

BULLETIN No. 73.

OCTOBER, 1896.

ALABAMA

# Agricultural Experiment Station

OF THE

AGRICULTURAL AND MECHANICAL COLLEGE,

AUBURN.

---

---

**Edible Fungi: A Wasted Food Product.**

---

---

LUCIEN M. UNDERWOOD.

MONTGOMERY, ALA.:  
THE BROWN PRINTING COMPANY, PRINTERS.  
1896.

---

---

**COMMITTEE OF TRUSTEES ON EXPERIMENT STATION.**

I. F. CULVER.....Union Springs.  
J. G. GILCHRIST.....Hope Hull.  
H. CLAY ARMSTRONG.....Auburn.

---

**STATION COUNCIL.**

WM. LEROY BROWN.....President.  
P. H. MELL.....Botanist.  
B. B. ROSS.....Chemist.  
L. M. UNDERWOOD.....Biologist.  
C. A. CARY, D. V. M.....Veterinarian.  
J. F. DUGGAR.....Agriculturist.  
F. S. EARLE.....Horticulturist.

**ASSISTANTS.**

J. T. ANDERSON.....First Assistant Chemist.  
C. L. HARE.....Second Assistant Chemist.  
R. G. WILLIAMS.....Third Assistant Chemist.  
T. U. CULVER.....Superintendent of Farm.

---

---

 The Bulletins of this Station will be sent free to any citizen of the State on application to the Agricultural Experiment Station, Auburn, Alabama.

---

---

## EDIBLE FUNGI: A WASTED FOOD PRODUCT.

—BY—

LUCIEN M. UNDERWOOD.

---

Among the neglected products of America suitable for food, none are so little understood as the mushrooms. The same is more or less true among all Anglo-Saxon peoples, yet the English are more accustomed to their use than either the Americans or the inhabitants of the colonies. Strikingly in contrast with this is the condition that prevails in continental Europe where various species of fungi form a very general article of diet and are prized alike by the nobleman in his palace and the peasant in his hut. Many species are dried during the growing season and saved for winter use when a fresh supply cannot be obtained, and in this form large quantities are imported to this country and used as food by emigrants from various European countries. In some countries, France especially, they are extensively canned and in this form are exported to America where they are used at the larger hotels and restaurants, and frequently in private families, though the price of the imported material is usually so high that their use under these conditions cannot become very general. In this connection it should be noted, that, while immense quantities of finer mushrooms annually go to waste in this country than those imported in cans from France, the native forms are rarely collected and sold for food except in the immediate vicinity of the larger cities. We pay from thirty-five to fifty cents for a small can of inferior French mushrooms, and allow bushels of the same species in much finer quality to rot in our fields and forests. A few years since I was obliged to wait for a train at a railroad crossing in Indiana. It was soon after the early fall rains and in a field adjoining the crossing I could easily have picked two or three bushels of *Agaricus campestris* while waiting for my train. When I reached Chicago on the train I found an inferior quality of the same species selling for fifty cents a pound in the open market.

Many people are not aware that a considerable number of our common fungi or "toadstools"\* are valuable articles of food, equal in nutritious elements to oysters, fish, or flesh, which various forms of our native species resemble in flavor and composition.

I find many others who are well aware that certain forms of mushrooms are useful for food, but are afraid to attempt their use because they fear they will be poisoned by the use of some unwholesome species. While it is a fact that many species are unfit for food, and a certain few are undoubtedly poisonous, this is no reason why we should neglect all mushrooms as articles of food. It would be as senseless to reject all kinds of berries because some berries are poisonous, or all kinds of root-foods because certain roots are poisonous. While the discrimination of the many species of fungi in a strictly scientific way is possible only to the few, certain common fungi that are useful for food are as readily distinguished from each other as currants are from pokeberries, or wheat from barley. In Germany, children are taught to discriminate the ordinary edible and poisonous fungi as a part of their school training and they can easily separate the edible forms from among a miscellaneous pile of many species. It argues a lack of good common sense for people to claim that they cannot learn how to distinguish one form of mushroom from another, for if they know beans from corn they can learn to distinguish the more common forms of edible fungi so as to recognize them at sight.

The species of fungi growing in the state of Alabama have not yet been sufficiently studied to give a complete list of the edible species that occur here, nor even to indicate the forms that are the most common during successive years. Rev. M. A. Curtis who studied the fungous flora of North Carolina for many years, published a list of over one hundred

---

\* Also called "frog stools" in some parts of Alabama. Some people suppose that the so-called "mushrooms" are edible while "toadstools" are poisonous. We know no such distinction, and in different places they are called either mushrooms or toadstools irrespective of their edible or non-edible characters.

edible species occurring in that state. There is no reason why most of the same species and perhaps others should not occur within our limits. We can only give at present notes on a few species that are common and have come under our direct observation during the past season.

Mushrooms, as we are familiar with them, are seemingly of rapid growth and appear most frequent, soon after a warm rain, though at the latitude of the central portion of Alabama they may be looked for during almost any season of the year. Certain species have a somewhat definite period in which to develop and do not vary far from their season year after year. Other species seem to appear at all seasons of the year whenever the conditions of heat and moisture are favorable for their growth. The real growing or vegetative parts of the mushroom are rarely seen; they consist of slender interlacing threads called *mycelium*, which penetrate the soil or other substratum on which the mushroom grows, and often extend to great distances and thus draw nourishment from a wide area. The mushroom having no green coloring-matter (*chlorophyll*) like ordinary vegetation, is unable to produce starch from inorganic materials, so must depend for its food on materials that have been already organized; these are found in decaying vegetable matter of various kinds scattered through the soil. The portion of the mushroom which we know as such is simply the spore-producing part of the plant. Many people cultivate mushrooms in stables or cellars or even in special pits prepared for the purpose. These mushroom beds are sown with the so-called "spawn," sold by dealers in garden seeds, which consists merely of masses of this mycelium grown among the fragments of a mixture of stable manure and muck. The species most commonly grown is one that is more or less common in a wild state throughout the United States and is known as THE FIELD AGARIC OF FIELD MUSHROOM (*Agaricus campestris*).

[Figure 1].

This is a typical umbrella-shaped mushroom, of which form we have many species. The plant consists of a cap or

pileus (*pi*) resting on a central stalk; underneath the cap appears a series of thin radiating plates which are known as the *lamellæ* or *gills*; part way down the stem appears a shreddy membranous ring called the *annulus*; this ring (*an*) is originally in the form of a veil which extends from the stem to the margin of the pileus so as to completely cover up the gills; as the pileus grows larger the veil breaks away from the edge of the pileus and remains in the form of a more or less complete ring about the stem. These parts are shown in Figure 1 which illustrates this species.

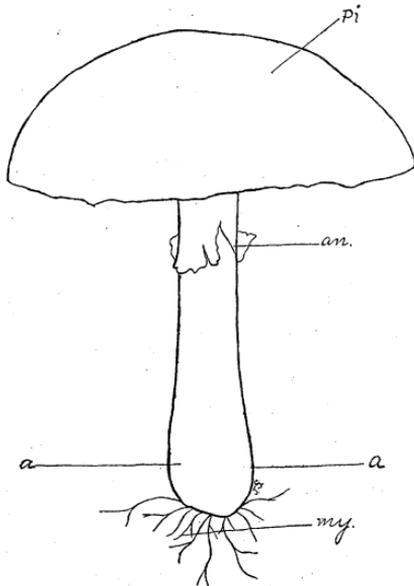


FIG. 1 *Agaricus campestris*; Edible; showing mycelium (*my*) constituting the underground *growing* portion of the plant; the annulus (*an*); and the pileus or cap (*pi*) being turned toward us does not show the gills or lamellæ beneath. The line *a a* represents the surface of the ground. Color of pileus white or grayish. About  $\frac{2}{3}$  natural size of ordinary specimens, though the size varies greatly; the stem also is often very short.

The common field agaric has a normally white pileus though this may be more or less varied with grayish flecks or spots. It can be readily distinguished by the four following marks, all of which should be present to be certain of the species, though the first two will separate it from all the deleterious forms that might be confused with it:

1. The gills are at first pink and with age turn brownish and finally become watery and nearly black.\*
2. There is a distinct veil which later appears as a ring or annulus on the stem.
3. The gills do not reach entirely to the stem.
4. The stem is either solid or stuffed with a cottony substance.

The field agaric more commonly appears in the fall of the year dependent to a great extent on the time of the fall rains. In Alabama it appeared last year at intervals from November to February. It more commonly appears in open places, notably in fields where sheep or horses are pastured. It can be cooked in any method which is adapted to oysters, though is best fried in a minimum of butter with proper seasoning. It is the most commonly eaten species of cool or moderately warm countries and is the species mentioned above as being imported from France as canned goods.

Another species which appears to be very common in the summer season in Alabama is known as

CÆSAR'S AMANITA (*Amanita cæsarea*). [Fig. 2.]

The species of *Amanita* are quite commonly regarded as poisonous and a number of them are known to be violently so. This noble fungus, however, is an exception to the rule and has been in use as an extensive article of food in Southern Europe since the time of the Romans. Under the name of "Boletus" it was fully described by Pliny as to its growth and development, and it was regarded as a dish of great excellence by the Roman epicures. In September, 1893, I saw hundreds of bushels of this fungus brought daily

---

\* This darkening is due to the ripening of the spores which are borne on the gills. A pretty experiment to show the spores of this or other kinds of mushrooms can be easily performed by cutting off the pileus and placing it on a piece of white paper, gills downward, under a tumbler or bowl. In from two to twelve hours (according to the ripeness of the plant) the spores will drop down on the paper in lines radiating out from the position of the stem. In the field agaric these spores will be dark brown or almost black. In other species they may be white, salmon colored, rusty yellow or various shades of brown up to black.

into the street markets of Genoa by the peasant women and sold as a common article of food. During the past summer when it was next to impossible to procure fresh beef in the markets at Auburn, bushel upon bushel of this fungus grew and went to waste in a single piece of woods within a mile of town, and in traveling on the railroads quantities of the same bright-colored fungus could be seen from the car windows in various other parts of the State.

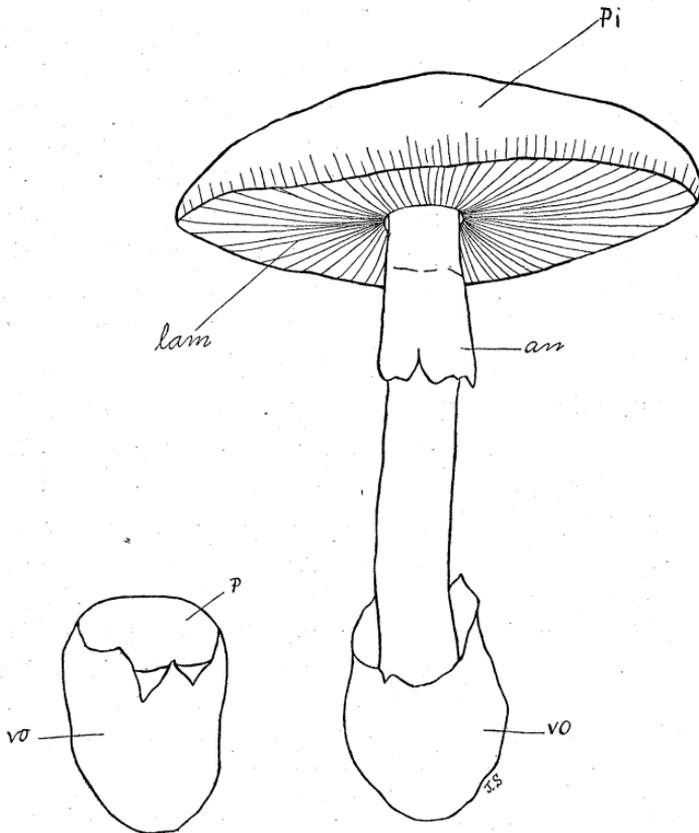


FIG. 2. *Amanita caesarea*; EDIBLE, showing young plant at the left just emerging from the volva, and fully expanded plant with cup-like volva (*vo*), annulus or ring (*an*), lamellæ or gills (*lam*) and smooth pileus (*pi*). Color of pileus usually bright or orange yellow. About  $\frac{1}{3}$  natural size.

The genus *Amanita* presents an additional structure to the ones above discussed and a character which is of vital importance in discriminating this particular species. By reference to Figure 2, this structure can be clearly seen. At the base of the stem of the mature fungus appears a cup with a somewhat irregular border; this is called the volva (*vo*) for in the young condition of the plant, the volva envelops the entire fungus like a wrapper; as the plant expands, the pileus pushes through this wrapper leaving its remains in the form of a persistent cup at the base of the stem. The species is a large one, often standing 8 to 10 inches high, and with a pileus 5 to 8 inches across when fully expanded. The pileus is of a bright reddish-yellow color, sometimes fading to a paler yellow color when older; the pileus is smooth and is never adorned with shreddy fragments of the volva; the gills and stem are pale yellow and there is a distinct veil which ultimately hangs like a skirt-like annulus on the stem; *the distinctive character, however, is the persistent cup at the base of the stem*, in connection with the combination of colors in pileus and gills above noted; if the cup (*volva*) is not present, the plant is not Cæsar's *Amanita* but is likely to be the fly-agaric which is poisonous! A *white* species with such a persistent cup is likely to be the white *Amanita* which is also poisonous! No one, however, having once seen Cæsar's *Amanita* with its bright orange or reddish-yellow pileus and delicate pale yellow stem and gills and distinct cup at the base could mistake it for anything else. In order, however, to emphasize the contrast between the two somewhat common members of the same genus we will present them in parallel columns:—

CAESAR'S AMANITA (*edible*)!

1. Volva persistent at the base of the stem in the form of a cup.
2. Pileus bright orange or rarely paler yellowish, smooth.
3. Gills and stem pale yellow.
4. Gills free, *i. e.* separate from the stem.

THE FLY-AGARIC (*poisonous*)!

1. No cup; base of stem mostly bulbous and scaly.
2. Pileus orange or yellow adorned with flocculent warts consisting of patches of the ruptured volva.
3. Gills and stem white, the gills rarely slightly yellow-tinted.
4. Gills attached to the stem and appearing to run down it in the form of slight ridges.\*

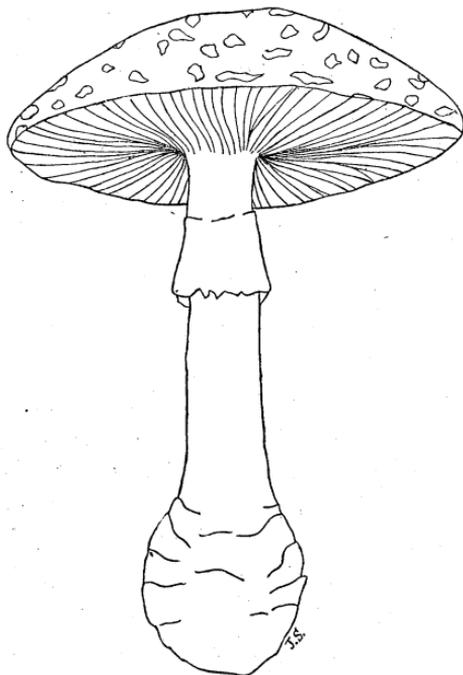


FIG. 3. *Amanita muscaria*; Poisonous, showing scaly bulbous base without a cup, and the floccose volva appearing in patches on the pileus. Color of pileus pale yellow to reddish yellow. About  $\frac{1}{2}$  natural size.

In Figure 3 we give an illustration of the fly-agaric which resembles Cæsar's *Amanita* slightly. It will be noted that the cup is not present at the base of the stem. This one character combined with the bright color of the fungus is the one character on which we must rely to determine the question of its edibility. If the cup is present the plant is safe; if it is absent the plant is poisonous.

\* A second smaller species (*Amanita Frostiana*) closely allied to the fly-agaric and doubtless often confused with it, differs by lacking this striate upper portion of the stem. It rarely has a pileus more than one or two inches in diameter while the fly-agaric is much larger. In other characters it is very much like the fly-agaric.

Hitherto Cæsar's Amanita has been reported from Vermont (*Frost*), New York (*Peck*), Ohio (*Morgan*) and North Carolina (*Schweinitz, Curtis*). It is very abundant in Alabama where the soil seems especially favorable for this species; it appears to be less common in more northern countries, being rare in the northern states mentioned and is found neither in England nor in northern Continental Europe. It is commonly found in open woods, occasionally growing in more shaded places. When it appears, usually soon after the first summer rain, it is found for a time in great abundance. Experiments with reference to the best methods of preserving this species for use at later seasons are very desirable. During the past season it was most common in July, but this period is likely to vary with the time of the summer rains.

#### THE PUFF BALLS (*Calvatia, etc.*)

A second group of fungi less related to the two species of edible fungi above discussed, than they to each other, are the plants commonly known as puff balls. These when dry are variously known as "puff balls" or "smoke balls" and in some portions of our state are known under the name of "devil's snuff boxes." The clouds of dust which rise from these when crushed, are the reproductive bodies or spores and are produced in prodigious quantities. These appear only when the plants are fully ripe. It is in the young condition that these "puffs balls" are edible and they are fully as nutritious weight for weight as beefsteak. There are a large number of species widely distributed throughout the country and several of these are common in Alabama. The various species vary in size from that of a marble to that of a man's head or even larger. When young they will appear of a pure white color when broken in two, and of a consistency somewhat intermediate between cottage cheese and curd. When the spores commence to ripen the interior become softer, and soon takes on either a purplish or olive color according to the color of the mature spores. It is only when the flesh is white that they are suitable for food, and at this time they may be sliced thin and fried in butter after first removing the outer skin. All the species of thin skinned puff-balls are edible\* but with few exceptions the smaller ones are not as valuable as the species that vary from the size of one's fist upward.

---

\* The tough skinned species of *Scleroderma* with a blue black interior would not be likely to attract anyone as articles of food. With this exception all the puff balls belonging to the genera *Calvatia*, *Lycoperdon*, *Bovistella* and *Bovista* are edible and could not be confused with anything else.

In conclusion, it should be said that there is a wide field of unused food products which may be made valuable articles of domestic consumption; these products are produced by nature with a lavish hand. The use of them as an article of food requires careful discrimination to distinguish the edible from the deleterious, but the discrimination of certain useful species when they are once known is as simple as the discrimination of cereals, or small fruits. Species are as clearly marked as among higher plants and the characters are just as constant. There is much to be done (1) In further learning what species occurring in this state, are useful for food; (2) In methods of cultivation or of extending the natural season of the native plants, and (3) In methods of preserving the plants so that they may serve as an article of export, or be made available for domestic use after their natural or prolonged season has passed by.

#### LITERATURE.

The literature relating to the edible fungi that can be recommended is unfortunately not very extended, corresponding with the slight extent to which the plants are used in this country. In Germany where fungi form a common article of diet, small works with colored illustrations of from forty to fifty edible and poisonous species can be obtained for a mark and a half (about thirty-five cents). The only work of a similar kind published in this country is Gibson's "Our Edible Toadstools and Mushrooms" which costs seven dollars and a half. Mr. Gibson has, however, an article in Harper's Monthly for August, 1894, that is valuable as far as it goes, giving good black and white illustrations of several species.

The Agricultural Experiment stations have published very little on this subject. Dr. Sturgis of the Connecticut station has recently issued (Annual Report for 1895) an excellent account of edible and poisonous fungi, illustrated by a series of half-tone plates which unfortunately do not bring out the best results. The U. S. Department of Agriculture has issued under the title of "Food Products," an account of various edible and poisonous fungi with fairly good colored plates. Nos. I, II and III have been issued already. The "Report of the Microscopist for 1892," issued from the same authority, also contains some illustrations. Dr. Farlow of Cambridge, also published "Notes for Mushroom Eaters" in Garden and Forest, Nos. 309-314 (Jan., Feb., 1894). Beyond the above, little American literature is available to the general public.