1999 Trial Year Notebook for the

Great Smoky Mountains National Park
All Taxa Biodiversity Inventory

Epigeous Macromycetes

Rod Tulloss

and the

Asheville Volunteer Fungal Department

This document is a work in progress. Any user should check with Rod Tulloss (ret@njcc.com or 609 448 5096) in order to be sure that the copy in hand is the most recent version.

Version printed June 14, 1999

Cover illustration and all layout by Rodham E. Tulloss.

Table of Contents

List of Figures

GSMNP ATBI—1999

This is a working document created for use in establishing the trial run of the GSMNP ATBI Fungal ATBI segment on larger, epigeous macromycetes. It was prepared by R. E. Tulloss. The date of printing of this copy is June 14, 1999.

1 General Introduction and Conventions

1.1 Hypertext Version Convention

In the hypertext version of this document, **bold underlined** text is hot. For example, cross references such as paragraph numbers may be underlined.

1.2 Fundamental Reference Work

The fundamental reference work for this study is the book of ATBI protocols by Rossman et al. (1998). In the remainder of the text, the book will be cited without a date.

The methods for this study are those classified as "direct observation" in Rossman et al. For the purposes of training, the key protocols are found in chapters 4 and 5 and in sections 6.1-6.2, 6.5, 9.1.1, 9.1.5-9.1.7, and 10.1.1. Participants may also want to read chapters 1-3 and 13-14 and the bibliographic sections A.4.1-A.4.2 and A.5.1.

1.3 Standard for Citation of Chapters, Sections, Requirements, and Recommendations

The chapters, sections, requirements, and recommendations found in this work are numbered, and are to be referenced, as are the chapters, sections, requirements and recommendations of Rossman et al.

1.4 Myxomycetes Excluded

Note that myxomycetes are not included in the scope of the present study; and, in fact, will be studied by members of a different TWIG.

2 GSMNP Resource Activity Permit

2.1 Permit Instruction Letter from GSMNP

A9033

November 6, 1998

Dear Resource Activity Permit Applicant:

Thank you for your interest. Your completed application will principally be reviewed for activities inappropriate in the National Park, potential scientific significance and contribution to the Park's natural resource needs. If you seek specimens that are readily available on other lands in the region, we would prefer you obtain them outside the Park. If approved, any special restrictions pertaining to your project, and general rules regarding the issuance of permits (below) must be followed.

In brief, permittee agrees to:

1. Provide a final report and, if necessary, a very brief progress report **on time** each year.
2. Keep rare species specific locations confidential.
3. Collect minimal numbers of specimens, and only for noncommercial public purposes.
4. Provide information on the number and kind of specimens actually collected.
5. Keep the Resource Activity Permit with them while working in the Park.

Please complete the attached application and return it to the following address or by fax.

Twin Creeks Natural Resource Center

1314 Cherokee Orchard Rd

Gatlinburg, Tennessee 37738

FAX (423) 436-5598

Please call Keith Langdon 423-436-1705 or Nancy Keohane 423-430-4740 if you have questions. Email Keith_Langdon@nps.gov or Nancy_Keohane@nps.gov.

Sincerely,

Keith Langdon

Supervisory Biologist

2.2 Application Form

(PLEASE PRINT CLEARLY OR TYPE) FORM GRSM/RAP-1/96(Rev)

United States Department of the Interior Great Smoky Mountains National Park

National Park Service

APPLICATION – RESOURCE ACTIVITY PERMIT 1999

APPLICANT NAME (include title,e.g.,Mr.,Ms,Dr,etc.):

Dr. Rodham E. Tulloss

ADDRESS: INSTITUTION NAME n/a STREET P. O. Box 57 CITY Roosevelt STATE NJ ZIP 08555-0057 COUNTRY U.S.A.

WORK PHONE: (609) 448-5096 FAX: (609) 426-4164 EMAIL: ret@pluto.njcc.com

PROPOSED RESOURCE ACTIVITY TO BE CONDUCTED WITHIN THE GREAT SMOKY MOUNTAINS NATIONAL PARK: Research for inventory of all taxa of larger, epigeous macromycetes.

TITLE: "Butterflies of the Soil"—a part of the DLIA/GSMNP sponsored 10-15 year ATBI Project

DESCRIPTION (Briefly describe objectives, techniques & significance of activity.): Using both a single transect and opportunistic collecting, 1999 will be a trial year for the epigeous macromycete "branch" of the GSMNP ATBI. Non-transect collecting will focus on a single genus as described in the Fungal TWIG plan of work (namely, the genus *Amanita*).

PERIOD OF ACTIVITY – FROM 27 March 1999 TO 31 December 1999

(Permits are ordinarily only issued through the last day of the calendar year. If activity will continue well into the new year, a renewal should be requested when your annual report is submitted.)

SPECIMENS TO BE COLLECTED (type/quantity – please be specific): All larger, epigeous macromycetes in the transect will be collected with the exception that cut-off rules will be applied to commonly collected species. Outside the transect, opportunistic collection will focus on the genus *Amanita* only. A single collection in good condition per visit per site is the maximum to be collected for any given taxon in the latter genus. Sites for opportunistic collection are to be determined. The number of sites will be greatly limited by available time and money.

WILL ANY SPECIMENS BE KEPT AS PART OF A PERMANENT COLLECTION? All collections that are successfully photographed, annotated while fresh, and dried will be kept as part of a permanent collection. Material will eventually be distributed largely to the New York Botanical Garden Cryptogamic Herbarium (NY) and the University of Tennessee Mycological Herbarium (TENN). Some duplicates will be distributed worldwide to knowledgeable specialists and will remain in their herbaria [e.g., the Rijksherbarium (Leiden), Faculty of Science Mycological Herbarium of the National Autonomous University of Mexico (D.F.), and the Mycological Herbarium of Academia Sinica, Yunnan].

DISPOSITION OF COLLECTED SPECIMENS (name of institution, collection, if applicable): See above. The temporary disposition of material to be determined will be in the personal herbarium of Dr. R. E. Tulloss (to be given to NY by existing will in case of death of Dr. Tulloss).

WILL ANY NON-TARGET SPECIMENS/RESOURCES BE HARMED DURING THESE ACTIVITIES? Minimally

Describe? Minimal disturbance will occur to soil within 6 inches of the surface (for deeply rooting specimens only), surface litter, and naturally fallen wood. Very infrequently a stone will be displaced, but will always be returned to the cavity from which it was temporarily removed. These actions may occasionally cause destruction of a small plant or of small (near terminal) roots of one or more trees. Worms or subterranean larvae may be damaged occasionally; however, deep digging for bases of specimens is not commonly necessary. No obvious holes or areas made bare of surface litter will be created.

VEHICLES (List make, model, color, year, & plate # if possible):

Dr. Tulloss will be using a rental car—different on every visit to the region.

NAME OF ASSOCIATES AND ASSISTANTS: Robert Barbour, Dr. Timothy Baroni, Dr. Stephen Bentivenga, Dr. Rick Bortnick, Anathea Brooke, Pam Coleman, Alan Cooke, Dr. Dennis Desjardin, Dr. Jonathan Dey, E. E. Emmett, V. E. Emmett, Dr. Robert Fogel, Jim Goldsmith, Dr. Richard Hanlin, Dr.Richard Harris, Whitey Hitchcock, Dr. Kathie Hodge, Rob Isner, Stephanie Isner, Margaret Kosko, Dr. David Largent, Dr. Coleman McCleneghan, Susan Mitchell, Dr. Steven Miller, Dr. Jack Murphy, Dr. Karen Nakasone, Dr. Lorelei Norvell, Steve Peek, Dr. Scott Redhead, Theresa Rey, Dr. Amy Rossman, Tom Rude, Dr. Gary Samuels, Dr. Markus Scholler, Dr. Carol Shearer, Gerald Sheine, Sondra Sheine, Dr. Joseph Spatafora, Allein Stanley, Peter Stanz, Dr. Greg Thorn, Mary Tulloss, Sarah Tulloss, Dr. Rytas Vilgalys, Dr. Thomas Volk, Laura Weishaupt, Sean Westmoreland, Pete Whelihan

OTHER APPLICABLE PERMITS n/a

Federal No: – Expir. Date: – State No: – Expir. Date: –

The information I have submitted on this application is correct to the best of my knowledge.

Signature of Applicant Date 25 March 1999

2.3 Persons Having Copies of Permit

Requirements

a Every person visiting the trial site or carrying out opportunistic collecting shall carry a copy of the research activity permit (**2.2**).

b The Asheville Mushroom Club coordinator shall keep sufficient copies of the permit available to provide one to each member of the volunteer group at each site visit.

c Upon sufficient notice (**2.3e**), the Asheville Mushroom Club coordinator shall provide additional copies to visiting professionals and volunteers.

d The on-site coordinator shall keep a copy for his/her own use.

e Additional visiting professionals and volunteers shall provide sufficient notice of their visit(s) so that the Asheville Mushroom Club coordinator can obtain sufficent copies for their use.

3 Participants and Contacts—Addresses, Names, Phone Numbers, Email Addresses

Name	Address	Phone No.	Fax No.	Email
Robert Barbour	145 White Pine Rd. Fletcher, NC 28801-4201	828 684 1666	828 681 1666	ruralite@aol.com
Tim Baroni	??	??	??	baronitj@snycorva.cortland.edu
Stephen T. Bentivenga	??	??	??	bentiven@vaxa.cis.uwosh.edu
Rick Bortnick	??	??	??	rnb@fast.net
Anathea Brooke	??	??	??	abrooke@worldbank.org
George Carroll	??	??	??	gcarroll@oregon.uoregon.edu
Dennis Desjardin	??	??	??	ded@sfsu.edu
Jonathan Dey	??	??	??	jdey@titan.iwu.edu
E. E. & V. E. Emmett	??	??	??	E-cubed@netcomuk.co.uk
Jody Flemming	??	??	??	jody@discoverlife.org
Robert Fogel	??	??	??	rfogel@umich.edu
Jim Goldsmith	P.O. Box 1107 Marion, NC 28752	work: 828 652 3000 home: 828 668 7378	??	mykogym@aol.com
Richard Hanlin	??	??	??	rhanlin@imap.arches.uga.edu
Richard Harris	??	??	??	bbuck@nybg.org
Whitey Hitchcock	??	??	??	??
Kathy Hodge	??	??	??	kh11@cornell.edu
Stephanie & Rob Isner	19 Saluda Street #2 Asheville, NC 28806	828 252 0337	??	??
Nancy Keohane	1314 Cherokee Orchard Rd. Gatlinburg, TN 37738	423 430 4740	423 436 5598	Nancy_Keohane@nps.gov
Margaret Kosko	??	??	??	??
Keith Langdon	1314 Cherokee Orchard Rd. Gatlinburg, TN 37738	423 436 1705	423 436 5598	Keith_Langdon@nps.gov
David Largent	??	??	??	dll2@axe.humboldt.edu
Coleman McCleneghan	Department of Biology Appalachian State University 572 Rivers St. P. O. Box 32027 Boone, NC 28608	828 262 2681	828 262 2127	mccleneghanc@appstate.edu
Steve Miller	??	??	??	fungi@uwyo.edu
Susan Mitchell	51 Kentwood Lande Pisgah Forest, NC 28768	828 884 4749	-	Sachem@CITCOM.net
Jack Murphy	??	??	??	Wiephy@deepsprings.edu
Karen Nakasone	??	??	??	K/fpl@fs.fed.us

Name	Address	Phone No.	Fax No.	Email
Lorelei Norvell	6720 NW Skyline Blvd. Portland, OR 97229-1309	503 297 3296	503 296 6745	lorelei@teleport.com
Steve Peek	26 Snelson Rd. Alexander, NC 28701	home: 828 645 5092		speek@ioa.com
John Pickering	??	??	??	pick@discoverlife.org
Scott Redhead	??	??	??	redheads@em.agr.ca
Theresa Rey	106 Bethel Drive Canton, NC 28716	work: 828 456 2407 home: 828 648 6752	828 456 2446	MycoMs@aol.com
Amy Rossman	??	??	??	AmyR@nt.ars-grin.gov
Tom Rude	??	??	??	rude0001@acpub.duke.edu
Gary Samuels	??	??	??	garys@nt.ars-grin.gov
Markus Scholler	Ernst-Moritz-Arndt-Universität Fachrichtung BIologie Mykologisches Lab. Jahn-Str. 15a D-17487 Greifswald, Germany	011 49 3834 864214	... 864202	scholler@microbiol. biologie.uni-greifswald.de
Carole Shearer	??	??	??	carolshe@uiuc.edu
Jerry & Sandy Sheine	93 Old Mill River Rd. Pound Ridge, NY 10576-1833	914 764 4673 914 764 9405	914 764 4604	gsheine@aol.com ssheine@aol.com
Joey Spatafora	??	??	??	spatafoj@ava.bcc.orst.edu
Allein Stanley	1057 Westminster Dr. Statesville, NC ??	??	??	astanley@i-america.net
Pete Stanz	??	??	??	??
Greg Thorn	??	??	??	thorn@uwyo.edu
Rod Tulloss, Mary Tulloss, & Sarah Tulloss	P.O.Box 57 Roosevelt, NJ 08555-0057	work: 609 448 5096 home: same	609 426 4164	ret@pluto.njcc.com
Rytas Vilgalys	??	??	??	fungi@duke.edu
Tom Volk	??	??	??	volk_tj@mail.uwlax.edu
Laura Weishaupt	??	??	??	lgw@fast.com
Sean Westmoreland	??	??	??	antedon@boone.net
Pete Whelihan	61 Ardimon Rd. Asheville, NC 28801-4201	828 254 6199	??	Jackieihan@aol.com

4 Travel Instructions

Note that addresses, telephone numbers, and email addresses will be found in the table in section 3.

4.1 Building Supply and Hardware Stores in Asheville

Lowe's on Tunnel Rd. in Asheville has 4' lengths of 3/8" and 1/2" rebar.

Directions to Lowe's coming from I-26: Take 240 bypass off I-26. Take exit for Rte. 70 off 240. Bear right off the exit ramp. Bear right at first light (you don't have a choice, really). Go straight at 2nd light. Bear left at 3rd light. (Stay in middle lane to do this. Don't take the hard left into the movie theater.) This is Tunnel Rd.—a very congested, commercial area. Lowe's is on the right at the 2nd or 3rd light.

4.2 Driving Time Between Diverse Sites

Theresa Rey's house to the trial site in the Park is about 1 hour, depending on traffic and road conditions. Getting into (and out of Cataloochee) involves a steep 1 lane dirt road, with hairpin turns that is often travelled by trucks w/ horse trailers, which can add alot of time to the trip. It's only around 13 miles, but it can take an hour one way.

From Asheville to Cataloochee, add on 45 min. or more.

Excluding the road into Cataloochee, the time from Cataloochee to Cosby is about 1 and 1/2 hours. The trip between the two places is just long enough to make going back and forth in one day an ordeal. For what it's worth, it also traverses the one of the most dangerous sections of interstate in the country—too many semis and too many poorly banked tight mountain curves.

From Theresa Rey's house to the Gatlinburg part of the park is 2 to 3 hours depending on tourist traffic.

4.3 From Greenville Airport to Steve Peek's House

Get direction from the airport to I-26. Take I-26 west until you see signs for I-40 east, I-240 east and I-40 west. This is a fairly major intersection and the end of I-26. Take I-240 east (the center exit) & follow to the intersection with 19/23 north. (I-240 and 19/23 are the same road for a short distance.) At this point you will need to merge quickly to the far left lane as you will exit I-240 just across the bridge. Take 19/23 North to the Marshall (25/70) exit. (The exit is under the overpass and loops around to the right.) There will be a stop light ahead of you. Approximately 3.4 miles from the light, take a left on Lower Flat Creek Road; and, in about 75 yards, take a right on Snelson Road (gravel). Steve's house is the third drive on the left (only paved drive on Snelson Rd.).

4.4 Location of Cataloochee Meeting Spot—Exxon Station

General directions: Take exit 20 off route 40 (Highway 276). Go the the Exxon station just off the exit ramp.

From Quality Inn: Exit the Inn from the front onto Highway 19. Get into the left turn lane before reaching the first light. Turn left (north) onto Highway 276 (Jonathan Creek Road). After 4-5 miles look for the Exxon station on the left side of the road.

4.5 Haywood Community College

From Exxon station: Turn left onto Highway 276 and get onto 40 East. Take exit 27 off I-40. On the long exit ramp, take the first exit—Exit 107 (Jones Cove Road). Get into the extreme left lane and make the first left going back under the highway. (There are good signs indicating the way to HCC.) Then make the first left after the underpass. This is Freelander Drive, which dead-ends in a T. Make a right and look for parking areas immediately on the left. Once you have parked, if you face back toward Freelander Drive, there are several brick buildings ahead and to your right. The second building is the Natural Resources building, and that's where the lab is.

5 Training

5.1 Training—General

Requirements

a The goals of general training shall be

i to introduce volunteers to the project goals and procedures

ii to introduce the concept of the transect, procedures associated with it, and courtesies expected with regard to the transects of other project groups

iii to introduce the basic tools, forms, and references to be used by volunteers

iv to make clear the emphasis on quality of collection, annotation, and processing

v to give sufficient training in use of the note taking forms so that volunteers can begin to take notes on fresh material at the next opportunity.

b The basic materials used in the general training shall include, but not be limited to, those listed below under "Materials Needed."

c The length of general training shall be six hours or less.

Materials Needed

1. Rossman et al. The following parts may be extracted for use in training: chapters 4-5 and sections 6.1-6.2, 6.5, 9.1.1, 9.1.5-9.1.7, and 10.1.1.
2. The present document for each attendee.
3. Photocopies of Glossary from *Flora Agaricina Neerlandica* for each attendee
4. Blank calendar for schedule development.
5. Tools for transect establishment (**7.2**).
6. Note paper.
7. Ring binders with blank tabbed dividers for each attendee.
8. Generic collecting form for each attendee (**Appendix A-1**).
9. Samples of taxon specific collecting forms for each attendee (**Appendix A-2** through **Appendix A-4**)
10. Pre-numbered labels.
11. Computer with field database software.
12. Photographic setup—copying stand, light box, materials for building a duplicate light box, flash unit, camera body, macrolens, list of common set-up errors.

5.2 Training—Genus Specific

This brief discussion is based on what Tulloss provided in the case of the genus *Amanita*. Information about other taxa specific collecting and note taking can be found in **Appendix A-3** (entolomatoid fungi) and **Appendix A-4** (*Russula*).

The presentation begins with a set of slides that introduces *Amanita* taxonomy by example (of basidiocarps), defines the sections of the genus, explains the techniques being used to distinguish new taxa, etc. The presentation supports the concepts that

- misapplication of European names and novelty are to be expected

- an ATBI is a process of discovery as well as identification of known taxa

- when new names are justified, the result is clarification of taxa, not confusion.

The basic training for collecting and processing specimens is spelled out in **A-2.1** and **A-2.2**. Forms for taking notes are provided in **A-2.5** through **A-2.7**.

A list of *Amanita* species reported or known from the Park supplemented by species known to occur in nearby areas of the Appalachians is supplied in **A-2.8**.

Materials Needed

1. Instructions on note taking from *Seminar on Amanita*, beginning with subsection labeled "In the Field." (21 pages)
2. Starter List for Genus *Amanita* Pers. in GSMNP (6 pages)
3. Draft Keys to Species of *Amanita* Occurring in the Northeastern U.S.A. and Eastern Canada (30 pages)
4. [Key to] Species of Section *Phalloideae* from North America Having Membranous, Limbate to Saccate Volvas (3 pages)
5. Provisional World Key to Species Closely Related to *Amanita hemibapha* with Notes on the "Slender Caesar's Mushrooms of Eastern North America (6 pages)
6. Draft Keys to Species of *Amanita* Subsection *Vittadinii* (6 pages)
7. Field note form ("Collecting Notes for Species of *Amanita*") (2 pages)
8. Record Form for Phenoloxidase Spot Testing (2 pages)
9. Record Form for Sulfuric Acid Spot Testing (1 page).

6 Collecting Schedule

6.1 Schedule of Site Visits—1999

At the initial meeting of the Asheville Mushroom Club volunteer group (Asheville Volunteer Fungal Department), the following schedule was established. The first transect (Fungus-1) is described in **7.3**. Entries for visits that have been completed are indicated by shading.

Site Visit	Visit Purpose	Dates	Site(s)
1	Establish transect and briefly survey site	27-28 March 1999	Fungus-1
2	Kick-off Weekend for ATBI. Collecting on transect and near trail to transect	29-30 May 1999	Fungus-1
3	Collecting on transect and near trail to transect	5-6 June 1999	Fungus-1
4	Collecting on transect followed by opportunistic collecting in other parts of Park	10-15 July 1999	Fungus-1
5	Collecting on transect followed by opportunistic collecting in other parts of Park	31 July - 1 August 1999	Fungus-1
6	Collecting [RET not attending]	28-29 August 1999	Fungus-1
7	Collecting [RET not attending if no money]	11-12 September 1999	Fungus-1
8	Collecting [RET not attending if no money]	2-3 October 1999	Fungus-1
9	Collecting [RET not attending if no money]	16-17 October 1999	Fungus-1

7 Collecting Methodology

7.1 Fundamental Procedures

Requirements

a On each collecting visit to the trial site, transect (**7.3**) collecting shall be completed before any other collecting is carried out.

b Collecting shall begin as early in the day as is feasible to take maximum advantage of daylight for annotation of fresh collections.

c Once any transect collecting is completed for a given day, other collecting shall be terminated early enough so that travel to a sorting site, sorting, and taking of color notes can be accomplished before natural light is compromised.

7.2 Transect Layout

Requirements

a In the first year, a transect (**7.3**) shall be established at only one site. (See Rossman et al., chapter 5.)

Materials Needed

1. Rebar - several 4 foot lengths for positioning along transect to make it easy to re-establish it.
2. PVC pipe - a 2 foot length for each transect to be slid over the rebar marking the starting point of the transect.
3. Indelible marker to mark compass bearing and transect identifier on the PVC pipe segment.
4. Maul - for driving in the rebar posts.
5. Surveyor's flagging - for marking the rebar posts. Also, it can be unrolled to create center lines on each visit and then taken back up after collecting is completed for that visit.
6. Scissors or knife to cut flagging to fixed lengths (to determine sides of transect on each visit).
7. Compass - for orienting the center line of the transect so that it can be re-established from a single post.
8. GPS unit - for recording approximate lat./long. of base post of transect.
9. Surveyor's "chain" - for measuring length (50 m = 163 ft 9 in) and width (4 m=13 ft 1.2 in) of each transect (perpendicular offset from centerline to side of transect is then 6 ft 6.6 in). Available item is 100 ft tape. Using five (5) evenly spaced stakes to define a transect, the distance between them in the English system is 40 ft 11.25 in.
10. Copy of Rossman et al.
11. Tree identification guide book.

7.3 Design and Location of First Transect (Fungus-1)

The first transect (**Figure 1**) was established on 27 March 1999.

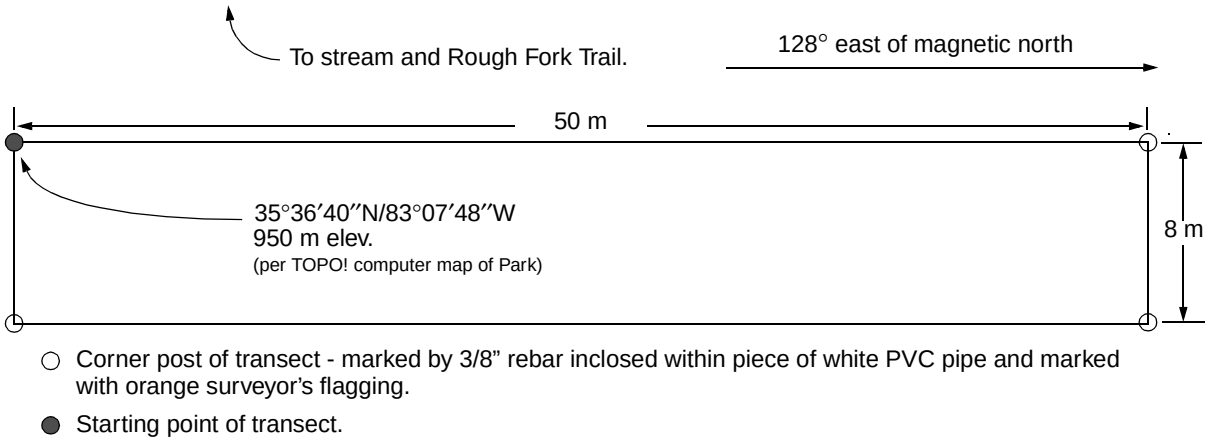


Figure 1. Design and location of Fungus-1 transect

Trees, shrubs, and vines found in the transect and in its vicinity include the following (*very* preliminary survey): *Acer pensylvanicum, Betula nigra, Catalpa sp., Hamamelis virginiana, Liriodendron tulipifera, Ostrya virginiana, Parthenocissus virginica, Pinus strobus, Quercus alba, Q. nuttallii,* Q. velutina, *Q. sp., Rhododendron maximum, Smilax sp., Toxicodendron radicans, Tsuga canadensis.*

Herbaceous plants found in the transect and in its vicinity include the following (*very* preliminary survey): *Cypripedium acaule, Goodyera pubescens.*

Ferns found in the transect and in its vicinity include the following: *Athyrium filix-femina* var., *Onoclea sensibilis, Osmunda cinnamomea, Polystichum acrostichoides, Thelypteris noveboracensis.*

Requirements

a The sole transect to be utilized in the trial year of 1999 shall be the Fungus-1 transect defined in **Figure 1**.

7.4 Collection Cards

Requirements

a In order to keep track of collections and associated notes, photographs, and spore prints and to facilitate processing when computer databases are not available, a system of collection cards like those employed in earlier projects (e.g., the Chiricahua Mycoflora Project) shall be used.

b The design of the collection card for the trial year (1999) of shall be as defined by Figure 2.

c For every collection made (on transect or through opportunistic collection), the project collection number of a single card shall be used in identifying the collection.

d Any duplicates separated from a collection shall be marked clearly with the project collection number of the original, complete collection.

e The perforations on the card permit the tabs (on the right in **Figure 2**) to be removed for the purposes defined as follows: For any given collection,

i one tab shall be placed with number clearly readable in the field of view of each photograph taken of the collection or a part of the collection

ii one tab shall be placed with a spore print taken from a sporocarp of the collection at least until the spore print and dried specimen are placed in a common packet

iii one tab shall remain with the collection in the herbarium in which the collection is deposited.

f When a collection is split to create a duplicate collection, if there is at least one tab from that collections collection card that can be left with the original collection, another tab from that collection card shall be enclosed with the duplicate collection.

Recommendations

g If certain off-transect localities are repeatedly visited, it the locality data (including altitude, latitude, longitude, and habitat) should be recorded and given a unique identifier (e.g., "meadow by Rough Fork Trail trailhead" or "RFT meadow") that can be used on collection cards to avoid repeatedly recording such data on the cards.

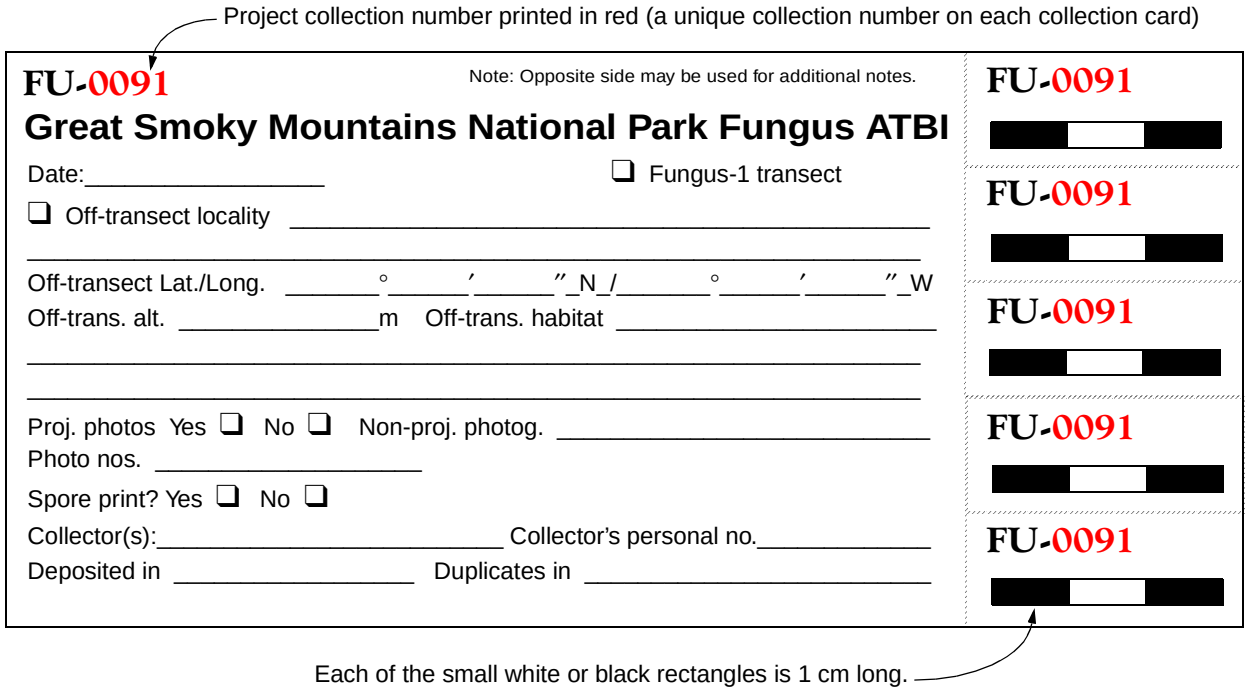


Figure 2. Layout of collection card for 1999 trial year

Comments

Note that the collection card design does not provide space for annotation of a collection. In order to promote higher quality annotation, separate annotation sheets specialized to various genera or larger fungal groups will be used (e.g., agarics, gastromycetes, *Amanita*, entolomatoid fungi, Russulales, etc.).

7.5 Collecting Trips

Requirements

a The primary responsibility of the collecting team shall be to scour the transect for larger epigeous macromycetes on each visit.

b The first order of business during a site visit shall be to examine the state of the transect and repair the marker posts or re-establish the transect if necessary.

Note: All the Transect Layout tools (**7.2**) are required on every visit in order to re-establish the transect in case of storm or other damage.

c With the exception of the shape of the transect and the fact that it will be searched in its entirety for macromycetes on every visit, the methods of collecting shall follow those of Rossman et al.

d A full set of collecting supplies shall be taken into the field on every site visit.

e No more than 8 persons (one per meter of width) shall collect within the transect on any given visit.

f Collecting of substrate from within the transect (for example, removal of sticks or leaves) shall be limited so that substrates are not significantly depleted.

g Common taxa with overwintering fruiting bodies (e.g., *Schizophyllum commune*) shall be collected only once from the transect and no more than once from any other site visited.

h Because processing of collections will take place nearby, it shall be sufficient to carry collections from the field in any manner that protects them against damage.

i As provided in Rossman et al., some taxa may be so common that their presence in the transect during a given site visit may be recorded, but not vouchered. A method for recording and accessing such data shall be developed. ***??***

Recommendations

j If the transect is densely populated with collectable material or if opportunistic collecting is producing a large number of specimens, collectors should not only start spore prints in the field as recommended by Rossman et al., but should place the spore print producing samples in cardboard boxes or trays at the site to improve the quality of the prints and relieve the burden in collecting baskets.

k Collecting supplies should include at least the following:

- i Baskets designed (in part) for *Amanita* (**A-2.1.3**) or other specialized collecting
- ii tackle boxes or other containers for small and delicate taxa
- iii foil or wax paper for wrapping collections in collecting packets
- iv collection cards (**7.4**)
- v markers that will mark wax paper
- vi notebook(s) (protected from rain)
- vii paper to place in collecting packets for taking spore print
- viii map(s)
- ix compass
- x specialized collecting items such as paper ice cream cups for *Russula* spore printing
- xi ***??***.

7.6 Opportunistic Collecting

Blaaa...***??***

7.7 Collecting Species of *Amanita* and *Limacella*

Preferred methods for collecting and processing material from the Amanitaceae are described in **Appendix A-2**.

7.8 Collecting Entolomatoid Fungi

Preferred methods for collecting and processing entolomatoid fungi are described in **Appendix A-3**.

7.9 Collecting Species of *Russula*

Preferred methods for collecting and processing species of *Russula* are described in **Appendix A-4**.

7.10 Collecting Other Agarics

Preferred methods for collecting and processing species of agaric other than those treated above are described in **Appendix A-1**.

8 Processing Methodology

8.1 Processing Fresh Collections

Requirements

a The processing of fresh material shall follow the procedures given in sections 6.1-6.2 and 6.5 of Rossman *et al.*

b When a collection is identified to genus in the field and a note taking form for this genus (or for an entity of higher rank including this genus) is available (see **Appendix A-2** through **Appendix A-4**), that form shall be used in annotating the collection.

c A general note taking form for agarics (**Appendix A-1**) shall be provided for use in all cases not covered by **8.1b**.

d A general note taking form for boletes (***??***) shall be provided.

e A general note taking form for the polypores (*sensu lato*) (***??***) shall be provided.

f A general note taking form for cupulate ascomycetes (***??***) shall be provided.

Recommendations

g In the cases of material appearing not to belong to any group for which note taking forms exist, notes should be taken on blank sheets of paper.

Materials Needed

1. Stapler, staples, and paper clips
2. card file for collection cards
3. field guides, keys, glossaries (especially the *Flora Agaricina Neerlandica* glossary distributed to all volunteers), other reference works
4. color books - Munsell (1975), Kornerup & Wanscher (1978), and Ridgway (1912) are preferred. Other color guides that have been used as part of the project include Eiseman and Herbert (1990) and the chart from the *Flora of British Fungi* (Anonymous, 1969).
5. Hand lens
6. pens/pencils
7. notepads
8. note taking forms
9. camera set-up
10. 35 mm slide film (fine grain)
11. good lighting
12. string and rulers
13. small trays made of screening for placing small specimens in dryer
14. computer for data recording
15. dryers
16. white glue (water soluble)
17. plastic bags (in a range of sizes) for samples.

8.2 Collection Day Debriefings for Quality Control

Requirements

a Close accounting shall be maintained of collection cards.

b At least the following points/questions shall be reviewed after each collecting day is complete in order to improve quality of the work and the collections that are its product.

- i Relation of collection cards to data entry.
- ii What characters got lost in transport or with time?
- iii How can we get better data?
- iv Could photos of fragile items be taken in field?
- v What data could better be taken in field?
- vi Should there be more or less focus on certain taxa?
- vii Should collection of one or more taxa be halted?
- viii Should there be a change in the list of wanted (unwanted) taxa?

8.3 Distribution of Collections to Identifiers and Herbaria

Requirements

a After each collecting weekend, all collections made during that weekend shall be placed in individual packets and shipped to herbaria.

b The decision as to which herbarium shall receive a given collection shall be made based on designation of a default herbarium and specific requests from persons acting as identifiers.

c In the trial year, the default herbarium shall be ***??***.

d All material not sent to a herbarium designated by an identifier, shall be sent to the default herbarium.

e The identifier/herbarium to receive a given collection or duplicate shall be noted on the collection card for that collection.

f If option **8.3m** is exercised for a given collection, then one duplicate shall have original annotation sent with its packet to the relevant herbarium and all other duplicates of the collection shall have copies of the annotation sent to their respective herbaria.

g Care shall be taken so that collections are not damaged by pages of annotation during shipment to herbaria.

h A mechanism for distribution of photographs of the collections shall be established.

i Before possible distribution of photographs, the on-site coordinator or his/her designee shall review the photographs for possible use on species pages of the DLIA web site.

j All unique photographs of a collection shall be available to be placed in the packet with the original annotation of that collection.

k If option **8.3m** is exercised for a given collection and if some photographs of that collection are identical to one another, then one member of each such set of photographs shall be available to be placed in the packet with the original annotation of the collection.

l When future resources permit, all data from collection cards shall be included in the collection data base for the Epigeous Macromycete branch of the Fungus TWIG.

Options

m A given collection may be split if more than one identifier has requested such a collection. (Note: Collection card tag placement in duplicate collections is described in **7.4d** through **7.4f**.)

n Under the conditions of **8.3k**, any photographs not required to be available to be placed in the packet with the original annotation of the collection may be made available to be distributed among duplicate collections if there are any.

Materials Needed

1. Computer for access to samples database (FUTURE)
2. boxes, labels, postage
3. standard cover letters
4. addresses of persons to receive material
5. large plastic bags and boxes for shipping
6. preprinted shipping labels***??***.

9 Web Pages

9.1 Sample Species Web Pages

Amanita sinicoflava Tulloss
Section *Vaginatae*
Note: Prior to its description, this species was often determined as "*Amanita fulva*."

Go to Technical Description.

BRIEF DESCRIPTION: *Amanita sinicoflava* has a Chinese yellow or "curry powder colored" or yellow-olivaceous or olive-tan cap is 25 - 66 mm wide. Grooves run inward from the cap edge for about 40% of the radius. Warts or patches of pallid to grayish volva are often left on the cap, but can be washed off easily by rain. This mushroom has a whitish stem (60 - 135 × 4 - 12 mm) decorated with somewhat darker fibrils. The stem lacks both a membranous ring and a bulb. The volval remnants are saccate and submembranous and becoming progressively grayer with age beginning from the top of the sac and working downward. The gills of this species turn grayer as the mushroom ages. The very plentiful short gills appear approximately squarely cut off on the end nearest the stem. The spore print is white. The species is probably symbiotic with oak, beech, and diverse conifers and is distributed widely in the northeastern and north central United States and, probably, in southeastern Canada—fruiting from late June to October. It is expected to be found in the Park. —R. E. Tulloss.

1. Amanita sinicoflava Tulloss. 1988. *Mycotaxon* 32: 421.

Illus.: Phillips. 1991. *Mushr. N. Amer.*: 19 (bottom).
Illus.: Kibby. 1993. *Illus. Guide Mushr. Other Fung. N. Amer.*: 87 (bottom).
Illus.: Bessette *et al.* 1997. *Mushr. NE North Amer.*: 274 (upper right).

Go to Brief Description.

TECHNICAL DESCRIPTION.

Etymology: *sinicoflava*, Chinese yellow—a common color for the pileus.

PILEUS: 25 - 66 mm wide, from pale olive-tan to olive-yellow to curry to brownish olive sometimes darker in disk (4B3, browner than 4B3, 4-5C4, 4-5C8, browner than 4C4, browner than 4C8, much more olive than 5C4, 5F7-8 (over disk in one specimen), 6D4), sometimes pigmentation developing/darkening after rupture of universal veil, occasionally paler to cream at margin, at first ovoid with umbo, expanding to broadly subcampanulate to convex to plano-convex with decurved margin, always retaining small pronounced umbo, dull, subviscid to dry; *context* (1-) 2.5 - 4 mm thick at disk, white to off-white, sometimes darker or yellowish under disk, unchanging, thinning evenly for about 60 - 80 per cent of the radius, then very thin to margin; *margin* striate ((0.3R-) 0.4R (-0.5R)); *universal veil* not present or rarely as one or very few small whitish to sordid patches graying with age.

LAMELLAE: close to subcrowded, 4 - 7.5 mm broad, free to narrowly adnate, occasionally with minute decurrent tooth, white to off-white to cream occasionally with faint orangish tint in mass, white to pale cream in side view, unchanging, after drying cream to pale tan sometimes with darker margin to light brown (between 3A3 and 4A3 to 4A3 to 4-5A4 to 5B4-5 to 5C-D4), with edge minutely fimbriate (lens); *lamellulae* in many ranks most longer than half pileus radius, truncate to subtruncate to subtruncate with small to broad attenuate tooth at attachment to pileus.

STIPE: 60 - 135 × 4 - 12 mm, white to off-white to pale cream to grayish, palest toward apex, becoming yellowish to tannish to brownish from handling, narrowing upward, flaring at apex, with surface longitudinally striate or faintly so at least near base, fibrillose for most of length, fibrils concolorous with pileus or paler or slightly sordid, coloring/darkening with exposure and handling, minutely punctate/pulverulent near apex, occasionally with faint lines at apex; *context* white, unchanging to rarely becoming brownish, larvae tunnels concolorous to rarely sordid tan, hollow with occasional white, cottony stuffing, with central cylinder 3 - 5.5 mm wide; *exannulate*; *universal veil* white to whitish at first becoming gray with exposure or handling, sometimes with small rusty or brick-red spots, interior pale orangish or pinkish becoming gray, submembranous to membranous, saccate to limbate, at first flaring above a constriction at about mid-height of sac with interior longitudinally pleated above point of constriction, collapsing on stipe with age, occasionally in large patches or smears or a ring on lower stipe and leaving only lower portion or very little of sac, highest point of limb reaching 26 - 39 mm from stipe base; *limbus internus* thin, fibrillose, cottony at about point of constriction of sac, rarely seen.

Odorless. *Taste* not recorded.

MACROCHEMICAL TESTS: Spot test for tyrosinase (L-tyrosine) - positive (only tested stipe context and stipe surface). Test voucher: Tulloss 8-16-85-C.

PILEIPELLIS: 40 - 70 µm thick, colorless for 5 - 10 µm at surface, but lacking differentiated suprapellis, with yellow-orange intracellular pigment in remainder of tissue; filamentous, undifferentiated hyphae 1.5 - 5.0 µm wide, densely interwoven, subradially arranged, often at least partially gelatinized; vascular hyphae $2.0^{\pm}$ µm wide, occasionally branching, sinuous, infrequent. PILEUS CONTEXT: branching, undifferentiated, filamentous to inflated hyphae, 2.1 - 16.1 µm wide, interwoven; acrophysalides to 63 × 26 µm; branching, vascular hyphae 2.1 - 12.2 µm wide, plentiful. LAMELLA TRAMA: bilateral; w_{cs} = ? µm; subhymenial base containing

branching hyphae and intercalary inflated cells (clavate to ellipsoid, up to 28 × 16.8 [28.4 - 69 × 17.6 - 45 µm] µm), with elements diverging at angles up to ?°; filamentous, undifferentiated hyphae 1.5 - 14.0 µm wide, ?; divergent, terminal, inflated cells not observed; vascular hyphae 2.8 - 6.6 µm wide, branching, common. SUBHYMENIUM: w_{st}-near = (10-) 15 - 25 µm; w_{st}-far = (40-) 50 - 55 µm; branching structure of short uninflated or partially inflated hyphal segments and occasional inflated cells, with basidia arising from elements of all types (least often from inflated cells). BASIDIA: (41-) 49 - 63 × 12.6 - 16.8 (-21) µm, clavate to broadly clavate, 4-spored to rarely 1- or 2-spored, thin-walled; no clamps seen. UNIVERSAL VEIL: *On stipe base, exterior surface*: occasionally with somewhat scattered remnant patches of a layer (one or two hyphal diameters thick) of longitudinally arranged, undifferentiated, filamentous hyphae up to 7 µm wide. *On stipe base, interior*: tissue becoming slightly denser toward inner surface; filamentous, undifferentiated hyphae 2.1 - 5.6 (-7.0) µm wide, branching, interwoven loosely, sometimes anastomosing; inflated cells plentiful, globose to subglobose to ellipsoid, terminal singly or (occasionally) in chains of two (rarely three), often with colorless partially inflated subterminal segment (holotype), difficult to reinflate in older specimens, 19 - 45 (-60) × 15 - 39 (-46) µm, with walls thin to slightly thickened; vascular hyphae up to 10.5 µm wide, branching, scattered, singly or in tangled clusters; no clamps seen. *On stipe base, inner surface*: occasionally having remnants such as those on exterior surface, but here gelatinizing or nearly entirely gelatinized. STIPE CONTEXT: longitudinally acrophysalidic; branching, filamentous, undifferentiated hyphae 2.8 - 5.6 µm wide; acrophysalides very long and narrow to 635 × 50 µm; vascular hyphae 5.6 - 9.1 µm wide, occasional, branching; no clamps observed. All tissues pale yellow in ammonium hydroxide.

BASIDIOSPORES: [645/33/25] (8.0-) 9.1 - 12.1 (-15.4) × (7.0-) 8.4 - 11.5 (-15.4) µm, (**L** = (9.5-) 9.8 - 11.4 (-11.7) µm; **L'** = 10.6 µm; **W** = (8.7-) 9.0 - 10.6 (-10.8) µm; **W'** = 10.0 µm; Q = 1.0 - 1.14 (-1.26); **Q** = 1.04 - 1.09 (-1.10); **Q'** = 1.06), inamyloid, thin-walled, hyaline, globose to subglobose to occasionally broadly ellipsoid, frequently slightly adaxially flattened; contents guttulate; apiculus sublateral to rarely lateral, truncate conic to cylindric, can be rather large relative to spore size; white in deposit.

Habitat and distribution: Solitary to occasionally subgregarious, at 10-1,000+ m elev. Maine, U.S.A.: In mixed woods of *Abies*, *Picea*, and *Thuja* (Bigelow 3963). Massachusetts, U.S.A.: In thin layer of damp loam over rock in moss under *A. balsamea* (Tulloss 8-17-86-A) or in loam under *Acer*, *Fraxinus*, *Betula papyrifera*, and scattered *Fagus grandifolia* (Tulloss 8-15-86-C). Michigan, U.S.A.: In *Tsuga canadensis* and northern hardwoods forest (Shaffer 3783). New Jersey, U.S.A.: With *B. lutea* f., *T. canadensis*, *Tilia sp.*, and *Ulmus sp.* (Tulloss 6-15-85-A, 10-6-85-A, -E) or in typical *Quercus-Pinus rigida* barrens (Tulloss 8-28-85-D) or in sandy soil of woods dominated by *Acer rubrum*, *Q. alba*, *Q. velutina*, *Rhododendron*, and *Spirea* (Tulloss 8-28-85-F). New York, U.S.A.: In duff over acid, glacial out-wash sands under *T. canadensis*, *F. grandifolia*, and *Prunus sp.* (Tulloss 8-22-87-E) or in wet loam in mixed deciduous woods composed of *Acer sp.*, *Carya sp.*, *Quercus coccinea* and *Q. rubra* (Tulloss 8-18-86-C). West Virginia, U.S.A.: At 990 m elev. In moist loam of mixed forest locally dominated by *F. grandifolia*, *T. canadensis*, *A. balsamea*, and *Acer* (Tulloss 8-31-96-A).

Collections examined: **U.S.A.**: MAINE—Aroostook Co. - *ca.* Guerrette, "state game preserve," 13.vii.1956 H. E. Bigelow 3963 (MICH). Cumberland Co. - Wolf Neck St. Pk., 16.x.1988 Moselio Schaechter *s.n.* [Tulloss 10-16-88-MS1]. [Hancock Co. - W of Pickerel Pond, 11.viii.1991 Stachula *s.n.* [Tulloss 8-11-91-E]. Penobscot Co. - University of Maine, 12.viii.1991 NEMF participant *s.n.* [Tulloss 8-12-91-C.] MASSACHUSETTS—Berkshire Co. - Adams, M. A. King & R. E. Tulloss 8-15-86-C (paratype, L); Balance Rock St. Pk., 15.viii.1986 R. Roper *s.n.* [Tulloss 8-15-86-L] (paratype); Cheshire, Camp Mohawk, 15.viii.1986 S. Sheine *s.n.* [Tulloss 8-15-86-F] (paratype); Mt. Greylock summit, R. E. Tulloss 8-17-86-A (paratype). Border Hampshire & Hampden Cos. - Mt. Tom St. Res., 27.ix.1986 Ellen Greer *s.n.* [Tulloss 9-27-86-EG8] (paratype). MICHIGAN—Marquette Co. - Sullivan Creek area, 12.vii.1968 N. Smith & T. Gilliam [TG 165]

(MICH). Ontonagon Co. - Porcupine Mtns. St. Pk., Government Peak Trail, 24.viii.1962 R. L. Shaffer 3783 (MICH as "*A. vaginata*"). [MINNESOTA—?. NEW HAMPSHIRE—Hillsborough Co. - Harris Center, 18.viii.1989 NEMF participant *s.n.* [Tulloss 8-18-89-C].] NEW JERSEY—Mercer Co. - Hopewell, R. E. Tulloss 7-6-81-B (paratype), 7-7-81-C (paratype), 7-18-84-D (paratype). Monmouth Co. - Shark River Co. Pk., 8.vii.1984 Susan Hopkins *s.n.* [Tulloss 7-8-84-F] (paratype), R. E. Tulloss 8-28-85-D (paratype), 8-28-85-F (paratype), Bruce Vansant *s.n.* [Tulloss 8-3-86-H] (paratype). Sussex Co. - Stokes St. For., M. A. King & R. E. Tulloss 6-15-85-A (paratype); Stokes St. For., Kittle Field Recreation Area, 6.x.1985 NJMA member *s.n.* [Tulloss 10-6-85-A] (holotype, NY)[, M. A. & R. E. Tulloss 9-28-97-A]; Wallpack Center, 6.x.1985 Neal Macdonald *s.n.* [Tulloss 10-6-85-E] (paratype). NEW YORK—Essex Co. - North Elba, 21.viii.1987 NEMF participant *s.n.* [Tulloss 8-21-87-L] (paratype, DTJ). Franklin Co. - Floodwood, 22.viii.1987 Joe Arnold *s.n.* [Tulloss 8-22-87-E] (paratype); Harrietstown, 21.viii.1987 Smith *s.n.* [Tulloss 8-21-87-K] (paratype, DTJ). Hamilton Co. - Raquette Lake, 21.viii.1987 Bill Roody *s.n.* [Tulloss 8-21-87-N] (paratypes: RET; TBORG; XAL). Otsego Co. - Arnold St. For., 16.viii.1985 R. M. Fatto *s.n.* [Tulloss 8-16-85-C] (paratype). Schenectady Co. - Mariaville, M. A. King & R. E. Tulloss 8-18-86-C (paratype). PENNSYLVANIA—Pike Co. - Pocono Environmental Educ. Ctr., M. A. King & R. E. Tulloss 6-20-81-A (paratype), 6-20-81-H (paratype)[, 24.vi.1989 Hanna Tschekunow *s.n.* [Tulloss 6-24-89-B]]. VERMONT—Bennington? Co. - NEMF '81 site, 30.viii.1981 NEMF participant *s.n.* [Tulloss 8-30-81-A] (paratype). Pownal Co. - NEMF '81 site, 29.viii.1981 NEMF participant *s.n.* [Tulloss 8-29-81-D] (paratype). VIRGINIA—Grayson Co. - Grayson Highlands St. Pk., Cabin Crk. Tr., 9.ix.1986 Robert S. Williams 323 (paratype).[WEST VIRGINIA—Tucker Co. - Canaan Valley St. Pk., E. terminus Abe Run Tr., jct. w/ Deer Run Tr., 31.viii.1996 R. E. Tulloss 8-31-96-A.]

DISCUSSION

There are two taxa which closely resemble *A. sinicoflava* macroscopically: *A. mortenii* Knudsen & Borgen (from Greenland) and *A. submembranacea* (Bon) Gröger (subalpine, from Europe).

Amanita mortenii may be distinguished from *A. sinicoflava* by the following characters:

- • The occasional presence of small, ochraceous flakes on the exterior, upper surface of the volval sac.
- • Thick-walled, acrophysalides throughout the context of pileus and stipe, lamella trama, and the universal veil. These are easily seen if the tissue is stained with Congo Red and viewed with an oil immersion lens at 1000×. The wall thickness is 1.0-1.2 µm.
- • Many thick-walled hyphae throughout the basidiocarp. Often the cell walls of such hyphae are not as thick as the walls of the inflated cells.
- • A cellular subhymenium.
- • Shorter acrophysalides in the stipe context.
- • A thicker pileipellis.
- • Generally narrower and possibly more plentiful, vascular hyphae.
- • Basidia slightly longer.
- • Spores slightly larger.

Amanita submembranacea may be distinguished from *A. sinicoflava* by the following characters:

- • In the volva of *A. submembranacea*, a broken, thin fibrillose-felted to submembranous outer layer is visible to the naked eye in many, well-preserved exsiccata; remnants of the outer layer superimposed on the grayish unbroken inner volval layer may give the appearance of bits of flaking paint on old canvas. This character is completely absent in *A. sinicoflava*.

- • The spores of *A. submembranacea* are about the same size as, or slightly larger than, those found in *A. sinicoflava*. Spores of "*A. subalpina*" may be as large as 12-17 × 12-15 µm (Moser, 1983).
- • A cellular subhymenium.
- • Shorter acrophysalides in the stipe context.
- • A thicker pileipellis.
- • Slightly longer basidia in most specimens.

In addition to the two taxa examined in detail above, there are a number of others which require mention because of some similarity to *A. sinicoflava*. The fungus illustrated as *A. strangulata* (Fries) Quélet by Merlo & Traverso (1983) has pileus coloration which is similar to, although paler than, that of *A. sinicoflava*. This European entity is distinguishable—at least by its larger spores (12-14 µm in diameter) and its smaller ratio of striation length to pileus radius.

The literature contains five other taxa in *Amanita* section *Vaginatae* with globose cells dominant in the universal veil and globose to subglobose spores. The universal veil in *A. sinicoflava* is similar to that of *A. ceciliae* of Europe (Corner & Bas, 1962 and Bas, 1984) and "*A. inaurata*" *sensu* Peck of North America (description and discussion under *A. ceciliae* (Jenkins, 1986)). However, *A. sinicoflava* can be distinguished from either of these fungi by its pileus with olive tones, a smaller habit, and a commonly more robust universal veil frequently appearing as a constricted, saccate volva on the stipe base rather than as warts on the pileus which latter occurrence is more common in *A. ceciliae* and "*A. inaurata*" *sensu* Peck The acrophysalides in the stipe of *A. sinicoflava* are up to twice as long as those of "*A. inaurata*" *sensu* Peck (Jenkins, 1986). *Amanita cinctipes* Corner & Bas (Corner & Bas, 1962) of southeast Asia has a universal veil similar to that of *A. ceciliae*, but sometimes appearing in small pyramidal warts on the pileus; its spores are reported to be smaller than those found in *A. sinicoflava*; *A. cinctipes* lacks an umbo; and its coloration is said to tend to grayish tones. *Amanita craseoderma* Bas (Bas, 1978) of the Amazon region has even smaller spores than *A. cinctipes*, a "very dark brownish grey" pileus, and considerably narrower basidia than *A. sinicoflava*. The pileus of *A. craseoderma* lacks an umbo. *Amanita groenlandica* Bas ex Knudsen & Borgen has a larger pileus than *A. sinicoflava* with shorter (0.1-0.2R) marginal striations, no umbo, and frequently a patch or patches of universal veil. Knudsen & Borgen (1987) also describe *A. groenlandica* as "relatively short-stemmed" and robust—another difference.

Three additional Western Hemisphere species of *Amanita* exhibit a universal veil somewhat similar to that in *A. sinicoflava*—*A. antillana* Dennis of Trinidad (Dennis, 1952 and Bas, 1978), *A. coacta* Bas of the Amazon region (Bas, 1978), and *A. constricta* Thiers & Ammirati of California (Thiers & Ammirati, 1982). However, all exhibit an average Q greater than that (1.06) seen in *A. sinicoflava*—1.2 in *A. antillana*, 1.3 in *A. coacta*, and approximately 1.2 in *A. constricta*. The closest of these to *A. sinicoflava* is the last named which can have a submembranous universal veil; however, *A. constricta* is further distinguished from *A. sinicoflava* by a gray-brown to hair brown pileus, red staining in the universal veil when moist, and striations that represent only about 0.2R (Thiers & Ammirati, 1982).

It should be noted that the collections of *A. sinicoflava* made in the Coastal Plain ecological region (those from New Jersey's Mercer and Monmouth counties) had, with but one exception, smaller spores than all other collections examined. I conjecture that this is due, at least in part, to the rapid loss of surface moisture due to the soil of the Monmouth County collection region being entirely composed of sand. Unlike many radicating species of *Amanita* section *Lepidella* which occur in the Coastal Plain, basidiocarps of *A. sinicoflava* sit high in the soil—even to the extent of the volval sac being almost entirely above ground. This fact can be confirmed even in exsiccata because one finds fragments of leaves (and almost no sand at all) attached to the surface of the very bottom of the stipe.

In the field in eastern North America, *A. sinicoflava* is distinguished from taxa close to *A. vaginata* (Bull. per Fr.) Vittadini and *A. fulva* by pileus coloration. Moreover, these taxa do not exhibit the graying, submembranous to membranous volval sac of *A. sinicoflava*. The prominent orange-rusty stains frequently found on the volva of *A. fulva* do not occur in *A. sinicoflava*. —R. E. Tulloss

Go to Brief Description.

Return to top of Technical Description.

Amanita sp. V3

Section *Vaginatae*
Note: Often wrongly determined to be *Amanita ceciliae* (B. & Br.) Bas, a Eurasian species.

Go to Technical Description.

BRIEF DESCRIPTION.

Amanita sp. V3 has a 55 - 82 mm wide, brown to pale brown cap that is often darkest in the center. Sometimes the margin is very pallid. Grooves run inward from the cap edge for about one-third of the radius. Warts or small patches of pallid to grayish volva are often left on the cap, but can be washed off easily by rain. This mushroom has a whitish stem (85 - 106 × 6 - 10 mm) decorated with bits of pallid to grayish volva. The stem lacks both a membranous ring and a bulb. Sometimes the volval remnants form a narrow ring near the stem base. The gills of this species turn grayer as the mushroom ages. The very plentiful short gills appear squarely cut off on the end nearest the stem. The spore print is white. The species is probably symbiotic with oak, beech, and conifers and is distributed widely in the northeastern and north central United States and, probably, in southeastern Canada—fruiting from late June to October. It is expected to be found in the Park. —R. E. Tulloss.

2. *Amanita sp. V3*

=*Amanita ceciliae sensu auct. amer. orient.*
non Amanita ceciliae (B. & Br.) Bas. 1984. *Persoonia* 12: 192.

Go to Brief Description.

TECHNICAL DESCRIPTION.

PILEUS: 55 - 82 mm wide, pallid brown with umbrinous tint (5B3 or 6C3—washed out brown, not tan) or grayish brown with disc browner (becoming darker with age*?*), sometimes pale cream over marginal striations, broadly campanulate, tacky to subviscid, subshiny to slightly metallic; *context* white, sordid under pileipellis in disc, not changing when cut or bruised, *?* mm thick at stipe, thinning evenly for half distance to margin, then membranous; *margin* striate (0.2 - 0.4R), nonappendiculate; u*niversal veil* as warts and small or (occasionally) large patches with pallid edges, whitish at first, then gray to grayish brown to dark gray to blackish gray, floccose-subpulverulent, detersile*;* p*ileipellis* apparently very thin.

LAMELLAE: free, lacking decurrent line on stipe apex, close to subcrowded, off-white (near stipe) and sordid (near pileus margin) or entirely sordid white in mass, sordid white (near stipe) and pale gray (near pileus margin) or entirely sordid white in side view, graying with age, $10^{\pm}$ mm broad, with white or whitish and minutely flocculose edge; *lamellulae* truncate, of widely varying lengths, plentiful, unevenly distributed.

STIPE: 85 - 106 × 6 - 10 mm, white to off-white, becoming faintly brownish from handling, narrowing upward, not flaring at apex, with white to grayish flocculence in upper half, with appressed silky patches below becoming dark fibrils on pallid ground, very base with white appressed cottony surface and short white pseudorhizae; *context* white, not changing when cut or bruised, hollow with central cylinder *?* mm wide containing sparse white cottony material; *exannulate*; *universal veil* in loose patches easily left in soil, located against stipe $10^{\pm}$ mm from base, pale gray to gray, not plentiful or as dark gray ring above white, “strangulate” zone.

Odor none. *Taste* pleasant, slightly nutlike.

MACROCHEMICAL TESTS: none recorded.

PILEIPELLIS: *?* µm thick, with strongly gelatinized surface; filamentous, undifferentiated hyphae 1.8 - 7.2 µm wide, dominantly subradially oriented, densely packed, light yellowish brown in mass; vascular hyphae 1.8 - 16.5 µm wide, rather common, prominent, yellow to yellow-brown, including occasional coils and twists, infrequently branching. PILEUS CONTEXT: filamentous, undifferentiated hyphae *?* µm wide, *?*; acrophysalides *?*; vascular hyphae *?* µm wide, *?*. LAMELLA TRAMA: bilateral; w_{cs} = 30 - 55 µm; subhymenial base containing inflated cells (e.g., 24 × 21 µm, thin-walled, subglobose to elongate), with angle of divergence *?*; filamentous, undifferentiated hyphae *?* µm wide, *?*, with inflated intercalary segments (e.g., 54 × 21 µm) in central stratum, with subhymenial base including uninflated and partially inflated hyphal segments, and inflated intercalary cells dominantly divergent at angles between 30° and 60°, with the divergent inflated cells subfusiform to ellipsoid to ovoid to broadly clavate (up to 82 × 33 µm, but most smaller than 55 × 28 µm) and with walls up to *?* µm thick; divergent, terminal inflated cells not observed; vascular hyphae *?* µm wide, *?*. SUBHYMENIUM: w_{st}-near = 15 - 40 µm; w_{st}-far = 35 - 60 µm; consisting of $3^{\pm}$ inflated cells or uninflated or partially inflated hyphal segments arranged in branching structure with those nearest bases of basidia having major diameter perpendicular to central stratum, with basidia arising (terminally or laterally*?*) from uninflated or partially inflated short hyphal segments or (terminally) from branched elements or from small inflated cells. BASIDIA: 40 - 69 × 11.6 - 16.5 µm, 4-sterigmate; clamps not*?* observed. UNIVERSAL VEIL: *On pileus*: with all elements eventually collapsing and gelatinizing; filamentous, undifferentiated hyphae 2.2 - 7.8 µm wide, plentiful to locally dominant,

loosely interwoven, frequently branching, often with yellowish (sometimes rather sordid yellow) subrefractive walls, with walls thin to (often) 0.5 µm thick; inflated cells hyaline, colorless to (more commonly) pale brown at first (brown in mass), then colorless to pale yellowish to pale grayish to pale brown to yellowish brown to brown, plentiful to locally dominant [in immature specimen (Stephenson 93-04), strongly dominant], terminal, singly or (occasionally) in chains of two, globose to subglobose to subpyriform to ovoid to ellipsoid to broadly ellipsoid to broadly clavate to clavate to peanut-shaped, up to 64 × 52 µm (but with major diameter rarely > 55 µm), with walls thin or up to 1.0 µm thick (not easily noted once gelatinization begun); vascular hyphae very infrequent or absent, 2.8 - 6.3 µm wide, otherwise like those of pileipellis. *From ring on stipe base*: as on pileus, except having slightly larger proportion of filamentous, undifferentiated hyphae and somewhat smaller inflated cells. *From patch on stipe*: as on pileus, with inflated cells up to 66 × 56 µm. STIPE CONTEXT: longitudinally acrophysalidic; filamentous, undifferentiated hyphae ***?*** µm wide, ***?***; acrophysalides ***?***; vascular hyphae 6.3 - 10.5 µm wide, branching, common (at least near surface).

BASIDIOSPORES: [80/4/4] (7.7-) 9.4 - 12.0 (-14.2) × (7.0-) 8.8 - 11.2 (-13.5) µm, (**L** = 10.0 - 11.0 µm; **L'** = 10.5 µm; **W** = 9.3 - 10.5 µm; **W'** = 10.0 µm; Q = (1.0-) 1.02 - 1.11 (-1.12); **Q** = 1.04 - 1.07; **Q'** = 1.06), hyaline, thin-walled, smooth, inamyloid, globose to subglobose, adaxially flattened; apiculus sublateral to nearly lateral, cylindric; prominent (up to 3.2 × 3.0 µm); contents monoguttulate with numerous small additional granules; white in deposit.

Habitat and distribution: Solitary to subgregarious. New Jersey: In wet loam of mixed deciduous forest including *Acer*, *Betula*, *Carpinus caroliniana*, *Carya ovata*, *Fagus grandifolia*, *Liquidambar styraciflua*, and *Quercus*. Virginia: In moist loamy clay of road bank under *Q. alba*, *Q. sp.* (of scarlet oak/pin oak group), *Pinus strobus*, *P. virginiana*, and *Cornus florida*. West Virginia: At 900 - 1220 m elev. In hardwood forest or in forest of mixed *Quercus spp.* and other hardwoods or in old growth *Abies* forest with *Betula lutea* f. or in wet soil of mixed forest including *Tsuga canadensis*, *F. grandifolia*, *Picea rubens*, *Betula*, *Acer*, etc.

Collections examined: **U.S.A.**: CONNECTICUT—Tolland Co. - Gay City St. Pk., R. E. Tulloss 8-31-97-Na, -Nb. MASSACHUSETTS—Worcester Co. - Worcester, Broad Meadow Brook Wildlife Sanctuary, 13.viii.1993 Joe Arnold *s.n.* [Tulloss 8-13-93-A]. NEW JERSEY—Monmouth Co. - Shark R. Co. Pk., C. Conover, S. E. K. & R. E. Tulloss [Tulloss] 8-30-98-C. Warren Co. - Stephens St. Pk., 4.viii.1996 NJMA foray participant *s.n.* [Tulloss 8-4-86-K]. VIRGINIA—Bath Co. - Douthat St. Pk., R. E. Tulloss 6-16-92-A. WEST VIRGINIA—Berkeley Co. - Hedgeville, "Sleepy Hollow," 1.viii.1976 U. Weiss *s.n.* (BPI 14460B). Marion Co. - Mill Fall Run, 5.x.1993 S. L. Stephenson & D. Binion [Stephenson] 93-04 (FWVA). Randolph Co. - Gaudineer Scenic Area, 26.ix.1992 R. P. Bhatt, S. L. Stephenson & A. Kumar A6 (FWVA). Tucker Co. - Canaan Valley St. Pk., Abe Run Tr., *ca.* E terminus & jct. w/ Deer Run Tr., R. E. Tulloss 6-25-96-A.
—R. E. Tulloss.

Go to Brief Description.

Return to top of Technical Description.

10 Expenses

Notes	Date(s)	Income	Expense
Airline ticket - Newark/Greenville	26-29 March 1999	-	$277.67
100 foot tape measure	25 March 1999	-	$25.33
photocopies for training	25 March 1999	-	$109.39
baggage handler	26 March 1999	-	$2.00
ground transport NJ	26 March 1999	-	$80.00
rental car	26-30 March 1999	-	$268.27
transect supplies (rebar, PVC pipe, flagging)	27 March 1999	-	$8.66
tolls	29 March 1999	-	$6.60
food	26-29 March 1999	-	$39.99
gasoline	28-30 March 1999	-	$35.90
Support from DLIA	15 May 1999	$853.81	-
photocopies of note forms, etc.	26 May 1999	-	$68.26
lodging	27-31 May & 4-8 June 1999	-	$531.32
use of own car (?? miles @.$.325 per mile)	27-31 May 1999	-	$336.38
rental car	4-8 June 1999	-	$233.64
tolls and gas for rental car	27-28 May & 7-8 June 1999	-	$33.30
food	27-31 May & 4-8 June 1999	-	$200.00
Theresa Rey expenses (plastic bags & wax paper)	27, 30 May 1999	-	$24.54
estimated below this point.....			
copying stand, camera, lens, foamboard		-	325
1 dryer		-	100
1 4-day trip @ $400		-	600
2 7-day trips @ $625		-	1600
printing and copying		-	280
20 rolls of film and developing @ $15.00		-	300
TOTALS		$853.81	$2281.25

11 Acknowledgments

The participants in the Epigeous Macrofungi ATBI wish to express their sincere gratitude to the following:

- Dr. Amy Y. Rossman, U.S. Fungus Collections, Beltsville, Maryland, for her role in formulating the work of a Fungus ATBI and her efforts to initiate the inclusion of fungi in the Great Smoky Mountains National Park ATBI
- Dr. Lorelei Norvell, Pacific Northwest Mycology Service, Portland, Oregon, for her tireless support of our work in her capacity as Chair of the Fungus Taxonomic Working Group for the ATBI
- The management and rangers of Great Smoky Mountains National Park for their generous and on-going support and their facilitation of our work in the Park
- The staff and volunteers at Discover Life in America for seed funding for the first year's work, for facilitation of our participation in the Memorial Day Nature Quest activity, and for their enthusiasm and support
- Prof. Douglas Staiger, Chairman, Natural Resources Division, Haywood Community College, Clyde, North Carolina, for making laboratory space available to us as near as possible to our trial transect.

12 Bibliography

Anonymous. 1969. Colour identification chart. *Fl. Brit. Fungi*. (H.M. Stationery Off., Edinburgh). unpaginated.

Bas, C., Th. W. Kuyper, M. E. Noordeloos and E. C. Vellinga. 1988. *Flora Agaricina Neerlandica* 1. viii+182 pp.

Eiseman, L. and L. Herbert. 1990. *The Pantone book of color*. (H. N. Abrams, Inc., New York). 160 pp.

Kibby, G. G. and R. A. Fatto. 1990. *Keys to the species of Russula in northeastern North America*, 3rd ed. (privately pub'd., Somerville, N.J.). ii+61 pp.

Kornerup, A. and J. H. Wanscher. 1978. *Methuen handbook of colour*. London. 252 pp.

Largent, D. L. 1986. *How to identify mushrooms to genus 1. Macroscopic features*. Mad River Press, Eureka, Calif. iv+86 pp.

Munsell Color. 1975. *Munsell soil color charts*. Baltimore. unpaginated.

Ridgway, R. 1912. *Color standards and color nomenclature*. (Published by the author, Washington, D. C.). iv+44 pp. + 43 pl.

Romagnesi, H. 1967. *Les russules d'Europe et d'Afrique du Nord* (1996 reprint). Gantner, Vaduz. 1033 pp.

Rossman, A. Y., R. E. Tulloss, T. E. O'Dell, and R. G. Thorn, eds. 1998. *Protocols for an All Taxa Biodiversity Inventory of fungi in a Costa Rican Conservation Area*. (Parkway Publ., Boone, NC). xviii+195 pp.

Tulloss, R. E. 1998. *Syllabus for a seminar on Amanita*, 4th ed. (N. Amer. Mycol. Assoc. & Mycol. Soc. San Francisco). vi+184 pp.

Appendix A-1
Generic Collecting Form for Fleshy Fungi

by Lorelei L. Norvell and Rodham E. Tulloss

The collecting form presented on the following page was developed by Marcangelo Puccio, a former student of Dr. Joseph Ammirati. It represents an intermediate level of detail between the more complex forms provided for some specific taxa in later appendices and the very simple form—relying on "free narratives"— that has proven very useful to one of us (LLN) in Pacific Northwest inventory work that relies extensively on contributions of parataxonomists with experience similar to that available from the volunteers for working on epigeous macrofungi in the GSMNP ATBI.

Note that part of the information on the form is already present on the collection card that will be associated with every collection. For this reason, we have filled in several blanks that would contain redundant information.

Upon completing the entry of data in the first four boxes on this form, the user should consider for a moment what other characters are striking in the fungus at hand and then discursively described such characters in the box marked "OTHER COMMENTS."

GENERAL EPIGEOUS AGARICS

Name of Fungus: _____

_____

GSMNP ATBI coll. no.:_____

Date

Collected by

Locality

Ha

Subs

Habit of Growth: _____

Color of Spore Deposit: _____

_____

_____

Pileus:

width: _____ mm thickness: _____ mm
shape: _____
color (young & old): _____
description of margin: _____ description of surface: _____
Flesh: taste:_____ odor: _____ consistency: _____
color/changes: _____
Latex: color/changes: _____

Lamellulae:

attachment: _____ spacing: _____
width: _____ mm form of edge: _____
color/changes: _____
lamellulae (frequency, regularity of spacing, shape, variation in lengths): _____
_____

Stipe:

length: _____ mm width (apex): _____ mm
width (base): _____ mm shape (exclud. base): _____
surface color/changes: _____
surface texture/decoration: _____
Flesh: texture: _____ hollow stuffed solid
color/changes:_____
Partial Veil: Y N form: _____
color/changes: _____
position: _____ layers (give no.): _____ attached movable
Universal Veil: Y N remnants on stipe base (do not confuse with bulb): Y N on pileus: Y N
form of remnants on base: _____
color/changes: _____
form of remnants on pileus: _____
color/changes: _____

OTHER COMMENTS: **See back of form? Y N**

Appendix A-2
Collecting the Amanitaceae

This is an extract from Tulloss, R. E. 1998. *Syllabus for a Seminar on Amanita, 4th Ed.* (North American Mycological Association & Mycological Society of San Francisco). 186 pp. Original pagination has not been preserved.

A-2.1 In the Field

The organizers of the first presentation of this seminar asked me to discuss every step of my collecting and note taking process. This seems to be a profitable thing to do despite the fact that some attendees at the seminar may be familiar with some of the practices. The steps are presented in the next three sections.

A-2.1.1Photographing

If a camera with macro or other close-up lens has been taken into the field, I make color slides of the whole fruiting body and unique features such as the universal veil material on the pileus, anastomosing lamellae, universal veil material on the lower stipe and bulb (if one exists). I attempt to fully utilize the macrolens—getting close to characters to be illustrated so that they fill the frame. Depth of field is increased by slowing the lens speed (if that is what can be controlled on the camera) or by stopping down the lens as much as is feasible. To avoid shadows that hide key features, I use reflectors (made from aluminum foil wrapped around sheets of cardboard) to light the side of the specimen away from the sun. I groom natural settings so that twigs, grass, etc. don't block the camera's view of the mushroom. After getting a spore print, a photo of the fruiting body in longitudinal section is often helpful (see below).

A-2.1.2Collecting

I remove the fruiting body from the soil carefully. Having the whole fruiting body is often necessary for determination of a collection. A bulb or lack of a bulb and the form and nature of any universal veil remains on the stipe base may be missed due to careless collecting. Some species of *Amanita* section *Lepidella* are deceptively deeply rooting. Some of the species of other sections can have half or more of the stipe below the surface of the ground. It is best to assume deep insertion in the substrate and excavate each specimen carefully. For digging I use a large-bladed knife or a narrow garden trowel. I have seen an aluminum tent peg used to good advantage for the same purpose.

A-2.1.3Basket Design

For carrying *Amanita* collections in the field, I use a very deep basket that is cross-laced with strings so that many rectangular "compartments" are outlined by the strings. *Amanita* specimens are wrapped in wax paper and arranged with stipes vertical (as they were in the soil) supported by the web of strings (strings in two layers are needed—say, one-third of the way up from the basket bottom and two-thirds of the way up). By storing the specimens in this way, the stipes don't coil up as they would have a tendency to do in many species of *Amanita* were the specimens laid on their sides. One can arrive home with a photogenic specimen...and something that's a lot easier to measure than it might have been otherwise.

A-2.1.4Notes

"Field notes" is a poor term for what is intended to be entered on my note form; some of these notes are best made after returning from the field. My note form (A-2.5) is largely self explanatory. One thing that may not be clear is that, if the stipe has a bulb, I measure the stipe above the bulb (to get stipe length and width) and the bulb (to get bulb length and width); I do not measure the overall length of the stipe and bulb since that can be computed by addition of the two lengths I do measure.

In the field, I find it useful to note collector's names, collection number, locality, date, quantity and distribution of fruiting bodies, soil, and habitat.

I do my best to take the time to note habitat information carefully. Trees in the area of collection (not just the closest tree) are important to know about. Scrub trees in undergrowth are also noteworthy (e.g., *Quercus* seedlings in a forest of *Pinus*). The absence of trees is also very important to note. (There are some amanitas that are apparently not ectomycorrhizal.)

If a color book can be carried into the field, colors of just-collected material are worth noting in terms of a color code. Otherwise, a best estimate of color should be made in common terms. Careful annotation of color using a color book can be done on return from the field, but beware of colors that change between collection and the laboratory.

A-2.2 In the Laboratory—Macroscopic Characters

A-2.2.1Dimensions

In order to make a meaningful ratio of the length of pileus striations to the diameter of the pileus, the pileus diameter must be measured along the pileus surface—must be measured as though the pileus were expanded to a fully planar condition. Such a measurement can be done by draping a piece of string or thread or a strip of paper over the pileus, holding the points on the string (for example) that are precisely at the opposing pileus margins, and then measuring the straightened string. Pileus thickness, breadth of lamellae, and dimensions of the stipe are all best measured after making a longitudinal section of the fruiting body. Therefore, I hold off on making these measurements until a spore print has been obtained (unless a spore deposit is not to be obtained—see "triage," below). I treat the length of the stipe above the bulb (if one is present) and the length of the bulb as two separate dimensions. The overall length of the mushroom is then computable from the thickness of the pileus, the length of the stipe, and the length of the bulb. I am wary with regard to measurements in the literature because I find bulb length sometimes included in stipe length and sometimes not included—even within a single work. There is no true bulb in species of section *Vaginatae*, and the apparent bulb in some species of section *Amidella* is usually only a very thick volval sac.

A-2.2.2Important Ratios

Two ratios that are important are the ratio of the length of the striations on the pileus margin to the radius of the pileus and the width of the central cylinder of the stipe to the overall width of the stipe. These should be recorded at least for the largest and smallest basidiocarps in a collection; and if one of the ratios is especially high or low in another basidiocarp of the same collection, that should be recorded as well.

A-2.2.3Decoration of the Stipe Surface

Very often, the stipe surface of an *Amanita* will be longitudinally striatulate (at least in age). Other forms of variation are numerous. Near the stipe apex on a number of species, the surface is pubescent, farinose, or pulverulent. In some taxa of section *Vaginatae* (e.g., *A. arctica*), a thin, subfelted layer may be oppressed to the upper stipe; the anatomy of such layers often suggests a poorly formed partial veil. In many members of section *Vaginatae* with exannulate stipes, the surface of the lower two-thirds of the stipe may be fibrillose; the fibrils may be concolorous with the (pallid) ground color or may range from subtle orangish white to orange or various shades of brown or gray or black. Sometimes a species with deeply pigmented stipe fibrils will also have marginate lamellae. Species with a friable or felted *limbus internus* of the universal veil often deposit such material on the stipe surface (below the annulus if there is one). This is the origin of the orange patches on the stipe of *A. hemibapha* (B. & Br.) Sacc. and on its Western Hemisphere relatives. Similarly, the *limbus internus* appears to be the origin of the ragged and collapsing false (second) annulus on the stipe of the taxon called "*:sensuA. caesarea*" by authors of the southwestern U.S.A. (The provisional name "*A. cochiseana*" is used for this entity in Appendix A7.) In a variety of taxa, the stipe surface may be decorated by warts or patches of the universal veil or by large or small recurved scales where the context splits (apparently in relation to adnate patches of universal veil).

A-2.2.4Colors

Colors can be expressed in your own terms, but it will be much easier to communicate about them if a color book such as the ones published by Methuen (Kornerup & Wanscher, 1978) and Munsell (1975) is employed. The set of soil colors published by Munsell is a good supplement (largely browns and grays) to the wide color range in Methuen. Since Ridgway (1912) colors can be translated into the Munsell code (Hamly, 1949), even though Ridgway's publication is a rather rare book now, the colors can be made meaningful to readers who lack it. If one has a copy of Ridgway (now selling in the range of $US 400 - 500), one shouldn't hesitate to use it.

The color of the universal veil and lamellae may change as a fruiting body ages. This is particularly notable in the taxa of section *Vaginatae* having a friable universal veil. The tendency in these taxa is for the universal veil to become grayer, browner, or even black with age. The lamellae tend to become significantly grayer. The color of the universal veil in an old basidiocarp is correlated to that in a young one. For example, the pale orangish white volva of one New Jersey Pine Barrens species (*Amanita sp. 49*) retains a faint orangish tint as it becomes gray; and the brilliant yellow-orange volva of a species collected in Maine (*Amanita sp. N29*) becomes red-brown. I check colors of the universal veil, annulus (if present), and lamellae in both young and mature fruiting bodies. Colors of the lamellae are recorded both in mass (viewed from below) and in side view.

Bruising or staining reactions on the surfaces or in the context of an *Amanita* can be important for determination. However, in at least one case (Tulloss, unpub. results) a species [*A. subsolitaria* (Murr.) Murr.] that does not normally change color when cut, will turn brilliant yellow occasionally—apparently due to some invasive agent. Because of this observation, an investigation of spores size and shape and anatomy should be undertaken in cases in which yellow staining occurs—before settling on a determination quickly. In *A. subsolitaria*, no mature spores have been found on yellow staining fruiting bodies; moreover, the lamellae are usually covered with budding yeast cells. The abnormal fruiting bodies have been determinable because normal fruiting bodies have usually been found close to or among yellow staining ones.

A-2.2.5Odor and Taste

When it comes to odor and taste, one is on one's own. I try to be as explicit as possible and use terms for odors and tastes that are likely to be terms for experiences common to many people. Since people are unlikely to taste amanitas in sections of the genus in which there are numerous poisonous taxa, taste is not as important a character to record as is odor. I usually taste specimens clearly assignable to section *Vaginatae*, but never swallow the material tasted.

A-2.2.6Spore Deposit

I obtain a spore print if at all possible (but see under “triage,” below) for every taxon studied. I set up for spore prints immediately upon returning from the field. Then I begin to systematically go through my collections filling out field notes forms as thoroughly as possible, making more photos or drawings as may be necessary or of interest. In many cases a satisfactory spore print is obtained by taking an index card the breadth of which exceeds the pileus diameter, cutting out a slot for the stipe to be slipped into, and then hanging the stipe in a tall glass or cup. In this way the plant is exposed to drying on internal surfaces as little as possible. The whole construction can have wax paper wrapped around its top so that evaporation from the pileus surface is reduced. Experimentation may lead to better techniques especially for very small and very large specimens.

A-2.2.7Phenoloxidase Spot Tests

Phenoloxidase tests (spot tests for laccase and tyrosinase) are often valuable and likely to become more so...at least for some taxa. I select at least one fresh fruiting body (it is best, if time allows, to test both a button and a mature specimen) and slice it longitudinally. Using a razor or a very sharp knife, I slice off a “silhouette” of the mushroom about 2 or 3 mm thick (if possible given the size of the stipe) from the exposed inner surface of one of the two half-mushrooms. I divide this silhouette down the center and place each half-silhouette on a non-reactive surface like a white dinner plate, a pane of glass, or a white porcelain-

coated lab tray. The two pieces could be on the same surface, but they must be far enough apart so that the liquids that are going to be placed on them don't run together, mix, etc. (For all types of macrochemical tests, I always dry the parts of the mushroom that I don't use for the test. On the herbarium label for such material I indicate that the collection is a voucher for a spot test. The collection can be checked later in case a mistake is made about its determination.)

Procedure for the spot tests: On one half-silhouette, drip syringaldazine solution until the whole half-silhouette is wetted. Mark down the time. Treat the other half-silhouette in the same way, but with para-cresol solution. Note the time that this is done. For 15 to 20 minutes note down the color changes (if any) as they occur on both half-silhouettes. I suggest the use of the note form presented in A-2.7 For each change, note the time. Or just make a note on the colored (reacting) regions of each half-silhouette every minute. This is easier than it sounds—especially if one uses simple abbreviations. On the chemical test form, for a half-silhouette of a mushroom in which you observe a positive reaction, shade in the area of the appropriate half-silhouette drawing corresponding to the visible reaction occurring on your specimen. Mark the time that you stopped observing for each test when you stop. This is sufficient. The other side of the form need not be filled out at this time—except for indication of the collection date and collection number so that the record of results can be correlated with the collection and your other notes.

A positive test for laccase (syringaldazine) is in the range of pinkish lavender to purple. The ethanol solvent in the syringaldazine solution can sometimes accelerate an oxidation reaction that occurs naturally (e.g., the pinkening reaction in some species of *Amanita* section *Amidella*). This phenomenon can be confirmed by using ethanol alone as a control. In cases in which a particularly strong oxidation reaction obliterates the sometimes pale purplish reaction from laccase, the purple color can sometimes be seen in excess reagent adjacent to the material being tested.

A positive test for tyrosinase is in the range of orange-red to orange-brown to rather dark brown. In a number of mushrooms, if the tyrosinase test set-up is left standing for some time (an hour or more), the dark pigment, melanin, will start to form; and areas where reaction has occurred may become nearly black. This terminal part of the reaction does not need to be recorded. Recipes for the reagents and a more extended discussion of applying them and recording test data can be found in (Marr, 1979) and (Marr et al., 1986).

A-2.2.8Sulfuric Acid Spot Tests

In the literature, only a supposed purple reaction on the lamellae of *A. phalloides* is commonly mentioned. Recently, L. J. Tanghe, G. Lincoff, and I have been experimenting with concentrated H_2SO_4 on the lamellae and other parts of a variety of species. A pink or pinkish lavender reaction is very common (unpub. results) on lamellae and elsewhere and is not even restricted to *Amanita* section *Phalloideae.* For a draft data recording form for H_2SO_4 spot tests, see A-2.6 I suggest that the tests only be performed with concentrated acid.

A-2.2.9Other Macrochemical Tests

Testing with iron salts. Almost nothing is known about reactions in *Amanita.* Experiments are needed. In the present state of knowledge, it may not be fruitful to define a taxon based mostly on a reaction to iron salts.

Testing with KOH. While the yellow reaction on the pilei of *A. bisporigera* Atk. and *A. virosa* Lamarck is well-known, a survey of reactions to KOH has not been made. Experimentation is needed. In particular the reports of yellow reactions on "normally" non-reacting species (*A. magnivelaris* Peck and *A. verna* (Bull.:Fr.) Lamarck) must be carefully confirmed on well-determined collections for which vouchers are preserved. Also, the hue and the intensity of the color reaction should be assessed in all cases. Color photographs are important for unusual color reactions or for varying shades of yellow on taxa usually not reported to be reactive.

Testing with ammonium hydroxide. Almost nothing is known about reactions in *Amanita.* Experiments are needed. In the present state of knowledge, it may not be fruitful to define a taxon based mostly on a reaction to NH_4OH.

Melzer's reagent. If one wants to test macroscopically for amyloidity of spores (I never do this, but some do), it can't be done effectively on the spore print. Paper will produce a dark amyloid reaction all by itself. One must scoop up a bit of material from the spore print and place it on a glass or ceramic surface for carrying out the test. A simpler procedure is to place a glass slide under the pileus while the spore print is being made and let some of the spore print be made directly on it. A drop of Melzer's reagent on a patch of white spores will produce a very distinct reaction (distinct to the naked eye) if the spores are strongly amyloid. Unfortunately, there are a few amanitas with weakly amyloid spores. In these cases, microscopic examination of spores in Melzer's reagent is required (see below).

A-2.2.10Triage

If I am limited on time, I don't eliminate all of the steps related to collection and photography if the most important steps can be managed at all. The steps I sacrifice are the following (in the order in which they would be abandoned): 1) tests for amyloid reaction of spores (can always be done with dried specimen), 2) phenoloxidase tests (a few tests per taxon will suffice for current studies), 3) photography in the field, 4) spore print (as long as spore color is demonstrated a few times...spores can be measure from lamellae of dried material), 5) recording odor and taste, 6) photography in the lab (when a collection belongs to a commonly collected taxon).

A-2.2.11Drying the Specimens

I prefer to dry material rapidly. For example, a forced air vegetable dryer with stacking trays can be used. When temperature regulation is possible, a forced air dryer should be set to operate at 55° - 60° C (130° - 140° F). If slower drying is required, the specimens should be cut in an orderly manner (e.g., longitudinally sectioned in quarters or eighths) and placed in a well-ventilated place with heat low enough so that the mushrooms don't cook. I have built a plywood cabinet with removable trays over four 200 watt light bulbs. The trays are simply frames onto which are stapled fiberglass screens. The light bulbs can be turned on and off individually. If the cabinet is placed in a dry spot (e.g., in a moderately air conditioned building), a satisfactory result can be obtained. A commercial dryer without forced air is also an option, a popular dryer among mycologists at present is the SIGG Dörrex dryer manufactured in Switzerland. Less expensive dryers with plastic (rather than metal) frames are available for drying fruits and vegetables; they also work well for mushrooms.

A-2.3 In the Laboratory—Microscopic Characters and Comments on Their Observation

Before describing the process by which I examine *Amanita* anatomy, it is important to acknowledge the fundamental importance of the anatomical discussions of Bas (1969). Bas' work should be reviewed thoroughly by any student of the genus.

Regarding thickness of cell walls: Measurements of wall thickness should be made at 1000× or greater magnification. Optical artifacts may suggest that walls are thickened when viewed at 400× or 500×.

I. Characters of elements common in many tissues.

A. Filamentous, undifferentiated hyphae [see (Tulloss *et al.*, 1992)].

1. Range of width

2. Range of wall thickness

3. Frequency of branching

4. Frequency of septa

5. Wall color (colorless or yellowish or sordid yellowish or ?)

6. Fasciculate?

7. Dominant orientation (e.g., often, but not always subradial in pileipellis)

8. Relative frequency as opposed to frequency of acrophysalides or other inflated cells

9. Form (e.g., coiling, branched, constricted at septa)

10. Decoration internally or externally

B. Vascular hyphae [see (Tulloss, 1994)].

Caution: Care must be taken to distinguish vascular hyphae from filamentous, undifferentiated hyphae with colored walls or subrefractive walls. Vascular hyphae have few or no septa, often are sinuous, often have an irregular outline, and often exude an insoluble roughly concolorous substance when broken or cut.

1. Range of width

2. Frequency of branching

3. Color (especially if not yellow)

4. Presence in fascicles of filamentous, undifferentiated hyphae

5. Frequency

6. Peculiarities of form (e.g., coiling, branched, etc.)

C. Acrophysalides and other inflated cells.

1. Range of size (at least largest seen and top of range in which most observed cells lie)

2. Color

3. Range of wall thickness

4. Relative frequency as opposed to that of filamentous, undifferentiated hyphae in same tissue

5. Range of shapes (noting if wall thickness or size is relatively common for a given shape)

6. Terminal or intercalary?

7. Occurring singly or in chains (if latter, give range of lengths of chains in number of cells per chain)

8. Decoration internally or externally

D. Spores [see (Tulloss *et al.*, 1992) and (Tulloss, 1994)].

1. Measure 20 per specimen (if that many can be found)

2. In cases in which Q is under about 1.7, spores should be measured in lateral view only—otherwise the value of Q will vary too much and be of less value taxonomically. Because of lack of a method such as this, subglobose spores are often reported as globose (i.e., with Q value too low).

3. Compute individual length/breadth ratio (**Q**) for each spore

4. Compute average length (**L**), average breadth (**W**), and average Q (**Q**) for each specimen

5. Compute overall averages of length, breadth, and Q (**L'**, **W'**, and **Q'** respectively) for each taxon. It is no harm to compute standard deviation for these averages; however, for a user of your data with only a small number of specimens before him/her, it is more useful to provide the ranges within which you have found the averages to fall. (See item 6.) A taxonomist with extended experience with a taxon may have measured spores from dozens of basidiocarps in many stages of development and in varying conditions dependent upon the stage of development when dried, the condition when dried, the speed of drying, the quality of preservation in an herbarium, etc. All these variables can alter spore sizes and shapes. The averages computed by such an expert may be spread out over a considerable range

6. Report ranges for length, breadth, Q, **L**, **W**, and **Q**

7. Report ranges by indicating lowest and highest values observed (extremes) and the range in which 90% of values fall

8. To evaluate whether a given specimen may have spores of unusually small or large size, I record the spore data according to spore length in columns labeled by length ranges (7.5 - 8.5, 9-10, 10.5-11.5, etc.). By measuring at least 20 spores per specimen, the columns taken together will either suggest a normal distribution (bell) curve or will demonstrate skewing or long tails on the distribution. Appropriate cautionary comments can then be made in a description based on specimens with skewed spore size distribution. Skewed spore size can be caused by a specimen having been senescent when dried, having partially dried *in situ* prior to collecting, having partially dried between collection and placement in a dryer, having been in initial stages of sporulation when dried, etc.

9. Hyaline or opaque?

10. Color. The term "hyaline" means "clear like glass." It should not be taken to mean "colorless" as well.

11. Wall thickness or decoration (see crassospore discussion, below)

12. Presence or absence of adaxial flattening

13. Irregularity of form (swollen at one end, constricted, "Y"-shaped, shaped like a flatworm, etc.)

14. Presence of "giant spores"

15. Reaction to Melzer's reagent and/or Cotton Blue. In cases of weak amyloid reactions, compare spores on an hymenial surface with the background color of the basidia and basidioles. The latter are never amyloid in *Amanita* to my knowledge, although they may sometimes have dextrinoid contents (e.g., in *A. mutabilis* Beardslee). Also, the spores may be compared to air bubbles in the mount.

16. Position and shape/size of apiculus. Typical shapes are cylindric and truncate-conic. To describe the shape accurately, it is necessary to examine the apiculi of spores in lateral view.

17. Form of contents [e.g., monoguttulate, multiguttulate, with (additional) small granules, etc.]

II. Tissue by tissue analysis.

A. Pileipellis.

1. Present or not? In a number of taxa of section *Lepidella* [notably, in most taxa of subsection *Vittadiniae* and in *A. rhoadsii* (Murr.) Murr. var. *rhoadsii*] a well-defined pileipellis is not present.

a. If present: thickness

b. If not present: relationship of pileus context to universal veil, characteristics of transitional region

2. Gelatinized to partially gelatinized suprapellis (thickness, color)

a. Is the gelatinous material caused by breakdown of hyphal cell walls?

b. Is the gelatinous material a matrix in which whole hyphae interweave loosely?

3. Predominantly ungelatinized subpellis (thickness, color)

4. Filamentous, undifferentiated hyphae

5. Vascular hyphae

6. Clamps

B. Pileus context.

In some taxa, there is a definite concentration of vascular hyphae near the stipe apex within the pileus context or in the apex of the stipe. The pileus context should be sampled both near to and distant from the stipe apex. Similarly the context of the stipe apex should be checked.

1. Filamentous, undifferentiated hyphae
2. Acrophysalides
3. Vascular hyphae
4. Clamps

C. Lamella trama [see (Tulloss, 1993; 1994)].

Caution: Divergent, terminal inflated cells are uncommon in the lamella trama of some taxa of *Amanita* despite the literature to the contrary. Many times cells that appear terminal were in fact intercalary before being displaced by sectioning. Careful examination of the apex of such a cell will frequently reveal an opening made in sectioning or the remains of a cell that was attached at that point.

1. Form taken by bilateral tissues, range of angles of divergence of basal elements of subhymenial tree
2. Central stratum
   a. w_{cs} = ? (always measure!); w_{ct}= ? (no longer used by me)
   b. Filamentous, undifferentiated hyphae
   c. Intercalary inflated cells
   d. Vascular hyphae.
3. Subhymenial base
   a. Organization, structure
   b. Filamentous, undifferentiated hyphae
   c. Inflated cells (terminal? intercalary?)
   d. Vascular hyphae
   e. Clamps
   f. Subhymenial tree—make drawing of hymenium and subhymenial tree inclusive of edge of central stratum if possible.

D. Subhymenium [see (Tulloss, 1993; 1994)].

Caution: Divergent, terminal cells appear to be quite rare in the lamella trama of some species of *Amanita* despite the literature to the contrary. Many times cells that appear terminal were in fact intercalary before being displaced by sectioning. Careful examination of the apex of such a cell will frequently reveal an opening made in sectioning or the remains of a cell that was attached at that point.

1. If divergent, terminal, inflated cells present,...
   a. w_{ex}-near = ? w_{ex}-far = ?
2. In all cases,...
   a. w_{st}-near = ? w_{st}-far = ?
   b. Types of cells from which basidia arise?

c. General characterization of form (cellular, coralloid, ramose, etc.). Often, it seems better to write a description of the drawing (see above) rather than to be limited to the set of terms introduced by Bas (1969).

d. Clamps

E. Basidia.

1. Range of size

2. Distribution of 4-sterigmate, 2-sterigmate, etc. basidia

3. Size of sterigmata (length and width at base) and any oddities of form

4. Wall thickness

5. Crassobasidia (see below)

6. Include in drawing with subhymenial tree and subhymenium (above)

7. Clamps (see below)

8. Oddities of structure/form [e.g., branched (rare)].

F. Universal veil.

Layering of the universal veil is common. This may range from the case in which there are a few more filamentous, undifferentiated hyphae in the base of a wart than in the apex to the development of as many as five distinct layers (e.g., in *A. volvata*). Each layer should be described separately. Since the distribution of inflated cells with respect to hyphae often differs between universal veil material left on the pileus and such material left on the stipe base, tissue from both regions should be investigated.

1. Draw tissue either from pileus or stipe base; if tissues of layers are very varied, draw those that are not dominantly hyphal.

2. On the pileus

a. Identify layers and treat each separately.

b. Filamentous, undifferentiated hyphae

c. Inflated cells

d. Vascular hyphae

e. Clamps

3. On the stipe base

a. Identify layers and treat each separately.

b. Filamentous, undifferentiated hyphae

c. Inflated cells

d. Vascular hyphae

e. Clamps

G. Stipe context.

A sample of this tissue should be taken in such a way that it does not represent only the stipipellis or only the material from the stipe's central cylinder.

1. Filamentous, undifferentiated hyphae

2. Acrophysalides

3. Vascular hyphae

4. Clamps

H. Partial veil.

Quickly collapsing inflated cells that serve to separate the partial veil from the edges of the lamellae are often found on the upper surface of the partial veil. In young material, such cells may be in good condition. These should not be mistaken for inflated cells that are intrinsic to the partial veil. In my descriptions, I only refer to the latter inflated cells in descriptions of partial veil tissue. While a subradial orientation of elements is common in the partial veil, I check for a cross-weave of other elements or a possible layering. A drawing should be made of the tissue of the partial veil.

1. Filamentous, undifferentiated hyphae

2. Inflated cells

3. Vascular hyphae

4. Clamps

5. Make drawing.

III. A few thoughts on determining material from anatomy.

It is often necessary for me to review spores, lamella trama, universal veil, and partial veil in order to have a hope of coming up with a definitive determination when macroscopic data is lacking. Microscopic characters are plentiful and very valuable in *Amanita*, and future keys should be available that are based on these characters (and possibly the presence or absence of clamps). But to be able to do efficient work in determining taxa, notes on macroscopic characters are necessary. The difference between an hour and a day spent on a single specimen is significant. As more and more taxa are described, the process is bound to become more difficult. Good notes on fresh material and good photographs will become more (not less) important.

IV. Finding basidial clamps.

Portions of lamellae that are least mature are the most likely places to find basidial clamps.

A. Stain with Congo Red or other cell wall stain.

B. Obtain a good section.

C. Check near lamella edge.

D. Check part of lamella nearest pileus margin.

E. Check for “V”-shaped bases of basidia in more mature regions of lamella (proliferated clamps).

A-2.4 Parasitized *Amanita* Specimens

I. Crassospores and crassobasidia.

My observations are based on taxa from subgenus *Amanita* (*A. morenoi* Raithelhuber and *A. pseudospreta* Raithelhuber) both collected in the same, very limited region of Argentina. A similar phenomenon has been reported (as rare) in several European taxa. I have seen the same phenomenon in a few North American taxa, but very rarely. See (Tulloss and Halling, 1997).

A. Basidia and spores with thickened walls.

B. Walls of basidia thicken as they approach maturity and sterigmata appear.

C. By the time apophyses appear, the thickened wall becomes distinctly decorated.

1. The thin outermost wall layer separates from the inner layer(s) and retains its undecorated form.

2. The remaining layer or layers bulge inward here and there forming roughly evenly distributed hemispherical depressions.

D. As spores form, they develop the same decorated walls.

E. Cause is as yet unknown.

II. Other parasitized *Amanita* specimens.

A. *Hypomyces hyalinus* (Schw. *ex* Fr.) Tul. parasitization.

1. Taxa involved.

a. *:sensuAmanita rubescens sensu* eastern North American authors

b. *Amanita flavoconia* Atk. var. *flavoconia*

c. Amanita sp. 10.

2. Range of *H. hyalinus.*

B. Yellow-staining specimens of *A. subsolitaria*.

1. Often found among normal specimens.

2. Rapidly staining yellow when cut.

3. Sometimes exuding orange fluid when cut.

4. Lamellae covered with dividing yeast cells.

5. Spores distorted and small.

6. Research questions.

a. Isolation of causative agent(s).

b. Mechanism by which such agent(s) causes the staining reaction.

c. Relation to yellow-staining mechanism in taxa accepted as unparasitized, *e.g.*, *A. cinereoconia* var. *croceescens* Bas, *A. crassifolia* Bas *nom. prov.*, and *A. rhoadsii* var. *flavotingens* Bas [placed with *A. subsolitaria* in stirps *Rhoadsii* by C. Bas (1969)].

C. Specimens of *A. polypyramis* (B. & C.) Sacc. with cheese odor.

1. Established as clearly related to parasitization by Hyphomycete by Morales Torres *et al.* (to appear).

2. *Amanita alexandri* Guzmán is, consequently, a synonym of *A. polypyramis.* The holotype of the former is infested by the hyphomycete.

3. Research questions.

a. Isolation of causative agent.

b. Mechanism by which agent alters the odor of the basidiocarp.

c. Relation to agent and mechanism in *A. aminoaliphatica* (below).

D. The case of *A. aminoaliphatica* Filippi *nom. inval.*

1. Odor “of aliphatic amines.”

2. Morphologically very close to *A. ovoidea* (Bull.:Fr.) Link.

3. Stipe context in some basidiocarps largely replaced by hyphae like those that parasitize *A. polypyramis.*

4. Research questions.

a. Isolation of causative agent.

b. Mechanism by which agent alters the odor of the basidiocarp.

c. Relation to agent and mechanism in *A. polypyramis* (above).

A-2.5 Collecting Notes for Species of *Amanita*

Developed by R. E. Tulloss, P.O. Box 57, Roosevelt, NJ 08555-0057.
It is suggested that, for convenience, the first four pages be copied two to a side on a single sheet.

Date of Collection:

Name of Collector(s):

Collector's Collection No.:(if assigned)

Field Diagnosis:

Locale of Collection:Park/Town/Borough/etc.

County State/Province Country

Type of Soil:

Species of Trees and other vegetation around collecting site:

Other comments on site ecology, collecting conditions, etc.:

_____

PILEUS: Diam.: Thickness. Color(s):

Shape (describe changes during expansion if possible, include inflexed or decurved margin, umbo, etc.):

Striate? Y N Length of Striation [Give a range of values when dealing with multiple basidiocarps. It is convenient to provide the information as a fraction (without computing the result) such as 14/43, where 43 is the radius of the pileus with 14 mm long striation.]: Appendiculate? Y N

Form of appendiculate material:

Dry/Viscid/Tacky/Shiny/Dull?

Odor? (Give it a name if possible.) Taste? (Give it a name if possible.)

Surface staining or bruising reactions?

Context color: Context staining:

Describe how the context thins from stipe to margin. (For example, ``slowly at first, then rapidly to a membrane for the last 1 cm nearest margin.'')

General Comments about pileus other than Universal Veil.

Universal Veil on Pileus: Color. Form. Texture.

Adnate or Easily removed?

Membranous/Submembranous/Felted/Floccose/Pulverulent/Other?

Staining or bruising reaction?

LAMELLAE: Color in mass: Color side view:

Breadth:

Free/Adnate/Narrowly adnate/Other?

Decurrent line on stipe?

Staining or bruising reaction?

Form of Lamellulae (truncate, subtruncate, rounded truncate, subattenuate, attenuate, attenuate in steps, other, evenly distrib., unevenly distrib., 1-length, 2-length, div. lengths, plentiful, uncommon).

Other comments on lamellae (forking, anastomosing, distant, subdistant, close, subcrowded, crowded, relation of thickest portion to stipe, other).

STIPE: Length (bottom of pileus context to top of bulb):

Width at midstipe:

Length of bulb: Width of bulb (at broadest point):

Shape of bulb (globose, subglobose, ovoid, fusiform, napiform, rooting, turbinate, carrot-shaped, other; or note if stipe simply clavate). (Note there is no bulb in Section *Vaginatae*. Don't confuse presence of volval sac with the presence of a bulb.) A small drawing is sometimes helpful in conveying bulb shape.

Color:

Staining or bruising:

Narrowing upward, narrowing downward, cylindrical, other?

Flaring at apex?

Decoration on outer surface:

Presence, position, color, form, staining of annulus:

Color of context: Staining or bruising of context:

Hollow/Stuffed/Solid? Diam. central cyl.:

Form of stuffing material:

Color in worm or insect tunnels in context:

Universal veil material on stipe base:

a. Sac: Distance from stipe base to highest point of limb:

Thickness at midpoint between top and attachment:

Texture. Color. Layered?

Tough/Flimsy?

When longitudinal section is made, is a little, inner limb present? If so, make a drawing showing how and where the inner limb is attached to the outer limb and where the latter is attached to the stem.

b. Not evident.

c. In warts. (Describe size*, color, placement, etc. Do they seem to cause the presence of recurved scales on the top of the bulb?)

d. In a collar as in *Amanita pantherina*. (Describe size*, color, placement, etc.)

e. In broken collars as in *A. muscaria*. (Describe etc.)

f. In a loose limb against stipe. (Describe etc.) Give distance from base to topmost point of limb.

g. In loose patches easily left in the soil. (Describe etc.)

h. Other.

_____

SPORE PRINT: Color: Other comments:

_____

Are color slides attached? Y N What identifying marks are on these slides?

Reactions to Reagents:

If some or all of these reagents are available, color reactions of various part of the fruit body may prove useful:

Reagent Used	P. Surf./Cont.	Lam.	St. Surf./Cont.	U. v. on P.	U. v. on St.
__% KOH					
__% H_2SO_4					
__% NH_4OH					
__% $FeSO_4$					

Separate forms are provided for phenoloxidase spot testing with the following:

L-Tyrosine

Paracresol

Syringaldazine

Additional tests:

Wieland [Meixner] Test

Other

A-2.6 Record Form for Sulfuric Acid Spot Testing

H_2SO_4 Spot Tests on Amanita

Form version: May 22, 1993

Amanita _____ date: _____

Collector: _____ Collector's no.: _____

Locality: _____

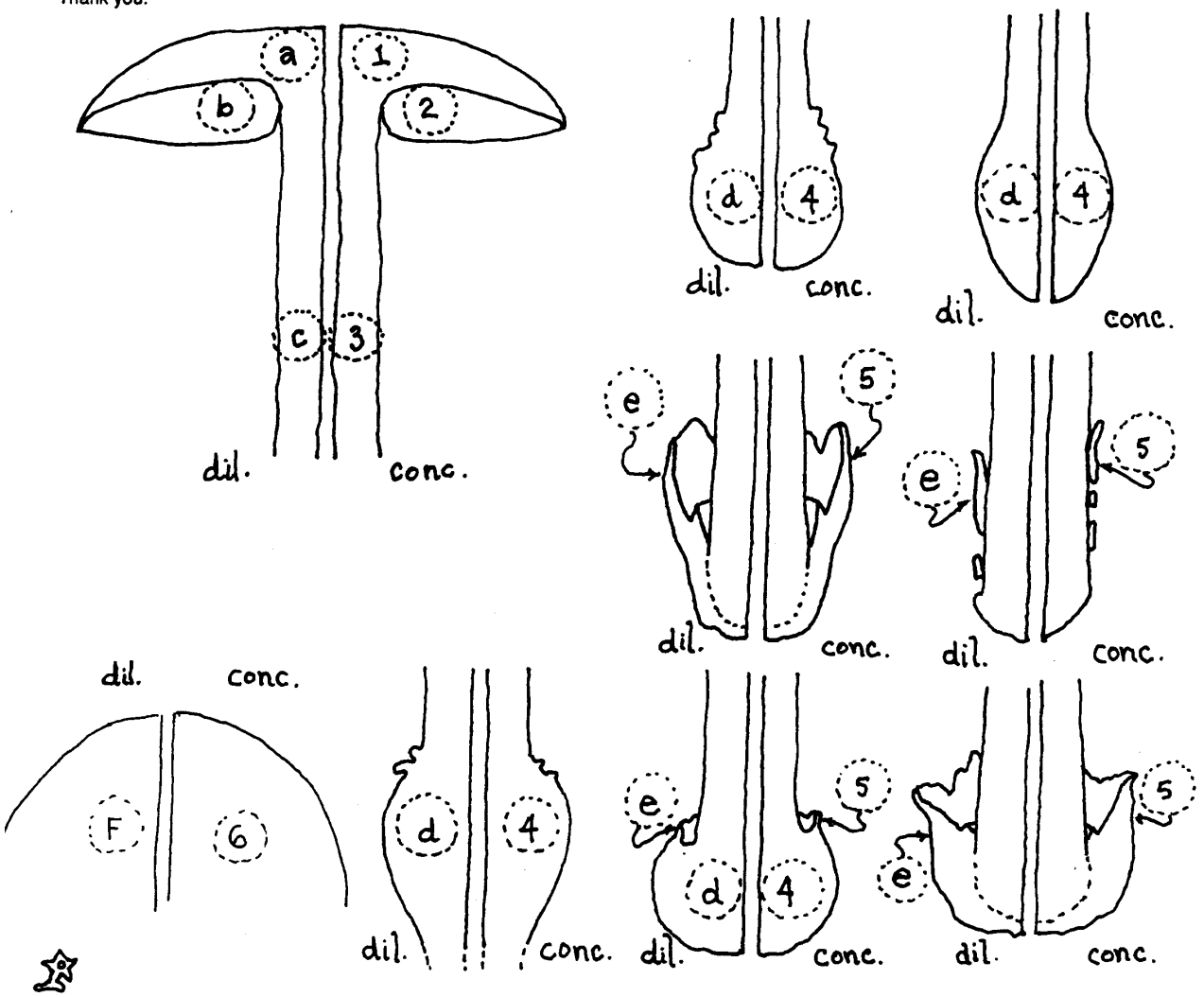
Make a thin longitudinal slice of the mushroom at its broadest part. Lay the slice on a surface that will not be damaged by acid. With a razor or sharp knife cut the mushroom "silhouette" into two equal halves. One half is to be tested with concentrated H_2SO_4 and the other half with dilute H_2SO_4 (15% by volume in water). Drops are to be placed on the pileus context, the stipe context at about the midpoint, the bulb (if there is one) at about the midpoint, the limb of the volva (if there is one) at mid-height, the surface of the lamellae. Since the reaction may be quick and fleeting, the results of each drop should be recorded before passing on to the next one. Take one eighth to one quarter of the portion of the pileus not used in the test of the longitudinal section. Attempt to peal the pileipellis from this piece and record to what degree the pileipellis can be pealed. If the pileipellis cannot be pealed from the underlying context, remove a piece of the pileipellis carefully leaving as much of the context in place as possible. Make two more spot tests: One on a part of the pileipellis that is still attached to a piece of the pileus and one on the context that has been bared by removing a piece of pileipellis. Record the results fully. Dry the remainder of the specimen and label it consistent with the data at the top of this sheet. Package the dried specimen carefully to protect from the Postal Service and send it with this completed form to:

_____

_____

_____

Thank you.



A-2.7 Record Form for Phenoloxidase Spot Testing

LACCASE, TYROSINASE TEST DATA

COLLECTION DATA:

NAME:_____ DATE:_____

COLL. NO._____ COLLECTORS:_____ PHOTOS:_____

LOCATION & HABITAT:_____

_____

SPOT TEST DATA:

TEST TIME:_____ COLOR OF CUT SURFACE:_____

_____ BRUISING?_____

LACCASE:

YOUNGEST SPOROCARP	INTERMEDIATE	OLDEST SPOROCARP
_____(- -) TOTALLY NEGATIVE	_____(- -)	_____(- -)
_____(- +) MINOR REACTIONS	_____(- +)	_____(- +)
_____(+ +) TOTALLY POSITIVE	_____(+ +)	_____(+ +)
_____(+ -) SPECIFIC AREAS POS. (E.G. Gills)	_____(+ -)	_____(+ -)

TYROSINASE:

YOUNGEST SPOROCARP	INTERMEDIATE	OLDEST SPOROCARP
_____(- -) TOTALLY NEGATIVE	_____(- -)	_____(- -)
_____(- +) MINOR REACTIONS	_____(- +)	_____(- +)
_____(+ +) TOTALLY POSITIVE	_____(+ +)	_____(+ +)
_____(+ -) SPECIFIC AREAS POS. (e.g. gills)	_____(+ -)	_____(+ -)

LACCASE: DEVELOPMENTAL PATTERN_____

_____

_____

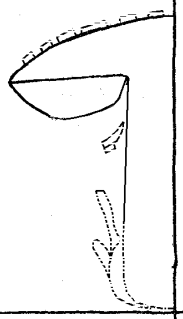
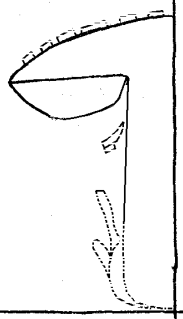
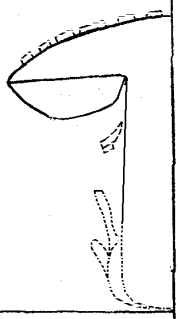
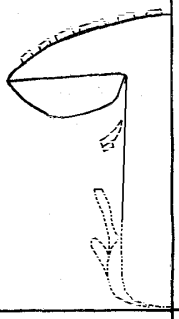
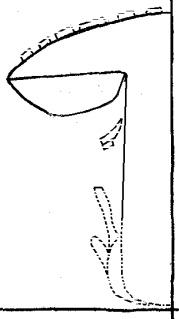
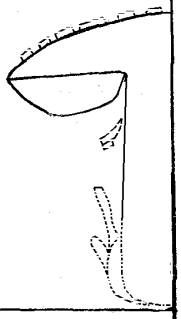
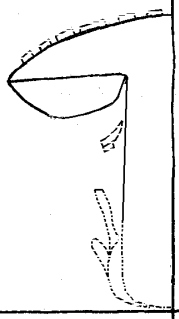
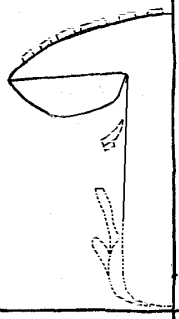
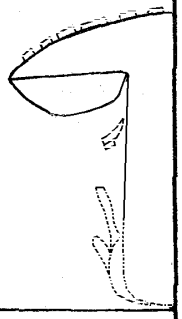
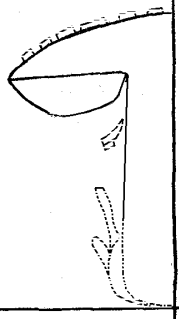
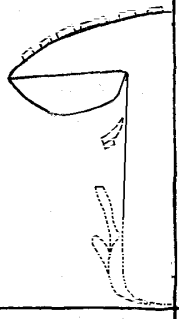
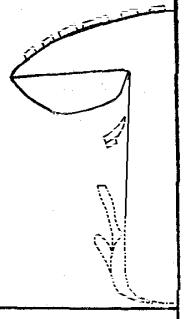
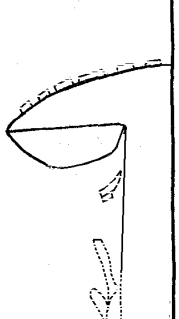
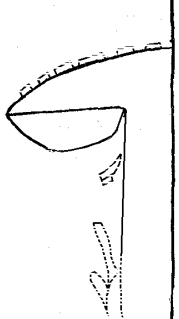
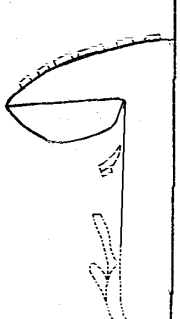
TYROSINASE: DEVELOPMENTAL PATTERN_____

_____

_____

COMMENTS:_____

_____

TEST	YOUNGEST SPOROCARP L_____ W_____	INTERMEDIATE SPOROCARP L_____ W_____	OLDEST SPOROCARP L_____ W_____
CONTROL # 1 distilled water			
CONTROL # 2 95 % Methanol			
TYROSINASE TEST .5 % L-Tyrosine			
TYROSINASE TEST 1 % p-cresol			
LACASSE TEST .1 % Syringaldazine			

A-2.8 Starter List for Genus *Amanita* Pers. in GSMNP

This is a preliminary view on species and distribution from literature and unpublished data of R. E. Tulloss.

For the purposes of this study, we began with **19** taxa in *Amanita* known definitively to occur in Great Smoky Mountains National Park based on monographic literature and Tulloss' unpublished data. At least **87** taxa were listed as probably present in the first drafts of this notebook. Based on 25 years collecting in the northeastern U.S. and 5 years collecting in central Mexico, we should assume that there are **200**-**300** taxa of *Amanita* in the Park. In addition within the Amanitaceae, there is at least one taxon of *Limacella* present.

- The current number of *Amanita* taxa known from the Park is **22**.
- The current number of *Amanita* taxa known from the Rough Fork area is **3**.
- The current list of *Amanita* taxa probable for the Park is now **89**.
- Number of species undescribed (excluding those well-known under misapplied name) is **1**.
- Number of species requiring a name although well-known under misapplied name is **1**.

Lists of herbaria in which taxa of a given species from a given site are deposited are followed by a reference in parentheses. (See the "Literature Cited" section at end of this list.)

Herbaria not in *Index Herbariorum*:

DTJ = priv. herb. of D. T. Jenkins

RET = priv. herb. of R. E. Tulloss

Other abbreviations:

HPL = Hesler-Petersen list

u.d. = unpublished data of Tulloss

The numbering format "*n* - *m*" indicates confirmed presence in the park. The value of *m* is a counter for such taxa within a given section of *Amanita*.

When the "Butterflies of the Soil" project is under way, records will be assigned to each species based on field identifications as collections are made. The record will include the ATBI number for the collection. When definitive determinations are available, the ATBI collection number will be in **red bold face Helvetica** type.

A-2.8.1 *Amanita* section *Amanita*

1. *Amanita agglutinata* (B. & C. *in* B.) Lloyd [N.B.: TENN records not revised by Jenkins or a later author are most probably assignable to one of the taxa of section *Amidella*.]

   ? [TENN (HPL)]

2 - 1. ***Amanita farinosa*** Schw.

   Cades Cove [DTJ, TENN (JE77)]

3 - 2. ***Amanita frostiana*** (Peck) Sacc.

   Cades Cove [DTJ, TENN (JE77)]

4 - 3. ***Amanita gemmata*** *sensu* Jenkins

   Cades Cove [TENN, (JE77)] [possibly *A. russuloides*]

   Parsons Branch [DTJ (JE77)]

   Roaring Fork [DTJ (JE77)]

5. *Amanita monticulosa* (B. & C.) Sacc.

6 - 4. ***Amanita multisquamosa*** Peck [=*A. cothurnata* Atk.; ≡*A. pantherina* var. *multisquamosa* (Peck) Jenkins]

Cades Cove [DTJ, TENN (JE77)]
Elkton [TENN (JE77)]
Roaring Fork [DTJ (JE77)]

7 - 5. ***Amanita muscaria*** var. ***formosa*** *sensu* D. T. Jenkins

Rough Fork [RET - **FU-0002**, **FU-0110**]

8 - 6. ***Amanita muscaria*** var. ***persicina*** Jenkins

Cades Cove [DTJ (JE77)] ****TYPE LOCALITY****

9 - 7. ***Amanita parcivolvata*** (Peck) E. J. Gilb.

Cades Cove [TENN (JE77)]

10. *Amanita pubescens sensu* Coker

11. *Amanita roseitincta* (Murr.) Murr.

12 - 8. ***Amanita velatipes*** Atk. [≡*Amanita pantherina* var. *velatipes* (Atk.) Jenkins]

Cades Cove [TENN (JE77)]
Mt. LeConte [TENN (JE77)]
Roaring Fork [DTJ (JE77)]

13 - 9. ***Amanita wellsii*** (Murr.) Sacc.

NewFound Gap [TENN (JE77)]
Smokemont [TENN (JE77)]

14 - 10. ***Amanita sp. 36***

Rough Fork [RET **FU-0109**]
Sugarlands Visitor Center Nature Trail [RET **FU-0131**]

15. Amanita sp. S1

= 10 known of 15+ probable

A-2.8.2 *Amanita* section *Vaginatae*

1. *Amanita arkansana* Rosen

2. *Amanita fulva sensu auct. amer.*

? [TENN (HPL)]

3. *Amanita jacksonii* Pomerleau [≡*Amanita umbonata* Pomerleau *non* (Sumst.) Sart. & M.; ≡*Amanita caesarea* var. *americana* Pomerleau]

? [TENN (HPL)]

4. *Amanita murrilliana* Sing. [≡*Venenarius gemmatus* var. *volvatus* Murr.]

5. *Amanita pachysperma* Atk.

6. *Amanita recutita sensu* Coker
   ? [TENN (HPL)]

7. *Amanita sinicoflava* Tulloss

8. *Amanita spreta* (Peck) Sacc.

9. *Amanita vaginata sensu lato*
   ? [TENN (HPL)]

10. *Amanita sp.* 21

11. *Amanita sp.* S3

12. *Amanita sp.* S5

13. *Amanita sp.* S6

14. *Amanita sp.* S7

= 0 known from park of 14+ probable

A-2.8.3 *Amanita* section *Amidella*

1 - 1. ***Amanita peckiana*** C. H. Kauffm. *in* Peck
   Indian Gap [FLAS (u.d.)]
   Laurel Falls [MICH (u.d.)]

2. *Amanitopsis volvata* var. *elongata* Peck

3 - 2. ***Amanita volvata*** (Peck) Lloyd
   Cades Cove [L (u.d.)]
   Kephart Prong Trail [MICH (u.d.)]

4 - 3. ***Amanita sp.* 41**
   Indian Creek [MICH (u.d.)]

5 - 4. ***Amanita sp.* 50**
   N of Bryson City [MICH (u.d.)]
   Indian Gap [FH (u.d.)]
   no locality [FH (u.d.)]

6 - 5. ***Amanita sp.* N39**
   Indian Gap [MICH (u.d.)]

= 5 known from park of 5 probable

A-2.8.4 *Amanita* section *Lepidella*

1. *Amanita abrupta* Peck
   ? [TENN (HPL)]

2. *Amanita altifissura* Jenkins

3. *Amanita atkinsoniana* Coker
   ? [TENN (HPL)]

4. *Amanita canescens* Jenkins

5. *Amanita chlorinosma* (Austin) Lloyd
   ? [TENN (HPL)]

6. *Amanita cinereoconia* Atk. f. *cinereoconia*
   ? [TENN (HPL)]

7. *Amanita cinereoconia* f. *croceescens* Bas

8 - 1. ***Amanita cinereopannosa*** Bas
   Cades Cove [L, TENN (BAS69)] ****PARATYPE from this site****

9. *Amanita cokeri* (E. J. Gilb. & Khner) E. J. Gilb.
   ? [TENN (HPL)]

10. *Amanita crassifolia* Bas *nom. prov.*

11. *Amanita daucipes* (Mont.) Lloyd

12 - 2. ***Amanita hesleri*** Bas
   Cades Cove [L, TENN (BAS69)] ****PARATYPE from this site****

13. *Amanita inodora* (Murr.) Bas

14. *Amanita longipes* Bas ex Tulloss & Jenkins

15 - 3. ***Amanita marginata*** Jenkins
   Cades Cove [DTJ (JE81)] ****TYPE LOCALITY****

16. *Amanita microlepis* Bas

17. *Amanita nitida sensu* Coker

18. *Amanita onusta* (Howe) Sacc.
   ? [TENN (HPL)]

19. *Amanita pelioma* Bas

20. *Amanita polypyramis* (B. & C.) Sacc.

21. *Amanita praelongispora* (Murr.) Murr.

22 - 4. ***Amanita ravenelii*** (B. & C.) Sacc.
Cades Cove [L, MICH, TENN (BAS69)]

23. *Amanita rhoadsii* (Murr.) Murr.

24 - 5. ***Amanita rhopalopus*** Bas f. ***rhopalopus***
Cades Cove [L, MICH, TENN (BAS69)] ****PARATYPE from this site****

25. *Amanita rhopalopus* f. *turbinata* Bas

26. *Amanita roanokensis* Coker

27 - 6. ***Amanita tephrea*** Bas *nom. prov.*
Cades Cove [MICH, TENN (BAS69)]

28. *Amanita sp.* S2

= 6 known from park of 28+ probable

A-2.8.5 *Amanita* section *Phalloideae*

1. *Amanita bisporigera* Atk.
? [TENN (HPL)]

2. *Amanita brunnescens* Atk.
? [TENN (HPL)]

3. *Amanita citrina sensu auct. amer.*
? [TENN (HPL)]

4. *Amanita citrina* f. *lavendula* (Coker) Veselý
? [TENN (HPL)]

5. *Amanita gwyniana* Coker

6. *Amanita hygroscopica* Coker
? [TENN (HPL)]

7. *Amanita longitibiale* Tulloss et al.

8. *Amanita magnivelaris* Peck

9. *Amanita pseudoverna* (Murr.) Murr.
? [TENN (HPL)]

10. *Amanita virosa sensu auct. amer.*

11. *Amanita virosa sensu* Coker

12. *Amanita sp.* S4

13. *Amanita sp.* S9

= 0 known from park of 13 probable (note: some cited names may be taxonomic synonyms)

A-2.8.6 *Amanita* section *Validae*

1. *Amanita excelsa sensu* Coker

2. *Amanita excelsa sensu* Jenkins
   ? [TENN (HPL)]

3 - 1. ***Amanita flavoconia*** Atk. var. ***flavoconia***
   Rough Fork [RET **FU-0027**]
   ? [TENN (HPL)]

4. *Amanita flavorubens* (B. & Mont.) Sacc. [=*Amanita flavorubescens* Atk.]
   ? [TENN (HPL)]

5. *Amanita franchetii sensu* Jenkins [=*A. aspera sensu* eastern N. American authors]

6. *Amanita rubescens sensu auct. amer.*
   ? [TENN (HPL)]

7. *Amanita rubescens* var. *alba* Coker

8. *Amanita salmonescens* Tulloss

9. *Amanita spissa sensu* ?Coker
   ? [TENN (HPL)]

10. *Amanita spissa* var. *alba* Coker *non* Rick *etc.*

11. *Amanita submaculata* Peck

12. Amanita sp. 18

13. Amanita sp. N5

= 0 known from park of 13+ probable

A-2.8.7 Additional members of the Amanitaceae reported from the Park (*Limacella*)

1 - 1. ***Limacella kauffmanii*** H. V. Smith

locality not cited [MICH?, TENN (HVS45)]

A-2.8.8 Starting List—Literature Cited

[BAS69] Bas, C. 1969. Morphology and subdivision of Amanita and a monograph of its section Lepidella. *Persoonia* 5: 285-579.

[JE77] Jenkins, D. T. 1977. A Taxonomic and Nomenclatural Study of the Genus Amanita Section Amanita for North America. *Biblioth. Micol.* 57: 1-126.

[JE81] _____. 1981. A new species of Amanita. *Mycotaxon* 13: 112-114.

[HVS45] Smith, H. V. 1945 ["1944"]. The genus *Limacella* in North America. *Pap. Michigan Acad. Sci.* 30: 125-147, pl. I.

Appendix A-3
Collecting Entolomatoid Fungi

by David L. Largent

The form for the Entolomataceae should be filled out completely only if you have the time and there only a few or no other species of fungi to be studied.

The most important features to record are marked with an exclamation point on the field note form.

When you have too many species of fungi to study, and if you find a good collection of the Entolomataceae, the following features and things to do are essential:

1. A color photograph is worth a 1000 words. Just make sure the mushroom fills up the field of view and that the surface of the pileus, the gill attachment, and the gill color are noted.
2. If there are too many fungi, note the following features:
   a. taste and odor
   b. whether the pileus is hygrophanous or not
   c. whether the pileal margin is translucent-striate (the gill shows through the pileus);
   d. color and attachment of gills
   e. color of pileus and stipe (using a color standard is best; however, common color names are essential if you have not standard available)
   f. surface of the pileus
   g. surface of the stipe
   h. some kind of information on substrate, habitat, and nearest tree associate (however, this may be too much if you have too many fungi)

Hope this helps and if you have any questions, feel free to ask.

Good Luck! Remember: This is a learning situation, and the more experience you get the better you will become at describing fungi.

ENTOLOMATOID FUNGI

Coll. No._____Name_____ Date:___/___/___ Photo: Color___BW___
Location: _____

Growth Habit!: Solitary___:___ Scattered___:___ Gregarious___:___ Connate___:___ Other___:_____
Substrate!: Lig.___ Terr.: in Moss___ Needle___ Leaf___ Grass___ Other_____
Overstory!: Ferns___ Rhodo.___ Mtn. Laurel___ Other_____
Associate!: **Hardwood**: Maple ___ Alder___ Oak___ Birch.___ Aspen___ Hick.___ Beech___ Other _____
Conifer: Pine___ Heml.___ Spru___ Fir___ Junip.__ Cedar___ Other_____
Specific name of associate_____

Measurements (use mm)

Pileus	Stipe (apx)-W	Stipe (apex)-L	Stipe (mid)-W	Stipe (mid)-L	Stipe (base)-W	Stipe (Base)-L	Lamellae Width	Lamellae Length	Trama

Pileus Shape: use second space for drawing

convex	parabolic	conic	campanulate	truncate	broadly convex	uplifted	upturned	convex-depressed
___:___	___:___	___:___	___:___	___:___	___:___	___:___	___:___	___:___

Depressed: umbil.___:___ shallow___:___ infund.___:___ **Umbonate**: Acute___:___ Broad___:___
Pileus surface!: shiny___:___ dull___:___ viscid___:___ lubricous___:___ moist___:___

	glabrous	appressed fibrill.	fibrill.	scaly	toment.	tomentulose	squamulose	squarrose	powdery	other _____
center	___:___	___:___	___:___	___:___	___:___	___:___	___:___	___:___	___:___	___:___
in between	___:___	___:___	___:___	___:___	___:___	___:___	___:___	___:___	___:___	___:___
margin	___:___	___:___	___:___	___:___	___:___	___:___	___:___	___:___	___:___	___:___

margin!: incurv.__:__ decurv.__:__ inroll.__:__ plane__:__ uplif.t__:__ str.!__:__ transluc.-str.!__:__ rimose__:__
entire!__:__ hygrophanous!__:__ Comments!_____

Lamellae: **attachment!**: adnate__:__ adnex __:__ sinuate__:__ short desc.__ :__ long desc.__:__ free__:__
spacing: crowded__:__ close__:__ subdistant__:__ distant__:__
shape: ventricose__:__ sigmoid__:__ narrow__:__ mod. broad__:__ broad__:__
margin: smooth__ :__ erodedserrate __:__ concolor__:__ marginate: light__:__ color(s)_____to_____

Stipe_Surface!: shiny_____ dull_____ viscid_____ lubricous_____ moist_____

	glabrous	appressed fibrill.	fibrill.	scaly	toment.	tomentulose	squamulose	squarrose	powdery	other _____
apex	___:___	___:___	___:___	___:___	___:___	___:___	___:___	___:___	___:___	___:___
in between	___:___	___:___	___:___	___:___	___:___	___:___	___:___	___:___	___:___	___:___
margin	___:___	___:___	___:___	___:___	___:___	___:___	___:___	___:___	___:___	___:___

shape: equal__:__ tapered upward__:__ tapered downward__:__ clavate__:__ other__:__
basal tomentum: abundant__:__ moderate__:__ scarce__:__ abundant__:__ other__:__
internal texture: solid__:__ stuffed__:__ hollow__:__ chalky__:___

Veil Remnants: absent__:__ **Partial Veil**: cortinate__:__ membr.(**annulus**)__:__ position: apex__:__ mid.__:__ base__:__
number of layers__:__ **Universal veil**: absent__:__ **volva**: membran.__:__ conc. rings__:__ intermixed__:__
other_____

	mild	bitter	acrid	farinose	“chlorine”	sweet	other	latent	immediate
taste!									
odor!									

Color and Color Changes:
Pileus!_____
Lamellae (surface!)_____**Edge!**_____
Stipe!_____
Bruising reactions and color of veils_____

Appendix A-4
Collecting the Genus *Russula*

by Steven L. Miller

Collections of *Russula spp.* require extensive annotation in order to be of value. This is especially true of small collections (less than three specimens). To emphasize this point, marking of some characters with an exclamation point (as was done on the collecting form for entolomatoid fungi) has been omitted. Since it is likely that there will be a number of new taxa in *Russula* encountered during the GSMNP ATBI, extensive note taking is very important in order to be able to describe novelties. A particularly important aspect is attention to chemical reactions.

For big collections it doesn't matter as much, but for small collections (one or two sporocarps) my approach to getting all the information needed is as follows:

1. Photographs: two are required using at least one sporocarp in good condition—1) pileus surface and 2) gills and stipe
2. Spore print: Take 25% of the cap and put it on a glass slide, cover so as to maintain humidity and reduce air movement. Obtain a thick print. With a clean razor, scrape all the spores into a small pile. Press a cover slip over the pile. Affix the cover slip to the slide with a strip of clear plastic tape. Using an adhesive risks alteration of the color of the spores if sufficient adhesive gets under the cover slip. This method has the advantage of concentrating spores and leads to a more repeatable color.
3. Chemical tests: Split the remainder of the mushroom through the cap and stipe. Describe and dry one half. Divide the second half of the stipe into 4 sections. Use FeSO4 crystals on the surface of one, phenol and other reagents on the inner tissue of the others.

In trying to save space on the note form, I decided that we could get sufficient information if notes on various characters were marked as to whether they were observed in young (Y), mature (M), or old (O) sporocarps. For example, a typical *Russula* might be convex in youth (Y), broadly convex at maturity (M), and plan or infundibuliform in age (O). Not exact, but not bad.

Spore color codes are from Romagnesi (1967).

Color descriptions should be based on Kornerup and Wanscher (1978) if possible. The color breakdowns given on the following form come from the booklet of Kibby and Fatto (1990). I guarantee there will be a number of undescribed species, and we will need top quality color information for publishing them.

The terminology used in this form is drawn from Largent (1986). For the meaning of "hyphal association," see Largent (1986: 24).

RUSSULA

Coll. No._____Name_____ Date:___/___/___ Photo: Color___BW___
Location: _____
_____

Growth Habit: Solitary___: ___ Scattered___: ___ Gregarious___ : ___ Connate___:___ Other___:_____
Substrate: Lig.___ Terr.: in Moss___ Needle___ Leaf___ Grass___ Other_____
Overstory: Ferns___ Rhodo.___ Mtn. Laurel___ Other_____
Associate: **Hardwood**: Maple ___ Alder___ Oak___ Birch.___ Aspen___ Hick.___ Beech___ Other _____
Conifer: Pine___ Heml.___ Spru___ Fir___ Junip.__ Cedar___ Other_____
Specific name of associate_____

Pileus dimensions_____ **-** _____ mm NOTE: Indicate Y, M, or O meaning "young," "mature," or "old."

Pileus Shape	convex	broadly convex	umbonate	plane	depressed	uplifted	infundibuliform
Y M O							

Margin Shape—x-section	inrolled	incurved	decurved	plane	upturned
Y M O					

Margin Shape—Surface View	entire	crenate	irregularly lobed	undulating	eroded	rimose
Y M O						

Margin Surface	not striate	obscurely striate	plicate	sulcate	tuberculate-sulcate
Y M O					

Striation length: _____ - _____ mm **Cuticle separability**: not separable___ 1/3___ 1/2___ 3/4___ all the way___
Cuticle texture once peeled: paper-like_____ gelatinous_____ plastic-like_____ other_____
Shininess: shiny___ dull___ other___ **Wetness**: dry___ moist___ tacky___ viscid___ other_____
Surface texture: smooth___ areolate (small medium large) pruinose___ rugulose___ other_____

Hyphal Association	glabrous	atomate	pruinose	velvety	scurfy	granulose	crustose	other
Y M O								

Color: Circle color name below; assign color code from color guide; describe as solid or zoned (margin, disc) or mottled or in age.
Red/ Purplish Red/ Blood/ Shade of Pink/ Salmon_____
Green/ Gray-Green/ Blue-Green/ Yellow-Green_____
Yellow/ Ochre/ Orange_____
Purple/ Violet/ Mauve/ Lilac/ Blue/ Lavender_____
Brown/ Gray/ Black/ Mixture of Colors_____

Trama Consistency	soft	hard	turgid	pliant	brittle	firm	elastic
Y M O							

Trama Thickness at Midradius: _____ - _____ mm
Pileus Trama Color: _____ **Color Change**:_____
Odor: not distinctive___ fruity___ geraniums___ shellfish___ honey___ other_____

Taste	mild	bitter	disagreeable	slightly acrid	slowly acrid	strongly acrid	quickly acrid
Y M O							

Lamellae: **Attachment**: free___ adnate___ adnexed___ adnate___ sinuate___ subdecurrent___
Density: crowded___ close___ subdistant___ distant___ **Lamellulae**: present___ absent___
Forking: not forked___ at stipe___ elsewhere_____ dichotomous___ anastomosing___ occasional___
Breadth at Midradius: _____ - _____mm **Shape in Profile**:_____
Margin of Lamella: entire_____ eroded_____

Lamellae Color	white	cream	pale yellow	ochraceous	other (give color details)
Y M O					

Lamellae Spotting or Staining: _____ **Color**:_____
Spore Print Color (circle): Ia Ib IIa IIc IId IIIa IIIc IVa IVc IVe
Stipe Dimensions: ____ - ____ mm tall; ____ - ____ mm wide at midpoint **Attachment**: central___ lateral___ eccentric___
Stipe Shape in X-section: terete ____ compressed____ other_____
Stipe Shape (Longitud. View): equal___ tapered to apex___ tapered to base___ subclavate___ clavate___ other_____
Stipe Topology: even___ fluted___ sulcate at base___ other_____
Surface Texture: smooth___ longitudinally rugulose (shallow medium deep) other_____
Stipe Color: unicolor_____ flushed with_____
Stipe Trama Texture: (**Y**/**M**/**O**) solid_____ hollow_____ stuffed_____
Stipe Trama Color: _____ **Color Change**:_____

Chemical Reactions (Stipe Trama)	$FeSO_4$ Crystal	2% Phenol	Formalin	Sulfo-Vanillan	Guaiac

Appendix A-5
The U. S. Department of the Interior
Catalog Work Sheet

The following three pages provide

1. Catalog Work Sheets Requirements document
2. A filled in sample of a Catalog Work Sheet
3. A blank copy of a Catalog Work Sheet.

The latter is available as a computerized form in Adobe® FrameMaker® formats from the author upon request (ret@njcc.com).

Appendix A-5.1Collection Condition Codes

The entry in the field labeled "CONDITION" is composed of two parts separated by a slash; e.g., COM/Gd. The two components are drawn from the two sets defined as follows:

Completeness Code		**Condition Status Code**	
COM	complete specimen	Ex	Excellent
IN	over 50% of specimen	Gd	Good
FRAG	less than 50% of specimen	Fr	Fr
		Pr	Poor

Appendix A-5.2Fields not Relevant to the Fungus ATBI

Some fields are relevant only to geological specimens or to collections made under water. These fields are colored pale gray on the Fungus ATBI version of the Catalog Work Sheet.

Appendix A-5.3Collection Numbers

In the case of the Fungus ATBI, we will use our collection card numbering scheme as the source for the "COLLECTION NO." field.

Individual collectors' numbers (if there are any) can be entered in the "REMARKS" field at the bottom of the form.

Appendix A-5.4The "TYPE" field

The "TYPE" field will only be marked (with an "X") if the collection being reported is designated as the holotype of a new taxon.

Appendix A-5.5Fields Reserved for Park Service Use

It is only necessary to fill in those fields for which the names are given in bold face type. The remaining fields either have a constant value or are to be completed by a Park Service official.

CATALOG WORK SHEET REQUIREMENTS

Federal Code of Regulations, Title 36, Section 2.5 (g) (1):

"Specimens placed in displays or collections will bear official National Park Service museum labels and their catalog numbers will be registered in the National Park Service National Catalog...."

In order to comply with the above regulation, it is necessary for the collector (Resource Activity Permittee) to complete a Catalog Work Sheet, Form l0-254D. A copy at this form is enclosed for your use; it may be reproduced if more than one copy is needed. Please complete the unchecked blocks (see sample) and return the form to the Resource Management and Science Division (RMS) at the address listed below. A convenient time for submission of the Catalog Work Sheet might be when Part II of the Resource Activity Permit (annual report) is submitted. However, it is understood that submission may depend on identification of the specimen, which would naturally delay completion of the work sheet.

Upon receipt of the Catalog Work Sheet, the Park Museum curator will complete a National Park Service museum label and return the label and appropriate instructions for attachment to the specimen. The specimens remain the property of the National Park Service, but may be on long-term loan to collecting repositories. Collections must be maintained in proper condition. You will be required periodically to inventory and verify the existence and condition of National Park Service specimens in your possession. Information on the proper care of collections may be obtained from the Park Museum Curator at Great Smoky Mountains National Park, Gatlinburg, TN 37738.

SEND COMPLETED CATALOG WORK SHEET TO:

Supervisory Natural Resource Specialist
Great Smoky Mountains National Park
107 Park Headquarters Road
Gatlinburg, TN 37738

CATALOG WORK SHEET

U. S. DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

MUSEUM CATALOG RECORD-NR

CLASSIFICATION	OBJECT LOCATION		CONTROLLED PROPERTY
	OBJECT STATUS AND YEAR	PARK ACRONYM / CATALOG NUMBER NUMBER	
	ACQUISITION TYPE	ACQUISITION DATE	ACCESSION NUMBER

OBJECT/SPECIMEN NAME	LOT QUANTIFICATION ITEM COUNT	STORAGE UNIT
Amanita bisporigera Atk. (Destroying Angel)		

DESCRIPTION

Ten dried specimens in packet with notes.

S A M P L E

COLLECTION SITE	PARK	TOWNSHIP/RANGE/SECTION	COUNTY	STATE
Mt. Mingus above Indian Gap	GRSM	CD Quad	Sevier	TN

WATERBODY/DRAINAGE	UTM/N	UTM/E	LAT.	LONG.	ELEV.	DEPTH
West prong Little Pigeon River	not recorded		not recorded		5400’	

HABITAT/DEPOSITIONAL ENVIRONMENT	FORMATION/PERIOD	DIMENSION/WEIGHT
Spruce-Fir forest, S slope		see notes

COLLECTOR	COLLECTION NO.	COLLECTION DATE	MAINTENANCE CYCLE	CONDITION
Bach, J. S.	FU-0078	30.v.99		COM/Ex

IDENTIFIED BY AND DATE	TYPE	VALUE AT ACQUISITION BASIS	CURRENT VALUE DATE BASIS	PHOTO NUMBER
Tulloss, R. E. - 30.v.99				

CATALOGER AND DATE	EMINENT FIGURE ASSOCIATION	OTHER NUMBERS

RESTRICTION	REPRODUCTION	PUBLICATION CITATION	PRESERVATION TREATMENT	CATALOG FOLDER	SIGNIFICANCE	

REMARKS (USE SPACE FOR INFORMATION TO BE ADDED TO CATALOG FOLDER)

This is a particularly large collection. It is a macrochemical test voucher. Photo-graphs were taken of the fresh basidiocarps as well as of the reactions to the chemical tests.

CATALOG WORK SHEET

U. S. DEPARTMENT OF THE INTERIOR

NATIONAL PARK SERVICE

MUSEUM CATALOG RECORD-NR

CLASSIFICATION	OBJECT LOCATION		CONTROLLED PROPERTY
	OBJECT STATUS AND YEAR	PARK ACRONYM CATALOG NUMBER	NUMBER
	ACQUISITION TYPE	ACQUISITION DATE	ACCESSION NUMBER

OBJECT/SPECIMEN NAME	LOT QUANTIFICATION ITEM COUNT	STORAGE UNIT
DESCRIPTION		

COLLECTION SITE	PARK	TOWNSHIP/RANGE/SECTION	COUNTY	STATE
	GRSM			

WATERBODY/DRAINAGE	UTM/N	UTM/E	LAT.	LONG.	ELEV.	DEPTH

HABITAT/DEPOSITIONAL ENVIRONMENT	FORMATION/PERIOD	DIMENSION/WEIGHT

COLLECTOR	COLLECTION NO.	COLLECTION DATE	MAINTENANCE CYCLE	CONDITION

IDENTIFIED BY AND DATE	TYPE	VALUE AT ACQUISITION BASIS	CURRENT VALUE DATE BASIS	PHOTO NUMBER

CATALOGER AND DATE	EMINENT FIGURE ASSOCIATION	OTHER NUMBERS

RESTRICTION	REPRODUCTION	PUBLICATION CITATION	PRESERVATION TREATMENT	CATALOG FOLDER	SIGNIFICANCE	

REMARKS (USE SPACE FOR INFORMATION TO BE ADDED TO CATALOG FOLDER)