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Don't Pick Poison! When Gathering Mushrooms for Food in Michigan
Michigan State University
Cooperative Extension Service
Ingrid Bartelli, Consumer Marketing Information Agent, Retired, MSU
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Don't Pick Poison!



**When Gathering
Mushrooms for Food
in Michigan**

**Cooperative Extension Service
Michigan State University
Michigan Department of Public Health
75 cents**

Editor's Note About the Author — INGRID BARTELLI retired in 1974 from a 30-year career with the Michigan State University Cooperative Extension Service. Beginning as a 4-H Club Agent in Baraga County in 1935, she served Michigan's Upper Peninsula throughout her Extension career. When she retired she was District Extension Consumer Marketing Information Agent. Long a dedicated student of mycology, and intensely interested in the proper identification of mushrooms and their safe use as food, she authored the first in this series of Extension Bulletins, *May is Morel Month in Michigan*, in 1968. She wrote the present bulletin, and other earlier titles listed on page 49, in her retirement on special contract with the MSU Cooperative Extension Service and the Michigan Department of Public Health. Two more bulletins in preparation will complete the series. She and her husband, Bart, live in the rural Marquette area of their beloved Upper Peninsula. — DEG

Cover photograph — Developing stage of the deadly *Amanita virosa*, "the Angel of Death."

Cover photograph (and others not credited) by author.

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Foreword and Acknowledgement

THIS PUBLICATION was financed jointly by the Cooperative Extension Service of Michigan State University and the Michigan Department of Public Health in an effort to reduce the number of cases of poisoning from eating wild mushrooms.

Without the infinite wisdom and counsel so generously provided by the foremost authorities in North America in mycology and toxicology, this publication would not have been possible. Those contributing include Dr. A. H. Smith, Distinguished Professor Emeritus, University of Michigan; Dr. Joseph Ammirati, Codirector of North American Poison Mushroom Research Centre, University of Toronto; Dr. Donald Simons, Chemist, duPont Corp., and present Chairman, North American Mycological Association Toxicology Committee, and Duane H. Mitchel, M.D., Denver, Colorado, pioneer educator in the medical implications of mushroom toxins.

As acknowledged in the text, many of the colored illustrations have been provided by Dr. A. H. Smith. The people of Michigan owe a debt of gratitude to these eminent authorities.

INGRID BARTELLI

*Consumer Marketing Information Agent, Retired
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Introduction

AT LEAST 50 of the larger species of wild mushrooms that grow in Michigan are known to be poisonous — there may be more. It is not unusual that several people die from mushroom poisoning each year in Michigan, especially when growing conditions are favorable for a big crop as they were in the fall of 1975. Hundreds of other people either land in the hospital (some suffer permanent organ damage) or they experience some degree of discomfort from eating toxic wild mushrooms.

Why? The purpose of this publication is to help prevent such unnecessary waste of life and needless suffering by documenting in a simple, nontechnical manner, some facts related to mushroom poisoning. Included are facts concerning specific poisons, identification information, some do's and don'ts along with directions on procedures to follow if you experience poisoning from eating wild mushrooms. To benefit, you must do more than look at the colored pictures — study this booklet in its entirety. It is not, however, within the scope of this publication to prescribe any treatment for victims of poisoning.

The ultimate decision whether or not to eat a wild mushroom is yours. Michigan State University, the Michigan Department of Public Health, the author of this publication and those contributing to the subject matter assume no responsibility for the safety or well-being of any mushroom collector.

Some Facts of Life

YOU'RE TAKING A CHANCE when you use wild mushrooms for food. The most important fact to keep in mind is to harvest only the mushrooms you know to be edible and to be so positive of their identity that you can select them — and them only — from among all the other mushrooms that grow in Michigan.

When you study the technical literature, it is frightening to learn that almost every species of wild mushroom eaten, even those that are regarded as excellent edible species, have caused some discomfort to someone. Even our famous Michigan morels are toxic to some few folks. But so, too, are such "safe" foods as wheat flour, eggs, strawberries, tomatoes, peaches, etc. A basic fact of life is: tolerance to wild mushrooms varies with the individual. Just because your neighbor can enjoy them is not proof that you can.

Contrary to some provincial beliefs, poisonous mushrooms grow in every county of our state — yes, even in Michigan's Upper Peninsula. Also, poisonous mushrooms will be found anytime during the fruiting seasons — spring, summer and fall.

Approximately 2,500 different kinds (species) of large, fleshy, wild mushrooms grow in Michigan. By "large and fleshy" we mean those fungi (mushrooms) big enough to be seen easily and large enough "to make a meal" when collected in quantity. The number would be increased by several thousand if the small microscopic fungi were included in the count. Within our approximate 2,500 large species, at least 50 species are known to be poisonous. Anywhere from 60 to 100 species are regarded to be generally safe for eating.

How can you tell them apart? You can't by any easy, magic method. You must learn to make positive identification of each individual mushroom you pick for food. The silver spoon, garlic, onion, or parsley methods of separation do not work!

What Is a Poisonous Mushroom?

Must a mushroom prove deadly when eaten to be considered poisonous? Can it be regarded as poisonous when it causes discomfort to a greater or lesser degree?

For purposes of clarification, in this publication, any mushrooms that prove toxic to you when eaten, whether they be deadly or discomforting, will be regarded as poisonous mushrooms.

Yes, Poisonous Wild Mushrooms Grow in Michigan

From documented case histories and reputations earned over the years, we have compiled a partial list of Michigan mushrooms known to be poisonous. Some are deadly, others discomforting.

<i>Agaricus meleagris</i>	<i>Gymnopilus validipes</i>
<i>Amanita bisporigera</i>	<i>Gyromitra</i> (entire genus)
<i>Amanita cothurnata</i>	<i>Hebeloma crustuliniforme</i>
<i>Amanita muscaria</i>	<i>Hebeloma sinapizans</i>
<i>Amanita pantherina</i>	<i>Inocybe corydalina</i>
<i>Amanita phalloides</i>	<i>Inocybe geophylla</i>
<i>Amanita spreta</i>	<i>Inocybe patouillardii</i>
<i>Amanita tenuifolia</i>	<i>Lactarius pallidus</i>
<i>Amanita velatipes</i>	<i>Lactarius scrobiculatus</i>
<i>Amanita verna</i>	<i>Lactarius torminosus</i>
<i>Amanita virosa</i>	<i>Laetiporus sulphureus</i> (erratic)
<i>Armillaria mellea</i> (if eaten when uncooked)	<i>Lepiota brunneoincarnata</i>
<i>Boletus luridus</i>	<i>Leucoagaricus naucina</i>
<i>Boletus satanus</i>	<i>Mycena leaiana</i>
<i>Boletus subvelutipes</i>	<i>Naematoloma fasciculare</i>
<i>Chlorophyllum molybdites</i>	<i>Omphalotus illudens</i>
<i>Clavaria (Ramaria) formosa</i>	<i>Panaeolus subbalteatus</i>
<i>Clitocybe bartelliae</i>	<i>Paxillus involutus</i>
<i>Clitocybe cerussata</i>	<i>Pholiota squarrosa</i>
<i>Clitocybe dealbata</i>	<i>Psilocybe caerulipes</i>
<i>Clitocybe dilitata</i>	<i>Ramaria formosa</i>
<i>Clitocybe morbifera</i>	<i>Ramaria apiculata</i>
<i>Clitocybe rivulosa</i>	<i>Russula</i> genus
<i>Clitocybe subdorifica</i>	<i>Sarcosphaeria crassa</i>
<i>Conocybe</i> genus	<i>Scleroderma citrinum</i> (<i>aurantium</i>)
<i>Coprinus atramentarius</i>	<i>Stropharia</i> genus
<i>Coprinus insignis</i>	<i>Tricholoma pardinum</i>
<i>Cortinarius gentilis</i>	<i>Tricholoma saponaceum</i>
<i>Entoloma lividum</i>	<i>Tricholoma subacutum</i>
<i>Galerina autumnalis</i>	<i>Tricholoma vaccinum</i>
<i>Galerina marginata</i>	<i>Tricholoma venenata</i>
<i>Galerina venenata</i>	<i>Verpa bohemica</i>
<i>Gomphus floccosus</i>	

Fact or Fiction — Who Knows?

There is much superstition regarding mushroom poisons. For example, "If you pick one of the known deadly mushrooms and return to the very spot from which it was picked on the following day, you'll find in its place a serpent — often with a jewel in its head."

There is also much superstition on how to tell a poisonous from a non-poisonous mushroom by some simple kitchen test. Not so!

The use of continually improved, sophisticated instruments and equipment by dedicated, eminent scientists is resulting in greatly increased knowledge in the field of mushroom toxins.

Dr. Joseph Ammirati of Erindale College, University of Toronto, is codirector of the recently instituted North American Poison Mushroom Research Centre. He and Dr. Donald Simons, chemist with the duPont Corporation in Wilmington, Delaware, are coauthoring a forthcoming technical publication on poisonous mushrooms to be released by the U.S. Department of Agriculture in 1977. Dr. Simons knows as much or more than anyone in the United States about the chemistry of mushroom toxins. He is current chairman of the toxicology committee of the North American Mycological Association.

The U.S. Department of Agriculture has established a Poison Fungi Center in Beltsville, Maryland, which will be a reporting station and clearing house for cases of mushroom poisoning.

Duane H. Mitchel, M.D., Denver, Colorado, has pioneered in educating the medical profession and the public on mushroom toxins. He is very capable and former chairman of the toxicology committee for the North American Mycological Association.

For several years, a seminar on mushroom toxins has been conducted at Aspen, Colorado, intended primarily for the medical profession. A book is promised as a result of these seminars to be edited by Dr. Barry Rumack of Denver, Colorado.

Many of the organized mushroom clubs, particularly those on the West Coast, have printed information on mushroom poisoning.

The most obvious sources of authentic information are the recognized authorities in the field of

mycology. We in Michigan are double blessed with two renowned mycologists, Dr. Alexander Smith, Professor Emeritus, with world-wide recognition, and Dr. Robert Shaffer, Director of the Herbarium, both at the University of Michigan in Ann Arbor.

Almost every mushroom book written by a recognized authority on mushrooms deals to some extent with mushroom poisoning. A word of caution, however: be sure that the literature you study is written by an authentic expert. There is some misinformation in print. Then, too, since new information is continually being discovered, some information in print becomes outdated.

Mushroom Toxins

Very briefly, some toxins of wild mushrooms and their effect on humans will be discussed. Since there is so much we still do not know about mushroom poisons, we must always be cautious when using wild mushrooms for food.

We must remember also that poisonous wild mushrooms are apt to contain not just a single poisonous chemical but often a combination of poisonous compounds.

Amatoxins

About 95 percent of reported mushroom fatalities have been caused by eating mushrooms from the genus (group) called *Amanita* or from the genus called *Galerina*. These mushrooms as well as certain mushrooms in the genera (groups) *Lepiota* and *Conocybe* contain a group of chemically related toxins collectively called amatoxins. Individual toxins bear such names as alpha-amatin, beta-amatin, and amanin.

Other than the toxins that are present in them, there is usually little similarity among these groups of mushrooms. The symptoms of poisoning from amatoxins in the *Amanita*, *Galerina*, *Lepiota* and *Conocybe* genera are slow to appear. You may not realize you have been poisoned until 10 or 12 hours after you have eaten the mushrooms. By that time

the poison has been pretty well distributed throughout your system. Severe stomach cramps along with vomiting and persistent diarrhea are often the first symptoms to appear. They often subside to be followed by severe pain from kidney and liver damage. Death usually follows in three to seven days.

In very recent years, some success in saving lives of victims in the U.S. has occurred when Dr. Donald Simons alerted a physician treating cases of poisoning about the thioctic acid treatment used in Czechoslovakia.

If you plan to eat mushrooms, it is imperative that you recognize the killers containing amatoxins; namely, those in the four genera *Amanita*, *Galerina*, *Lepiota* and *Conocybe*.

Gyromitrin

A second type of toxin, called **gyromitrin**, is found primarily in the genus *Gyromitra*, a false morel commonly called the beefsteak, elephant ears or the brain mushroom. The poisons have recently been shown to be **monomethylhydrazine derivatives**. Monomethylhydrazine (often used in rocket fuel) affects the nervous system, with damage to liver, blood and kidneys. Onset of symptoms is usually delayed six to eight hours after eating. In research studies it has reportedly caused tumors in mice.

Gyromitra poisoning manifests itself by a bloated, too-full feeling in the stomach, followed by vomiting and a persistent diarrhea. Headache, severe stomach cramps and intense pain in regions of the liver are followed by a jaundiced condition with its characteristic yellow coloration.

Death is not certain with this type of poisoning but a miserable two weeks of hospitalization, with permanent damage to the liver and kidney a likely possibility, makes it imperative to avoid eating mushrooms of the *Gyromitra* group.

Yet we know that thousands of people eat *Gyromitra esculenta* deliberately. They get by with it because monomethylhydrazine is volatile — it evaporates when heated — and because liquid in which the mushrooms are cooked is discarded. Apparently humans have some tolerance to the poison, and only when it is consumed in large quantities or repeatedly does it trigger the symptoms of *Gyromitra* poisoning. It is suspected, however, that even though one does

not experience the poisoning symptoms, some damage to kidneys, blood and liver does occur.

Mushrooms of the *Gyromitra* genus must be regarded as definitely poisonous and not fit for consumption.

Muscarine

Another group of mushrooms contain the poison muscarine and its associates. Certain species of the *Clitocybe* genus and most species of *Inocybe* are the culprits. They commonly grow in lawns or under shrubbery, in the woods and abundantly along roadsides. This makes them readily accessible to young children who put everything they get their hands on into their mouths. Also the people who collect *Marasmius oreades* (the fairy ring mushroom that grows in lawns) for food have been known to accidentally include some of the innocent-looking *Clitocybe* or *Inocybe* specimens in their collections. Fatalities are not common, however.

Muscarine and related chemicals manifest their poisonous effects within one half to two hours after being eaten. Blurred vision, excessive sweating and watering eyes are accompanied by a slowed heart-beat, reduced blood pressure and congestion of the circulatory system in the lungs, resulting in asthmatic breathing.

Youngsters and those who carelessly collect *Marasmius oreades* for food are most apt to be victims of muscarine type of poisoning from species of *Clitocybe* and *Inocybe* mushrooms.

Muscimol and Ibotenic Acid

The central nervous system is the target of muscimol and ibotenic acid poisons found in a group of *Amanita* mushrooms.

One half to one hour after eating, drowsiness is followed by an intoxicated feeling, confusion and delirium, along with muscular spasms and visual hallucinations. Symptoms may last as long as four hours. The completely-out-of-it feeling is followed by deep sleep as though one had been anesthetized.

The fatality rate from mushrooms containing ibotenic acid and muscimol is estimated at 1 to 5 percent.

Acetaldehyde Syndrome

Soon after *Coprinus atramentarius*, a species of inky cap, is consumed along with some alcohol, an alarming physical reaction occurs which may last as long as eight hours. Symptoms are initiated early after combining alcohol and *C. atramentarius* or by the consumption of alcohol up to 48 hours after eating this mushroom. Intense flushing of the face and neck, a metallic taste in the mouth, heart pounding and a feeling of swollen hands are the early symptoms. Nausea, vomiting and a state of confusion generally follow. *C. atramentarius* contains a chemical compound that interferes with the metabolism of alcohol, causing acetaldehyde to accumulate in the blood. The dramatic reactions cease with time and reassurance.

Do not mix *C. atramentarius* and alcohol if your stomach be the container!

Currently Unidentified Toxins

There are those poisons in a great many mushrooms which are on record as producing a powerful stomach ache followed by vomiting and diarrhea. Symptoms occur one half to one-and-a-half hours after eating and may last three or four hours. Recovery is usually complete in a day or two.

Certain species of *Agaricus*, *Lactarius*, *Entoloma*, *Russula*, *Tricholoma*, *Chlorophyllum*, *Pholiota* and *Scleroderma* are among the many wild mushrooms known to cause gastronomical distress.

Psilocybin and Psilocin

The central nervous system is affected also by the poisons **psilocybin** and **psilocin** found in several dozen mushrooms among the genera *Psilocybe*, *Conocybe*, *Panaeolus* and *Stropharia*. Many of these mushrooms are of the small brown-spored varieties. Therefore the cautionary advice is to avoid eating all L.B.M.s (little brown mushrooms).

In summary, a great many mushrooms contain one or more poisonous substances. There may be additional toxins not yet isolated and identified. If you wish to enjoy wild mushrooms for food, you

must study until you are certain of positive identification, not only of those which are regarded as edible, but also those that are poisonous. There is no other way to insure your safety and survival.

Why Are People Poisoned?

There are few known reports of deliberate suicide from ingestion of wild mushrooms. The majority of mushroom poisonings can be classed as accidents. If we are aware of what caused these accidents we can gain some benefit from mistakes of previous victims.

1. People have been poisoned because of innocence or ignorance. You don't realize there are poisonous mushrooms so you pick "mushrooms" — any and all — as blissfully as you'd pick wild flowers. A case in point:

A Chicagoan became an outdoor recreation enthusiast. In winter months he joined the crowd that headed north to ski resorts. In the spring and fall he knew some of the same crowd headed north again to collect wild mushrooms in the woodlands. One weekend he found his way to northern Michigan and chanced upon a heavy fruiting of miscellaneous mushrooms. He collected three bushel baskets full of mushrooms, put them in the trunk of his car and headed back for Chicago. Probably the only thing that saved his life was the fact that mushrooms packed in such quantities, in deep containers and transported in the hot trunk of a car, would become completely decomposed, putrid mush by the time he reached his destination.

We must recognize the fact that there are poisonous mushrooms and we must learn to identify the "bad" ones as well as the "good" ones.

2. Many people have been poisoned by mushrooms because they ate too much at one sitting or because they ate them repeatedly at successive meals. We humans have tolerance levels. Very small amounts of poison may produce no visible reactions. Take fish, for example. Polychlorinated biphenyl (PCB), a poison, is present in some Great Lakes fish. "Safe" level of consumption for humans is set at so

many parts per million. More than the specified amount results in fish classified as "unfit for human consumption." Because some of the fish toxins build up and accumulate in the body to the "unsafe" limits, we are warned to eat fish no oftener than once each week. The same holds true of some toxins found in mushrooms, so we are warned that **over-eating at one time or eating the same mushroom at successive meals can cause poisoning.**

This is a common cause of poisoning in the spring among those people who persist in eating a poisonous false morel named *Gyromitra esculenta*, commonly called the beefsteak or brain mushroom. It is possible to consume small amounts of this mushroom without experiencing any visible signs of poisoning, so the hard-to-convince insist it is edible. If you should be one of the hard-to-convince, visit one of the casualties who has indulged beyond his tolerance level. Ask him how he enjoyed his 10 to 14 days in the hospital. Ask him, too, how much permanent damage resulted to his liver. Invite him to join you in a mushroom feed and see how fast he turns you down.

3. Mistaken identity is cause for many accidents resulting in mushroom poisoning. It is easy to mistake the identity of a mushroom. So many mushrooms look alike. You may think you know but you really do not. You may be taking advice from someone who knows as little as you — or less — about mushroom identification. There are a lot of dangerous "self-appointed authorities" at large.

4. Carelessness ranks high among reasons for mistaken identity, especially in years of heavy fruitings. "Stump" mushroom collectors have carelessly included some deadly poisonous *Galerina autumnalis* growing with their *Armillaria mellea* on the same stump to cause some of the fatalities on record in Michigan.

5. You may be picking at a time when it is hard to identify a mushroom: at dusk when it's too dark to see detail clearly; in the rain or soon after when mushrooms are wet. Or perhaps you pick mushrooms when your senses of observation are dulled by fatigue or by alcohol.

6. It is easy to make a mistake in identity if you collect mushrooms in the button stage. How many wild flowers could you identify from the bud alone? The button stage of a mushroom is similar to the bud stage of a flower.

You must be absolutely certain of the identity of every single mushroom collected for food.

7. The cases of mushroom poisoning among young children often result from the developmental fact that a child learns about his world by trying to eat everything he can get to his mouth. There have been numerous cases of toddlers having eaten raw wild mushrooms, some of which have been poisonous. On lawns and under garden shrubbery are favorable habitats for several species of small, innocent-looking, poisonous mushrooms that pose a hazard for young, "learn-by-eating" children. The fact that the mushrooms are eaten raw adds to the hazard.

8. Some accidents have been caused because the victim had to perform — to show off. "See this mushroom! It's good to eat. I'll prove it to you!" So he eats one raw. He may even convince his friends to be "heroes" and do likewise.

If you must show off, choose some method other than eating wild mushrooms.

9. Wild mushrooms, even some considered edible, have caused distress when eaten by persons who tend to be allergic to various foods, pollens, etc. Some mushrooms considered to be edible have caused distress when eaten by persons in poor health.

If you are allergic or in ill health, avoid eating wild mushrooms.

10. Then we have a few accidents among the folks whose minds are geared to their stomachs. They live to eat. They seem to have no problem convincing themselves that, "There are so many of them they have to be good to eat," or "It's so big it'll make two or three good meals." The sheer beauty of some wild mushrooms makes them look "good enough to eat."

11. A surprising number of persons insist on experimenting, using themselves as guinea pigs. This

is more apt to be true among the young and adventurous, often seeking some mind-affecting or intoxicating results. They'll often continue their "experiments" until they do suffer some poisonous effect.

These are a few of the more common causes of accidental mushroom poisoning. There are many others.

The Problem of Identification

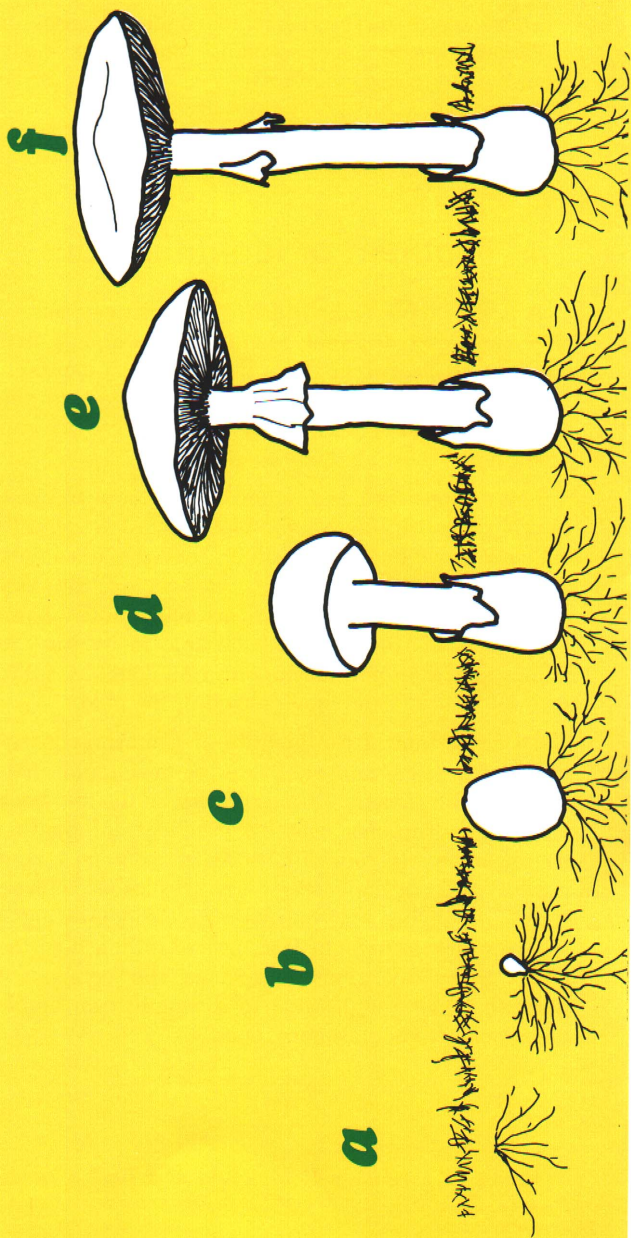
It is no simple task to learn the positive identity of some 2,500 different Michigan mushrooms that could be collected in enough-for-a-meal quantities. No one could name them off at a glance, but the renowned mycologists at the University of Michigan could name most of them on sight.

Lay persons such as you and I must learn to make positive identification of the **one** species we plan to eat and learn to distinguish it from the remaining 2,499. But we're safe only if we recognize also any poisonous mushroom of similar appearance. Even after years of study we may be able to identify no more than a dozen mushrooms. As long as we're sure of one, we can enjoy collecting for food.

To be certain of the identity of a mushroom, we must have some comprehension of mushroom anatomy and physiology. Almost every authentic book on wild mushrooms contains excellent information on taxonomy. If you wish to learn, you must read the text and not limit your study to colored pictures. It is unthinkable that one would consider eating a wild mushroom without first understanding how the plant grows. We must recognize the component parts that make it possible to distinguish an edible mushroom from poisonous ones.

Invest in a reliable field guide and find a qualified teacher.

Amanita Anatomy



White *Amanita* Mushrooms Are Poisonous at All Stages

- a** A spore of a white *Amanita* lands on a supply of food in a suitable environment. It germinates and produces within the soil a vegetative growth called **spawn** or **mycelium**. The mycelium is composed of many fine hair-like threads called **hyphae**.
- b** A nodule develops in the mycelium which will grow into the **fruiting body** (mushroom) of the plant.
- c** The egg-shaped button of the *Amanita* is encased in a thick membrane called a **universal veil**.
- d** The developing mushroom pushes a hole through the top of the universal veil membrane, leaving a cup-like structure called a **volva**, at the base of the stalk at or just beneath the surface of the soil. As the stalk grows in length, another membrane, called a **partial veil**, is evident. It covers the gills beneath the cap, reaching from its attachment around the stalk to its attachment to the cap margin.
- e** When the cushion-shaped cap expands and begins to flatten, the partial veil breaks away at the margin of the cap but remains attached to the stalk. The soft membrane falls downward to form a skirt called an **annulus** or **ring** on the stalk.
- f** When mature, the cap has expanded to a flat cushion-shape. The gills are exposed and the spores, which have developed and ripened on the sides of the gills, can drop freely into air currents to be carried off and begin the cycle again. The partial veil hangs as a ring on the stalk, and the universal veil forms the cup or volva at the base of the stalk, which may be out of sight beneath the surface of the soil. This beautiful pure white mushroom has earned the titles, **Angel of Death** and **Destroying Angel**.

When overmature, the edges of the cap turn upward; decomposition discolors the cap surface and the ring on the stalk disintegrates and may fall off.



White Amanita Mushrooms

By way of review, we will study the anatomy of mushrooms in the genus *Amanita*, which includes species that are the most deadly of all wild mushrooms. Several dozen species of *Amanita* grow in Michigan. But because they fruit so abundantly, *Amanitas* will be found in numbers to equal other genera with many more species.

Most of the deaths from mushroom poisoning are caused by eating *Amanitas*.

Do Amanitas Grow in Michigan?

Yes, and in great abundance. Some begin to fruit in early summer. Many species fruit heavily in late summer and fall right through to snowfall. When they grow is referred to as **season of fruiting**.

How do they grow? This is referred to in your literature as **habit or manner of growth**. *Amanitas* grow singly, often in patches (gregarious), on the ground (terrestrial) and most often in a woodland setting.

For a brief review we will refresh our minds on how mushrooms grow, in general, and more specifically, on how mushrooms of the genus *Amanita* grow.

Mushrooms reproduce by spores. A microscopic spore of a mushroom plant, which serves the same purpose as a seed in an ordinary plant, is carried

off by the wind or other means of transportation. If it should fall on a spot with favorable growing conditions, the spore will germinate.

Mushrooms contain no chlorophyll, the green coloration that makes it possible for most plants to manufacture food. Therefore, in order to survive and continue to grow, the spore must land on a supply of the particular food it needs and in an environment conducive to growth. The germinating spore develops into a mass of minute, hair-like threads that spread out through the nutrient medium. These threads are the vegetative part of the plant referred to as mycelium. We seldom see the mycelium. The mycelium produces the mushroom or fruit just as an apple tree bears apples.

Many mushrooms are extremely specific in their food requirements. They live only on the dead carcass of an ant or grub, the heartwood of a specific tree, or in association with a certain species of tree, etc. *Amanitas* seem to prefer some type of tree cover. Some prefer aspen, and others prefer jack pines on sandy dry land. Many grow in cool, moist, mixed hardwood and conifer woodlands. Others prefer hedge rows and brush land for cover.

There is a tremendous diversity in size, shape and color of mushrooms. Size varies from microscopic to fruiting bodies that fill a bushel basket. Most mushrooms that we collect for food range from a few inches to 10 or 12 inches in height.

The visual image of a mushroom to most people is that of a cap on a stalk with a gilled structure on the underside of the cap. But many mushrooms vary from this popular image. The purpose of the mushroom fruit is to bear spores and they are produced in a half dozen different ways, resulting in different shapes of mushrooms. Some spores grow on gills under the cap, others on upright branches resembling coral. Some spores are produced on spines or teeth, in cups, or in pits on the cap surface. Others produce spores in tiny pores or within small tubes beneath the cap. Some spores are produced within a ball-like structure that we know as puffballs.

Amanitas belong to the group of mushrooms that produce spores on the sides of gills that form on the underside of the cap. (The cap is called a *pileus* in technical literature.)

The *Amanita* fruit begins to form as a small lump or nodule of mycelium which is out of sight in the duff and soil. When the tiny fruit body first devel-

ops from the mycelium, it looks much like an egg. The entire mushroom is encased in a tissue covering it much as soft egg shell. This tissue is called a **universal veil** because it encases the whole fruit. At this early stage, the fruit does not always penetrate through the soil surface.

All young mushrooms are called buttons just as young flowers are called buds. As the *Amanita* button grows, the cap breaks through the encasing universal veil. In some species the cap pushes a hole through the top of the enclosing shell and grows up to its full height, leaving a cup-like **volva** at the base. In other *Amanita* species, the universal veil tissue is soft. As the cap ruptures the veil, some of the veil sticks to the cap as patches, warts or freckle-like speckles. The remainder forms folds or rings of tissue at the bulbous base of the mushroom.

As the cap and stalk of the *Amanita* emerge and become taller, a second type of veil is apparent. This is a tissue covering the gills on the underside of the cap. The tissue is attached to the stalk and extends out to the edge of the cap, forming what is called a **partial veil**. As growth continues, the cap expands, causing the partial veil to break from its attachment. In the case of *Amanitas*, the veil usually breaks away at the edge of the cap but stays attached to the stalk to form a ring or skirt on the upper part of the stalk.

After the partial veil breaks away from the edge of the cap, the gills, where the spores are produced, become visible. The gills are the blade-like structures that radiate from the stalk out to the edge of the cap, like spokes of a wheel. It is important in identification to study the manner in which the gills join the stalk. In the case of *Amanitas*, the gills are not attached to the stalk. They grow up to it but typically remain free from the stalk.

When the *Amanita* fruiting body is mature, it has grown as tall as it will be. The cap has enlarged from its cushion-shape to a large, basically flat circle.

Another indication of maturity is the ripening of the spores. When spores are ripe they are discharged from the gills by the millions to be carried away by the wind. Even though they are extremely minute, the spores provide important clues to mushroom identity. Their shape and size can be determined only by using a high power microscope. But the

color of the spores, a most important clue, can be determined by collecting them in great enough quantity on a piece of white paper to determine the color. This is called a **spore print**.

Spore color of mushrooms, as determined by viewing a spore print, varies from white through the color spectrum to black. Because spore color is constant, it becomes a reliable feature in identification. In the case of *Amanitas*, the color of the spore print is white. Always check the spore color of a mushroom to be identified by the simple procedure of making a spore print according to the following procedure:

To make a spore print you will need a mature mushroom and a piece of white (always use white) paper. In case of a gilled mushroom, cut the cap off the stalk and set the cap on the paper with the gill surface down — the same direction as when the mushroom is growing. It will help to place a bowl over the whole thing so the cap and gills do not dry out and the spores are not disturbed as they fall on the paper. A wrap of wax paper works well if you're working in the field. After a period of time (like overnight) lift the cap off the paper and observe the color. The mass of spores that fell make the spore print. And if the mushroom is an *Amanita*, the spore print will always be white or nearly so.

Colors of other parts of *Amanita* mushrooms vary greatly. Cap color varies from white to shades of gray, lavender, yellow, brown, red and green. Some are intense yellow, orange or red. The white ones usually have smooth tops, while others are decorated with patches or freckles of the universal veil tissue. The size of *Amanitas* varies. Some are two or three inches high, others a foot or more. Even with all these variations, all *Amanitas* have some common characteristics:

1. Most important common characteristic is evidence of a universal veil, the remains of which are evident as a cup or volva at the base of the stalk (stipe), as zones or folds of tissue on the bulbous base of the stalk and/or as freckles, warts or patches clinging to the surface of the cap.
2. Also important is the presence of a partial veil which forms a ring or skirt of tissue encircling the stalk just beneath the cap in most species.

3. The fact that the gills do not or barely reach the stalk is diagnostic. They are free from the stalk but held in place by their full-length attachment to the underside of the cap.
4. The white to very pale color of the spore deposit adds to the list of *Amanita* characteristics that will help us identify these most poisonous of all wild mushrooms.

The characteristics are there if we look. Too often we pick mushrooms as we do daisies. We pay no attention at all to the base of the plant. We may have to dig away several inches of duff or soil to observe the volva at the base of the *Amanita* fruiting body. Because the tissue of the partial veil is tender, the ring on the stalk may be washed or brushed away. If we look carefully, we usually will see some evidence of ring remnants. Certainly we must study the gills and their attachment. And to know the color of spores we must make a spore print.

It is imperative to learn to identify and avoid the mushrooms that have proven to be the most deadly of all poisonous wild mushrooms — the *Amanitas*.



Learn To Recognize Poisonous Mushrooms

In an effort to help you recognize poisonous mushrooms, identifying characteristics are described on the following pages along with colored pictures of some of the more common species that grow in Michigan. The mushrooms are grouped according to the toxins they contain, (shown in bold type in parentheses) as noted earlier in this publication.

group **I** (amatoxins)

In this group are those containing amatoxins, which chemically are cyclic octapeptides. They include *Amanita phalloides*, *verna*, *virosa*, *tenuifolia*, *bisporigera* and *spretta*; and *Galerina autumnalis*, *marginata* and *venenata*.

Symptoms¹

First symptoms come late—6, 24, 48 hours (average 10 to 14 hours) after eating the mushrooms. Sharp abdominal pains are followed by violent vomiting and a persistent cholera-like diarrhea (stools often contain blood and mucus). These symptoms tend to subside and the patient appears to improve. In three to four days the patient's condition begins to worsen with symptoms of liver and kidney failure leading to death in 7 to 10 days. Autopsy findings are: marked gastrointestinal edema, hemorrhagic gastroenteritis, lymphoid tissue and lymph node hyperplasia, fatty degeneration of the heart and liver, central lobular necrosis of the liver similar to that seen in carbon tetrachloride poisoning, tubular necrosis of the kidneys, and swollen brain with multiple hemorrhages and degenerative nerve cell damage. Death is primarily from liver and kidney failure.

Treatment

It is not within the scope of this publication to prescribe treatment. Authentic information can be found in papers by Donald M. Simons, Ph.D., "The Mushroom Toxins" printed in the Delaware Medical Journal, Vol. 43, Number 7, July 1971, page 177; also by Duane H. Mitchel, M.D., "Mushroom Poisoning, Superstition to Science" printed in Life and Health, June 1974.

Information on treatment of mushroom poisoning should be available to the medical profession at the various poison centers throughout the state.

¹As described in paper by D. H. Mitchel, M.D., titled, "A Summary of Present Knowledge of Mushroom Poisoning" published in Life and Health, June 1974. (Reprinted with permission.)

White Amanitas – The Angels of Death

Amanita virosa, *verna*, *tenuifolia*, *bisporigera* and *phalloides* all contain the deadly amatoxins.

With the exception of *A. phalloides* and *A. spreata*, they are all white or nearly so. *A. phalloides* has greenish tints with darker radiating streaks on the cap but the gills and stalk are white. The other species may have a slight creamy tinge.

All of these species of *Amanita* grow out of a well-defined cup or volva. You may have to dig through a few inches of duff to find it at the base of the stalk. The cup was the universal veil which enclosed the entire mushroom in its early developing button stage.

The mature *Amanita* mushroom of this group will have a flaring ring or skirt of tissue encircling the stalk near its upper portion. This partial veil broke away from the edge of the cap when it expanded but remained attached to the stalk.

The stalk, which is slightly narrower at the top than at the base, is white in all of these deadly species.



(*Amanita spreata*)

Courtesy A. H. Smith

Amanita spreata is very common in the sandy pine-oak barrens of Michigan. The base of the stalk of this deadly dingy white *amanita* is buried deep beneath the soil surface, so the rather delicate volva at the base is not visible unless dug out of the ground. The distinguishing volva of *amanita virosa*, pictured on the front cover, is more apt to be visible since it grows closer to the surface of the soil.

The cap is cushion-shaped when young but expands to nearly flat or slightly upturned in age. It is smooth and dry.

The gills beneath the cap are white and are not attached to the stalk but taper to nothing next to the stalk.

The mature plant is usually 7 to 12 inches tall. It grows singly and isolated or in groups.

The white *Amanitas* grow in mixed woodland areas. They fruit abundantly in midsummer, late summer and fall. These beautiful, clean, white, pure-looking mushrooms fruit in such abundance that they dominate the mushroom flora in August and September in many of the hemlock-hardwood or birch-balsam mixed woodlands of the Upper Peninsula of Michigan. Deadly *A. sprete* fruits abundantly in sandy oak woods of Michigan.

Anyone collecting wild mushrooms for food must learn to recognize and avoid the white *amanitas*. They truly are "Angels of Death."

Galerina autumnalis

Galerina autumnalis is also a condemned murderer. It is believed to contain the same type of cyclic octapeptide toxins as the white *Amanitas*. In no respect, other than their ability to kill, do the *Galerinas* resemble the *Amanitas*.

The small unattractive, dingy brown *G. autumnalis* grows on or near rotting wood as compared to the stately, slender white *Amanitas* that grow from the soil. But the results, should either be eaten, are the same — almost certain death.

G. autumnalis grows out of decomposed wood, preferably hardwoods, in dense clusters or masses in cracks in the bark of old logs. Occasionally, single or small groups will occur.

The fruiting body ranges from 2 to 4 inches tall, and the entire plant is a dingy yellow-brown. The cap is cushion-shaped, 1 to 1½ inches wide, smooth and slightly sticky when moist.

The gills are dingy, creamy-tan at first, turning to dingy brown in age. The stalk is 2 to 4 inches tall and ¼ to ⅓ inch wide. It is somewhat rough and

scaly and of cartilaginous structure so it bends easily without breaking. A most important feature is the presence, at least on some of the specimens in a cluster, of a narrow, band-like ring of sticky fibrils (or remnants of such) on the upper part of the stalk.

The color of the stalk is dull white at the base of the cluster when compacted together; the upper parts vary from a silky tan to dingy dark brown. A distinguishing characteristic is the darkening of the stalk from the bottom up as the fruiting body ages.

The spore color, as observed from a spore print, is a dingy yellowish-brown.

There are several species of *Galerina* but *G. autumnalis* is the one found commonly in Michigan. All *Galerinas* should be avoided.



(*Galerina autumnalis*)

Courtesy A. H. Smith

Galerina autumnalis has been responsible for several deaths in Michigan. This dingy, brown mushroom grows on or near wood with fruiting seasons in the spring and again in the fall when moisture is sufficient.

group **2** (gyromitrins, or hydrazines)

Mushrooms containing **monomethylhydrazine** and its derivatives are in this group. These toxins have been collectively referred to as gyromitrins or hydrazines. Species in this group include *Gyromitra esculenta*, *infula* and *brunnea*.

Symptoms (see footnote 1, page 23)

These are similar to those of the Amanita toxins (Group 1), but the latent period is shorter (usually 6 to 8 hours). A feeling of fullness in the stomach precedes the vomiting and the watery diarrhea which could persist for as long as two days. Headache, lassitude, cramps and intense pain in the regions of the liver and stomach are followed by jaundice.

Treatment (see page 23)

Gyromitra esculenta

'Tis no surprise that this false morel has caused so much trouble. The recently identified poisons in it are monomethylhydrazine and derivatives. And (in case you've forgotten) we repeat: monomethylhydrazine is the very toxic material used in rocket fuel! However, consumption of *G. esculenta* is more apt to propel you to a hospital bed than to the moon.

G. esculenta (*Helvella esculenta* in some literature) is commonly called the beefsteak, brain or elephant ears mushroom. It is one of the earliest to fruit in the spring (during April and May in Michigan). It is deliberately collected by hundreds of morel hunters anxious to get a taste of spring after a long cold winter. It fruits in abundance, particularly in the sandy pine country so prevalent in Michigan.

The toxins in the *Gyromitras* affect the nervous system primarily, but also the kidney and liver. Blood damage also results. Dogs suffer from symptoms similar to man from poisoning by *Gyromitras*.

Some people consume this mushroom deliberately. They will not be convinced that it should not be

eaten. They may be spared apparent toxic effects for several reasons:

1. They are basically in good health and nonallergic.
2. They consume only small amounts at a time, and do not eat this mushroom at successive meals so they do not exceed their tolerance level of the *Gyromitra* toxins.
3. They parboil the mushroom in a large quantity of water which is discarded, and avoid breathing the fumes as the mushroom is cooked.
4. Then they cook the mushroom in an uncovered pan, allowing the remaining volatile toxins to escape.

No matter what the circumstance, *G. esculenta* and several other species of *Gyromitra* must be considered to be poisonous and not fit for consumption.

G. esculenta is 2 to 8 inches tall. The cap varies a great deal in color and texture. Some are pale creamy-tan, reddish-brown or even a dark, almost black, brown. The cap may be smooth, lobed and billowy or deeply wrinkled (like a brain). It is irregularly spherical, sometimes flattened or depressed on top and tending to be saddle-shaped. A single fruiting body may be composed of 3 to 5 irregular lobes.

The margin of the cap usually turns in toward the stalk.



(*Gyromitra esculenta*)

In spite of the fact that some people persist in gathering this early spring fruiting mushroom for food, it must be considered poisonous. The toxin in *Gyromitra esculenta* is a derivative of monomethylhydrazine — a highly toxic component of rocket fuel.

The stalk varies from white to creamy-tan. It is 1 to 2 inches wide and often fused together to give the appearance of a multiple stalk, but the typical interior has only one channel. *G. esculenta* grows from the soil.

Another species known to be poisonous is *G. infula* (often called *Helvella infula*). It has a saddle-shaped cap, fruits in midsummer to fall on moist, rotted conifer or hardwood logs.

group 3 (*muscarine, muscarine isomers*)

These mushrooms contain the toxins **muscarine** and **muscarine isomers**. They include *Clitocybe dealbata*, *subdorifica*, *cerussata*, *dilitata*, *rivulosa* and *morbifera*; also many species of *Inocybe* including such lawn-inhabiting species as *Inocybe geophylla*, *pudica* and *lilacina*.

Symptoms (see footnote 1, page 23)

Within 30 to 120 minutes, miosis, blurred vision, excessive perspiration, salivation, lacrimation, bradycardia, increased peristalsis with crampy pain and watery stools, reduced blood pressure and pulmonary congestion with asthmatic breathing. The perspiration, salivation, lacrimation symptom combination does not occur in other mushroom poisonings.

Treatment (see page 23)

Clitocybe dealbata

C. dealbata is one of a dozen or so small, pale, harmless-looking, poisonous mushrooms that lurk in lawns and hide in hedges.

Victims are most apt to be youngsters who pick and eat anything they can get into their mouths. Some victims are those who get careless when collecting *Marasmius oreades*, the common fairy ring mushroom, for food. These poisonous, small *Clito-*

cybes and *Inocybes* may fruit in and among the fairy ring mushrooms.

The toxin involved is muscarine and muscarine isomers.

C. dealbata is small. The cap is cushion-shaped when young, then expands to almost flat when mature and even to depressed at the center in age. It measures $\frac{1}{2}$ to $1\frac{1}{2}$ inches in diameter. The color is pale whitish when dry and turns to a pale grayish-brown when wet. The margin of the cap tends to curve in toward the stalk.

Gill characteristics are important in distinguishing the difference between edible *M. oreades* and poisonous *C. dealbata*. The gills of *C. dealbata* are white or dingy white, fine and fairly close together. They attach squarely to the stalk or run down the stalk for a short distance.

The gills of *C. dealbata* are deepest at a point midway between the edge of the cap and the stalk. By comparison, the gills of *M. oreades* are not nearly as crowded and are very thick at the juncture with the cap. They are deepest and rounded near the stalk. They barely touch the stalk, being almost free.

The stalk of *C. dealbata* is tough, solid, thin and about $\frac{1}{8}$ inch wide, with the same dingy white color as the cap and $\frac{3}{4}$ to $1\frac{1}{2}$ inches tall. It often looks as though it has a fine powdery coating. The color of the spore deposit is white.

C. dealbata fruits singly or in patches in grass or lawns from August through the fall.



(*Inocybe geophylla*)

Courtesy A. H. Smith

Inocybe geophylla is common throughout Michigan. It is one of the several mushrooms in the genus *Inocybe* and the genus *Clitocybe* that contains the toxin, muscarine.

Inocybe

There are many species of *Inocybes*. They are small mushrooms, mostly dull gray, tan or brown in color. The cap is often somewhat pointed at the top, silky-looking to somewhat scaly and often with splits or cracks from the margin to the center of the cap.

The spore deposit of the *Inocybes* is a yellowish-brown. The gills are attached to the stalk and are usually a dull brownish color when mature.

They fruit most abundantly from midsummer through the fall in grass, lawns, under hedges and in woodlands. Abundant fruitings are found along roadsides.

There is no purpose in collecting any of these small, dingy, often dirty-looking mushrooms for food.

group 4 (*muscimol, ibotenic acid*)

These mushrooms contain the toxins **muscimol** and **ibotenic acid**. Included are *Amanita muscaria*, *pantherina* and *cothurnata*.

Symptoms (see footnote 1, page 23)

Within 30 to 60 minutes a feeling of drowsiness is followed by a state resembling alcoholic intoxication. Following this, a hyperkinetic state of confusion, muscular spasms, delirium and visual hallucinations occurs, lasting as long as four hours. Vomiting usually does not take place. Drowsiness and deep sleep follow, and recovery is often quite rapid though a fatality rate of 1 to 5 percent is reported.

Treatment (see page 23)

More Guilty Amanitas

Amanita muscaria, pantherina, cothurnata and gemmata are among the common Michigan mushrooms that contain the toxins **muscimol** and **ibotenic acid**. This group of *Amanitas* is more colorful than the deadly, white, angel-of-death group of *Amanitas*.

Amanita muscaria

A. muscaria is one of the most photogenic of all mushrooms. Its photograph adorns the cover of Dr. A. H. Smith's popular "Mushroom Hunter's Field Guide." It is a large mushroom growing to be as much as 12 to 16 inches tall with broad flat cap 8 to 10 inches in diameter. Most average to be 8 to 10 inches tall with a cap 5 to 7 inches wide.

The color is striking. Common Michigan varieties vary from yellow to orange to a deep orange-red. Yet a common variant of the northern Michigan jack pine forests is all white.

The universal veil tissue (that tissue which encases the entire mushroom when it just begins to emerge from the soil) is delicate and fragile. Some of the soft veil tissue breaks up and adheres to the cap as freckles or warts while the remainder sticks to the bulbous base in a series of zones or folds. In



(*Amanita muscaria* — button)

Courtesy A. H. Smith

Amanita muscaria fruits heavily throughout Michigan during late summer and fall. In the button stage, this mushroom is short and thick. The universal veil tissue remains as "freckles" on the cap and folds of tissue rolled around the base of the stalk.

the brightly-colored variants, the freckles are usually cream-colored in a most attractive color pattern.

The gills are white, not attached to the stalk, and the spore deposit is white.

The stalk is white to pale yellow, stuffed, becoming hollow and bulbous at the base. The basal part of the stalk is encircled with ragged rings and folds of remnants of the universal veil tissue. A rather large, fragile, flaring annulus (ring) is attached around the stalk at a point about two-thirds of the distance up from the base.

A. muscaria grows singly in patches from the soil under conifers, aspen, in brushy places, hedge rows and pastures. It is an abundant, conspicuous mushroom all over the state of Michigan during summer and fall, and it is poisonous!

A. muscaria has been referred to as the fly agaric because it has reportedly been used to poison flies by sprinkling sugar or milk on the cap and gills to lure flies to imbibe on the poisonous mushroom.

A. pantherina is included because it is a member of the group containing **ibotenic acid** and **muscimol** toxins and is to be expected in our Upper Peninsula.



(*Amanita muscaria* — mature)

Courtesy A. H. Smith

Amanita muscaria has several color variations. Those growing under two-needle pines are apt to be all white. Those fruiting in aspen stands are most frequently yellow-orange in color. Those fruiting under spruce trees are often a deep orange-red. All are equally toxic.

group **5** (acetaldehyde syndrome)

These mushrooms evoke the acetaldehyde syndrome when consumed with alcohol. The active toxin, coprine, has only recently been identified. *Coprinus atramentarius* is the one Michigan mushroom known to be toxic when consumed along with alcohol.

Symptoms (see footnote 1, page 23)

The symptoms may occur shortly after consumption of an alcoholic beverage plus the mushroom or on consumption of beer, wine or liquor up to 48 hours after the mushroom is eaten. Symptoms include a flushing of the face and neck, a metallic taste in the mouth, paresthesia of the extremities, palpitation, tachycardia and a feeling of swelling in the hands. The initial symptoms are usually followed by nausea and vomiting. Occasionally visual disturbances, vertigo, weakness and confusion occur.

Treatment — Time and reassurance

Coprinus atramentarius

Mill yards rich in wood debris and sawdust are the preferred habitat, since its growth seems to be



(*Coprinus atramentarius*)

Courtesy A. H. Smith

Coprinus atramentarius produces toxic effects when consumed with alcoholic beverages.

associated with buried wood and concentrations of organic debris.

The cap color is a dingy brownish-gray. Sometimes the top center of the cap is slightly rough or scaly. There may also be grooves or ridges radiating from the center of the cap down to the margin as though some pressure had been used to keep the cap wrapped snugly around the stalk.

The almost-round button stage grows to be 1 to 3 inches broad. In early stages the cap and the exposed base of the stubby stalk, below the area where the margin of the cap is tight against it, are coated with sheer, silvery gray or brownish, silky fibers radiating from the top of the cap down over the stalk.

The margin of the cap is usually uneven or wavy. As it expands, exposing the white stalk underneath the cap, a distinct irregular zone (not a ring or annulus) is evident near the base. It is formed by the color difference between the white stalk and the base covered by the same gray-brown fibers as cover the cap.

The gills under the cap are pale gray at first. They expand, darken and turn to "ink."

The hollow stalk grows to be 2 to 6 inches long, about $\frac{1}{2}$ to 1 inch thick, equal in width unless growing in a very dense cluster when the base may be narrower. The color is silky white above the basal zone and similar to the gray-brown cap color at the base of the stalk. It grows in dense clusters.

The heaviest fruitings occur in the fall — September and October — when there is ample moisture and cool weather. Occasionally there will be lighter fruitings in June if there is sufficient rainfall.

group 6 (*gastrointestinal irritants*)

These mushrooms contain gastrointestinal irritants. There are many diverse mushrooms in this group among such genera as *Agaricus*, *Lactarius*, *Entoloma*, *Russula*, *Tricholoma*, *Chlorophyllum*, *Omphalotus*, *Pholiota*, *Scleroderma*, *Boletus*, plus many others.

Symptoms (see footnote 1, page 23)

Within 30 to 90 minutes, vomiting and mild to severe diarrhea and abdominal cramps. In most cases the symptoms terminate spontaneously within 3 to 4 hours and recovery is complete in a day or two.

Treatment (see page 23)

Chlorophyllum molybdites - *The Poisonous Green-spored Lepiota*

It takes long and diligent study for an amateur to learn to identify a mushroom, even to learn to pronounce and spell the name. To add to the confusion is the fact that a single mushroom may be called by two or three different names. Take *Chlorophyllum molybdites*, for example. The names *Lepiota* or *Leucoagaricus* are used in older literature to designate genera. It has also been called *Lepiota morgani*. Until the time when everything is known about each mushroom, the "name" confusion will continue.

Chlorophyllum molybdites is a beautiful, rather large, tall and stately mushroom. It grows in large colonies, often in arcs or fairy rings, from the ground in grassy places, waste areas, particularly those near deserted sawmills, and in moist, rich soil or open pastures and meadows.

The cap is 3 to 12 inches in diameter. When young, it looks much like a round, pale tan ball on top of a tall, whitish stalk. The cap expands to almost flat with the tan surface breaking up into patchy scales except on the center of the cap. The white cap tissue shows between the scales.

The gills beneath the cap are white until the mushroom is mature at which time the ripe spores give a greenish-gray cast to the gills. When spores are collected in mass from the mature specimen they will be dull to bright green. This green spore color is the characteristic used to identify this poisonous species.

It is important to remember that the green coloration of the gills and the green spores are apparent only when the spores are mature.

The gills of *C. molybdites* are deep, close together and end before they reach the stalk with no attachment to the stalk. Because of the free gills and the difference in texture of cap and stalk in this

group, the stalk can be easily pulled out of the socket in the cap, leaving a clean rounded separation at the top of the stalk.

The stalk of *C. molybdites* is 3 to 12 inches tall and up to 1½ inches in diameter at the swollen base. There is no volva or cup at the base of the stalk as in the genus *Amanita*. It tapers to slightly smaller at the top. The smooth, white, firm, stuffed stalk has a persistent thick, double annulus or ring on the upper third of the stalk.

Both the stalk and the gills stain yellowish and then turn dark brown when bruised.

C. molybdites fruits from midsummer through fall.

The toxins are unknown but have caused severe gastrointestinal distress, nausea, vomiting and diarrhea.

Leucoagaricus naucina – *The Smooth-capped Lepiota*

This mushroom is earning a bad reputation for itself and should be avoided. It is a uniformly white or a smoky-white color. The ring on the stalk, which has a swollen base (no cup or volva), along with its smooth appearance, its size and coloration, make



(*Leucoagaricus naucina*)

Courtesy A. H. Smith

Leucoagaricus naucina is dingy white when young, maturing to a tannish off-white color. Its toxins produce stomach distress. This mushroom bears some resemblance to *Amanita virosa*. There is no volva at the bulbous base of *Leucoagaricus naucina*.

it easy for the careless or uninformed collector to confuse it with the deadly white *Amanitas*.

The cap of *Leucoagaricus naucina* is 2 to 4 inches broad and cushion-shaped. It is dry and smooth.

The gills are white at first, becoming a dingy pinkish-brown in age, free from the stalk and close together. The stalk is 2 to 4 inches tall, about ½ inch in diameter with a swollen base, smooth, white and separates easily from its socket in the cap.

There is a tough, persistent, rolled, collar-like ring on the stalk.

Spore deposit is white or pinkish in mass. *L. naucina* grows scattered or in colonies in grassy and waste places from August to October.

L. naucina toxins cause gastrointestinal distress in some cases but it is most dangerous because it can be so easily confused with the deadly white *Amanitas*.

Omphalotus illudens – The Poisonous Jack-O-Lantern Mushroom

Omphalotus illudens is a large, gaudy mushroom. It is sometimes carelessly mistaken for *Armillaria mellea*, one of the most widely collected of the “stump” mushrooms, because of the fact it grows in clusters on or from wood. Because of its orange



(*Omphalotus illudens*)

Courtesy A. H. Smith

Usually the cap, gills and stalk of *Omphalotus illudens*, the jack-o-lantern mushroom, are a uniform orange color, but occasionally the stalk will be near white as in this illustration. It grows in dense clusters at the base of trees or stumps. It is more abundant in the Lower Peninsula of Michigan.

color, other collectors have mistaken it for *Cantharellus cibarius*, the yellow chanterelle. There is no similarity other than color between *O. illudens* and *C. cibarius*.

O. illudens grows in dense clusters at the base of trees or stumps — usually oak trees in Michigan — or from buried wood. It fruits from midsummer through early fall. In Michigan it is much more apt to be found in the Lower Peninsula than in the Upper Peninsula.

The bright orange-yellow caps are usually 2 to 5 inches in diameter but may grow up to 8 inches. They are at first cushion-shaped with a bump on the center of the cap. As they mature, the center may be depressed below the cap margin, but the bump is still evident. The outer margin of the cap is inrolled at first, remaining incurved at maturity. The caps may be irregularly shaped, depending on the number crowded together — up to 100 in a large cluster.

The gills extend down the stalk for a considerable distance (long-decurrent). They are bright orange-yellow, close together and rather shallow. They are phosphorescent in the dark, earning the “jack-o-lantern” name.

The spores are creamy white in mass. The stalks are 3 to 8 inches long, $\frac{3}{8}$ to $\frac{3}{4}$ inches thick and narrower at the base where they are crowded together. They are solid and smooth with a rosy-orange color. There is no ring or annulus on the stalk — one important characteristic which separates poisonous *O. illudens* from edible *Armillaria mellea*.

O. illudens is an example of a beautiful mushroom growing in ample quantity but not edible.

Genus entoloma - (Avoid all species)

Some species are extremely poisonous, so avoid them all. It is hard to recognize the 200 or more species of this group of mushrooms. They are called *Rhodophyllus* in some references. Most of them have medium to small, grayish-tan fruiting bodies. There is no ring or annulus on the stalk and no cup or volva at the base. The characteristic that laymen regard as a warning is the color of the spore deposit. When collected in quantity on a piece of white paper, the spore deposit is reddish.

None is an important edible species. *Entoloma abortivum* is about the only one recognized as edible, and it is suggested that you limit your collecting to the white, globular, aborted form (called "hunter's hearts" by northern Michigan collectors) rather than the gray, pink-spored normal fruiting body. *E. abortivum* grows on or near wood in the fall.

Other species of *Entoloma* grow mostly on the ground in humus in wasteland, fields, along edges of bogs and in woodland areas. Many small forms grow on rotting wood. They can be found during all seasons from early spring until killing frost in the fall.

Entoloma lividum is definitely poisonous. It fruits heavily in summer and fall in wet seasons. The cap is pale grayish-tan, 2 to 3 inches wide. The margin is inrolled when young. The mature cap is almost flat, often with a bump in the center. It is smooth and may feel a bit sticky when wet.

The smooth stalk grows to be 2 to 3 inches tall and $\frac{1}{4}$ to $\frac{1}{2}$ inch thick.

Be sure to study the gills and make a spore print. The pink color does not develop until the spores ripen, so be sure to check the mature specimens.

The young fruiting bodies with pale-grayish gills could easily be confused with species of *Lyophyllum*, *Pluteus* or *Tricholoma* which you might be collecting for food.

Tricholoma

Tricholoma is a large genus, and the species are difficult to identify. Many are large, fleshy and of mild flavor, making them desirable to food collectors. However, some species are suspect, some of doubtful edibility and some are definitely known to be poisonous. Avoid eating *T. pardinum*, *saponaceum*, *subacutum*, *vaccinum* and *venenata*.

Tricholomas fruit abundantly in late summer and fall, from the soil, usually in patches, often in rings or arcs. They grow profusely in sandy jack pine forests.

The spore deposit is white in most species; creamy-lilac in those species ordinarily called *Lepista*. The stalks are thick and fleshy with gills firmly attached to the stalk. The gills are often notched at the junc-

ture with the stalk. There is no ring on the stalk nor volva at the base.

Critical study must be made of the *Tricholoma* genus before any species are consumed for food. The species which cause stomach and intestinal distress must be avoided.



(*Tricholoma venenata*)

Courtesy A. H. Smith

Tricholoma venenata is one of the several toxic species of the fall-fruiting *Tricholomas* so prevalent in Michigan. Other species of this genus are edible, but unless you know which are good, avoid all *Tricholomas*.

Boletes

Bolete is the name given to a mushroom which bears its spores within very small tubes varying in length from $\frac{1}{4}$ to 2 inches which are packed together in a layer with an open end toward the ground. The tubes form a layer beneath the cap where the gills are located in a typical mushroom.

Some *Boletes* are excellent edible species and some are definitely poisonous.

There are two rather simple tests to separate out those that cause distress. First, observe the color of the tube mouths. That will be the exposed part of the layer under the cap. Avoid eating any *Bolete* that has red-colored tube mouths.

A second test to delete poisonous species is to pinch or cut the flesh of the cap and the tube layer under the cap. Watch for a color change. Avoid eating any *Boletes* that turn blue when cap is pinched or bruised.



(*Boletus subvelutipes*)

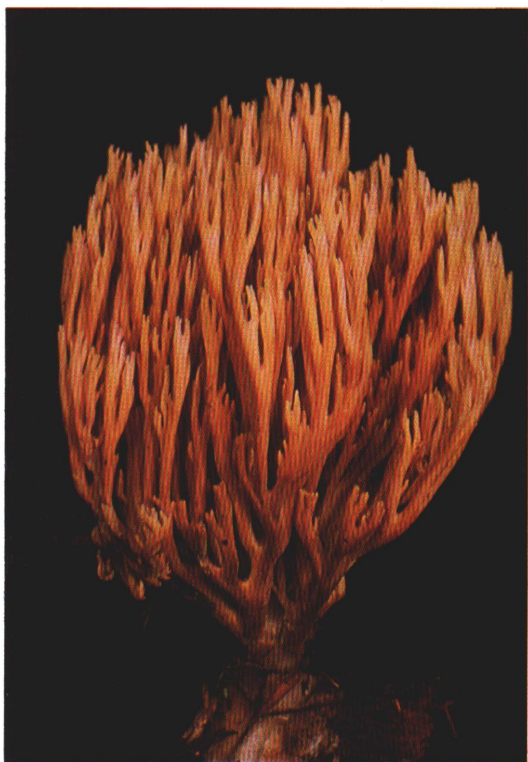
Courtesy A. H. Smith

Avoid all *Boletes* with red tube mouths (the spongy surface beneath the cap) and those that stain blue when bruised. Poisonous *Boletus subvelutipes* display both warning colors — the red tube mouths and blue stains.

Clavaria

Some mushrooms grow up from the soil or on wood as a mass of upright branches. They resemble coral growths; hence, the popular name, coral mushrooms. Some species are too bitter to be consumed for food. Several species are suspected to be poisonous, among them *Clavaria (Ramaria) formosa*. The colors of this compact, closely branched mushroom are pale yellow on the tips of the branches and a peachy, salmon-pink on the branches beneath the tips down to the ground level. Beneath the ground duff, the base of the plant is white. They grow to be 2 to 6 inches tall.

Avoid orange, salmon or pink *Clavarias*. Also avoid those in which the flesh in the base of the mushroom is more or less rubbery and translucent, like stiff gelatin.



(*Ramaria apiculata*)

Courtesy A. H. Smith

“Coral” mushrooms are composed of a mass of upright branches. A few are edible. *Ramaria apiculata* is not edible. Avoid orange, salmon or pink colored coral mushrooms, also those with a rubbery translucent base.

B—PUFFBALLS

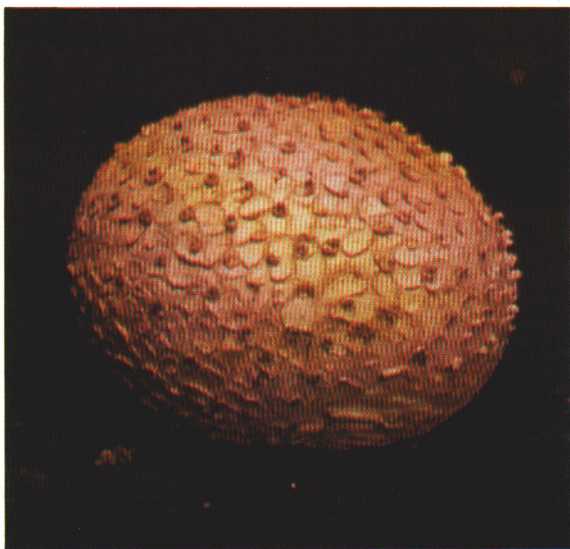
Generally, puffballs are considered to be safe for consumption if they are of a firm, white marshmallow-like consistency in the interior.

Scleroderma citrinum is a round puffball — with a thick, tough, scaly, rough exterior. The color of the exterior is pale dingy white, yellow, or brownish-yellow tan. When mature specimens are cut in half, the interior is a dark purple-blue color.

The flesh is white in very young specimens but

soon becomes grayish-violet, then blackish-violet, usually before the specimens are half grown.

S. citrinum is considered to be poisonous. In the literature it has commonly been called *S. aurantium*.



(*Scleroderma citrinum*)

Courtesy A. H. Smith

Scleroderma citrinum could easily be confused with an edible puffball. The interior of this poisonous mushroom is an inky blue. Edible puffballs have a white interior.

Decomposed Mushrooms

Never eat a partially spoiled or decomposed mushroom. It is no more edible than a rotten fish. Yet I have seen people collect mushrooms so old and decomposed that their identity can hardly be established. For food, use only fresh, young specimens of those mushrooms known to be edible.

Raw Uncooked Mushrooms

A case in point — severe gastrointestinal distress has been caused by eating fresh, uncooked and dried uncooked *Armillaria mellea*, the popular stump mushroom. Cooking destroys some mushroom toxins. Always cook all wild mushrooms before eating them.

Other Poisonous Mushrooms

Many additional mushrooms found in Michigan are poisonous.



(Lactarius torminosus)

Lactarius torminosus is an example of a poisonous species of the group of mushrooms that “bleeds” a clear, milky or colored juice (latex) when bruised. This latex often changes color on exposure to air.



(Mycena leaiana)

Mycena leaiana is a beautiful orange mushroom, which grows in clusters on wood. It causes gastrointestinal distress.



(*Verpa bohemica*)

This early spring fruiting false morel causes stomach distress and loss of muscular coordination.

group 7 (*psilocybin and psilocin*)

Avoid All L.B.M.s (little brown mushrooms)

There are a great many small, poisonous dark-colored mushrooms (brown, gray or black). Most are too small to be considered a source of food. Yet there are cases of poisoning when these mushrooms have been eaten accidentally or intentionally. Small children eat them from lawns as do some careless collectors of *Marasmius oreades*, the lawn-inhabiting fairy ring. Some folks experiment with many different mushrooms in an effort to discover some with mind-affecting symptoms and are poisoned as a result.

Rules and Regulations

First, anyone collecting wild mushrooms must abide by the rules of good citizenship.

Should You Collect Wild Mushrooms?

1. Not unless you are willing to study until you learn the positive identification of the mushroom you seek and become selective in your collecting.
2. Not unless you assume the responsibility of your own safety and well-being. Are you properly dressed? Always carry a compass and learn to use it correctly. Have you overcome any foolish fears you might have had of the "woods" and the creatures that live in it?
3. Not unless you are a responsible citizen who respects no trespass, private property, no littering and posted land signs.
4. And certainly not unless you have the same respect for every living plant, bird or animal that shares the mushroom hunting area, as you do for yourself as a person.
5. Then, not unless you are absolutely certain the mushroom is safe to eat. Collect carefully and do not mix collections of different species. (A shallow flat box or basket is best — never use plastic.) Promptly clean, refrigerate, cook or preserve your collections upon returning home. Unless you intend to use the mushrooms, don't pick them.
6. Finally, not unless you guard against becoming an "instant" expert, thereby endangering the lives of folks you choose to advise.

In Case You Are Poisoned

Report to a doctor immediately. If the doctor isn't knowledgeable about mushroom toxins, he can get reliable information from the Poison Center, University of Michigan Hospital at Ann Arbor, if you live in Michigan.

Avoid self-dosing with medications or curatives. These may aggravate rather than relieve the situation. See a doctor.

Save some fresh specimens in the refrigerator of the mushrooms you eat. It is much easier to identify

the mushroom from a fresh specimen than from the material pumped from your stomach.

So others may profit from your mistake, send a detailed history of your case of poisoning to Dr. Joe Ammirati, North American Poison Mushroom Research Centre, Erindale College, University of Toronto, Mississauga, Ontario, Canada L5L 1C6; Dr. A. H. Smith, University Herbarium, University of Michigan, Ann Arbor, Michigan 48104; or Dr. Donald M. Simons, 2209 Centerville Rd., Wilmington, Delaware 19808.

The Sale of Wild Mushrooms For Food

In Michigan, the Food Inspection Division of the State Department of Agriculture is responsible for enactment of Michigan's Food Law, Act No. 39 of Public Acts of 1968. The law requires that **any food sold for human consumption be wholesome and of a variety that is known to be safe.** There is no specific regulation concerning mushrooms.

Most states have laws regarding sale of wild mushrooms for human consumption. The authority is usually vested in the state department of agriculture, the state department of health or the state food inspection department.

In some foreign countries where wild mushrooms are sold on the open market, much like our farmers' markets, the ministry of health determines which species of mushrooms can be sold. As many as 50 or 60 different species are permissible for sale in some countries. Inspectors are hired to see that the mushrooms are actually those on the label.

In Michigan, if anyone sells fresh mushrooms for food or in prepared foods, **the responsibility for quality of a food product is upon the seller.**

We know that quantities of fresh mushrooms gathered in Michigan are sold for food, particularly Michigan morels. We know, too, that there are restaurants which cook and serve wild mushrooms. In each case the seller is responsible for quality.

Are we in Michigan and in other states in need of a certification or grading program to enlarge the market for wild mushrooms and to establish consumer confidence?

Make Some Rules For Yourself

Don't eat overmature or spoiled mushrooms.

Don't overeat, especially when first trying them.

Don't mix several kinds of mushrooms when collecting or eating.

Do know what you are seeking and collect only those known to be safe for consumption.

Do study reliable literature to help you recognize and identify mushrooms.

Do enroll in courses on sight identification of mushrooms conducted by reputable organizations (such as Cranbrook Institute of Science) or institutions. (University of Michigan has been a leader in offering educational courses in mycology for amateurs as well as professionals.)

Do have your identifications checked by an authority so you know they are correct.

Do check each and every mushroom as you collect it.

Do eat only one kind at a time.

Do keep some fresh specimens for the doctor in case you get ill.

Do, in case you become ill, be truthful with your doctor. It's better to appear stupid than to be dead.

Do report all incidents of poisoning so the next fellow won't make the same mistake.

Do assume responsibility for your own safety and well being.

Other Extension publications in this series are:

May Is Morel Month in Michigan, Extension Bulletin E-614. (25 cents)

Mushrooms Grow On Stumps, Extension Bulletin E-924. (75 cents)

Wood Waste Makes Wonderful Mushroom Collecting, Extension Bulletin E-925. (60 cents)

Best Of The Boletes, Extension Bulletin E-926. (60 cents)

(Available from the MSU Bulletin Office, P. O. Box 231, East Lansing, MI 48824)

