

Don't Eat Those Wild Mushrooms

...unless you know what you are doing!

Ellen Crocker, *Postdoctoral Scholar, Department of Forestry*
Nicole Ward Gauthier, *Extension Plant Pathologist, Department of Plant Pathology*

Mushrooms are strange and wonderful things – some are beautiful, some are ugly, some are delicious, and some are deadly. Mushroom hunting is a fun and rewarding hobby that can turn a hike through local woods into a puzzle-solving adventure. Many people are drawn to mushroom hunting and the potential to forage for food. Unfortunately, there is a dark side to mushroom foraging: poisoning. Each year, wild mushrooms lead to numerous illnesses and even a few deaths.

While the threat of mushroom poisoning is real, most mushroom-caused illnesses can be prevented if collectors are well-informed and cautious. This fact sheet provides introductory information regarding mushroom safety.

WHEN ARE MUSHROOMS DANGEROUS TO CONSUME?

Poisonous mushrooms

Some mushrooms contain toxins that directly cause poisoning. Different mushroom toxins can cause different symptoms—ranging from mild stomach distress to liver failure and death. A few mushrooms, like the appropriately named Destroying Angel or Death Cap (both *Amanita* spp.)(FIGURE 1) contain potentially lethal toxins and kill a few Americans every year.

FIGURE 1. TWO POISONOUS MUSHROOMS THAT CAN CAUSE LIVER FAILURE AND DEATH, THE DESTROYING ANGEL (A) AND DEATH CAP (B).



Several other mushroom toxins can cause an intense upset stomach. One example is the Jack-O'-Lantern mushroom (*Omphalotus illudens*), which is sometimes confused with the edible Chanterelle (*Cantharellus* spp.). Despite its similar appearance and appealing odor, consumption of the Jack-O'-Lantern results in stomach pain, vomiting, and diarrhea. This is why it's important to carefully identify each mushroom, rather than relying upon superficial appearances.

Environmental toxins

Mushrooms can also absorb toxins from the environment, so it is important to know the history of the site from which specimens were collected. If site history is unknown (e.g., lawn that may have been recently treated with pesticides), do not consume mushrooms from the area.

Preparation, interactions, and allergies

Even mushrooms that don't contain toxins can sometimes cause illness. Many mushrooms, like Morels and some that are commonly found in grocery stores, must be properly cooked to avoid illness. For example, popular Shiitake mushrooms (*Lentinula edodes*) can cause a severe rash in people who are allergic to it in a raw or poorly-cooked state.

Compounds in some mushrooms may also react with other foods or drugs. For example, some Inky Caps (*Coprinopsis* spp.) are tasty but poisonous when combined with alcohol. When consumed up to 5 days before drinking alcohol, these mushrooms can cause sweating, nausea, vomiting, and even heart problems. Other mushrooms are also known to adversely react with various medications, drugs, and alcohol.

Poorly stored mushrooms

Surprisingly, most illnesses associated with consumption of edible mushrooms are a result of microbial spoilage or decaying mushrooms. Bacteria can contaminate mushrooms during collection, transportation, or storage. See safety tip 6, below, to avoid illness from contaminants in poorly stored mushrooms.

7 TIPS FOR SAFE MUSHROOM COLLECTING

1 Learn to identify mushrooms

Like driving a car, mushroom foraging can be dangerous without training, patience, and practice. Those who are interested in mushroom foraging should first learn to accurately identify mushrooms (FIGURE 2). Poisonous mushrooms can look similar

FIGURE 2. KNOWING THE PARTS OF A MUSHROOM AND THEIR CHARACTERISTICS ARE CRITICAL TO PROPER IDENTIFICATION.

Cap

- The top portion of the mushroom.
- Cap shape, color, and texture are used in identification.
- Cap can vary and change greatly over time.

Ring (or annulus)

- Remnant of a membranous tissue (veil) that completely covered the mushroom in its early stages of development.
- Some mushrooms have them, some don't, and some lose them with age so look at mushrooms closely and at different stages.

Stem (or stalk)

Many, but not all, mushrooms have stems. Stems can vary by:

- Shape and size
- Texture (chalk-like? string cheese texture?)
- Color (some change color, bruising when touched)
- Presence of remnant ring or volva

Volva

- Present at the base of some, but not all, mushrooms (a remnant on those mushrooms that initially developed from an egg-like sac).
- Carefully dig up mushrooms to determine if volva is present as cutting their stems may cut off volva.

Gills, pores, tubes, veins, teeth, etc...

- Examine the underside of the cap to identify spore-producing structures, a key part of mushroom identification.
- Common ways that mushrooms present spores include:

Spores

Spores enable mushrooms to reproduce and spread to new places. Spore color can be important in identification. To check spore color, make a spore print:

- Remove mushroom stem.
- Place cap gill (or pore) side down on a sheet of paper (white if you expect dark spores, black if you expect light or both if you are unsure).
- Cover with a bowl 12-24 hours.
- Check spore print left on paper.

to edible mushrooms at certain life stages, so careful observation and identification of each mushroom is critical. Train with a plant pathologist or mycologist, and refer to reputable identification guides. Do not hesitate to ask for help or to confirm identification with experts. Be sure to also learn the poisonous species in the area while learning the edible ones. A great way to learn mushrooms is to join a local mushroom club. Note: if an expert identifies a sample as an edible species, it does not necessarily mean that others growing nearby are the same species.

2 Identify ALL the mushrooms to be eaten

The same mushroom species can look different at different life stages or when growing in different sites. Thus, it is important to identify each mushroom each time any are collected. Once the key characteristics of a favorite mushroom are known, foragers should look for those identifiable features during each collection.

3 Start small

When experimenting with a new mushroom, eat only a little in case of adverse reaction. Wait a few days before eating more. Research the preparation and safety of each mushroom species, as well as food and drug interactions. In addition, always store a few samples of mushrooms that have been eaten in the refrigerator for professional identification...in case there is a need for medical attention.

4 Know mushroom look-alikes

While mushroom identification is notoriously difficult, the good news is that it is relatively easy to avoid the most dangerous mushrooms. Collect and consume only those mushrooms that have been positively identified as edible, and know all of the similar but poisonous look-alikes (FIGURE 3). This greatly minimizes risk of poisoning.

5 Do not trust folklore

Many common hunting anecdotes are dangerously incorrect. Do not trust folklore regarding identification of poisonous mushrooms. For example, **not all** poisonous mushrooms have pointed caps, and **not all** all white mushrooms are safe to eat! Unfortunately, there are no shortcuts to determining whether a mushroom is poisonous. Science-based information and experience are critical.

6 Store mushrooms properly

Whether storing supermarket mushrooms or those collected from the wild, take these steps to reduce contaminants:

- Cut off or clean any dirty portions (once the mushroom is identified as edible). Stalk bases and dirty (soiled) portions may contain bacteria that can grow during transport or storage.
- Store mushrooms in paper (not plastic) bags. Plastic bags create humid conditions where bacteria and other contaminants thrive.
- Keep mushrooms cool; refrigerate immediately after collecting.
- Before preparing mushrooms for consumption, closely inspect and confirm that they are clean and fresh. Discard old mushrooms and any that appear damaged, wilted, or slimy.

7 When in doubt, throw it out

As the old saying goes: “There are old mushroom hunters and there are bold mushroom hunters. But there are no old, bold mushroom hunters.” When in doubt, don’t risk it—remember that delicious edibles can be purchased from many grocery stores, and questionable mushrooms are not worth the potential consequences or the worry.

IF A POTENTIALLY DANGEROUS MUSHROOM HAS BEEN EATEN...

SEEK MEDICAL ATTENTION IMMEDIATELY!

If safety tip 3, above, was followed, some small samples have been saved for identification. This can make the difference between life and death. For example, without medical attention, the survival rate after consumption of toxic *Amanita* mushrooms is approximately 50 percent; but with medical treatment, survival rates increase to around 90 percent.

FOLLOW THE LAW WHILE COLLECTING

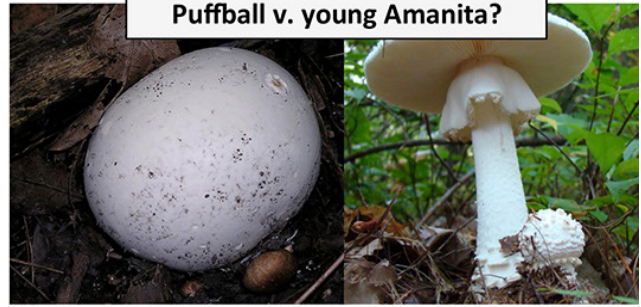
Remember to only collect mushrooms where permitted to do so. Check with parks and public areas regarding regulations and apply for permits, if needed. Do not hunt on private property without permission.

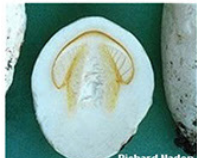
Chanterelle v. Jack-O'-Lantern?



Traits	Chanterelle	Jack-O'-Lantern (poisonous)
Gills?	Close but not true gills. Instead, has smooth gill-like ridges (look melted and are more difficult to remove from cap than normal gills) under the cap to the stem.	Yes. These mushrooms have sharp and non-forking gills that go down the stem of the mushroom a little from the cap.
Growth pattern?	<ul style="list-style-type: none"> Typically solitary or in pairs. Typically growing out of soil. 	<ul style="list-style-type: none"> Typically in big clusters. Typically out of woody material (tree base or roots).
Color in stem?	Cut stem is usually white inside.	Cut stem is usually orange inside.

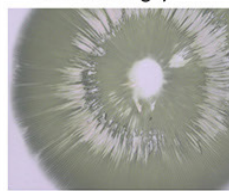
Puffball v. young Amanita?



Traits	Puffball	Amanita (some very poisonous)
Form?	A ball shape (may be oblong or miss-shaped, can vary widely in appearance, even having a stem or stalk).	Mature mushroom has a cap and stalk, but at early stage covered in sack and appears egg-like.
Slice it in half? (top to bottom)	<ul style="list-style-type: none"> Inside you will only find flesh or spores, depending on how old the puffball is. (Only eat them when young, no spores). If it is gooey inside, it might be a slime mold or immature stinkhorn, not for eating. 	If the egg-like button stage is cut in half, a mushroom form is evident. 

Shaggy Mane or Shaggy Parasol v. Green-Spored Parasol?



Traits	Shaggy Mane or Shaggy Parasol	Green-Spored Parasol (poisonous)
Spores?	<ul style="list-style-type: none"> Black (Shaggy Mane) or white (Shaggy Parasol) spores.* <p>*Many other mushrooms have white or black spores. On its own, this information is not diagnostic, just helpful for distinguishing from the Green-Spored Parasol.</p> 	<ul style="list-style-type: none"> Green (make a spore print since the spores may not be evident by examining the gills of young mushrooms, which are white but color with age).

Morel v. False Morel?



Traits	Morel	False Morel (poisonous)
Caps?	<ul style="list-style-type: none"> Typically uniform shape (cap usually longer than stem). Inward pits and ridges. Cap attaches at base to stem. 	<ul style="list-style-type: none"> Can have an irregular shape or bulge outwards. Wavy, lobed, or wrinkled (brain-like). Cap attached at top but not around stem.
Inside? (cut open top to bottom)	<ul style="list-style-type: none"> Hollow from top (cap) to bottom (stem), looking like a rubber mold. 	<ul style="list-style-type: none"> Stem has cottony fibers inside. Parts may be hollow (air pockets) but typically not symmetrical.

FIGURE 3. BEFORE FORAGING FOR MUSHROOMS, KNOW THE LOOK-ALIKES OF COMMON EDIBLES AND THE KEY TRAITS THAT DISTINGUISH THE TWO.

ADDITIONAL RESOURCES

On the Internet

- Field Guide to Common Macrofungi in Eastern Forests and Their Ecosystem Function, GTR NRS-79 (USDA)
http://www.fs.fed.us/nrs/pubs/gtr/gtr_nrs79.pdf
- Mushrooming (Missouri Department of Conservation)
<http://mdc.mo.gov/discover-nature/outdoor-recreation/mushrooming>
- MycoKey – The Mycological Identification Site
<http://www.mycokey.com/newMycoKeySite/MycoKeyIdentQuick.html>
- MushroomExpert.com
<http://mushroomexpert.com/>
- North American Mycological Society
<http://www.namyco.org/>
Note: includes a list of regional mushroom clubs
- Various online forums and groups for mushroom identification, for example,
<http://mushroomobserver.org/>
Note: Be very careful with these sites; as with all social media, there is a risk of unsolicited commentary and misinformation. However, many of these groups are filled with knowledgeable and enthusiastic mushroom hunters. While these groups and forums can be helpful tools, they should not be an exclusive source of identification information.

In print

- *A Field Guide to Southern Mushrooms*. Nancy Smith Weber and Alexander H. Smith. 1988. The University of Michigan Press: Ann Arbor, Michigan. 280pp.
- *Field Guide to Mushrooms*. G. Lincoff. National Audubon Society. 1981. Knopf Publishers. 928 pp.
- *Mushrooms Demystified*. David Arora. 1986. Ten Speed Press: Berkeley, CA. 958 pp.
- *Mushrooms of Northeastern North America*. Bessette, Bessette and Fischer. 1997. Syracuse University Press. 582 pp.
- *Mushrooms of West Virginia and the Central Appalachians*. William C. Roody. 2003. University Press of Kentucky: Lexington, KY. 536 pp.
- *North American Mushrooms: A Field Guide to Edible and Inedible Fungi*. O. Miller and H. Miller. 2006. Falcon. 592p.

February 2016

Acknowledgements

Thanks to Kathie Hodge (Associate Professor, Plant Pathology and Plant-Microbe Biology, Cornell University) and Chad Niman (Primary Forest Products Specialist, KY Forestry Extension, University of Kentucky) for helpful comments on drafts of this article.

Photos credits--Kathie Hodge, Cornell University (1a); Ellen Crocker, University of Kentucky (2-gills, teeth & spore print); Richard Nadon, mushroomexpert.com (3-young Amanita cross-section); Bugwood.org: Norman D. Davis (1b), Joseph O'Brien, USDA-Forest Service (1a, 2-pores, 3-Amanita), USDA Forest Service, Northeastern Area (2-Amanita, 3-Chanterelle), Robert L. Anderson, USDA Forest Service (3-jack o' lantern), Curtis E. Young, The Ohio State University (3-puffball, 3-green-spored parasol spores), Joseph LaForest, University of Georgia (3-Amanita), George Hudler, Cornell University (3-shaggy mane), Gerald Holmes, California Polytechnic State University at San Luis Obispo (3-green-spored parasol), Chris Evans, University of Illinois (3-morel), Dave Powell, USDA-Forest Service, retired (3-false morel)

Educational programs of the Kentucky Cooperative Extension Service serve all people regardless of race, color, age, sex, religion, disability, or national origin.