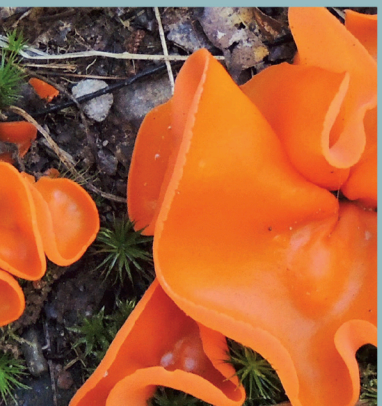

Mushrooms of the Gulf Coast States

A Field Guide to Texas, Louisiana, Mississippi, Alabama, and Florida

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Preface

THE GULF COAST STATES OF TEXAS, Louisiana, Mississippi, Alabama, and Florida comprise bioregions that support an almost unimaginable amount of mycological diversity. Starting in the western mountains of Texas, this area encompasses hill country, plains, and lake regions. It reaches down and across to the sandy oak and pine woods and the maritime forests of the Gulf Coastal Plain and barrier islands, to the swamps and marshlands of the Atlantic Coastal Plain. With an estimated eight to ten thousand mushroom species occurring in Texas alone (and just over 1,300 species collected and documented at the date of this printing), it is impossible to imagine, much less describe, every species, variety, or fungal form that may be encountered in this area.

Mycologically, the Gulf Coast States are basically uncharted. There are only three books exclusively dedicated to any of its five states: *Mushrooms of Mississippi: And Other Fungi and Protists* (2000), by Dr. George H. Dukes Jr.; *Common Florida Mushrooms* (2000), by Dr. James W. Kimbrough; and *Texas Mushrooms: A Field Guide* ([1992] 2013), by Susan Metzler, Van Metzler, and Dr. Orson K. Miller Jr. (scientific advisor). It can be a notoriously difficult area to collect fungi in. Most of it is humid and subtropical (except for the southwestern tip of Florida, which boasts a tropical designation), and it is filled with the hindrances that thrive in such a simultaneously lush and harsh climate: snakes and other reptiles; stinging, biting, and blood-sucking insects and arthropods; intrusive mammals, such as wild hogs; high temperatures; and often unexpected and violent storms. Fungi fruit, mature, and decay in days, making correct timing imperative. A profusion of plants can make access to some areas frustrating, while commercial and residential development makes access to others impossible.

The present book is by no means a complete account of the mycoflora found in this geographically, biologically, and socially complex area. Our primary objective is to provide a current, comprehensive guide for some of the more commonly collected mushrooms of the Gulf Coast States, as well as a reference for some of the more unusual or less often encountered fungi found here. We hope to give our readers a base from which to begin exploring the mycological uniqueness of this most beautiful area. What will you discover?

Introduction

Geographic Area Covered by This Book

This book describes and illustrates macrofungi found in the Gulf Coast States, from Texas across to, and including, Florida. It is also a useful resource and reference guide for the north central and northeast portions of Mexico, for the Atlantic Coastal Plain of Georgia, South Carolina, North Carolina, and Virginia, and adjacent geographic areas as indicated on the map below.

Why Collect and Study Wild Mushrooms?

When you ask people why they collect and study wild mushrooms, you are likely to get a variety of answers. By far, the most popular response is collecting wild mushrooms to eat. Outdoor enthusiasts appreciate their beauty and diversity, while others enjoy photographing them. Mushrooms are used to make jewelry, paper, and paint and to dye wool, silk, and other fibers. In recent years, there has also been a growing interest in ethnomycology: the study of human-fungal interactions, which includes researching not only the importance of fungi as food but also their medicinal qualities, their historical use in religious rituals, and their exciting new uses in biotechnology. Perhaps the most important reason to be involved in the world of mycology is to increase our knowledge and appreciation of the vital role fungi play in the very health and well-being of our planet.

Mushroom Structure and Function

Mushrooms belong to the Kingdom Fungi. Until about 1960, they were classified as plants. However, plants and fungi have some significant differences that separate them. Two notable differences are that fungi have chitin in their cell walls while plants do not, and

Geographic area covered by this book

fungi lack chlorophyll and cannot produce food for themselves. They obtain nutrients by external digestion and absorption. One group, the decomposers (**saprotrophs**), extract what they need from dead and decaying matter. Another group (**parasites**) attacks living plants, animals, or other fungi to supply their needs. A third group of fungi establishes a mutually beneficial relationship with living trees or other vascular plants. Called a **mycorrhizal** relationship, the participating partners obtain a portion of the nutrients and water that they need from each other.

A mushroom is a **fruitbody** that arises from a larger fungal organism, much like an apple is the fruitbody of an apple tree. The fungal organism, called the **mycelium**, is a vast network of fine filaments called **hyphae** that are interconnected and interwoven. It is usually concealed in the soil or within decaying wood or in other fungal substrates, such as mulch, leaves, or dung. When conditions are correct—proper temperature, moisture, nutrients, pH, daylight length, and so on—this living network gives rise to a fruitbody, the mushroom, that produces microscopic reproductive structures known as **spores**. If carefully done, picking a mushroom has no more of a negative ecological impact than picking a piece of fruit from a tree.

From a strict or narrow perspective, a mushroom is a fleshy fruitbody that has a cap, stalk, and gills. However, when broadly applied, mushrooms include fungi with many different shapes, sizes, fertile surfaces, and support structures. These are arranged in sections as described and illustrated in the "Color Key to the Major Groups of Fungi" (p. 8). The **fertile surface**, or specific portion of a mushroom on which spores are produced, may take the form of gills, tubes, spines, branches, or other surfaces.

In a mycorrhizal relationship, fungal mycelium is united with the root system of trees and other vascular plants in a partnership that provides otherwise inaccessible moisture and nutrients. The fungal partner in a mycorrhizal relationship increases the host plant's ability to obtain water and nutrients, including nitrogen, phosphorus, and potassium. In turn, the host plant gives the fungus carbohydrates, vitamins, and other nutrients essential for its growth. Because of this partnership, the growth of the host plant is accelerated. Additionally, plants in a mycorrhizal relationship tend to resist diseases much better than those without a fungal partner. Some mushrooms form mycorrhiza only with conifers, others only with hardwood trees, while others may have more than one mycorrhizal partner.

Two major types of mycorrhizal relationships are commonly found in association with trees and other vascular plants: **endomycorrhizae** and **ectomycorrhizae**. In an endomycorrhizal relationship, the fungal partner forms highly branched processes called **arbuscules** between the cell wall and the plasma membrane of the host plant root cells. In an ectomycorrhizal relationship, the hyphae of the fungal partner surround the lateral roots of the plant partner and form an extensive layer called a fungal sheath or mantle. The hyphae form what is called a **Hartig net** by entering the first few layers of the root and growing between—but not penetrating—the outer cortical cells. Most of the mycorrhizal mushrooms described in this book form ectomycorrhizal relationships. The vast majority of endomycorrhizal fungi are microscopic and, with rare exceptions, do not form a visible fruitbody.

Fungal mycelium in soil is widespread, allowing the formation of complex, diffuse mycorrhizal networks. For instance, two or more plants of the same or different species

may be linked by the continuous mycelium of one or more fungal species. This integration of multiple fungal and plant species allows interaction, feedback, and adaptation which influences the growth, health, behavior, and survival of the species linked together in this way. Evidence now suggests that plants and fungi in these mycorrhizal networks communicate by biochemical signaling (Babikova et al. 2013), and the biodiversity and overall health of our forests are directly related to this mutually beneficial relationship.

Collecting and Documenting Wild Mushrooms

Recommended equipment for collecting mushrooms is neither expensive nor complicated. The basic items include a basket or rigid-sided container for carrying your specimens; a sturdy knife for digging, cutting, and cleaning; and waxed paper, brown paper lunch bags, or waxed paper sandwich bags for wrapping the mushrooms. We also find the following to be very useful: insect repellant, a walking stick, a compass or GPS tracker, cell phone, camera, trail maps, a whistle (voices do not carry well in forests), a pen or pencil and paper for taking field notes (or phone recorder), water, and a snack (unless bears are a possibility).

Dress appropriately for local weather conditions and the terrain where you will be collecting. Carry an awareness of possible encounters with wildlife and various arthropods: wild boars, snakes, alligators, ticks, chiggers, fire ants, spiders, and scorpions are common in some areas of the Gulf Coast States. Be mindful and use care when collecting. A walking stick is often useful to push and move aside brush and branches and to remove spiderwebs from your path before walking face-first into them. Whenever possible, collect with a friend or, at the very least, be sure to tell someone where you are going.

Collecting methods vary depending on whether you are collecting for identification purposes or collecting for the table. When gathering known mushrooms for eating, see appendix C, "Mushrooms for the Table" (p. 571). When gathering unknown mushrooms for identification, it is important to collect entire specimens in various stages of development. This includes parts of the mushroom that may be partially buried. Carefully dig up specimens using a sturdy knife. Do not pull them up or cut them off at the base.

Once collected, it is important to keep your mushrooms in good condition to make sure key identifying features are not lost or damaged. Wrapping collections of a single species together in waxed paper or in brown paper sandwich bags is the most commonly recommended technique. This prevents different species from becoming mixed together, minimizes the loss of—or damage to—key features, and keeps specimens fresher by allowing moisture to escape and slowing down decay. Plastic wrap or plastic bags, on

Cowl knitted using mushroom-dyed wool

the other hand, speed up decay by retaining moisture. Do not collect every mushroom you find. Leave a few specimens in the field to help ensure continued spore dispersal.

Be aware of regulations and possible restrictions about collecting in state parks, national parks, on state lands, in conservation areas, and in other posted areas. Do not collect on private property without first obtaining permission. Finally, and maybe most importantly, collect gently. Disturb the substrate and the habitat as little as possible. In this way, you minimize damage to the mycelium and help ensure continued fungal growth, while leaving the area unspoiled for others to enjoy.

Take notes about *where* the mushrooms were growing (the substrate, location, and nearby tree species), *when* you collected them (month and date), and *how* they were growing (solitary, scattered, or in groups or clusters). You might want to taste and smell the mushroom you collected and add your observations to your notes. The taste, odor, and color of a mushroom's flesh are important features used in identifying specimens. If you choose to taste a mushroom, *be advised that some mushrooms taste hot and peppery and may irritate, burn, or numb your mouth if they are chewed for an extended period. However, you cannot be poisoned, and there is no significant risk, if you do not swallow the tissue*. To safely taste a mushroom (even poisonous ones), place a small piece onto the tip of your tongue, chew it with your front teeth for a few seconds, and then spit it out. If the taste is mild (not bitter or peppery), wait a minute and then chew a second small piece for fifteen to thirty seconds and again spit it out. Some mushrooms develop bitter or acrid tastes slowly, or the taste may be subtle. Wrap your field notes with your collections for future reference.

Taking one or more photographs of a mushroom in its natural habitat is also an excellent way to document its features. Specimens may undergo color changes and appear quite different several hours after being collected. Placing mushrooms in an air-conditioned environment or in the refrigerator may significantly alter their appearance. A documentary photograph showing various growth stages of a mushroom, as well as all its parts—including cap, entire stalk with its intact base, a cut specimen showing the cap and stalk flesh, gills or pore surface, and the presence or absence of any staining reactions—provides valuable information that greatly helps with identification, especially when identifying specimens several hours after they were collected.

Making a Spore Print

Sometimes prominent macroscopic field characteristics are not enough to identify wild mushrooms. Spore prints often bridge the gap between macroscopic and microscopic features and therefore can be an essential step in the identification process. Formed when mushroom spores drop undisturbed onto a surface, they are most helpful when working with boletes or gilled mushrooms and are sometimes useful when studying polypores, coral mushrooms, or other fungi.

Spore prints are simple to make. Cut the cap from the stalk, place it gill- or pore-side down on a piece of clean white paper, cover it with a cup or bowl to protect it from drafts, and leave it undisturbed for several hours or overnight. If you wish to save your specimen for further study or depositing into an herbarium, do not cut the stalk from the cap. Instead, cut an "X" in a stiff piece of paper,

Making a spore print

insert the mushroom stalk through it so the fertile surface rests just above the paper, and suspend this over a glass that is tall enough to accommodate the length of the stalk (see photo). Dark spore prints on white paper are easy to see, while white or pale colored spore prints may require holding the paper at an angle to a bright light source. Clear glass is a useful alternative to paper: the spore deposit left on the glass can be held against light and dark backgrounds to determine its color. Aluminum foil, clear plastic, and half-white/half-black paper are also good choices. Wrapping mushroom caps in a piece of white paper while collecting in the field often provides a ready-made spore print to work with once you get home.

Notes on the Descriptions of Illustrated Species

With few exceptions, each fully described species consists of the following components:

Scientific name: The Latin binomial, or scientific name, is provided for each species. Some of the species names included in this book are currently based on European collections and, following future molecular analysis, may eventually be given new species names. The names we use may not be the same names found in other field guides because of recent taxonomic changes. We use currently accepted names based on those listed in either Index Fungorum (www.indexfungorum.org) and/or MycoBank (www.mycobank.org/).

Every mushroom species name consists of two parts. The first part is the genus, the first letter of which is always capitalized. The second part is the epithet, or species name, with all letters in lower case. Immediately following the scientific name is the author citation, which indicates the name of the individual(s) credited for first describing or subsequently renaming the mushroom. The author citation may be simple. For example, the entry "*Agaricus alachuanus* Murrill" indicates that this species was described and named by William Murrill. When the original author's name is enclosed in parentheses and followed by the name of one or more additional authors, it indicates who later reclassified the species. For example, "*Gymnopus biformis* (Peck) Halling" was originally described by Charles Peck as *Marasmius biformis* and later transferred to the genus *Gymnopus* by Roy Halling.

Synonyms: Former names assigned to a species are listed here. We also include the author citations for these names. Whenever synonyms are provided (including within the text), each is preceded by an equal sign. Not all synonyms, including some of the basionyms (original names), are provided for every species. In some cases, there are too many to list (sometimes more than twenty former names!) and/or some synonyms are not commonly used, or they are not included in other current reference guides.

Common name: One or more common names are listed when available. Resources for these names include other field guides and internet sites.

Macroscopic features: Information about the appearance of the mushroom, including size, shape, color, and staining reactions, is described here. Additional information including the odor and taste of the flesh is also included.

Spore print: Color shade and ranges are included in this section. Vital information for using portions of the keys to boletes and gilled mushrooms require this information.

Microscopic features: Although the descriptions in this book emphasize macroscopic features, we have provided microscopic information, including spore size, shapes, surface features, and color, for those who own or have access to a microscope. Additional microscopic information for structures such as asci, cystidia, paraphyses, and setae is included when it is useful for the identification of specific species.

Occurrence: The habit, substrate, habitat, and fruiting periods are described here. Mushrooms may appear outside of the stated fruiting period because of unusual weather conditions, incomplete understanding of particular species, the effects of climate change, or (as our friend Bill Yule often states) "mushrooms misbehaving."

Edibility: Species known to be edible are listed as such. Those described as poisonous, not recommended, or edibility unknown *should not be eaten*.

Remarks: This section includes brief discussion of similar species, the meaning of specific epithets, macrochemical test reactions when useful or diagnostic, and personal observations and comments by the authors.

How to Use This Book

This book is a guide designed to help readers identify more than one thousand fungi that occur in this region, more than 650 of which are fully described and illustrated. Although identifying mushrooms is sometimes possible by comparison to photographs, we highly recommend using the "Color Key to the Major Groups of Fungi" and the additional second-

ary keys when provided in the material on specific groups.

Mushroom species in this book are sorted into major groups based on the similarities of their macroscopic features and are arranged alphabetically. The color key contains eighteen major groups, each accompanied by a brief description of the key characteristics of the species included in it.

Mushroom identification may be easy, but sometimes it can be a difficult or seemingly impossible task. Microscopic examination may be required for positive identification of some species. The mushroom you are attempting to identify may not be included in this book, it may be too young or too old to be identifiable, or it may be an undescribed species. If you know a species and wish to read about it, consult the index. If the mushroom you wish to identify is unknown, follow the steps described in the Mushroom Identification Procedure below.

Mushroom Identification Procedure

1. Using the color key, determine which major group best describes your unknown mushroom. In some cases, the mushroom you are attempting to identify may actually be illustrated in the color key.

2. Go to the section of the book that deals with the major group appropriate for your mushroom, read the descriptions and examine the color illustrations provided in the group you have selected, and determine which species most closely matches your unknown specimen.

Because boletes, gilled mushrooms, and polypores are such large groups, secondary keys are provided to help narrow down identification choices.

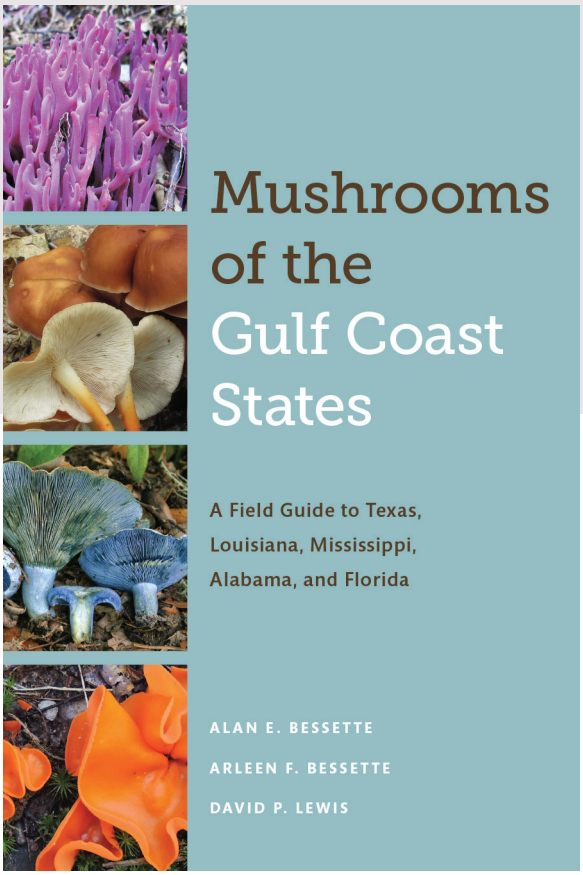
3. The secondary keys are dichotomous and consist of paired couplets. Carefully read each couplet *completely* and choose which one most closely describes your unknown mushroom. Proceed through the key until an individual species or group of species is identified.

4. If an individual species is identified, locate the description and color illustration that matches it; read the description and examine the color illustration. In some cases, the mushroom you are attempting to identify may not be the one fully described and illustrated. Instead, it may be one of the species partially described in the "Remarks" section. Partially described species may be illustrated in the color key; if not, additional resources may be required for positive identification.

5. If the couplet identifies a group of species, read each of the descriptions, examine the color illustrations, and determine which choice most closely matches your unknown specimen. Again, be sure to read the "Remarks" section of each description.

6. If the key choices do not result in a positive match, reread the key. If you remain unsuccessful, return to the color key and read the information provided for possible similar groups. If still unsuccessful, your unknown mushroom may not be included in this book.

The first book devoted to the nearly 1,400 mushroom species found in the five-state Gulf Coast region—with more than 650 color illustrations and dichotomous identification keys that will delight foragers, cooks, and scholars alike



The weather patterns and topography of America's Gulf Coast create favorable growing conditions for thousands of species of mushrooms, but the complete region has generally gone unchartered when it comes to mycology. *Mushrooms of the Gulf Coast States* at last delivers an in-depth, high-quality, user-friendly field guide, featuring more than 1,000 common and lesser-known species—some of which are being illustrated in color for the first time.

Using easily identifiable characteristics and a color key, the authors enable anyone, whether amateur mushroom hunter or professional mycologists, to discern and learn about the numerous species of mushrooms encountered in Texas, Louisiana, Mississippi, Alabama, and Florida. Wild-food enthusiasts will appreciate the information on edibility or toxicity that accompanies each description, and they will also find the book's detailed instructions for collecting, cleaning, testing, preserving, and cooking wild mushrooms to be of great interest. Providing encyclopedic knowledge in a handy format that fits in a backpack, *Mushrooms of the Gulf Coast States* is a must-have for any mushroom lover.

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