

# The Agricultural Experiment Station

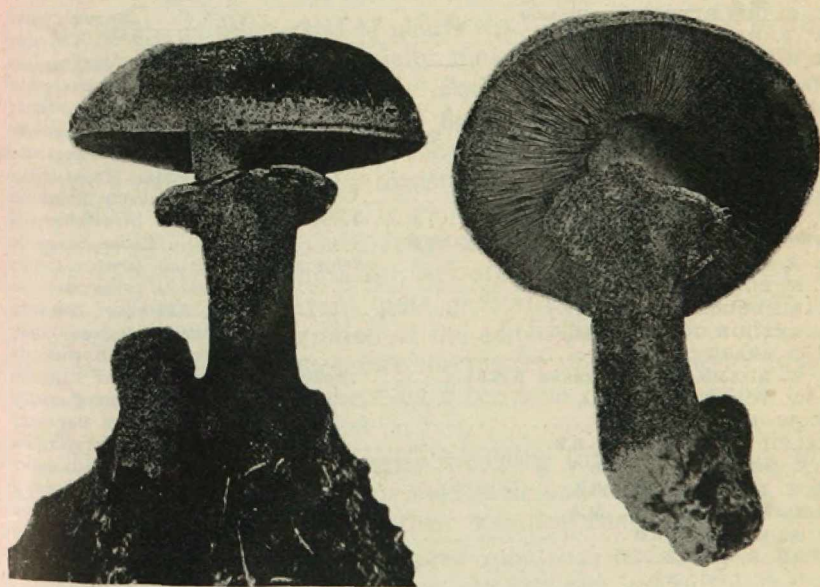
OF THE

Colorado Agricultural College

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## Some Colorado Mushrooms

By B. O. LONGYEAR



The Common Mushroom---Edible

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FORT COLLINS, COLORADO

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# The Agricultural Experiment Station

FORT COLLINS, COLORADO

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# Some Colorado Mushrooms

By B. O. LONGYEAR

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Mushrooms and toadstools. What contrasting emotions of pleasure and repugnance these two terms convey to most persons. One suggests a wholesome, appetizing and nutritious article of food, while the other conjures up an idea of some noxious, dangerous or poisonous growth. The popular idea, moreover, that the two may be readily mistaken one for the other deters a great many people from using any of these plants for food in this country; consequently a large part of the annual crop of native edible fungi goes to waste for lack of a familiar knowledge of the different species by the public.

## POPULAR IDEAS ABOUT MUSHROOMS.

Probably no other class of plants is so little understood by the public as the fungi and especially those fleshy forms commonly called mushrooms and toadstools. Perhaps the most common idea is that there are just two kinds of fleshy fungi. Mushrooms, edible, and toadstools, poisonous; hence the usual query is, "How do you tell a mushroom from a toadstool?" This question suggests the popular notion that there is some test or arbitrary rule which if applied at random to such fungi as one may come across will enable the finder to distinguish which are edible and which are poisonous. There also prevails quite generally an idea that there is no certainty in the recognition of the edible kinds without the use of some such rule and therefore the matter of eating fleshy fungi is extremely hazardous except by those who hold the secret formula.

The botanist does not classify the fleshy fungi in this way, but calls them either mushrooms or toadstools and recognizes the poisonous species among them by their botanical characters.

No dependence should be placed upon such tests as the blackening of a silver spoon in cooking, the salt test, the avoidance of bright colors, whether the caps will peel or not, and such general rules as are sometimes recommended. Another popular notion about certain of these plants is that toads have something to do with their origin and growth. This is purely a superstition and has no foundation in fact, as determined by a scientific study of these plants.

## THE TRUE TEST OF EDIBILITY.

The scientific way of testing the fungi one finds is to learn to know the species according to their botanical characters so that the same plant can be recognized wherever it is met with. By acquiring this knowledge it is then possible to learn the qualities of the fungus by reference to books or bulletins on the subject or by submitting the matter to a botanist or other person who has this information. Any person with average powers of discernment may soon come to know several species of edible fungi at sight just as the different vegetables in the garden are recognized. This means that the botanical characters of these plants should be studied and that they be known by these characters rather than by some general and uncertain test or rule.

## FEW POISONOUS SPECIES.

When compared with the large number of edible or harmless species of fleshy fungi which occur in our state, the number of poisonous or dangerous species is very small. Almost all of the latter, moreover, grow only in timbered places or in recently cleared woodlands so that there is almost no danger in using the species found outside of such areas.

It is advisable, however, for persons who desire to gather the fleshy fungi extensively for food to learn to know the poisonous or harmful species as well as the edible ones.

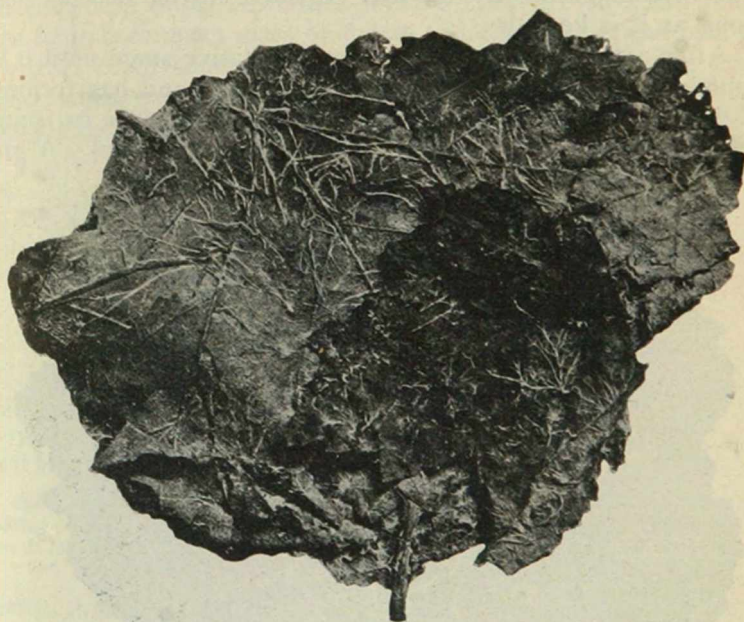
The only general test which has been advocated for persons who care only to know if a certain fungus is edible or not is the physiological test. This consists of tasting a very small fragment of the fungus without swallowing any of the juice. If no unpleasant symptoms arise within the next twenty-four hours, a slightly larger piece may be chewed and a part of the juice swallowed. After another twenty-four hours a still larger piece may be eaten, providing no poisoning symptoms appear. If a piece the size of a small pea is thus used, no serious results will occur even when a poisonous species is being tested, although symptoms of poisoning would be sure to arise if that were the case. While this method is perfectly safe when followed by a careful person whose imagination is under good control, it is recommended principally for the person who possesses the courage to try any plant's properties upon himself.

## THE NATURE AND GROWTH OF FUNGI.

Mushrooms and toadstools belong to that great class of lowly plants known as Fungi. While they differ widely in size, struc-

ture, and habits of growth, all species of fungi have certain characters in common. They are without flowers and are entirely destitute in all stages of growth of the green coloring matter, chlorophyll, found especially in those plants which bear true foliage. On account of the absence of this chlorophyll, the fungi are dependent plants and must gain their livelihood either at the expense of other living plants or must feed upon the dead remains of such plants.

In the first case they are parasites, such as the smuts, rusts, mildews and other disease-producing organisms of the higher plants. The mushroom fungi belong mainly to the second division, those which live upon dead and decaying organic matter, such as



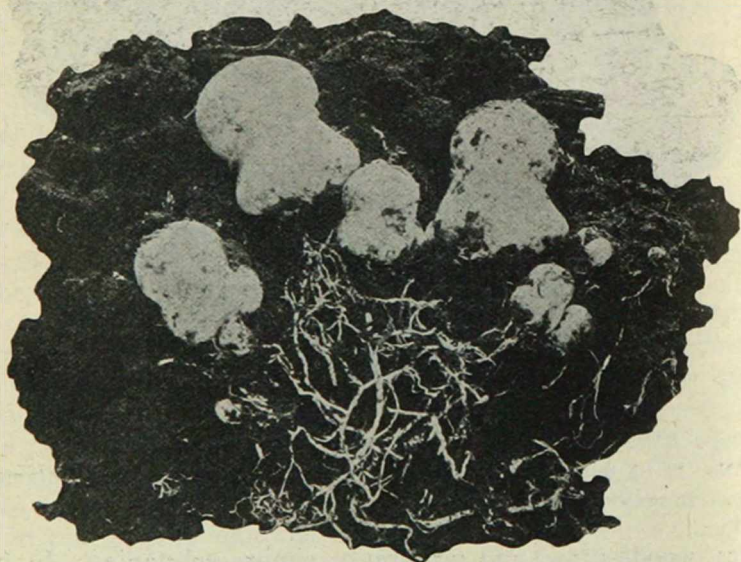
No. 1. A mass of decaying leaves covered with delicate filaments of some fungus which is causing their decay.

leaves, wood, straw, and manure, or similar substances. In fact, the decay of such material is largely due to the presence of these fungi in their vegetative stage of growth.

During this early vegetative period of a fungus, it consists of delicate, cobweb-like filaments or threads which are almost too slender to be seen with the unaided eye unless they are very numerous and massed together, when they give a moldy appearance to

the material upon which they are growing. Under the high powers of the microscope these delicate filaments are seen to be thin-walled tubes which branch and unite to form an intricate network somewhat like the root system of a flowering plant. This network of minute tubular threads, known as mycelium, grows rapidly under proper conditions of moisture and heat and dissolves and absorbs the nutritive substances in the material upon which it grows. If this happens to be a mass of fallen leaves, a pile of manure or a piece of wood, these materials soon show the signs of decay. Most fungi require an abundance of moisture to enable them to grow. For this reason, the mushroom crop is especially abundant during or following a period of wet weather and it is a matter of common knowledge that vegetable matter will not decay as long as it is kept dry.

After a fungus has grown in its vegetative stage until it has accumulated a supply of reserve food material and has formed a well developed mycelial system, it may begin to produce its fruiting stage in the form of the mature mushroom or toadstool. A great



No. 2. Root-like strands of mycelium of the common cultivated mushroom giving rise to the button stage of the fungus. This shows how the little mushrooms are formed in the mushroom bed.

many of the little threads of mycelium may unite to form root-like strands which in turn give rise to small globular bodies, the future mushrooms. This process usually takes place a little below the

surface of the soil, the mass of leaves or other decaying vegetation, or upon the surface if it is a decaying log or stump. These little bodies rapidly increase in size until they are prepared to expand into the mature mushroom. In some species of fleshy fungi this last stage of growth is very rapid so that these plants appear to spring up in a night, while in others it requires several days for the complete unfolding of the fruiting part.

### SPORES.

During this period of expanding to full size, the mushroom is also maturing an abundance of spores. Spores are the minute bodies by means of which the fungus is able to start a new generation elsewhere or to reproduce itself. They are so small that in some fungi a compact mass of spores as large as the head of a parlor match could contain as many as ten millions of these microscopic bodies, enough to cover an acre and a half at the rate of one spore to each square inch of surface. Their minute size enables

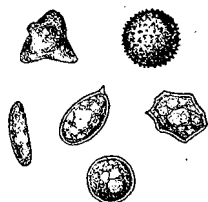


Fig. 3.

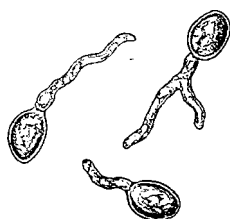


Fig. 4.

No. 3. Fungous spores showing a variety of shapes as found in different kinds of fungi. Highly magnified.

No. 4. Spores of the common mushroom germinating. Each one is sending out a thin-walled tube which is the beginning of the network of mycelium of the fungus. Highly magnified.

them to float readily in the air like the finest particles of dust and it is only when large numbers of them are thrown into the air at one time, as from a mature puff ball, that we are able to see them as a miniature cloud of smoke. The enormous number of spores which even one mushroom may shed readily accounts for the ease with which these plants find every suitable place in which to grow.

When the spores of fungi fall into a suitable condition of moisture and heat and with the proper food supply at hand, they may germinate by sending out a slender germ tube. This germ tube begins at once to gather nourishment from the material suited to its growth and in this way a new colony of the fungus is soon established. Frequently a period of drought may set in after the myce-

lium has reached a considerable growth. In such a case it may dry up for a time to be started into activity again when the moisture supply is renewed. This is the condition in which mushroom spawn is sold for the starting of mushroom beds, the so-called bricks or flakes being compact masses of half decomposed manure filled with the mycelium of the cultivated variety of the common meadow mushroom.

### STRUCTURE AND CLASSIFICATION OF FUNGI.

In their structure the tissues of a fungus are much simpler than those of other plants. If a small fragment of the flesh of a

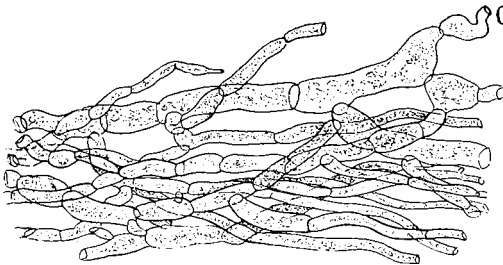


Fig. 5.

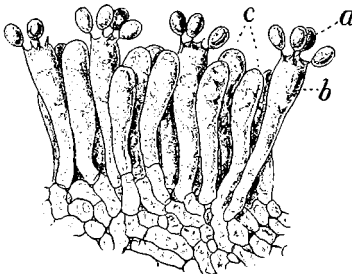


Fig. 6.

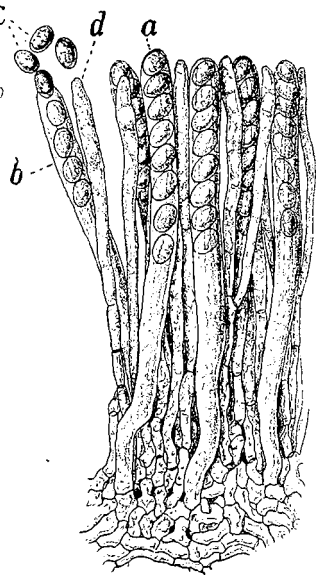


Fig. 7.

No. 5. Small portion of the tissue of a mushroom showing the tubular filaments which go to make up the flesh of the softer part of the fungus. Highly magnified.

No. 6. Small portion of the spore-bearing layer of one of the fungi belonging to the class Basidiomycetes. The spores (a) are produced on the ends of little stalk-like projections of the basidia; (b), (c), sterile cells intermingled with the basidia. Highly magnified.

No. 7. Small portion of the spore-bearing layer of a Morel. The spores (a) are produced inside of long thin-walled cells or sacs called Ascii; (b), (c), sterile cells intermingled with the spore-bearing cells. The spores are discharged by the breaking open of the ends of the asci, as at (c). Highly magnified.

mushroom is examined under the higher power of a compound microscope it will appear to be made up of interwoven thin-walled, freely branched tubes which are divided at frequent intervals by



thin cross-walls into more or less elongated cells. Thus the body of the fungus is found to be made up of the same filaments which form its mycelium; in fact, it is a continuation of the mycelial threads thickly interlaced and partly grown together. In the denser parts of some hard and woody fungi the cells of the tubular filaments are thick-walled, short and entirely grown together, while in the soft kinds the mycelial tubes are loosely interwoven, thin-walled, and have fewer partitions.

The cells thus formed contain varying amounts of water and protoplasm, the living substance of the plant. This protoplasm is usually nearly colorless and appears minutely granular, with larger particles of food material floating in contact with it.

All the larger, fleshy fungi are divided into two classes, depending upon the manner in which they bear their spores: (1) The Basidiomycetes; (2) the Ascomycetes. In the first class, the spores are produced upon the ends of certain elongated cells called basidia, while in the second class the spores are formed within similar cells.

In most fungi of the mushroom type only a certain limited part of the fungus produces these spore-bearing cells which are thickly crowded together to form a continuous layer known as the *hymenium*. The form of the fungus and the shape of the parts upon which the hymenium or spore-bearing layer of cells is spread are some of the principal characters by which a fungus is recognized by the botanist. Fortunately it is not necessary for a person to determine these matters by the use of a microscope in learning the names of the more common edible species of fleshy fungi, but it is necessary that one be able to recognize the location of the hymenium and that the shape of the parts which bear it be noted in order that accurate work in identification be done.

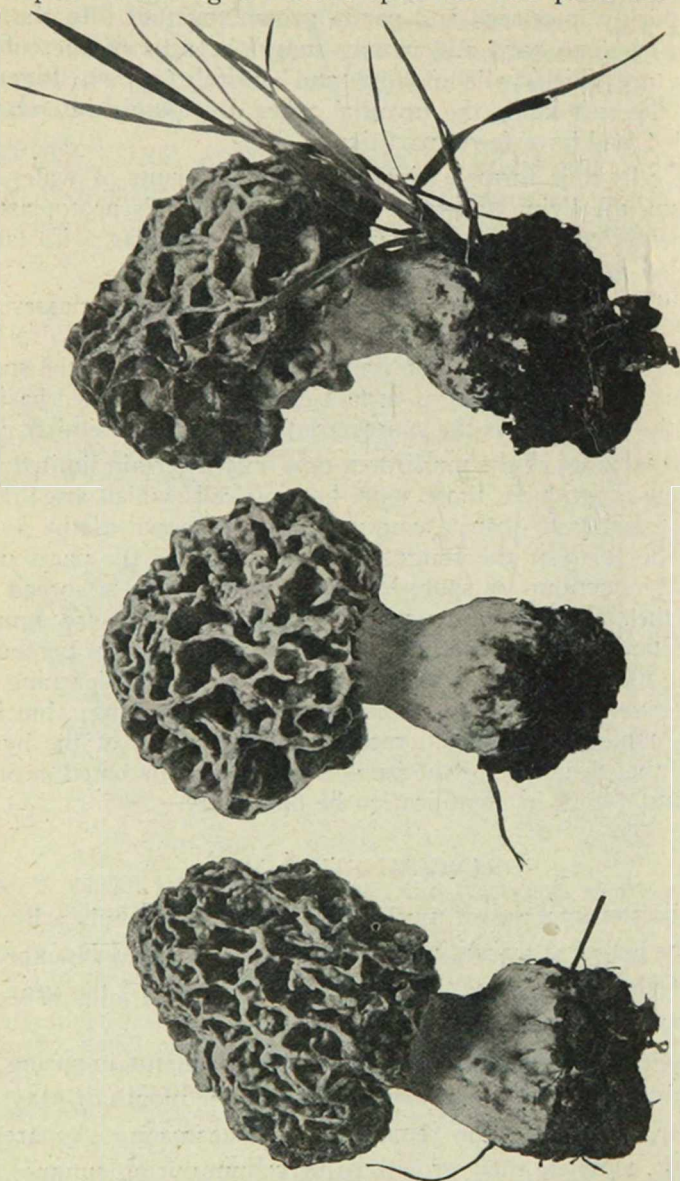
### SPRING MUSHROOMS.

While some species of mushrooms occur during only a limited part of the growing season, there are others which may be expected to appear almost any time during the warmer part of the year, especially soon after a period of rainy weather.

Among the earliest mushrooms to be looked for in spring are the Morels. They appear principally during the month of May and then disappear during the remainder of the season. Apparently these fungi complete their growth of mycelium during summer and autumn and are then ready to produce the fruiting part early in the following spring. They belong to the class *Ascomycetes* in which

the spores are produced within the fertile cells of the hymenium or spore-bearing layer.

Upon examining a mature specimen two parts are noticed:



No. 8. Specimens of the common Morel (*Morchella esculenta*).

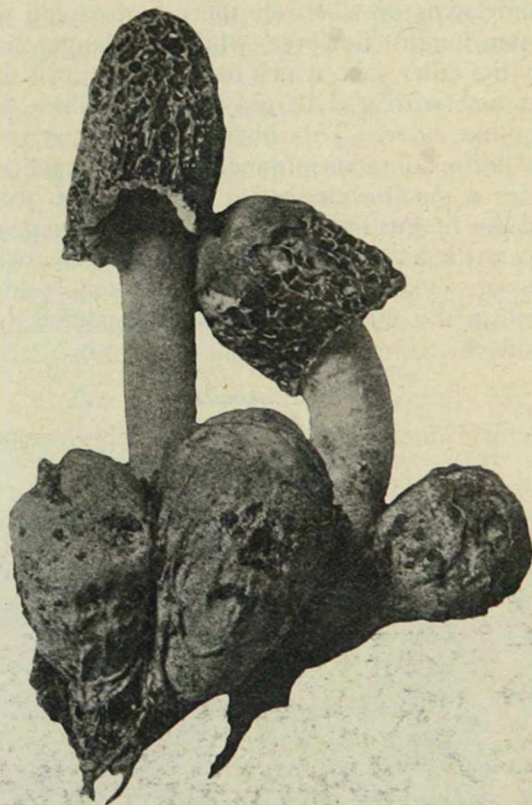
(1) A hollow stem; (2) a head or cap borne at the top of the stem and known botanically as the pileus. While at least five species of

Morels occur in this country, only one has been found in Colorado by the author.

The hymenium in the Morels covers the sides of wrinkles or variously branched ridges upon the surface of the pileus or cap and the spores are discharged into the air by the breaking open at the tips of the cells which contain them.

*The Common Morel (Morchella Esculenta).*

This is the most familiar mushroom to many persons who often call it the "sponge mushroom" from the resemblance of its pileus or cap to a small sponge. It grows in small groups or scat-



No. 9. The Stinkhorn fungus. A cluster of three eggs and two mature specimens. This is the only fungus liable to be mistaken for the Morel. It is readily distinguished, however, by its powerful carrion-like odor when mature.

tered individuals especially on the grassy land and among the cottonwoods, which border our streams and the lover of mushrooms

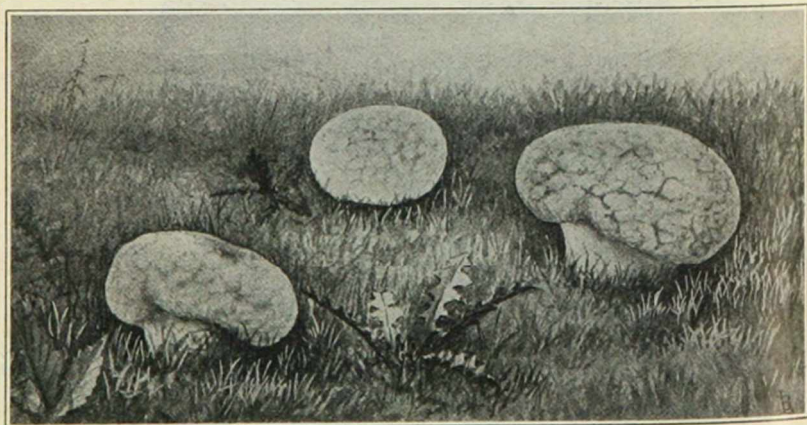
soon learns to look for them each spring in the same haunts. It loves the leaf mold which gathers among broad leaf trees in particular and has been found at times in favored places upon undisturbed soil near the shade trees of a vacant city lot.

The color of the stem is nearly white, while the cap is grayish or leaden when young but acquires a buff tint as it matures. The usual size of the plant is from two to four inches in height, although larger specimens are sometimes found.

The only fungus at all likely to be mistaken for the Morel is the Stinkhorn fungus which not infrequently appears along sidewalks and ditch banks, bordered with cottonwood trees and even in gardens and lawns or wherever there is decaying wood in the soil. The latter fungus, however, while not dangerous, is readily recognized by the taller stem which bears a small bell-shaped pitted cap coated at first with a dark grayish green slime possessing a strong carrion-like odor. This ill-smelling fungus is at first entirely covered by a tough membrane, in which condition it somewhat resembles a small, soft-shelled egg. When about to push above ground the fungus bursts through this covering which is left in the ground at the base of the stem. Sometimes a whole nest of these fungous eggs may be unearthed if the soil is dug up where they occur and in this condition they are considered by some persons to be edible.

#### *The Puffballs.*

Puffballs are among the most interesting members of the fleshy fungi. They occur almost everywhere, on open grassy



No. 10. A purple-spored puffball commonly found growing in meadows and pasture land.

ground, sometimes in dooryards and frequently in woodlands. Some grow only from the earth, while others may be found attached to much decayed wood.

When young and fresh they are nearly always white in color throughout, the interior being firm and in appearance much like cottage cheese. In this condition they are prime for eating and should never be destroyed. As they mature, however, the interior portions acquire a yellowish, brownish or purplish color and a soft and watery consistency, which unfits them for food. In a few days' time the moisture dries out leaving the tougher outer part filled with a cottony mass of fibers mixed with dark colored, dusty spores. In this condition they are fit objects for the small boy with a stick who delights in making them puff out smoke-like clouds of spore dust.

The spores of puffballs are produced in clusters at the ends of the fertile cells of the hymenium or spore-bearing layer which lines the walls of small, irregular cavities within the fungus. As the puff ball matures, these walls partially melt and cause the watery condition of the interior, while the spores are left mixed with thread-like cells of the walls. The fact that the puffballs are so easily recognized in every stage of their growth and that none of them are poisonous or harmful, so long as they are firm and white inside, makes them especially desirable and safe for the novice to collect for food.

*The Cup-Shaped or Purple Puffball.*  
(*Calvatia lilacina* variety *occidentalis*.)

This is perhaps the commonest of our larger puffballs and is at the same time one of the best for the table. It may be looked for in meadows and in grassland that is used for pasturage. When full grown it is about once or twice the size of one's fist and has the form of a flattened sphere with a narrowed base.

At first the outer covering (*peridium*) is white and nearly smooth, but as the fungus matures it becomes slightly cracked into very irregular areas and acquires a purplish color. As the inside moisture evaporates the *peridium* gradually flakes away, exposing the purple spore-mass within. In time the wind scoops out the spores, together with the cottony threads and scatters them far and wide, leaving the hollowed-out base of the fungus attached to the ground.

*The Giant Puffball (Calvatia gigantea).*

This fungus is not only the Goliath of its tribe, but when well developed has no rival in size among the fleshy fungi. It frequently attains the size of a football while specimens nearly sixty inches in circumference and weighing fifteen pounds have been seen by the

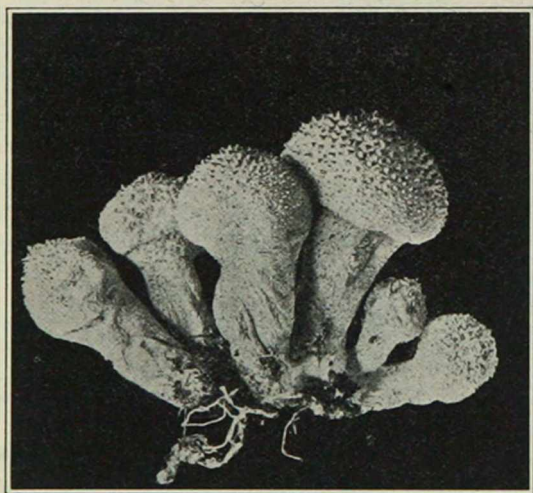
writer. While this fungus occurs not infrequently in the humid sections of the United States, it has been rarely found in Colorado. It should be sought for in grasslands, especially of our mountain parks. A single well developed specimen is capable of furnishing a fungus omelette for a whole neighborhood.

The surface of this puffball, when young, resembles white kid leather, while its resemblance to a large rounded mass of freshly raised bread dough is quite striking. A specimen much too large to be used by a family at one meal has sometimes been utilized during several days, or so long as no discoloration appeared, by slicing it off as desired for cooking.

The spore mass of the giant puffball is olive brown in color and is discharged as in the preceding species.

*The Gemmed Puffball (Lycoperdon gemmatum).*

The name of this little puffball was suggested by the fact that its surface is thickly studded with little pointed warts which fall away at maturity and leave the surface of the peridium marked with slight indentations. While the size is small, one or two inches



No. 11. A cluster of the gemmed puffball. This little puffball often occurs in large numbers on mossy ground in woodlands.

high, it makes up for this to some extent by its numbers. It grows usually in clusters of three or four to several dozen in number, and occurs in woodlands usually about decayed wood lying on the ground.

The shape of this puffball is more elongated than that of the preceding species and instead of breaking irregularly, to discharge

the spores, it opens by a small rounded mouth at the extreme top of the plant. A mature dry specimen when suddenly pressed between the fingers, will give off repeated puffs of smoke-like spore dust and thus illustrates unusually well the origin of the common name of "puffball" applied to the plants of this character.

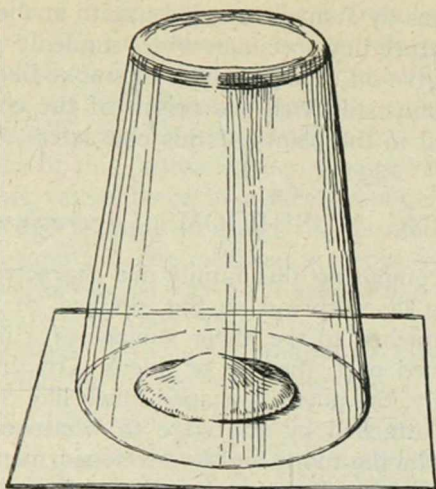
### GILL-BEARING MUSHROOMS (*Agaracineae Agarics*).

The fungi composing this family are characterized by having the spore-bearing layer spread on the surface of thin, radiating plates or gills attached to the lower surface of a more or less expanded or flattened part, the cap or pileus. In the simpler members of this family, the pileus is shaped much like one of the valves of a clam shell attached by one edge to whatever the fungus is growing upon. In the more highly developed members the pileus is bell-shaped or inverted saucer-shaped and is raised upon a central stalk with the gills radiating from its upper end toward the margin of the pileus. When very young or in the button stage the pileus is mostly rounded in shape and the stem is very short, in which condition the whole plant is often egg-shaped. As the fungus is about ready to mature its spores, the stem rapidly lengthens lifting the pileus into the air, where it soon opens out and allows the spores to drop from the gills attached to its lower surface.

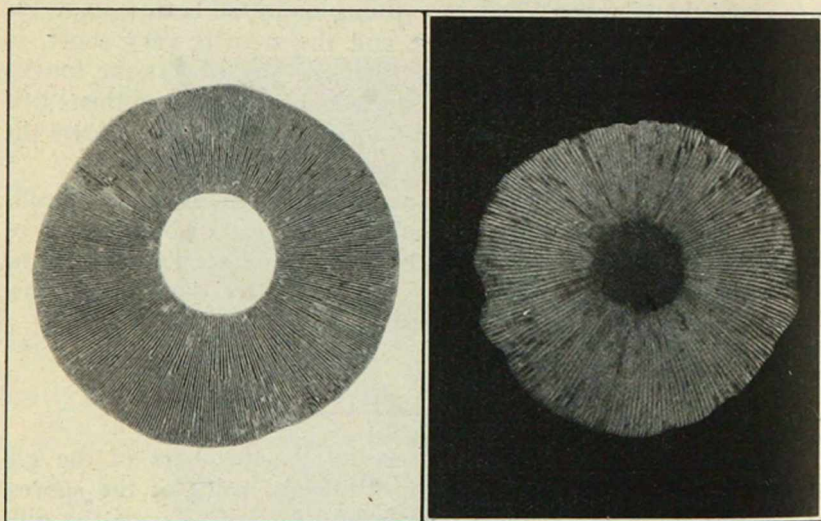
The spores of the gill fungi are borne upon the ends of cells called basidia the same as in the puffballs. Instead of being enclosed by the outer walls of the fungus, however, they are exposed to the air as soon as the cap or pileus expands and are thus readily cast off and wafted away by the gentlest breeze.

### SPORE PRINTS.

In order to identify with certainty the members of the gill fungi or agarics, it is necessary to know the color of the spores. While this can often be told by a careful examination of the gills which are usually powdered with the dustlike spores, it is determined most surely by making a spore print. If the cap is carefully removed from the stem and placed gills down upon a piece of white paper and covered with a tumbler or bell jar, the spores will settle upon the paper and form a spore print (Figs. 12-13). This process may require from one-half to three or four hours, depending somewhat upon the freshness of the specimen. If the spores are white, they can hardly be seen except by looking across the paper. If black paper is used for those species which have white gills, the



No. 12. Making a spore print.

No. 13. Spore prints of common mushroom and smooth *Lepiota*.

spores will show very distinctly and if the paper is first coated with a very thin layer of mucilage the spores will be held in place and the spore prints are thus made permanent.

#### THE AMANITAS.

The *Agaricus* family is the only one which contains the deadly poisonous species of fleshy fungi, the *Amanitas*. The *Amanitas* are umbrella-shaped mushrooms which in the early or button





Fig. 24

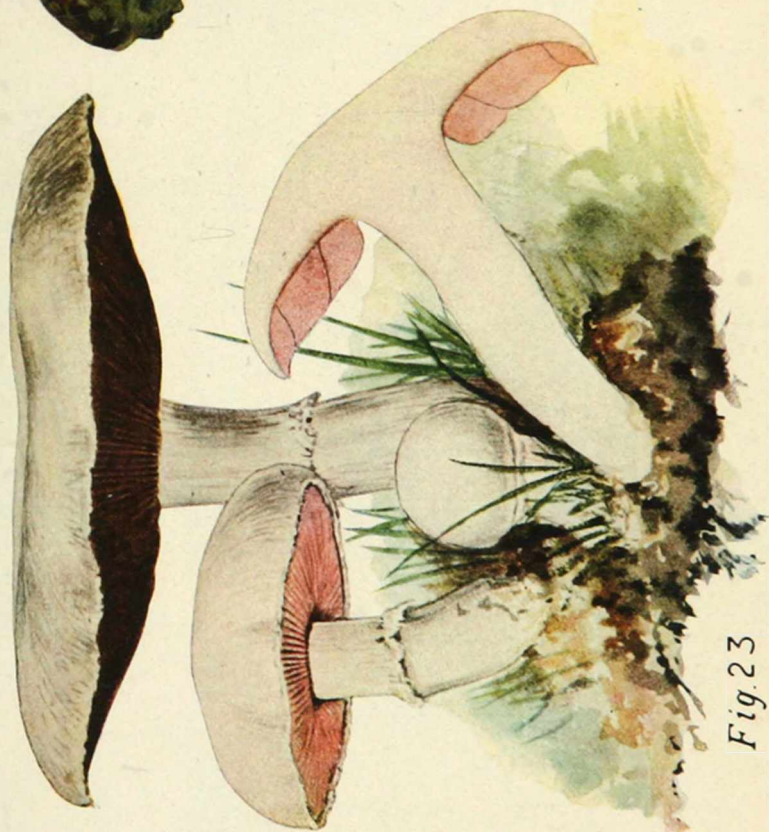
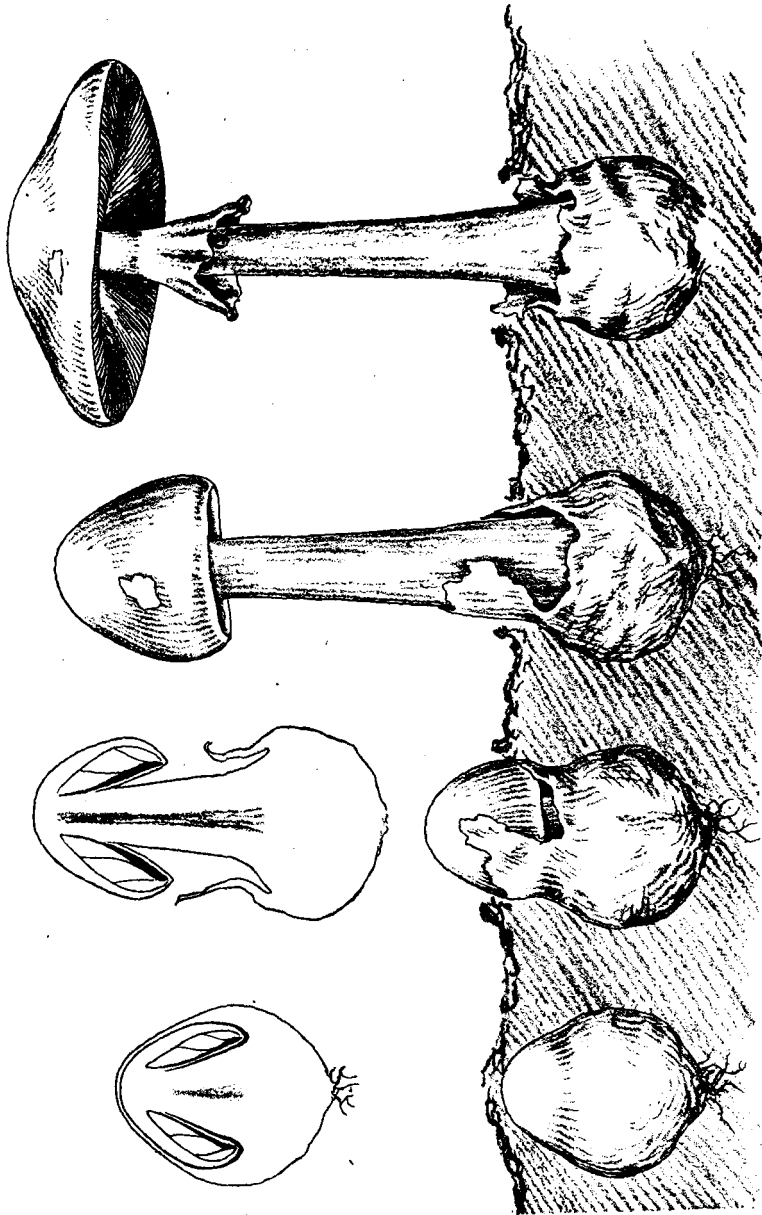


Fig. 23



stage are in the form of egg-shaped bodies which begin just below the surface of the soil or decayed leaves where the fungus grows,



No. 14. The Deadly Amanita. From a drawing showing the fungus in several stages of development from the egg to the mature plant (*Amanita phalloides*).

Each egg consists of one fungus enclosed by a membrane or coating which splits open as the mushroom is ready to appear above the

ground. The remains of this covering, known as the volva, forms a sheath or coating of loose scales around the base of the stem after the fungus is full grown, but as it is usually hidden under the surface of the soil, the base of the stem should be carefully dug up in order to show this character. In some of the *Amanitas*, moreover, small portions of the upper part of the volva remain as loose patches or warts upon the top of the cap and thus help in the identifying of the specimen.

Just as the fungus emerges from the volva, by the rapid lengthening of the stem, a second or inner membrane may be seen which joins the margin of the cap or pileus to the upper part of the stem and covers the gills from view. By the spreading of the pileus, this membrane is torn loose from its margin and clings as a loose ring upon the upper part of the stem, where it may be found in most species as long as the fungus lasts.

The following descriptions refer principally to the mature plant.

*The Deadly Amanita (Amanita phalloides)—Poisonous.*

*Cap*—Two to three inches broad; varying in color from nearly pure white to smoky brown in different varieties; smooth, often with one or more small patches of the whitish volva sticking to it.

*Gills*—Wide, numerous, white.

*Spores*—White.

*Stem*—Three to five inches high, enlarged at base, white or tinged with the color of the cap, pithy or hollow.

*Ring*—Curtain-like, near upper end of stem.

*Volva*—Cup-like or sheath-like, white or yellowish white.

Occurs in woodlands or recently cleared ground where leaf mold abounds. While this fungus has not been seen in this state by the author, it should be looked for and carefully avoided, as it is one of the most poisonous plants known, when eaten.

*The Fly Amanita (Amanita muscaria)—Poisonous.*

(See colored plate.)

*Cap*—Two to four inches broad, bright orange or light scarlet, thickly sprinkled with small, yellow-white warts or fragments of the volva which stick closely to the smooth surface.

*Gills*—Usually white or sometimes faintly tinged with yellow, broad, numerous.

*Spores*—White.

*Stem*—Three to six inches long, enlarged and coated with scaly fragments of the volva at the base, pithy, becoming hollow white or tinged with pale yellow.

*Ring*—Soft and clinging, often breaking and disappearing in old plants, yellowish white.

*Volva*—Soft, breaking up into scales or fragments which cling loosely to the enlarged base of the stem and sometimes disappear in old plants.

Occurs almost entirely among trees in moist places in gulches and mountain parks or in forests of Lodgepole pine. It is not uncommon, but is so striking in appearance with its brilliantly colored cap adorned with whitish warts that it can scarcely be mistaken for any other fungus. While perhaps not quite so deadly as the first species, it is very dangerous when eaten and has taken its toll of lives in almost every country of the world. The common name, "Fly Amanita," which has been applied to this plant, is due to its poisonous effect upon flies. The writer has seen specimens of this mushroom, left to dry in the open air, which were surrounded by a circle of dead flies that had fed upon this natural fly poison.

Undoubtedly, other species of Amanitas occur occasionally in our state, but any person who becomes familiar with the two described should have little or no difficulty in recognizing them as belonging to this genus. Any umbrella-shaped fungus which has white spores, a ring on the stem and a volva at the base of the stem is an Amanita and should not be eaten. These characters, together with the fact that these fungi are confined to woodlands or the near proximity of trees or recently cleared forest should make it readily possible to entirely avoid them.

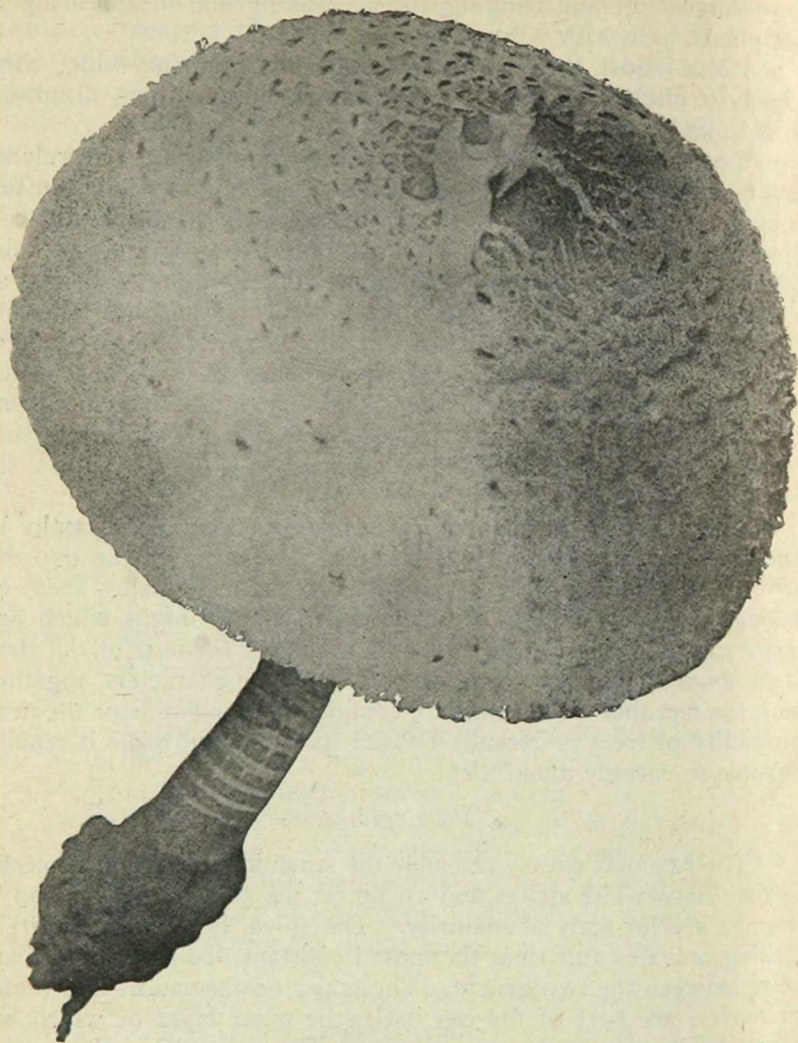
#### *The Lepiotas.*

The Lepiotas closely resemble the Amanitas in certain respects, as they have white spores and a ring on the stem, while the cap is in most species scaly at maturity. The volva, however, is entirely lacking and this furnishes the most important distinguishing character between the two genera. The scales on the cap of a Lepiota, moreover, are part of the cap itself, the outer layer of which becomes broken up as the cap enlarges. The ring, also, is better developed than in the Amanitas and in some species becomes free from the stem and capable of being moved up and down.

*Morgan's Lepiota (Lepiota Morgani)*—Dangerous.

*Cap*—Four to eight inches broad, sometimes larger; rounded and later flattened; whitish with numerous brownish or yellowish scales, thicker at the center.

*Gills*—Crowded, not quite reaching the stem, whitish at first then becoming greenish in color.



No. 15. Morgan's *Lepiota* (*Lepiota Morgani*) showing upper surface of a large specimen.

*Spores*—Dirty yellowish green.

*Stem*—Tapering upward from a somewhat swollen base, tinged with brownish, smooth or sometimes the surface becomes slightly cracked as in the specimen figured.

*Ring*—Thick and large, movable on the stem. Occurs mostly in open ground, in meadows or pastures, usually several or many

individuals growing near together, sometimes forming a large ring or circle.

This fungus, while attractive in its large size and pleasing appearance, has the reputation for making at least half of the number of persons who eat it very sick for a time and should be avoided as dangerous. It is so unlike any other known mushroom which occurs in open ground in the color of its spores that it can be very easily shunned by taking care to determine this matter.

*Smooth Lepiota (Lepiota naucina)*—Edible.

*Cap*—Two to five inches broad, rounded, usually smooth and white, sometimes brownish and scaly, as in one of the specimens figured; flesh thick, white, or pinkish when old.

*Gills*—Numerous and crowded, white, later pinkish or brownish.

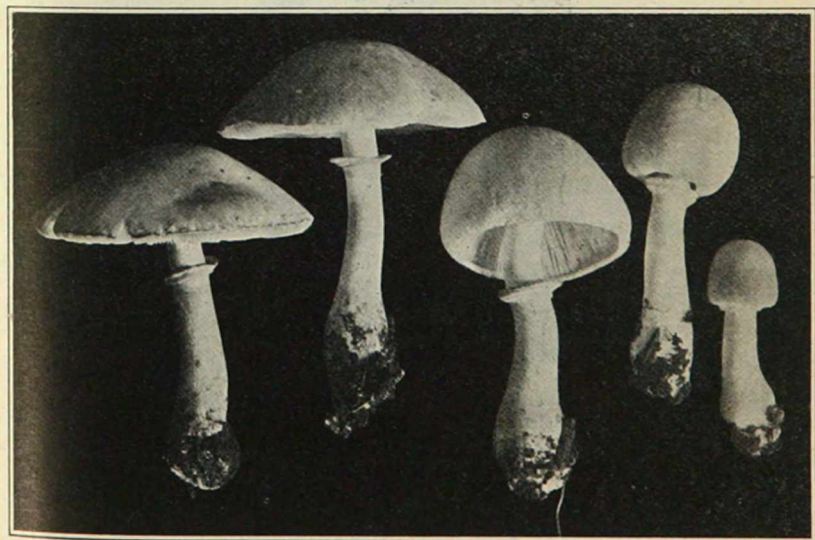
*Spores*—White, or pale pinkish in mass.

*Stem*—Two to four inches tall, tapering upward from the somewhat swollen base; white or colored like the cap; may be readily separated from the cap by bending it to one side.

*Ring*—Narrow, sometimes free on the stem.

Occurs occasionally in groups in rich lawns and in the vicinity of trees or hedgerows where leaf mold has accumulated.

This is one of the most desirable of the umbrella-shaped fungi and is equal in every way to the cultivated common mushroom. It



No. 16. The smooth *Lepiota (Lepiota naucina)*. Edible.

appears usually during the latter part of summer and early autumn and should be known to every lover of mushrooms.

*Oyster Mushroom (Pleurotus sapidus)*—Edible.

*Cap*—Two to six inches broad, shell-shaped, often quite irregular, smooth, smoky or wood brown in color. When young moist and rather tough.

*Gills*—Not crowded, extending down onto the short stem, white.

*Spores*—White on black background, pale grayish or lavender on white background.

*Stem*—Very short or sometimes wanting, attached to one edge of the cap.

Grows in crowded masses or clusters, often of many individuals upon decaying stumps or logs of cottonwood, poplar and similar wood. This fungus can often be found year after year in the



No. 17. The oyster mushroom (*Pleurotus sapidus*). Edible. A large cluster growing upon the trunk of a dead cottonwood.

same places and occurs almost throughout the season when the moisture conditions are favorable. The caps should be used while comparatively young as they become tough with age and are also apt to be infested by insect larvae if left for some time.





No. 18. The oyster mushroom (*Pleurotus sapidus*). A small cluster from a cottonwood stump.

*Elm Tree Pleurotus (Pleurotus ulmarius)*—Edible.

This species closely resembles the preceding one except that it usually has a longer stem which is more nearly central in attachment to the cap and the color of the fungus is white or yellowish. It grows mostly upon dead elm wood and is usually solitary. Like the other species of pleurotus the flesh is rather tough.



No. 19. Elm tree *Pleurotus* (*Pleurotus ulmarius*). Edible. Single specimen growing from decayed part of an elm tree.

*Common Mushroom, Meadow Mushroom (Agaricus campester)*  
*Edible.*

(See cover and colored plate.)

*Cap*—Two to five inches broad, broadly rounded, or flattened when mature, varying from smooth to silky hairy or minutely scaly and from white to grayish or reddish brown.

*Gills*—Broad, crowded, at first pink, gradually becoming dark purplish brown as the cap expands and matures.

*Spores*—Purple-brown.

*Stem*—Two to four inches tall, thick, solid or spongy within, colored like the cap.

*Ring*—Soft and delicate, often disappearing with age.

Occurs in open grassy ground, pastures and meadows during

summer and autumn. This is the fungus known to most persons as the Mushroom. It is the mushroom of the markets where it may appear in the fresh condition from the local mushroom cellars, or in tin cans from across the sea. The spawn of this fungus is sold by seedsmen either as brick spawn or flake spawn, in either case consisting of dry compact masses of decomposed horse manure filled with the mycelial threads of the fungus in a dormant condition. The cultivation or growing of mushrooms consists in preparing beds into which the spawn is planted after being broken into small fragments. The mushroom beds are usually located in cellars, sheds, or specially constructed houses where a rather uniform temperature can be maintained and from which insects can be excluded. Natural caves or tunnels made in the mining of various minerals have been very successfully employed in some parts of this country. As fungi do not require light to enable them to grow, such places as caves are often well suited to the purpose and the absence of light is an advantage in keeping the mushrooms away from the fungus-eating insects which attack them so greedily in open air.

Fresh stable manure is first piled, watered, and allowed to heat, with an occasional forking over to prevent burning. At the end of two or three weeks or after the temperature has subsided, the fermenting manure is packed into the beds to a depth of nine or ten inches and allowed to lie for another week, when it should be ready for the spawn. Spawning the beds consists in breaking the spawn into pieces an inch or two square which are then planted just below the surface of the moist manure. The beds are then allowed to remain during another period of about two weeks, when they are covered with an inch or two of garden loam.

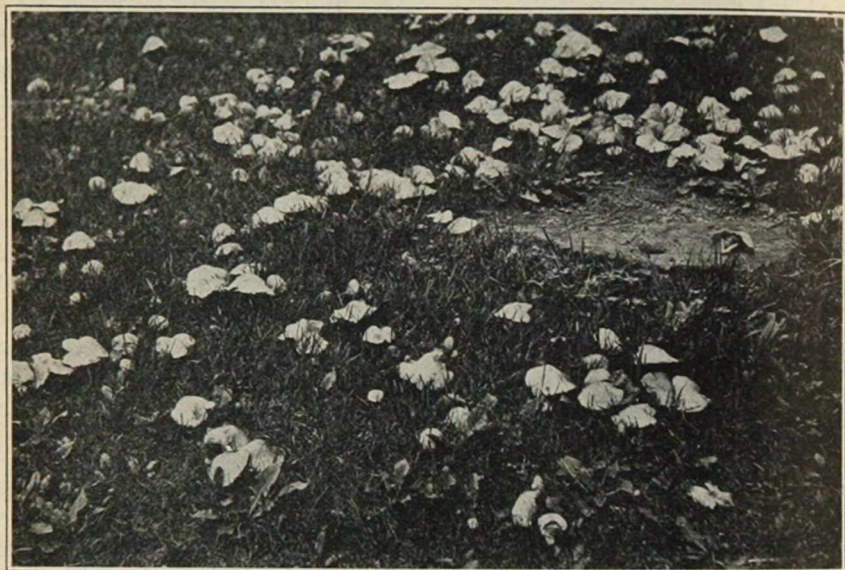
As soon as the mushroom buttons begin to appear, the beds are lightly sprinkled with water once or twice a week, but should not be drenched. The time during which a bed may continue to bear well may vary considerably. In some cases it is only five or six weeks, while in others it may be nearly as many months.

The successful growing of mushrooms is so largely a matter of experience and the use of good spawn under suitable conditions that the reader is not expected to find these explanations of the process sufficiently detailed to undertake the work without further study of the subject from publications devoted more fully to it.

While this is the first species to be brought under general cultivation, it has been found possible to grow a number of other species almost as readily.

*Small Hypholoma (Hypholoma incertum)*—Edible.

*Cap*—One to two and a half inches broad, broadly conical or bell-shaped, with thin wavy margin to which fragments of white



No. 20. The small *Hypholoma (Hypholoma incertum)*, growing in profusion in a lawn around an old cottonwood stump. Edible.



No. 21. A cluster of the small *Hypholoma*. Natural size.

membrane are attached; dull yellowish or brownish white, showing purplish tinge near the margin; flesh very thin and tender.

*Gills*—Narrow, crowded, joined to the stem; nearly white at first, becoming purplish brown.

*Spores*—Purplish brown.

*Stem*—One to three inches tall, slender, hollow, white.

Occurs in lawns and moist grassy places. While the individual specimens are small and the flesh thin; this is usually compensated for by the large numbers which often grow together as shown in the photograph.

### *The Coprini or Inky Caps (Coprinus).*

These plants form a very characteristic group of the gill fungi. They are often very abundant during or following rainy weather and are familiar objects to everyone. Evanescence is one of their chief characteristics. Some of them literally spring up in a night, spread their fragile caps for a brief period, and vanish at the sun's touch. Others are more enduring, remaining for a day or two, but seldom longer, soon drooping into a slimy mass of inky dejection very aptly suggestive of the common name "inky caps."

In this condition of sodden collapse they are not calculated to prove very inviting to the mushroom collector, but if gathered before the caps expand and while the gills are still light colored, they are excellent eating. Furthermore, none of the species are known to be poisonous and are easily distinguished from any of the poisonous fungi.

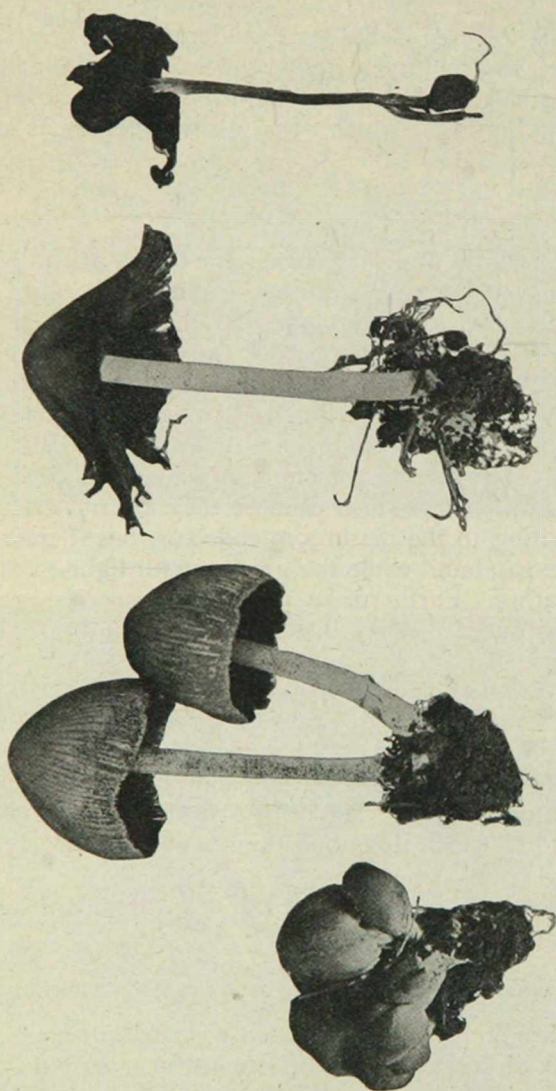
The caps of these fungi when young are folded close to the stems with the thin, delicate gills packed closely together. The gills are white or light colored, at first, but soon become darker, passing through various shades of pink, purple, and brown, to black, finally melting into an inky liquid. The color of this liquid is due entirely to the black spores which it contains and which are largely set free in this way.

The three species described are the most abundant and desirable kinds for food.

### *The Glistening Coprinus (Coprinus micaceus).*

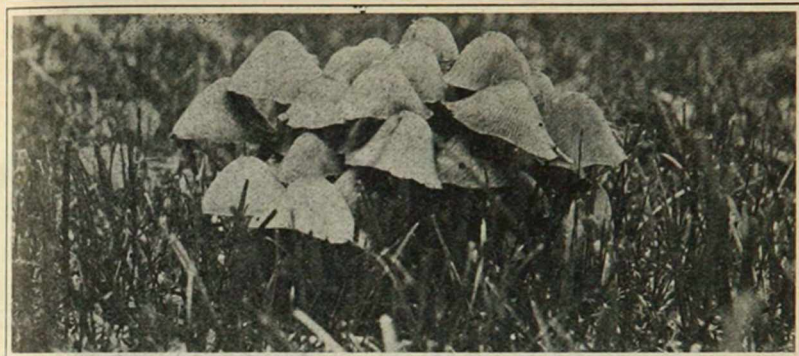
This mushroom often grows in dense clusters of many individuals at the base of decaying trees or stumps, near an old door step, or at the edge of a sidewalk. Sometimes it appears in the open lawn, but this is usually an indication of the presence of buried wood in the soil. The caps when folded are conical, oblong or egg-shaped, with fine grooves running lengthwise. The color is yellow-

ish, brownish yellow, or tan, while the surface is frequently sprinkled with glistening, mica-like particles that give this mushroom its name. These shining particles do not always appear on the caps, however. In young specimens the margin of the cap is at first



No. 22. The Glistening Coprinus (*Coprinus micaceus*) showing four stages in the development of this mushroom.

slightly attached to the stem near the base and leaves an encircling ridge where it breaks away. The stems are quite slender, smooth, white, with a narrow hollow and are easily broken. The



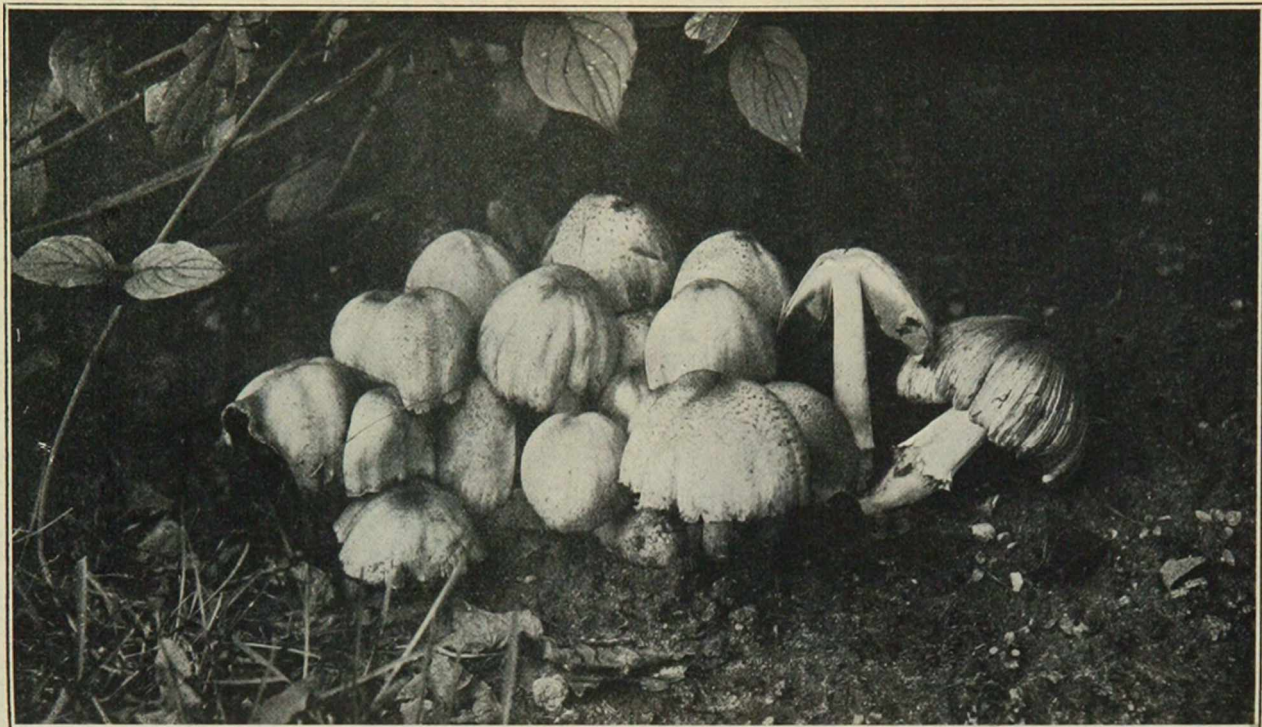
No. 23. The Glistening Coprinus. A cluster growing in a lawn where a cottonwood tree has been removed.

gills, at first white, change through brownish purple to black and in rather dry weather they shrivel and dry up instead of melting into ink.

The Glistening Coprinus occurs mostly during late spring and early summer, but is not infrequently found during the autumn following rainy weather.

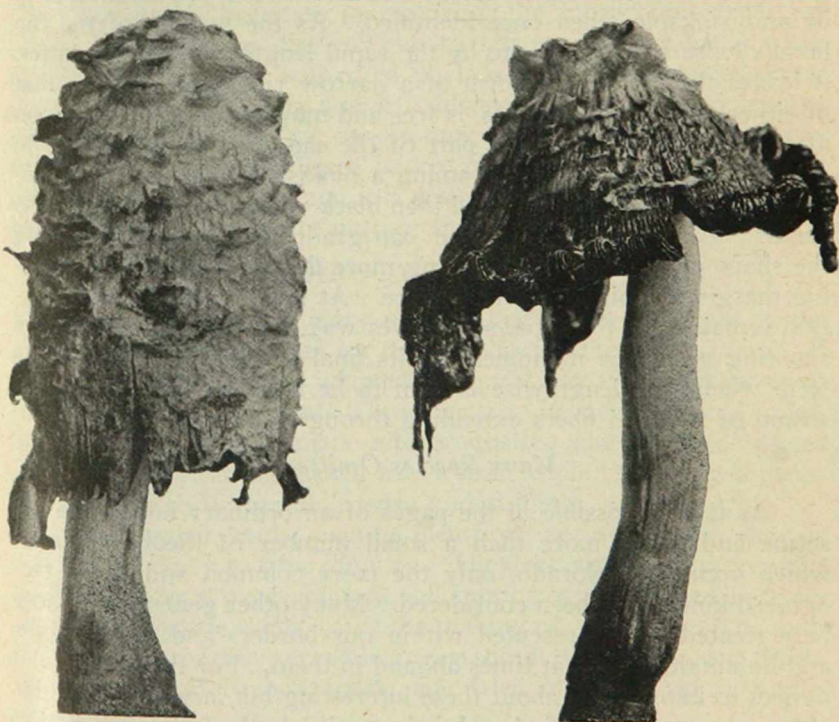
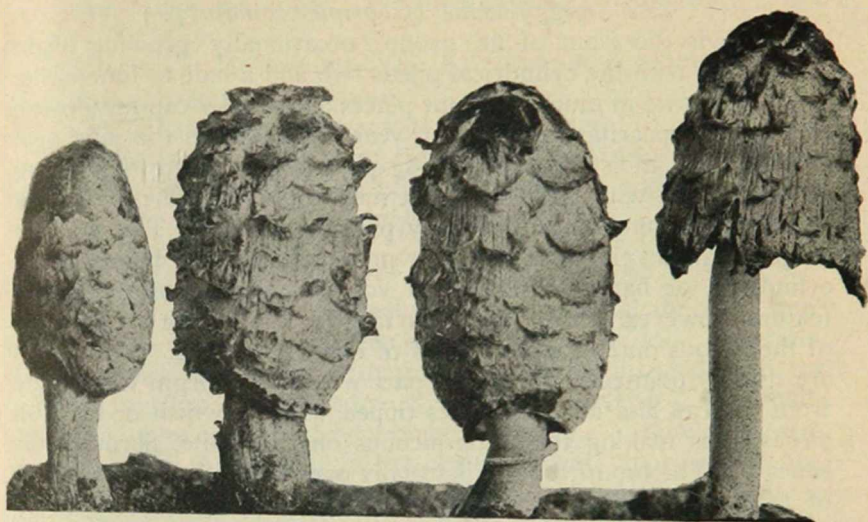
*Inky Cap (Coprinus atramentarius).*

This is a somewhat larger mushroom than the glistening coprinus and is readily distinguished by the shape and color of the caps. It usually occurs in grassy places where the soil is rich, many often crowded together, the short stems being almost hidden from view. The caps are from one to two inches high, oval or egg-shaped, sometimes slightly indented at the top, and of a gray or brownish gray color. The caps have fine lines extending to the margin, some of them being quite deep grooves and in consequence the margin is apt to be rather irregular. It leaves a rather prominent ridge where it was attached to the stem. The surface of the caps is frequently quite scaly, due to the breaking up of the surface during growth, while in other forms the longitudinal striations or fine grooves are alone present. The caps when open assume a flattened bell-shape with the margin usually upturned and rolled back. The stems are white, smooth above and somewhat scaly or rough below the ridge-like ring and are comparatively short at first, but lengthen as the caps expand, often reaching a height of six inches. It is oftenest found during summer and autumn.



No. 24. The Inky Cap mushroom (*Coprinus atramentarius*). Edible





No .25. The Shaggy Mane mushroom (*Coprinus comatus*), showing the different stages in the development of the fungus. Edible.

*The Shaggy-Mane (Coprinus comatus).*

This is the giant of its group, occasionally growing eight inches high with the cylindrical pileus two and a half to four inches long. It grows in much the same places as the inky-cap mushroom, frequently appearing in profusion year after year in the same spot in some rich, moist lawn or grassy place where filling or grading has been done with fertile soil. It may appear in June, but is apt to be more abundant in the rainy part of autumn. The caps are longer than in either of the two preceding species, being nearly cylindrical or barrel-shaped when young. Their most noticeable feature, however, is the shaggy surface formed by the breaking up of the fibrous outer coat into tufts of delicate threads. These tufts are usually pointed at the lower part where they begin to separate from the cap and are sometimes tipped with brownish or blackish pieces, thus making them conspicuous on the white, fibrous layer beneath. The top of the cap is usually overlaid with a ragged piece of the same color. Although considerable variation in different plants may be found, they are so characteristic in appearance as to be unmistakable when once identified. As the margin of the cap breaks loose from the stem, by the rapid lengthening of the latter, it leaves the veil in the form of a narrow ring which unlike that of either of the above species, is free and movable on the stem. Soon after this occurs, the lower part of the cap and the gills begin to darken, the latter at first becoming a pinkish salmon color, gradually deepening to brownish and then black when the melting process begins. At this time, too, the cap gradually expands, assuming the shape of a bell, then becoming more flattened with the dissolving margin dripping with inky juice. At length, only a small portion remains but this, too, soon gives way, leaving the naked stem standing a slender monument to its final dissolution. The white stem when split lengthwise is seen to be hollow and to contain a strand of mycelial fibers extending through it.

*Many Species Omitted.*

As it is impossible in the pages of an ordinary bulletin to describe and figure more than a small number of the fleshy fungi which occur in Colorado, only the more common and easily recognized kinds have been considered. Many other genera than those here treated are represented within our borders and our foothills and mountain forests at times abound in them. For the person who desires to know more about these interesting but largely unfamiliar plants, the reader will find such information in the following works: "Mushrooms, Edible and Otherwise," *M. E. Hard.* The Ohio Library Co., Columbus, Ohio.

"The Mushroom Book," *N. L. Marshall*. (Doubleday, Page & Co.)

"Minnesota Mushrooms," *F. E. Clements*. (University of Minnesota, Minneapolis, Minn.)

"One Thousand American Fungi," *McIlwaine*.

"Principles of Mushroom Growing and Mushroom Spawn-Making," *B. M. Duggar*. (U. S. Department of Agriculture, Bureau of Plant Industry, Bulletin No. 85.)

### GATHERING FLESHY FUNGI FOR FOOD.

In collecting any of the fleshy fungi for eating, the same general precautions should be taken as with any other food materials. All specimens that are over mature or that are infested with the larvae of mushroom-eating insects should be discarded. Puffballs should be white inside when cut or broken open. Yellow or brownish stains near the base or in the center indicate approaching maturity and, although not necessarily poisonous in this condition, the fungus is apt to be bitter and unpleasant in flavor.

Care should be taken in removing the mushrooms from the soil so that adhering dirt will not be left on the specimens while carrying them. This will often obviate the necessity of washing the fungi before cooking and it is always very difficult to remove the soil from the gills of mushrooms which have been carelessly handled. An ordinary lunch basket is an excellent receptacle for carrying the mushrooms and it is desirable to wrap the larger specimens in thin paper before putting them in the basket.

### MUSHROOM COOKERY.

Almost as many culinary methods have been employed in the preparation of mushrooms for the table as for the various kinds of meats. In fact, they are adapted to almost any treatment given to meats, fish, fowl and eggs. Thus they may be stewed, baked, fried, broiled and escaloped, made into croquettes and patties or mixed with chopped meat and baked into a loaf, while they form a pleasing addition to thickened gravies and stuffing.

The tougher kinds, such as pleurotus, are adapted to stewing and require forty to fifty minutes. They are also readily prepared by grinding in a meat chopper and mixing with chopped beef for the filling of pattie shells or for the making of meat loaf. The puffballs are very daintily served by being sliced, dipped into egg batter, the same as for French toast, and fried in butter until lightly browned.

The very tender species, such as the Coprini or Inky-caps, are well suited to being served on toast after being stewed for fifteen

to thirty minutes and thickened with a flour and milk sauce to which a little butter has been added.

Almost any of the various species are well suited to being baked with cracker crumbs after the manner employed in preparing escalloped oysters or tomatoes and a mixture of kinds can be utilized at one time in this manner. Almost any good cook book will be found to contain numerous recipes for mushroom cooking, only a few of which are mentioned here.

