Some Common Mushrooms

PINE CONE MUSHROOM

This is the thirty-fifth in Nature Magazine's series of educational inserts.

By E. LAURENCE PALMER

DURING my student days in college, I was more or less surrounded by men and women who spent most of their spare time in the summer and fall months in the fields, a basket on one arm and a roll of paper in the other hand. While I was collecting seeds, they were collecting mushrooms. When they found one, they knelt down, picked it, and gently wrapped it in paper. A collection complete, they hurried back to the laboratory to photograph, describe or dry their findings. They were fully as enthusiastic about these beautiful fungi as was my German professor about his mosses, my wife about her fossils, or others about their birds, snakes, ferns, irises, roses, postage stamps, old buttons, old glass, iron grills, china or sea shells.

In spite of the fact that I was associated for years with these able naturalists, and "took" a number of courses on the fungi under that master mycologist George F. Atkinson, I never could myself go "all out" for the fungi the way I could for many other things in Nature. That does not mean that I do not recognize their varied appeal. They offer profitable occupation for many people. They are potentially more valuable than they now are practically. At the same time, they are potentially more destructive of many of our biological assets. A mass of sulphur polypores extending in a confusing mass of shelves from an oak tree must offer highly varying appeals to the forester, the cook, the artist, the scholar, and the amateur collector. Any series, such as this of which these eight pages are a part, must give these plants consideration. So here we are.

The greatest danger in writing an article of this sort is that some may assume that a fungus they find looks enough like one figured and described here to satisfy them as to its identity. Yet it may have minor differences that are important, and it may really be a dangerous species. The best advice to beginners, then, is to learn to know a few mushrooms well, and stick to those known to be safe when planning to use them for food.

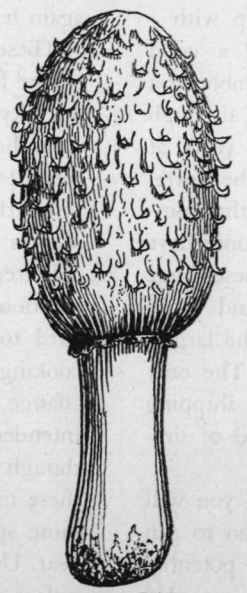
One of the most recent popular books on edible mushrooms recommends four that are considered foolproof, but it would seem that this number could be safely enlarged. Certainly, anyone wishing to make a list of safe mushrooms would include only those whose dangerous relatives can be easily identified, those of which there is likely to be an abundant supply generally available, and those that are edible in the best sense of the word.

MOREL

Any list of safe mushrooms would, of course, include the morels, or sponge mushrooms. Sometimes, they are tremendously abundant and they are always delicious. I remember collecting nearly a bushel of these on a trip with my botany class in Iowa, coming back to the laboratory, raiding a nearby home economics kitchen for some butter and enjoying a feast that still stands out with me as a high spot in mushroom sprees. Never since have I ever seen or eaten so many morels at one time, and never until now have I admitted where I got butter at a time when all the stores were closed.

HONEY MUSHROOM

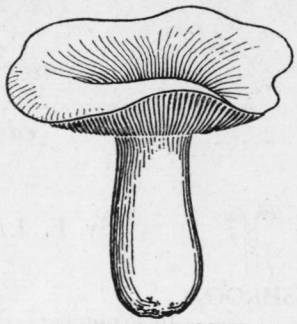
So delicious are morels that it is surprising that their culture has not been undertaken seriously. They grow in good clean woodlands rather than in manured pastures or cellars, and they have a pleasant flavor and a firmness that makes one enjoy biting into them. True, they sometimes harbor little animals in their hollow interiors, but, if the morels are split and washed before being cooked, all of these potential side dishes may be avoided. In common with some other delicious mushrooms, however, they can not always be found in abundance at a given place, year after year. In contrast, I know a stump in the woods, two hundred yards from where I type this, that each year produces in abundance a mushroom that is perfectly safe and good to eat even though it is tougher than field mushrooms or the morels. Sometimes, I wonder if it might not taste much better if it were as elusive as are the morels. Perhaps a part of the joy of eating morels comes from finding them, just as the flavor of trout seems to be improved by catching them yourself.



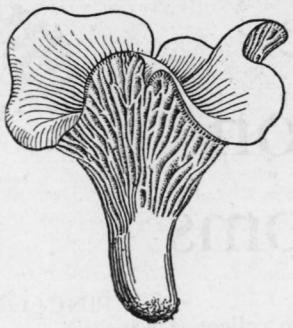
INKY-CAP

Another perfectly safe group of fungi to use is the puffballs, if one merely remembers to eat only those with solid white centers. That rule is so simple that anyone can apply it safely, and the shape of the puffballs is such that the only possible confusion might arise by collecting

FAIRY-RING MUSHROOM



PUNGENT RUSSULA



CHANTERELLE

OYSTER MUSHROOM

MILKY-CAP MUSHROOM

HEDGEHOG MUSHROOM

FLY AMANITA

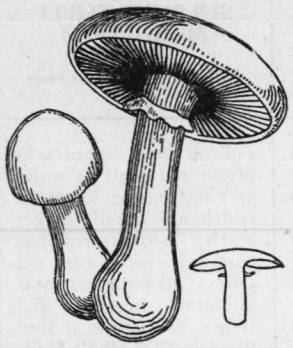
some poisonous gill fungus in its initial stages. If one remembers to cut the balls in two, the gills will show in the balls, and so there need be no danger of confusion.

Scarcely a year passes but someone calls me up and asks if it is safe to eat a big white puffball that is a foot in diameter. Frequently, I am tempted to suggest that it would be better if they sent it over to me for identification, thinking that maybe in that way I might get a few slices for myself, but I restrain myself. Usually, I try by phone to let them know how much I like these big puffballs, but to date no one has taken the hint. Instead, they have told me some time later how delicious they were, and how they really had more than they could eat. I remember one of these huge puffballs — collected on a field trip with a class—that provided a good helping for each member of a group of twenty. But, although I have camped for years at the same spot at the corresponding week in the summer, never but that once have I found one of these huge balls there. If one could control this vagary, and could harvest regularly cultivated puffballs as large as the largest produced by Nature, he would have something. The only difficulty with them is that they do not stand shipping and storing as do commercial mushrooms. Instead of drying gracefully, they go all to pieces.

If you will read the chart section on puffballs, you will find an excellent opportunity for your imagination to run wild. You might make a wild estimate as to the potential volume of the second generation of the largest recorded puffball, assuming that each spore produced a puffball the size of the largest. People have let their imaginations run wild along other lines, however, and we have folk lore contending that a cut, mature puffball applied to a cut finger will stop the flow of blood, while still other legends tell us that the spores are dangerous. We have the tale that meteors falling to the ground become "earth-stars." An earth-star is, of course, a sort of puffball.

Possibly the most delicate of the mushrooms that are safe and abundant are the shaggy-manes, inky-caps and their ilk. These are the compact little mushrooms that appear all summer, springing frequently from the place where an old tree had lived. There are two excellent patches of these mushrooms growing on lawns between my home and my office. Each year we get at least one good crop from them. I admit that I always feel a bit sheepish collecting these from in front of a home whose owner I do not even know, but, after seeing one crop of the delicious things go to waste without their being harvested, one somehow feels as though it were only fair that he make the most of an opportunity. Consequently, I provide myself with a good big paper sack on the proper day, make it a point to go early or come home very late so I can slip in, fill the bag and be on my way, safe in the thought that, even if I were seen, I would not be recognized. Of course, one could go up to the house and ask permission to make the harvest, but the value of the fungi might then become so appreciated that I would never again have the chance to make a harvest.

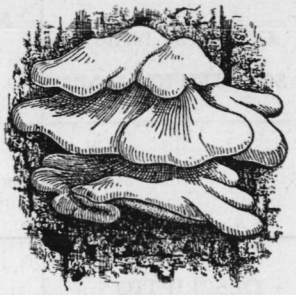
These fungi of the genus *Coprinus* are all characterized by the fact that, when mature, their gills "melt" down into an inky mass. When young, the fruit bodies are usually cone-shaped, with exceptionally fine gills crowded closely together and usually showing a silvery appearance over the gill surface. These mushrooms could never be a commercial success since they spoil within a few hours. But, if they are collected in their prime, parboiled briefly in a strong salt solution, and then fried quickly in hot butter, they are hard to beat. Frequently, they break down badly in the cooking process, but, where this occurs, one need merely change plan and decide that mushroom soup was what was intended. *Coprinus* soup is a delicious dish to drink, even though it may look a bit like hot ink. One nice thing about these mushrooms is that they persist in coming up in the same spot through a long summer season, and year after year. Usually, the inky-caps are sufficiently abundant to provide a meal for the whole family without the necessity of



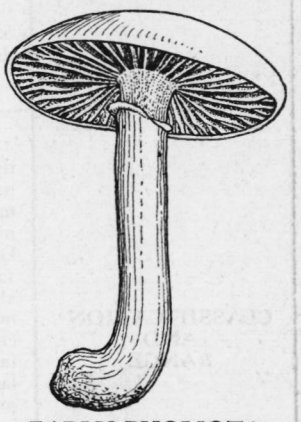
COMMON MUSHROOM

CORAL OR CORAL FUNGUS

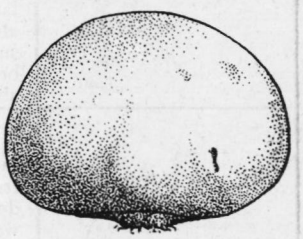
VELVET-STEMMED COLLYBIA



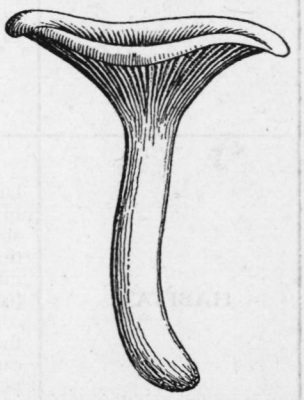
SULPHUR SHELF MUSHROOM



EARLY PHOLIOTA



PUFFBALL



JACK-O'-LANTERN

running all over the county to get what is wanted. Shaggy-manes are more likely to be found growing in small clumps, or alone, and while they are much larger than the inky-caps, it usually requires much more exercise to collect a satisfactory mess.

We have been told that sometimes firms, desiring to give to their inks a microscopic quality that may be used in identifying signatures, make a practice of mixing the ink of these inky-caps into their commercial ink. The spores, persisting, may be identified microscopically in the signature if there is any reason why such signature is needed to be microscopically distinctive.

The polypores are generally safe for anyone who might wish to eat them. They are easily identified by the finely punctured undersurface from which are shed thousands of spores. Most of those that we find as shelves on tree trunks are too tough to have culinary value but, when young, many of these have good possibilities. The sulphur polypore is probably the most popular of all of these, unless it might be the beef-steak mushroom, which, in texture and color, if not in taste, resembles one of those toothsome decorations that used to adorn dinner plates in the days before rationing took over.

Some of the fungi whose spore-bearing surface is marked by many pores have the form of the ordinary mushroom. Members of the genera *Boletus, Boletinus* and *Strobilomyces,* for example, have many species of which the more dangerous ones are usually unpleasant to the taste and smell so badly that they would not be eaten anyway. Since these rarely occur in great numbers, and since some are suspected of being dangerous, it might be better to leave them all alone unless you become a specialist. However, you probably need not get worried if one does happen to be eaten.

All this brings us up to the point of trying to see if there is any rule one may apply to help one know when a mushroom is safe to eat. I well remember an uncle of mine—a high school principal—telling me something about peeling the tops to find out whether the species was safe, but whether he said it was safe if it did peel, or was not safe, I cannot recall. Anyway it makes no difference, because no such rule is valid. Neither is it safe to say that if the mushrooms stain a silver spoon when being cooked they should be discarded as being dangerous. And there are no valid rules based on bitterness, color, juice color, odor, taste or color change.

George F. Atkinson, who tried to teach me more about mushrooms than I then absorbed, used to tell of his technique for learning whether a mushroom was safe or not. He would take the tiniest nibble of a given mushroom, and if in a day or so he felt no ill effects, he might try taking a still larger bite. Continuing this technique of making a guinea pig of himself, he eventually came to the conclusion that a given mushroom was good or bad. Frankly, I cannot enthuse over this system sufficiently to apply it personally, particularly when there are enough mushrooms of known virtue to satisfy most of my rather generous wants in this direction.

The nature of the poisonous substances in some mushrooms is such that ill effects should not be expected immediately. While most of them will begin to make themselves felt within six or seven hours, with others it may be as much as two days later before the symptoms appear. So virulent are the poisons in some of the bad mushrooms that a single forkful may be sufficient to cause death. Thus it is not smart to take any chances with them, nor should one for a minute rely on the judgment of amateurs who may have made collections in the wild. The safest thing is to stick to a few species you know, or to depend on commercially grown mushrooms purchased through some reliable dealer. Do not risk your own life and the lives of some members of the family by making a purchase from some backdoor peddler who assures you that he knows all about his wares.

Of course, there are always individual differences in the effect mushrooms have on us. (Continued on page 312)

COMMON NAME SCIENTIFIC NAME	MOREL. SPONGE MUSHROOM *Morchella* sp.	CLUB OR CORAL MUSHROOM *Clavaria formosa*	HEDGEHOG MUSHROOM *Hydnum coralloides*	SULPHUR SHELF MUSHROOM *Polyporus sulphureus*
DESCRIPTION	Erect fruit body; to 6 inches tall, with cap occupying from ½ to 2/3 upper portion, and being rather deeply and irregularly impressed with dark areas separated by lighter areas; stem and cap-portion hollow, somewhat yellow-flesh-colored, brittle and tender but moist. Stem does not continue deep into ground as such.	Upright, repeatedly branching, with branch tips always pointing upwards in contrast with downward pointing teeth of hedgehog fungus. *C. formosa* is to 8 inches high, with stout stem to an inch through extending deep into ground, brittle, brightly pink, red or orange when young, but yellow to brown when old.	A profusely, irregularly branched, hemispherical mass to one foot across, of pure white fungus material bearing from beneath the branches downward-hanging teeth to ¼ inch long; a single fruit body often weighs to over one pound. Whole mass arises from a common stem. Teeth cover all of under surface.	Fruit body appears as bright red shelf or series of shelves, the lower of which are usually larger with undersurfaces crowded with round pores. Older shelves show radiating furrows and ridges that create a fan-like effect for whole fruiting body, and in the older shelf the rim is thin.
CLASSIFICATION AND RANGE	Order Helvellales. Family Helvellaceae. Ordinarily classed with Ascomycetes, but by some placed in separate group, Discomycetes, including some other cup fungi in all of which spores are borne in sacs lying closely crowded on fruiting surface. Morels are woodland species found over most of United States and in Europe. Frequently most abundant in woodlands recently burned over although not limited to such areas. Fire may not be important factor in abundance.	Order Agaricales. Family Clavariaceae. Fruiting Clavariaceae are practically all erect or sprawling, but upward pointing at tips with branches usually flattened. Coral fungus, a species of *Hydnum,* should not be confused with coral fungi, a general name for Clavariaceae. In Hydnaceae, fruiting tips point downward; in Clavariaceae, upward. *C. stricta* and *C. formosa* represent crowded, branched forms; *C. pistillaris* a solitary type. Widely distributed in North Temperate Zone.	Order Agaricales. Family Hydnaceae. Fruiting surface covered with downward pointing teeth, spines, warts or sometimes interrupted folds. Bear's head fungus, closely related, has teeth to 4 inches long and *H. repandum* has teeth beneath white, buff or yellow cap, supported by coarse stem. Coral fungus widely distributed through United States in woodlands. *H. putidum* has coarse, spongy stem; when fresh, smells like perspiring human.	Order Agaricales. Family Polyporaceae. Family includes a variety of forms, some umbrella-like as in *Strobilomyces* and *Boletus,* and many shelf-like or even plate-like, but all marked by crowded pores on undersurface of the fruiting body. Related beefsteak mushroom, *Fistulina hepatica,* has soft, fleshy shelf that is juicy and blood-red when young, but tough and hard when old. Other genera and species in family are always hard or woody.
REPRODUCTION	Spores: shed from hollows in upper part of fruiting body, usually during damp or rainy weather. Different species vary in shape of fruiting body and in nature of pits near top. Related *Gyromitra* seems to be a many-capped morel; not edible.	Spores borne all over the upper surface of branches, in *C. formosa* being light yellow in mass and probably being responsible for the color of that part of the fruiting body that bears them. Spores may be carried by insects attracted to the colored areas, some of the spores being minutely spiny.	Spores of hedgehog fungi, borne on downward pointing teeth, freed from them and carried to new food supply in which they germinate, develop a tissue-destroying plant-body from which they eventually bear new fruiting bodies, usually in late summer.	Spores shed from downward pointing pores, new layers of which may be formed in succeeding years in suitable weather conditions at 4.5 million per square inch per hour or 375 million a week. Wood rotted by fungus resembles red-brown charcoal, with concentric and radial cracks filled with large sheets of fungus.
HABITAT	Found in wet woodlands usually from May to June but highly variable in different years, so that a place that may yield many in one year may have none the next. The conditions under which they thrive apparently cannot be duplicated to permit raising commercially.	Many clavarias seem to grow merely from the ground in wooded areas though some grow directly from rotting wood; some bear fruiting bodies at any time of the year and some are tough, while others are soft and watery. Few, if any, have fruiting bodies buried in forest floor.	Coral fungus found only on decaying hardwood, while bear's head may be found on living or dead hardwoods; therefore fruiting bodies may be found more than one year on the same source. Other coral fungi may live on rather well-rotted woody plant tissue.	Lives on woody plants that are alive or dead, favoring cone-bearers, oak, cherry, maple, chestnut, butternut, walnut, alder, locust, apple, pear, but also found on other trees. It fruits in fall when summer droughts have passed, and appears year after year on same logs.
RELATION TO MAN	Morels possibly excel all other fungi in food value and since all are edible and most are delicious, they are popular with amateurs. Insects sometimes are found inside, but, cut open, washed and fried in butter, morels are hard to beat as a table delicacy.	Probably no clavarias are poisonous and while many are edible, few are delicious. Greatest weakness seems to be that of being too tough; some have a disagreeable flavor but others have little distinctive taste. Should be cooked slowly, then fried in butter, to taste like noodles.	Coral fungus and bear's head fungus are edible. *H. repandum* considered one of best of table mushrooms. Single fruiting head of coral fungus may be a meal for a family. Coral fungus may appear "flat" and tough, but is remarkably free from insect pests. Sometimes bitter, but not if just boiled, then stewed slowly.	Fruiting shelves cannot be confused with any poisonous mushroom and if collected young, parboiled in salt water and fried in butter, have a delicious taste. Older shelves are tough. The plant is, of course, a pest to trees, and it may be desirable to burn infected logs to protect healthy trees.

PINE-CONE MUSHROOM *Strobilomyces strobilaceus*	SHAGGY-MANES AND INKY-CAPS *Coprinus* sp.	COMMON OR FIELD MUSHROOM *Agaricus* or *Psalliota campestris*	EARLY PHOLIOTA *Pholiota praecox*	FLY AMANITA *Amanita muscaria*
Fruiting body: like coarse umbrella, with cap to 4 inches across, soft, spongy, with surface covered with coarse, hairy, upright, blackish brown scales, with margin scale-fringed; under surface crowded, with pores that are white at first but change to black when wounded and have angular openings. Stem: to 5 inches long and to ¾ inch thick, brittle.	Fruiting bodies to 20 inches tall but usually under 6 inches. In general, rather cylindrical, with cap expanding upper portion. Delicate, with gills fine, closely crowded, and in age breaking down to make an inky mass. In shaggy mane, *C. comatus,* the outer part of cap is shaggy and in inky cap, *C. atramentarius,* it is not.	Fruiting body: with a cap to 4 inches wide, hemispherical, then convex, then expanded, soft, satiny white, with margin much incurved at first. Flesh: thick, firm, white, with good flavor and scent. Gills: free from stem, thin, crowded, white, then pink, then blackish brown. Stem: to 3 inches long, and to 2/3 inch thick, with ring usually persistent.	Fruiting body: umbrella-shaped, with cap that is to 2 inches broad, convex or plane, slightly sticky when moist, white or pale tan and with incurved margin. Gills: crowded, grown to stem or unequal and widest at center, at first dirty-white or gray, but becoming rusty when mature. Stem: to 3 inches long and to ¼ inch thick, spongy inside of hollow.	Beautiful fruiting body, with cap to 6 inches across, at first spherical, then convex, then almost plane, with surface slightly sticky, yellow or deep orange, and with margin minutely striated; surface covered with thick, angular, persistent scales. Stem: white or sulphur yellow, with ring and conspicuous cup.
Order Agaricales. Family Polyporaceae. *Strobilomyces* differs from *Boletus,* other common fleshy pore-bearing stool-shaped mushroom, in that tubes are white, are at first covered by veil, and do not separate easily from cap as they do in *Boletus.* Flesh of pine-cone fungus, at first a pale tan, when broken becomes a dark blue in few minutes, and exudes a reddish brown juice. Pores are to an inch long. Stem is less woolly than cap.	Order Agaricales. Family Agaricceae. *Coprinus* is black-spored, usually, but not always, with gills melting into black mass with age. This melting is sufficient character to distinguish most members of group, although relatively slender cylindrical shape of whole fruiting body is definitely characteristic. Plants all delicate and break easily. In some smaller species, caps split at top, but lower edge remains united.	Order Agaricales. Family Agaricaceae. Brown spored. Stem and cap easily separated; lacks cup but possesses ring. Species resemble white-spored *Lepiota* but while some lepiotas are poisonous, few if any psalliotas are. Among other better known species are the horse mushroom, the flat-top, the sylvan, the reddish brown, Rodman's and others.	Order Agaricales. Family Agaricaceae. Ochre-spored or rusty spored or yellow-brown spored. More than a dozen genera. Gills do not separate readily from cap; stem is essentially central, and usually with ring persistent on it when young, but without cup at base. Among better known species are the scaly pholiota, *P. squarrosa,* the sticky or fatty pholiota, *P. adiposa,* and this species. Common names suggest major differences.	Order Agaricales. Family Agaricaceae. White-spored. With central stem easily separating from cap, with both cup and ring, ring being white or yellow, ragged, large and soft, and cup being fragile and white or yellow. Widely distributed and very poisonous as are many other species in genus, although some are safe to eat. Unfortunately, resembles delicious Caesar's mushroom whose gills are white or yellowish, while here the gills are definitely yellow.
Spores are shed downward from pores when fruiting body is in its prime in fall and summer. While mature fruit body may become soft and decayed, old one may become dried and black, and resemble a piece of dead wood. Spores are dark brown in mass, nearly globular and roughened.	Spores are possibly carried by insects and other animals that light on the fruit bodies when they are inky and somewhat sticky. In that condition, it is not likely that spores would be wind-borne. A single plant may give rise to an enormous number of caps that appear in varying maturity.	Spores shed from caps, fall on suitable material and there develop a whitish network that persists from year to year if nourished properly. Commercial plantations are started by using this material cut into small pieces and placed with suitable food and water. Minor spore differences in cultivated and wild forms.	Fruiting early pholiotas may be found on lawns, meadows and along roadsides, from May to June, while scaly pholiota is found on living or dead trees from September through October and fatty pholiota on stumps or tree trunks from September through frost, the last being conspicuously yellow on dead or dying hardwoods.	Spores are shed from the fruiting body in June or November and develop in suitable food on ground, commonly along roadsides or in open woods but not so common in pine woods as is the Caesar's mushroom. It rarely appears in clumps or in great numbers in any restricted area.
Found on ground, not usually in great numbers but over most parts of U. S. and into Canada. Stem and cap are favored hosts for larvae of many insects and so specimens should be examined carefully before they are used as food. Rather rapid color change may be used as some index of relative freshness of plant.	Saprophytic, living on decaying wood, manure, leaves and other plant material. Most abundant in wet weather from early summer to late fall. Mass of fruit bodies is relatively short-lived. When collected for food or other purposes, caps are good for but a few hours, so not likely to be commercially important.	Naturally, found in pastures and grasslands or on cultivated areas where manure has been spread generously and where too much cultivation has not taken place. Yield in summer, small; but in fall, large. Commercially, plants are commonly grown in cellars, old mines and tunnels on manured beds properly watered.	Pholiotas live on dead or dying trees or on the ground and in general shape resemble the white-spored armillarias and purple-spored stropharias. The plant body must persist from year to year since fruiting bodies appear year after year on the same sites.	Poisoning by fly agaric is evident some 3 or 4 hours after fungus has been eaten, while related death angel may not be evident until even 40 hours later. In either case, poisoning may be fatal, preceded or not by a muscular paralysis. Death may follow 2 or 3 days after appearance of first symptoms or may be quicker.
Not easy to confuse this plant with any poisonous species. Not likely to be sufficiently abundant anywhere at any time to make up an important part of the volume of any collection. Related species are found in Europe, but this is most common in United States and Canada.	Among most delicious of mushrooms, whether considering shaggy manes or inky caps, not easily confused with any poisonous species, and so favored by amateurs. Parboil quickly in saltwater, then fry even more quickly in butter or, the caps may be eaten raw, salted or buttered. Spores used to identify inks.	This species probably is eaten as food more than all others, though it is not so important to commerce as the yeasts that cause ferments, or the rusts and smuts that destroy crops, or the molds that have their own role. Spawn develops best at 50° to 60° F. and mushrooms should develop in less than 10 weeks after beds are established.	Pholiotas here suggested are all edible and make fairly good table mushrooms; some prefer to peel off the sticky or sometimes tough caps before using them. A single great mass may weigh well over a pound and be adequate for a meal for an entire family.	Treatment of poisoning by these plants calls for a quick and thorough cleaning of the intestinal tract with salts, and mustard to encourage vomiting and bowel movements and, of course, a physician's help should be enlisted as quickly as possible. It is best never to eat fungi you do not know for certain.

COMMON NAME SCIENTIFIC NAME	HONEY OR SHOE-STRING MUSHROOM *Armillaria mellea*	JACK-O'-LANTERN *Clitocybe illudens*	VELVET-STEMMED COLLYBIA *Collybia velutipes*	OYSTER MUSHROOM *Pleurotus ostreatus*
DESCRIPTION	Fruiting bodies: to 12 inches tall, with cap to 8 inches across, and stems to nearly 1 inch in diameter. Usually honey colored, but sometimes white or dull reddish brown, being darker in center of cap, which is usually covered with dark brown to blackish scales, although these may be absent. Usually, many fruits in clusters.	Fruiting body: borne in clusters arising often from a common point, with stems to 5 inches long and ½ inch thick and cap, to 5 inches across, with raised portion in center when young, or depressed when old; margin often waxy. Whole plant a bright saffron yellow though flesh inside is soft and white or yellow.	Fruiting bodies appear in crowded masses on trunks of trees with stems bent upward, to 5 inches long, yellow when young, but densely covered with brown velvet when old and bearing caps that are to 3 inches across, at first red-brown, then tan, then glistening with sticky gelatinous substance. Gills: white, narrow, crowded.	Fruiting body often described as looking like an oyster, although this is not always obvious. Cap is developed unevenly to one side of short, thick stem or there is no stem, and gills are thin, extend down onto stem, are white, soft and spongy. Cap may be over 8 inches wide, with top, white or ivory and smooth.
CLASSIFICATION AND RANGE	Order Agaricales. Family Agaricaceae. White-spored. Differs from amanitas and lepiotas in that cap does not break cleanly and easily from stem, tissues of the two being continuous. Stem usually bears ring (annulus) though this is not always distinct. No cup (volva). Presence of annulus separates it from related *Tricholoma* and *Clitocybe,* in both of which stem and cap are grown together. World-wide distribution.	Order Agaricales. Family Agaricaceae. White-spored. Lacks both ring and cup; has stem and cap grown firmly together. Unlike as with otherwise similar *Tricholoma,* gills at their bases extend down onto stem. Many species: including edible, mealy-surfaced *C. laccata,* short-stemmed giant, ivory, funnel-shaped, lacquered, cloudy, fragrant, and clustered clitocybes.	Order Agaricales. Family Agaricaceae. Collybias differ from mycenas in that cap margin in *Collybia* is at first bent inward rather than straight, gills of neither are decurrent, and while cap and stem are grown together they are of obviously different texture. White-spored with relatively thin gills. Related *C. radicata* grows on ground, with flat cap and rootlike base to stem. Both common and well distributed.	Order Agaricales. Family Agaricaceae. *Pleurotus* differs from related *Hygrophorus* in that former has thin gills that are not much broadened near cap, while latter has gill waxy and broadened nearest cap. Among species of *Pleurotus* are oyster mushroom, the olive pleurotus, the elm pleurotus, the latter, of course, being most common on living or dead elms. All lack ring and but for off-center placing of stem, in some ways resemble *Clitocybe.*
REPRODUCTION	Spores shed in summer attack roots of host trees, entering bark and spreading under bark until roots are killed and spreading until eventually tree is killed. Growth may take place for many years before new fruiting bodies are produced, the hidden tissue often appearing as cords or strands.	Like the armillarias, some clitocybes may spread through cords from root to root underground. The spores, of course, are shed from the fruiting bodies and can attack wounded woody plants and there develop new plant bodies that may eventually bear other fruit bodies.	Spores from this plant may be shed from the fresh fruit bodies from earliest spring even into January, it being one of the fungi appearing most widely spaced through the year. Fruit appears either from dead trees or from wounds or dead spots in living trees.	Spores: white, elongate and when carried probably by wind to an exposed suitable wood, develop a plant body from which eventually new fruit bodies may develop. It is reported that fungus can be spread by placing infested wood on exposed suitable uninfected wood.
HABITAT	Host plants include many cone-bearers as well as forest trees and small fruits. In newly cleared lands, the diseased roots of forest trees may infect newly planted orchard trees or other cultivated woody plants. The dark subterranean cords may spread infection from tree to tree.	*C. illudens* is most conspicuous at base of decaying stumps and at night is often luminescent. Wood being rotted by this fungus may be collected and used to supply an eerie light in a tent while camping, though the luminescence is most conspicuous only in wet weather.	Plant may injure living trees by destroying the old wood that provides support. A favored species is basswood, but it is found frequently on other hardwoods. The fruiting is most vigorous in late fall and winter; records are probably of persistent fall specimens.	Oyster mushroom may be found on many kinds of wood, usually hardwoods. Fruiting bodies decay rapidly in wet weather and are almost always badly infested with insects, particularly active young beetles that crawl along gills. Slugs also feed on them rather frequently.
RELATION TO MAN	Economically injurious to important woody plants destroying timber and reducing fruit production. The fruit bodies are considered edible but not choice, as they are too tough. Often appears in large numbers after first killing frosts and may be canned for use as food.	A wood destroying fungus. Supposed to be poisonous or unwholesome, though bad element is apparently destroyed or removed by boiling. Soldiers in North Africa have written me of excitement caused at night by steady glow of roots cut in trenches in front lines.	Plant injurious to woody plants, but fruiting bodies provide excellent food for man. They may be collected and eaten fresh, fried in fat, or canned and used later in season. The related *C. radicata* is also edible, but not usually so abundant.	*Pleurotus* species generally edible, although some are better than others. Oyster mushroom may be tough when old. If specimens can be found young and free from insects, a single clump of fruit bodies may make a good meal for a whole family. Elm pleurotus common on city elms.

DELICIOUS MILKY-CAP MUSHROOM *Lactarius deliciosus*	PUNGENT RUSSULA *Russula emetica*	CHANTERELLE *Cantharellus cibarius*	FAIRY-RING MUSHROOM *Marasmius oreades*	PUFFBALLS *Lycoperdon* and *Calvatia*
Fruiting body: stool-like, when bruised, gives off a milky or colored juice. Cap: sticky when moist, to 4½ inches across, convex when young; funnel shaped when old; mottled orange to red or changing to green with similar juice. Flesh: soft, spongy, brittle, white to orange. Gills: decurrent. Stem: to 3 inches long.	Fruiting body: umbrella-like. Cap to 3 inches broad, sunken in center, sticky when moist, smooth, brittle, with skin peeling easily to show faint reddish flesh. Cap: red, but paler with age. Gills: not crowded. Stem: to 3 inches long, to ¾ inch thick, solid or pithy, fragile. Flesh: mostly white.	Fruiting body: like wavy margined cup only slightly depressed in center and with rather coarse, uncrowded gills extending down stem from beneath cap. Cap: to 3 inches across, fleshy, smooth, firm, like yellow of an egg. Stem: to 2 inches long, solid, flexible. Whole plant fragrantly scented.	Fruiting bodies appear usually in rings widening each year. Cap: to 3 inches wide, tan or ivory, smooth with rounded centers raised rather conspicuously, somewhat leathery in dry weather, reviving in wet. Stem and cap separate cleanly, easily. Stem: to 4 inches long, slender but tough. Flesh: firm and white.	White or whitish balls, when young, varying in size from one to a few inches through in *Lycoperdon,* to a maximum of 5 feet high and 4 feet wide in *Calvatia,* and in shape from spheres, to somewhat elongated vases, to depressed spheres with surfaces smooth or otherwise. Fruiting bodies, above ground.
Order Agaricales. Family Agaricaceae. White-spored, resembling russulas, but differing from them primarily in possession of colored or milky juice, which exudes freely in plant or more particularly, in broken gills. Gills: brittle, rigid, may or may not extend down stem in different species. Important species include scented milky-cap, the flesh-colored, the watery, the peppery, the indigo, the coral-colored, the fleecy, and others.	Order Agaricales. Family Agaricaceae. White-spored. Resembles *Lactarius* but lacks its milky or colored juice when broken and is, like it, ordinarily rather brittle. Few russulas "bleed" slightly and, if anything, cap of russulas are more brittle than those of *Lactarius* due in part to the bunching of tissues, a character not visible without a microscope. Many russulas are edible but a few are disagreeable and this one is reported to be poisonous by some.	Order Agaricales. Family Agaricaeae. Blunt-edged gills extend down onto stem distinguishing this genus from other white-spored fungi. Three common species include orange-yellow *C. aurantiacus* of doubtful food value, the vermilion-red, *C. cinnabarinus,* and this species, both of which are edible. Color usually sufficient identification for these, though gills of *C. cibarius* are fewer branched, and more decurrent than in *C. aurantiacus.*	Order Agaricales. Family Agaricaceae. White-spored. Closely related to *Collybia* and differing primarily on fact that while *Marasmius* may wither and dry with lack of moisture, it will revive when water is restored. *Collybia,* on other hand, will not revive once it has been wilted but is more likely to decay and be destroyed. This species widely distributed while related *M. cohaerens* is more limited to northeastern United States.	Order Lycoperdales. Family Lycoperdaceae. Related *Scleroderma* with underground fruit bodies thick-walled, and with black or purple interior, is in Order Sclerodermatales. Lycoperdales includes all true puffballs and earth-stars. *Calvatia,* the giant puffball, breaks the fruit body wall irregularly. Some, with papery walls, are classified under the genus *Bovista.* Related earthstar, *Geaster,* breaks fruit body to form a many pointed star that opens and closes in dry and wet weather.
Spores: shed from July to November, and landing on damp ground in coniferous woodlands, may germinate to develop a subterranean plant body that eventually will bear new fruiting bodies. Fruiting bodies: not commonly clustered in great numbers as is common with those mushrooms that may be found on stumps or on woody plants.	Fruiting bodies appear from July to October, from the plant body hidden in rotten logs or in the forest floor. This species is not common in the open, and some russulas favor pines and spruces, while some grow in sand and some are at their best in open hardwood forests.	In July and August, fruit bodies appear singly or scattered in groups on ground, usually in coniferous woodlands or in hardwood forests. *C. aurantiacus* grows in abundance from rotten wood, probably saprophytic. While this is classed as a white spored mushroom, spores are faintly yellow and elliptical.	Rings are formed as follows: A spore falls on suitable ground and develops a plant body that exhausts suitable food where growth begins. In season, fruiting bodies are sent up at edge of this roundish area. Next season, food is further exhausted, widening ring. This continues from season to season.	*Lycoperdon* species usually rupture more or less papery fruit body to free air-borne spores through definite area at top. Spores, wind-borne. Fruit bodies white throughout at first, but later black. A 5 lb., 3 oz. puffball yields about 7,000,000,000,000 spores. If each matured, second generation would be 800 times size of earth.
Food of the plant body is evidently associated with evergreen woods. While this species and some others are edible, there are a number of species that are not, and some that are poisonous. Stem in this species is frosted or covered with bloom at first, spotted with orange and turning green where touched.	Species name *emetica* assumes that this plant may serve as an emetic. Certainly, it has a strong and distinctive taste but there are large numbers of persons who eat it regularly and enjoy it, while some books label it as poisonous. Some go so far as to say that there are no poisonous russulas.	Orange-yellow C. is found from July to September; the yellow, from July through August; and the red C. from July through October. Yellow is particularly well known and favored in Europe as well as in the United States and Canada.	These fungi are common in grassy fields and orchards or on lawns, crops of new caps appearing from time to time from spring until fall and from year to year. Insects do not infest these mushrooms, commonly, and while drought may shrivel them, they may be made edible by merely soaking tops in water.	Plants are saprophytes living on decaying plant material either in open grassy fields or in wooded areas or in cultivated lands. One species, *L. gemmatum,* is often found in considerable numbers on well rotted logs, though pear-shaped *L. pyriforme* is even more partial to old wood.
Some consider this species a favored mushroom but others disagree. Since there are dangerous or inedible species in the genus, it is safer to avoid eating any of the milky-juiced mushrooms unless more exhaustive data than are here given are available to make identification sure.	Economic importance: small. Since fruits usually do not appear in great numbers. Not likely to appear in a mess of mushrooms unless mixed with others. It is possible that they have been considered dangerous because of their strong taste and because they may be mixed with dangerous plants.	Fragrance and nutty taste as well as abundance of chanterelle has made it famous and popular world over but more particularly in days of ancient Rome. To some, nutty flavor is somewhat bitter; and to some, orange-yellow species is considered as poisonous.	Favored table mushroom because of good qualities but more so because specimens may be collected, dried and then soaked for use as food instead of going through troublesome process of canning. Dried fairy-rings sliced and added to soups are delicious. Drying may be done in sun or in ovens.	All puffballs with white interiors and fruit bodies above ground are edible and some are delicious. Larger calvatias may make many meals for a family. Fruits may be sliced, parboiled in salt water and fried in butter or in hot fat to make a delicious dish. Should be eaten only when collected white.

(Continued from page 307) We know that some are affected more than are others by poison ivy, by ragweed pollen and by other natural substances. Undoubtedly, we also vary in our reaction to poisoning by fungi. Cooking may make a great deal of difference in the quality of a mushroom. We know that some kinds are poisonous if eaten uncooked, or poorly cooked, but are perfectly safe if they have been once cooked thoroughly, and if the water in which they are first cooked is discarded. A thoroughly cooked mushroom to some is as unappetizing as a thoroughly cooked steak, so it is better not to rely on the cooking as a safeguard against trouble. Of course, this is not true of all mushrooms, since a well cooked fairy-ring mushroom may be as pleasing between the teeth as a partly cooked field mushroom.

We have used the term "fruit-body" rather freely in the chart data on mushrooms, and yet we have referred to something that is technically different from the fruits discussed in the insert "Our Fruit Stores." The mushrooms we eat are the spore-bearing portions of certain fungi that get their food wholly from other plant sources. The major portion of these plants is hidden in the material that they use for food. Usually, it is a white substance known as *mycelium,* or "spawn," capable of penetrating living or dead wood, or of extending itself from plant to plant underground. Some of the mushrooms preying on living plants are parasitic, while others, getting their sustenance from dead plant material, are saprophytes. The commercial mushroom is in the latter class, developing largely in the partly-decayed plant material to be found in manure. When the mycelium has developed to a certain point, the plants produce, rather suddenly, the spore-bearing objects that we notice readily. Really, then, a mushroom does not grow so rapidly as we might assume since it merely represents a rather sudden development of a plant part that may have taken a long time to develop. Conditions of temperature, light and, more particularly, of moisture, are among the important factors determining the appearance of the spore-bearing bodies. Of course, there is a tremendous wastage of the spores produced, and only an infinitesimally small number of those produced develop into mature new plants.

Since a generous proportion of the more important mushrooms live largely on dead plant material, they can be considered useful in clearing ground that may then be available for the growth of new plants. The fact that many of them destroy useful timber makes them most unpopular with lumbermen, and so we find infected wood and old stumps bearing mycelia frequently collected and burned in forest management practice.

There is a rich literature that anyone may use to train himself to know the common fungi better. In the writer's judgment, the best buy for a beginner is without question, *Toadstools and Mushrooms* by H. T. Güssow and W. S. Odell, published by the Dominion Experimental Farms, Ottawa, Canada, $1.00. Other good references include: *Mushrooms, Edible and Poisonous* by George F. Atkinson, Henry Holt and Company, (in libraries); *Mushroom Growing* by D. M. Duggar, Orange Judd Company, $2.00; *The Mushroom Book* by Nina Marshall, Doubleday, Page and Company, (in libraries); *Fieldbook of Common Gilled Mushrooms* by William Sturgis Thomas, G. P. Putnam's Sons, $3.50; *The Mushroom Handbook* by Louis C. C. Krieger, Macmillan, $3.50; *Mushrooms of Field and Wood* by Margaret McKenny, John Day Company, $2.00.

AN IMPOSING ARRAY OF A PUFFBALL, *LYCOPERDON PYRIFORME,* ON A ROTTING LOG. THERE ARE ENOUGH OF THESE FUNGI TO FURNISH MANY DELICIOUS MEALS. PHOTOGRAPH BY L. W. BROWNELL.