orellanosus* was described from dried specimens collected in western Michigan in 2010, and was responsible for the first documented orellanine poisoning in North America. To date it has only been found in Michigan, but it may occur elsewhere with hardwoods in the Midwestern and Northeastern states (Ammirati, 2021). *Cortinarius rubellus*, responsible for the second documented orellanine poisoning in North America, has been found in Washington, Canada and possibly Maine (a photo of only the cap of something that resembles a *Cortinarius* in section *Orellanii* was posted to iNaturalist.org).

I found a probable *Cortinarius* section *Orellanii* in Cordova, Alaska in 2010 and photographed it, but did not ID it to species nor save. According to Ammirati, in some years *C. rubellus* can be common in boreal forests.

**History of Orellanic Syndrome and Symptoms**

Due to the long delays between ingestion and serious symptoms, orellanine mushroom poisonings are often not suspected in cases of acute kidney failure. In fact, the "orellanic syndrome" was not even described until the 1950s, following a mass poisoning in Poland in 1952. *Cortinarius orellanus* was the culprit; 102 people were poisoned, resulting in 11 deaths. The late Tom Duffy, M.D., wrote a nice synopsis of this medical detective work in "Toxic Fungi of Western North America":

"The genus *Cortinarius* [as a whole]… had no significant poisonings attributed to it until a mass poisoning of 102 people occurred in Poznan, Poland in 1952. Stanislaw Grzymala, an epidemiologist, identified the offender as *Cortinarius orellanus.* An unusual cluster of symptoms was usually present in addition to very mild GI symptoms: decreased kidney function with increased urination, intense thirst, marked dryness and burning of the mouth. Some cases progressed to terminal renal failure. This startling epidemic had a very marked delay in onset of symptoms—from 2 days to 3 weeks. As with amanitin poisoning, early appearance of symptoms usually indicated more severe toxicity" (Duffy, 2008).

The orellanine poisoned Québécois firefighter discussed here also experienced unusual flavors in commonly eaten foods; the fatigue that he described is a common complication. Known symptoms of orellanine poisoning, with many more documented since that original cohort of 102, can also include pain in the area of the kidneys, vomiting and diarrhea in the initial phase, and headache (Spoerke, 1994; Benjamin, 1995).

**Incidence and Likelihood of Orellanine Poisonings**

Poisonings with these highly toxic fungi are extremely rare in North America, with only two confirmed examples to date, but less rare in Europe, where mushroom hunting and consumption is far more common. At least fifty more orellanine poisonings have been recorded from Europe since this syndrome was first recognized in Poland (Flament, 2020). Because these mushrooms only occur in high latitude temperate to subalpine conifer forests, poisonings with these *Cortinarius* are highly unlikely across most of the lower latitudes of North America. And yet,

they are the reason that mushroom hunters everywhere in North America are cautioned not to eat any *Cortinarius* (Arora, 1986; Desjardin, 2014; Wikipedia, Cortinarius).

An intriguing reference to mysterious, otherwise uncounted orellanine poisonings in North America can be found on Medscape, in an online seminar titled "Orellanine Mushroom Toxicity" (Brozen, 2019). Several years worth of data was pulled from the American Association of Poison Control Centers' (AAPCC) Toxic Exposure Surveillance System, but with no further details than those shown below. In sum total, they reported 23 exposures to "orellanine containing mushrooms" from 1996-2003, "but no deaths." However, many of the mushrooms listed as potentially containing orellanine in the cited Medscape document have not been shown to contain orellanine (*C. callisteus, C. gentilis, C. splendens, C. cinnamomeus group, C. semisanguineus group*)(Hintikka, 2002), and all *Cortinarius* are notoriously difficult to identify to species. Just what these so called poisonings entailed were left to one's imagination, so it is hard to give much credence to these unsupported statistics. (Brozen, 2019)

**Recognizing *Cortinarius* in Section *Orellani***

*Cortinarius* are a morphologically diverse and widespread genus, and delimiting species of *Cortinarius* from similar looking species can be difficult even for some experts. What distinguishes our North American *Cortinarius* in section *Orellani*, and what are other potential lookalikes? *Cortinarius* in section *Orellani* are medium sized, fleshy gilled fungi with dry, often matted fibrillose caps when young, umbonate or peaked, uniformly reddish/orange caps, seldom or only slightly hygrophanous, and with similarly colored stipes, that may have yellowish (in *C. rubellus*) bands along their club-shaped or slightly enlarged in the center stipes. Their context can be whitish or yellow. The two species found in North America are described below:

*Cortinarius orellanosus*

"Pileus 30-50 mm diam, convex-umbonate to broadly convex-umbonate, disc becoming broad and dome-like, margin incurved to decurved, edge split in age, surface dry, fibrillose to fibrillose scaly, orange brown to reddish brown with ochraceous brown on outer margin, darkening in age. Context yellowish white to dull ochraceous. Odor and taste not recorded. Lamellae deeply adnexed, subdistant to distant, moderately thick, dull orange brown to rust brown, all mature,

darkening in age. Stipe 65-75 mm long, 8-13 mm thick above, base enlarged then tapered downward, basal mycelium whitish, surface dry, with some superficial veil fibrils, pale yellowish to pale ochraceous, with some yellowish white streaks above, discoloring brownish to reddish brown with age.

Basidiospores (9) 9.5-10 (10.5) × (5.5) 6.5-7 µm, Q = 1.5, n = 20, elliptical to broadly elliptical, rarely subamygdaliform, distinctly verrucose, nondextrinoid or only slightly so. Type collection found under oak in Kent County, western Michigan. *C. orellanosus* is most closely related to *Cortinarius orellanus* in section *Orellani,* sharing similarities in cap color and many microscopic features and hardwood host, but also showing significant genetic differences (Judge, 2010).

*Cortinarius rubellus*

Mushroom features include a domed to umbonate to peaked non-hygrophanous to slightly hygrophanous, dry orange-brown to reddish-brown cap that is wooly fibrillose to fibrillose squamulose; pale yellow flesh; adnexed to sinuate gills that are yellow-brown to rusty-brown; dry yellow-brown to red-brown stem that is club shaped or wider in the middle, and has yellowish veil bands; radish to indistinct odor and taste; conifer habitat; basidiospores are ornamented, subglobose to broadly elliptical or elliptical, with considerable variation in shape. The size is variable as well, but most fall into the range 8.9-10.4 (-11.1) X 6.7-7.8 (-8.9) µm (Gibson, 2021; Robertson, 2006).

The recent write-up on this *Cortinarius rubellus* poisoning on https://blog.mycoquebec.org (in French, but easily translated online) has even more taxonomic detail, photographs and micrographs, too. I recommend visiting and viewing.

These orellanine containing species have a distinctive aspect, but could possibly be mistaken for *Cortinarius* in *Telemonia (C. gentilis)* or section *Dermocybe (those with similar coloration), Limonii (C. limonius and C. kroegeri) and Callestei (C. callisteus and relatives) (Robertson, 2006)*. Best to avoid collecting for the table any and all *Cortinarius* species that look even remotely like these. In fact, never pick and eat any wild mushrooms that you don't know well. Some unfortunate poisoning victims have mistaken orellanine *Cortinarius* for chanterelles, and even more incredibly, *Psilocybe semilanceata* (Franz, 1996)!

**Does orellanine occur in *Cortinarius* species that are not in section *Orellani*?**

*Cortinarius armillatus* in subgenus *Telemonia* is a commonly eaten species in both Russia and China, and occurs throughout Europe (Boa, 2004). It is a birch associated species that can be found across North America, wherever *Betula* grows. *C. armillatus* was found to contain trace amounts of orellanine in a highly sensitive bioassay, but showed less that 1% of the amount found in *Cortinarius rubellus* (Shao, 2016). There have been no documented poisonings with this species. *Cortinarius splendens, a* European *Cortinarius* in section *Calochroi,* was implicated in 2 cases of nephrotoxic mushroom poisoning from Switzerland in 1983. The delayed poisoning syndrome was similar to that of orellanine, but only occurred after multiple meals of this species, and with milder symptoms and rapidly resolving kidney damage (Schliessbach, 1983). This was the only recorded incidence of this type of poisoning, and the actual presence of orellanine was never determined.

**Evidence of Edibility of *Cortinarius* and "Guilt by Association"**

The invaluable United Nations F.A.O. document, "Wild and Edible Fungi, A Global Overview of Their Use and Importance to People," authored by Eric Boa in 2004, shows 16 *Cortinarius* species both eaten and sold in markets around the world (*C. armillatus*, *C. glaucopus* and *C. praetens* are a few), and there are surely many species missing from this list (Boa, 2004). Here in North America, Charles McIlvaine, for whom this journal is named, gave evidence of eating twenty different species of *Cortinarius*, although few received high marks for deliciousness (McIlvaine, 1900). Included in his list are *Cortinarius violaceus*, *C. armillatus*, *C. squamulosus*, *C. turmalis*, *C. varius*,
*C. purpurascens*, and *C. caerulescens.* Many have eaten *Cortinarius caperatus*, formerly placed in *Rozites*. With so many *Cortinarius* being eaten by so many people all over the world, shouldn't we be seeing far more poisoning reports, if this genus as a whole really is so dangerous? It is true that specific identification of *Cortinarius* is difficult for most, and that might limit both our toxicology and edibility data.

As I researched *Cortinarius* poisonings in general, I found that information was dominated by studies of dramatic orellanine poisonings, even though these orellanine containing *Cortinarius* within the northern hemisphere are restricted in range to northern latitudes and are few in number, at least compared to the many hundreds of *Cortinarius* species found across North America. The only well documented poisoning by a species other than *Cortinarius section Orellani* that I could find online was the 1983 *Cortinarius splendens* case, discussed earlier. Two cases of so-called poisonings by *Cortinarius* were listed in the NAMA "30 Years of Mushroom Poisoning" report, published in 2006. The first was with *Cortinarius violaceus*, with symptoms of "sneezing and drowsiness!" The second was of someone who ate 35 caps of *Cortinarius semisanguineus*, which resulted in "cramps and dermatitis" (Beug, 2006). Neither set of symptoms is cause for general alarm, or indicative of real toxicity.

It is probable that the reputation of many *Cortinarius* have suffered from "guilt by association," by merely being in the same genus as these potentially deadly, orellanine containing *Cortinarius.* Dangerous and deadly species fascinate us, but they shouldn't blind us to reality: there have only been two known serious poisonings with any species of *Cortinarius* in North America, and these two species have distinctive macro-characteristics. *C. rubellus* has a restricted northern distribution; we have little information about the distribution of *C. orellanosus*, but it may be more widespread in northern broadleaf forests of the Midwest and in the Northeast (Ammirati, 2021). With a modicum of caution based upon likelihood of occurrence, as well as distinctive morphological characters of *Cortinarius* in section *Orellani*, and the general avoidance of lookalikes, perhaps it's time for a reevaluation of our attitudes towards the toxicity and edibility of this genus as a whole?

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**References**

Ammirati, Joseph, 2021, personal communication.

Arora, David. 1986, "Mushrooms Demystified," Ten Speed Press: 419.

Benjamin, Denis, 1995, "Mushrooms: Poisons and Panaceas," W.H. Freeman and Company: 242-263.

Beug, Michael W., Shaw, M. et al, 2006, "Thirty-Plus Years of Mushroom Poisoning: Summary of the Approximately 2,000 Reports in the NAMA Case Registry," McIlvainea 16 (2): 61.

Boa, Eric, "Wild Edible Fungi," F.A.O., 2004, Annex 3: A Global List of Wild Fungi used as food, said to be edible or with medicinal properties. http://www.fao.org/3/y5489e/y5489e00.htm

Brozen, Reed, 2019, "Orellanine mushroom Toxicity," Medscape. https://emedicine.medscape.com/article/818036-overview

Depres, Jean, Dauzet, Patrice et al, 2020, "Intoxication grave par un cortinaire une premiere au Quebec," Le blogue Mycoquebec. https://blog.mycoquebec.org/blog/intoxication-grave-par-un-cortinaire-une-premiere-au-quebec/

Desjardin, Dennis, Wood, M. et al. 2014. "California Mushrooms: The Complete Identification Guide," Timber Press: 267.

Duffy, Thomas J., "Toxic Fungi of Western North America," 2008, Mykoweb. https://www.mykoweb.com/TFWNA/P-32.html

Duravage, Marilyn T., 2021, personal communication.

Flament, Estelle, Guitton, J. et al, 2020, "Human Poisoning from Poisonous Higher Fungi: Focus on Analytical Toxicology and Case Reports in Forensic Toxicology," Pharmeceuticals 13: 454.

Franz, M., Regele, H., 1996, “Magic mushrooms: hope for a ‘cheap high’ resulting in end stage renal failure,” Nephrology Dialysis Transplantation 11(11): 2324-2347.

Gibson, Ian, 2021, “Cortinarius rubellus,” Matchmaker (Mycomatch).

Hintikka, Eeva-Liisa, Korhonen, M., 2002, “A note on the claimed toxicity of “*Cortinarius gentilis*,” Karstenia 43(1): 9-12.

Judge, Bryan S., Ammirati, J. et al. “Ingestion of a newly described North American mushroom species from Michigan resulting in chronic renal failure: *Cortinarius orellanosis*.” June 2010, Clinical Toxicology 48(6): 545-9.

Marilyn TD, 2020, “Poisons Help; Emergency Identification For Mushrooms & Plants,” Facebook.
**https://www.facebook.com/groups/144798092849300**

McIlvaine, Charles. 1900.”One Thousand American Fungi,” Something Else Press: 306-325.

Robertson, Christie, Wright, L. et al, 2006, “Cortinarius rubellus Cooke from British Columbia, Canada and Western Washington, USA,” Pacific Northwest Fungi, Vol. 1 (6):1-7.

Schliessbach, B, Hasler, S. et al, 1983, “Acute kidney failure following Cortinarius splendens (Fries) or “yellow clubbed foot” mushroom poisoning (so-called orellanus syndrome)”, Schweiz Med Wochenschr, 113(4): 151-3.

Shao, Dahai, Tang, S. et al, 2016, “A novel orellanine containing mushroom *Cortinarius armillatus*,” Toxicon, Vol. 114: 65-74.

Spoerke, David G. and Rumack, B., 1994, “The Handbook of Mushroom Poisonings,”: 249-264.


Figure 1. *Cortinarius rubellus* a. from Quebec, Canada (photographer: Renee Lebeuf). b. from Washington state, USA (photographer, Rand Workman).