SOME COMMON *AMANITA* SPECIES OF OKLAHOMA

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ABSTRACT

Brief descriptions and photos are presented for twenty species of the mushroom genus *Amanita* that are common to Oklahoma. The descriptions and illustrations introduce mushroom morphology and terminology for Amanitas that are important for their identification. Short diagnoses are also presented for each of the seven sections of *Amanita*. The species are arranged according to their placement in each section. One species, *A. persicina*, has not yet been reported for Oklahoma but we include it with the speculation that it is present in the pine forests of eastern Oklahoma.

Key words: Agaricomycetes, Amanitaceae, mushrooms, biodiversity

INTRODUCTION

Amanita is a charismatic genus because of its reputation for having some of the deadliest poisonous species, because of the lore associated with several species, and because of their artistic beauty. Amanitas rank among the most photographed or painted of all wild mushrooms. Illustrations of Amanitas are frequently featured on tea towels, coffee cups and many other kitchen items.

Amanita is a fairly large genus of gilled mushrooms, estimated to contain about 1,100 species worldwide. Nearly all species form ectomycorrhizae with forest trees such as oaks, hickories, beeches, and many genera of conifers. This association is beneficial to both the host trees and the fungus—the plant trades photosynthates in exchange for fungus-acquired nutrients from the soil. Amanitas will therefore most often be encountered in forested areas as long as the mycorrhizal tree species are present. The geographical "hot spot" that has the greatest diversity of Amanitas in North America, and perhaps the entire world, is the Southeastern/Gulf Coast regions of the United States. We cannot estimate for sure how many species occur in Oklahoma but it could be as many as one hundred.

In this article, we report on and illustrate some of the frequently encountered Amanitas in Oklahoma. By way of brief descriptions and photos, we also introduce the morphological characters that are important in their classification and identification. Brief summaries of the sections of *Amanita* are provided in order to aid the collector in providing placement of a species within the genus if it cannot be identified to species. We are slightly biased in featuring species that occur in hardwood forests of central Oklahoma because that is where the first author has done most of his collecting. Further exploration of the pine and mixed hardwood-pine forests of

Oklahoma should yield additional diversity of Amanitas. We do indicate which species are poisonous, but refrain from indicating which species are edible. It is incumbent upon the collector to thoroughly learn the morphological characters of fungi in general in order to correctly identify edible species and eliminate the risk of confusing edible with poisonous ones. Scale line in the photos = 2.5 cm.

DESCRIPTION OF THE GENUS *AMANITA*

Spore print is white, and spores are amyloid or inamyloid; lamellae are free, that is, the lamellae are not attached to the stipe; universal veil is present; presence of a partial veil that leaves a persistent or fugacious annulus, with the exception of section *Vaginatae* that lacks a partial veil. The universal veil is a membranous tissue that encloses the entire mushroom in the button stage (Figure 7). The universal veil can take on two different forms: in one form a membranous volva (sac) remains at the base of the stipe (Figure 7), in the other form, the universal veil leaves fragments in the form of patches, warts or powdery material on the pileus surface, and there may or may not be a few velar patches, warts or ridges on the stipe base (Figure 5).

An important microscopic feature for *Amanita* is the reaction of basidiospores to Melzer's Reagent, an iodine solution (for recipe see Bunyard 2019). This is a test used on many other genera of mushrooms as well. Spores are said to be amyloid if they turn blue-black in the reagent and inamyloid if there is no color reaction. To conduct this test, lamellar sections or spores taken from a spore print are viewed under a microscope to see if there is the color reaction. Determining the amyloid reaction is important for assigning a fungus to a section of *Amanita* and may be necessary for confirming a species identification.

SECTIONS OF *AMANITA* WITH EXAMPLES OF SPECIES

The genus *Amanita* is typically divided into seven sections based on the macroscopic and microscopic features that the species possess.

Section *Amanita*. Species of this section share the following characteristics: stipe that terminates with a bulbous base; small universal velar patches or warts on the pileus and basal bulb and absence of a saccate volva; presence or absence of an annulus that often flares out from the stipe; striations (narrow grooves) at the pileus edge. The pilei often have bright colors such as red, yellow or orange. Microscopically, the spores are inamyloid.

Amanita farinosa Schwein (Figure 1) is one of the smaller *Amanita* species. The pileus has a grayish coloration and a powdery dust-like covering over the entire surface. It lacks a partial veil and a membranous volva. The universal veil material at the stipe base is a grayish, powdery-granular covering. This *Amanita* has only been recorded from southeast Oklahoma in mixed pine-hardwoods.

Figure 1 *Amanita farinosa*

Amanita multisquamosa Peck (Figures 2 and 3) is characterized by the tan to yellowish tan pileus that has numerous whitish velar patches on the surface, and the pileus edge is striate. It lacks a membranous volva; instead, the upper portion of the basal bulb of the stipe has a collar-like rim encircling it. The stipe has a membranous annulus that soon clings to the stipe or disappears. *Amanita multisquamosa* belongs to the "pantheroid" complex of species and all are to be considered poisonous (Bunyard and Justice, 2020).

Figure 2 *Amanita multisquamosa*

Figure 3 *Amanita multisquamosa*

Amanita pubescens Schwein. sensu Coker (Figure 4) is characterized by the pale yellow pileus covered with warty velar patches, the lack of an annulus, and the stipe base which is bulbous to turnip-shaped and which generally lacks any volval material except when young. The stipe is rather short compared to the width of the pileus. It is often found in grassy areas near oak trees in city parks.

Figure 4 *Amanita pubescens*

Amanita persicina (D.T. Jenkins) Tulloss & Geml (Figure 5) is one of the most colorful and recognizable *Amanita* species and has the common name of "Fly Agaric." Most older field guides list the species as *A. muscaria* (L.:Fr.) Lam. and the type variety, var. *muscaria*, is endemic to Europe and Asia. It is also found in Alaska, but not in the continental United States with the possible exception of several occurrences with

Figure 5 *Amanita persicina*

introduced tree species. There are, however, at least two variants of *Amanita muscaria* that have been described from North America: *A. muscaria* subsp. *flavivolvata* Singer, a red-capped subspecies from the western states, and *A. muscaria* var. *guessowii* Veselý, which has yellow to yellow-orange pilei and occurs in the eastern U.S. *Amanita persicina* is the accepted name for the fungus in the complex that is common along East Coast and Gulf Coast regions. The pileus is orange-red to light orange at the center and light orange to yellow on the margin, and has light-colored universal veil patches or warts scattered over the surface. The stipe base is bulbous and lacks a membranous volva but has low rings or ridges of tissue. An annulus is present and is easily torn or collapsed. We include *A. persicina* because we anticipate that it or another variant in the complex does occur in Oklahoma under pines in the eastern part of the state, even though we have yet to confirm its presence. Species in the "muscaria" complex are poisonous.

Section *Caesareae*. Fungi of this section lack velar warts on the pileus so the surface is smooth. The universal veil leaves a persistent membranous, saccate (cup-like) volva at the stipe base. Other features of section *Caesareae* include the lack of a bulbous base, striations at the edge of the pileus, and hollow stipes in mature specimens. Typically, the pilei exhibit bright colors such as red, yellow, orange, or sometimes combinations of those colors. While the lamellae of many species in other sections are typically a white or pallid color, the lamellae in this section are often yellow, or sometimes yellow-orange. Microscopically, the spores are inamyloid. Many species in this section are sold as edible mushrooms at the open markets in Mexico, Europe, Africa, and Asia.

Amanita arkansana Rosen (Figure 6) has a yellow to yellowish orange, smooth pileus that lacks velar patches and is striate at the edge. The lamellae are whitish to pale yellow. The stipe is light yellow and the annulus is flared but soon clings to the stipe. A white saccate volva is present at the stipe base. *Amanita cahokiana* Tulloss & Sanchez-Ramirez nom. prov. is a cryptic species that has a yellower pileus than *arkansana*. Further collecting should reveal if only one or both species occur in Oklahoma.

Figure 6 *Amanita arkansana*

Amanita jacksonii Pomerleau (Figure 7) is one of the more colorful and striking species of *Amanita*. The pileus is bright red to orange-red, lacks velar patches on the surface, and is striate at the edge. The lamellae are light yellow and the stipe is yellow to yellow-orange. The annulus is persistent but often collapses, and a white saccate volva is present at the stipe base. In many of the older field guides this fungus is identified as *A. caesarea*, but that is a European species and does not occur in North America.

Figure 7 *Amanita jacksonii*

Amanita spreta Peck (Figure 8) is a rather large mushroom with a light brown to grayish brown, smooth pileus that is striate at the edge. The lamellae and stipe are white. The partial veil is flaring and the stipe base has a white volva that can vary from saccate to smaller cupulate.

Figure 8 *Amanita spreta*

Section *Vaginatae*. This is the largest section of *Amanita* and contains about 400 species worldwide. The universal veil either leaves a saccate volva at the stipe base or the volva is absent and the veil remnants are patches on the pileus surface. A partial veil is lacking. The spores are inamyloid. Features that *Vaginatae* share with section *Caesareae* include the lack of a bulbous base, striations at the edge of the pileus, and hollow stalks in mature specimens. Species in sect. *Vaginatae* are distinguished from those of sect. *Caesareae* by the lack of bright pileal colors and by the lack of a partial veil.

Amanita fulva (Schaeff.) Fr. (Figure 9 and 10) has a fulvous-colored pileus, often with a low raised umbo, and the pileus edge is striate. The stipe base has a saccate volva but it lacks a partial veil. This is the only confirmed volvate species in sect. *Vaginatae* from Oklahoma although we have encountered considerable undocumented diversity of fungi with a volva in this section.

Figure 9 *Amanita fulva*

Figure 10 *Amanita fulva*

Amanita* cf. *ceciliae (Berk. & Broome) Bas (Figure 11) is a species in section *Vaginatae* that lacks a membranous volva; rather, the universal veil leaves most of the remnants as grayish patches on the pileus surface. The stipe base at most may have a few scattered velar patches and, typical for the section, a partial veil is lacking. The pileus is brownish gray to gray and is distinctly striate to sulcate at the edge. *Amanita ceciliae* is a European name so it is very probable that the fungus illustrated here will eventually be newly described along with several other North American taxa in the complex (Tulloss and Yang, 2020).

Figure 11 *Amanita* cf. *ceciliae*

Section *Amidella*. This section is characterized by two features: pileus surface possessing universal veil patches or floccose remnants, and a well-formed saccate volva, which can vary in shape from nearly globose to elongate and is often large and baggy. The pileus and stipes of species of this section often stain pinkish upon bruising, at least when young and fresh. During maturation, the discoloration becomes brownish red. Microscopically, the spores are amyloid.

Amanita peckiana Kauffman (Figure 12) is distinguished by its rather short stature, whitish basidiomes that discolor pinkish to brownish, thin partial veil that soon disappears, and by the well-developed saccate volva. It is a rarely

Figure 12 *Amanita peckiana*

encountered species but we have several records of it from Oklahoma.

Section *Validae*. This section shares the following set of features: bulbous stipe base, persistent partial veil, and universal veil remnants in the form of warts on the pileus surface. The color of the pilei ranges from white to bright yellow to drab grays and reddish-brown. Some have the odor of cut raw potatoes and a few have fruity odors. Some species develop pinkish or reddish-brown stains when handled or bruised. The spores are amyloid.

Amanita amerirubescens Tulloss nom. prov. (Figure 13) is easily recognized because all parts of the mushrooms stain wine-red to reddish brown. The pileus varies from brown to yellowish brown and is covered with cream to pale yellow velar patches or warts. The lamellae and stipe are white to begin with but quickly discolor wine-red. The stipe base is slightly swollen, often with no trace of the universal veil; an annulus is present but soon clings to the stipe. This species is listed as *A. rubescens* in most field guides, but that is a European species that does not occur in North America. *Amanita amerirubescens* is currently treated as a species complex, meaning that more than one species with similar features are found in this complex. Currently, at least nine taxa are known to occur in this complex based on molecular analyses, but

differentiation based on morphology is often very difficult (Tullos and Yang, 2020).

Figure 13 *Amanita amerirubescens*

Amanita brunnescens G. F. Atkinson (Figure 14) has a brown pileus but sometimes the pigmentation is mainly at the center as is shown in the photo. Velar patches are usually present on the pileus and a partial veil is present on the stipe. The stipe base is bulbous and generally lacks volval remains, but the presence of vertical clefts in the base is a good distinguishing

Figure 14 *Amanita brunnescens*

feature of this species. All parts of the basidiome may stain brown to orange-brown. The odor of raw potatoes is detected when the lamellae are crushed.

Amanita canescens D. T. Jenkins (Figure 15) has a gray to brownish gray pileus surface that is covered with velar warts over much of the surface. The stipe is white but the surface fibrils often discolor dull orange. A membranous annulus is present, whose underside also has an orangish color. A membranous volva is absent, but remnants of the universal veil as irregular patches can be present on top of the swollen base.

Figure 15 *Amanita canescens*

Amanita flavoconia G. F. Atkinson (Figure 16) is a distinctive species and is easily recognized by its yellow to yellow-orange pileus with scattered yellowish universal veil remnants on the surface. The annulus is flared at first but then may collapse to the stipe. A saccate volva is not present, rather there are scattered yellow universal veil remnants atop the swollen base and sometimes on the lower portion of the stipe. The yellow remnants can also remain in the soil as the fungus is dug up.

Figure 16 *Amanita flavoconia*

Amanita flavorubens (Berk & Mont.) Sacc. (Figure 17) has a similar appearance to *A. amerirubescens* but it has more pronounced yellow coloration to the pileus, velar patches, and stipe. The stipe has a membranous annulus and the base has no or only slight remnants of the universal veil. The exterior of the stipe and to some extent the gills of this *Amanita* also become reddish-brown when bruised or in old age, but their degree of staining is not as dramatic as that observed in specimens of *A. amerirubescens*.

Figure 17 *Amanita flavorubens*

Section *Lepidella*. Section *Lepidella* is characterized by the following set of features: stipe bases that have a pronounced bulb that often tapers downward (radicating), universal veil remnants as warts on the pileus surface and often on the stipe base, and lack of a membranous volva. The pileus and stipe surfaces of some species have a powdery coating that easily comes off upon touching. Pilei also frequently have an appendiculate margin where small pieces of partial veil material hang down from the pileus edge. Microscopically, the spores are amyloid. Some species have interesting odors which have been described as being reminiscent of "old ham" or "old tennis shoes" or chlorine-like. Many species in this section are very large with the pilei often attaining a diameter of 12 inches or larger.

Amanita abrupta Peck (Figure 18) is an all-white mushroom with a pileus that has subconical velar warts covering most of the surface. Also distinctive is the turnip-shaped stipe base that is flattened on top and which

Figure 18 *Amanita abrupta*

lacks a membranous volva. At most, the universal veil leaves a few scattered floccose warts on top of the swollen base.

Amanita longipes Bas ex Tulloss & D.T. Jenkins (Figure 19) is another all-white fungus that has a pulverulent-floccose coating on the surfaces of the pileus and stipe, and lacks the pointed warts on the pileus. The carrot- or turnip-shaped stipe base is also characteristic. The partial veil is

Figure 19 *Amanita longipes*

very fleeting and is only seen on young expanding mushrooms, leaving almost no trace on the stipe. A membranous volva is lacking. This fungus is found in hardwood forests and is associated with oaks, compared to the much larger *A. polypyramis* which is a pine associate.

Amanita polypyramis (Berk. & Curt.) Sacc. (Figure 20) is one of the largest *Amanita* species that will be encountered. It is so large that it can be spotted in the forest while driving on a highway! It occurs under pines so it is only found in eastern Oklahoma. In addition to its large size and bulbous base, it is entirely white and the pileus and stipe are covered with a white pulverulent-floccose surface layer that is the remains of the universal veil. This coating easily comes off when touched. The partial veil mostly remains attached to the pileus edge as the pileus expands and then easily falls off as can be seen in the photo. *Amanita polypyramis* has a chlorine-like odor when fresh.

Figure 20 *Amanita polypyramis*

Amanita thiersii Bas (Figure 21) is one of only a few Amanitas that occur independently of forest trees and is often described as being a "free-living" *Amanita*. It is a fairly large mushroom and is common on lawns in Oklahoma in the late summer and early fall. The pileus and stipe are white and have a floccose-pulverulent coating on their surfaces. This coating is very delicate and will easily sluff off and coat a person's fingers when the stipe is touched or handled. The partial veil may remain attached to the stipe. The lamellae are initially a light cream color, but often become creamy yellow as they mature. Another large lawn mushroom is *Chlorophyllum molybdites*, but it has green lamellae and brownish scales on the pileus.

Figure 21 *Amanita thiersii*

Section *Phalloidae*. Species in this section typically have the following features: pilei that are white or if pigmented, have subdued tones of brown or greenish-yellow and lack any striations or radial lines on the pileus edge; stipes with partial veils that are attached near the apex; and bulbous bases that are encased in a membranous volva. Microscopically the spores are amyloid. All members of this section are likely to be deadly poisonous and should not be eaten.

Amanita bisporigera G. F. Atkinson (Figure 22) is known as the "Destroying Angel" because of its toxicity. It is easily recognized by its all-white coloration, smooth pileus that is typically not striate at the edge, bulbous base encased by a saccate volva, and flaring annulus near the stipe apex. All parts of the mushroom turn yellow where a solution of KOH (3%-10%) is applied. It is somewhat common during the summer months and found associated with oaks and other hardwood trees. The

combination of these features should be a warning sign that it is potentially deadly poisonous if eaten. According to Bunyard and Justice (2020) there is a complex of five or six species that share similar morphology to *A. bisporigera*. Older field guides will have this species listed as *A. virosa* which is a European taxon that does not occur in North America.

Figure 22 *Amanita bisporigera*

FURTHER READING

A field guide on *Amanita* was recently published by Bunyard and Justice (2020) that is an excellent source of information on Amanitas for North America. Dr. Rodham Tulloss, who is perhaps the preeminent scholar on Amanitas in the United States, maintains an excellent website that includes much technical information on the genus (Tulloss and Yang 2020). Michael Kuo also has an excellent website for mushrooms in general including Amanitas (http://www.mushroomexpert.com). To learn more about mushroom morphology and taxonomy in general, most all mushroom field guides provide excellent information for the beginner.

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