



United States
Department Of
Agriculture

Forest Service

Pacific Northwest
Research Station

General Technical
Report
PNW-GTR-572
January 2003



Handbook to Additional Fungal Species of Special Concern in the Northwest Forest Plan

Michael A. Castellano, Efrén Cázares, Bryan Fondrick,
and Tina Dreisbach



Authors

Michael A. Castellano is a research forester, **Bryan Fondrick** is a biological technician, and **Tina Dreisbach** is the regional mycologist, U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Forestry Sciences Laboratory, 3200 SW Jefferson Way, Corvallis, OR 97331; and **Efrén Cázares** is a senior research assistant professor, Department of Forest Science, Oregon State University, Richardson Hall 321, Corvallis, OR 97331.

Cover

The mushroom genus *Gomphus* is represented by four species in the Pacific Northwest. *Gomphus* is placed in the family Gomphaceae and is typified by often gregarious to caespitose habit, gross scales on the cap surface, and wrinkled hymenium. *Gomphus bonarii* (Morse) Singer, a strategy 3 fungus species from table C-3 in the record of decision, is presented on the cover. Locally abundant and widespread throughout northern California, Oregon, and Washington. Photo courtesy of D. Arora.

Handbook to Additional Fungal Species of Special Concern in the Northwest Forest Plan

Michael A. Castellano, Efrén Cázares, Bryan Fondrick, and Tina Dreisbach

U.S. Department of Agriculture,
Forest Service
Pacific Northwest Research Station
Portland, OR
General Technical Report PNW-GTR-572
January 2003

Abstract

Castellano, Michael A.; Cázares, Efrén; Fondrick, Bryan; Dreisbach, Tina. 2003. Handbook to additional fungal species of special concern in the Northwest Forest Plan. Gen. Tech. Rep. PNW-GTR-572. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 144 p.

This handbook is a companion to the *Handbook to Strategy 1 Fungal Species in the Northwest Forest Plan*, Gen. Tech. Rep. PNW-GTR-476, published in October 1999. It includes 73 record-of-decision (ROD)-listed fungal species not contained in the first handbook, as well as updated site, field, and collecting forms; an expanded set of artificial keys to all fungal species from both handbooks; and an updated, partially illustrated glossary. The main purpose of this handbook is to help facilitate the survey, collection, and handling of potential ROD-listed fungal species by USDA Forest Service and USDI Bureau of Land Management employees. Each species is represented by a condensed description, a set of distinguishing features, and information on substrate, habitat, and seasonality. We also present a list of known sites within the range of the northern spotted owl, a distribution map, and additional references to introduce the available literature on a particular species.

Keywords: Mycology, mushrooms, sequestrate fungi, truffles, biodiversity, monitoring, rare fungi, forest ecology.

Contents

I - 1	Introduction
M - 8	Methodology
K -13	Keys to Taxa
S3 - 34	Species Information
A - 106	Acknowledgments
R - 107	English Equivalent s
R - 107	Literature Cited
H1 - 108	Appendix 1
H2 - 109	Appendix 2
H3 - 136	Glossary

Introduction

Purpose of This Handbook

This handbook is a companion to the *Handbook to Strategy 1 Fungal Species in the Northwest Forest Plan* PNW-GTR-476 published in October 1999. It includes 73 record-of-decision (ROD)-listed fungal species not contained in the first handbook, as well as updated site, field, and collecting forms; an expanded set of artificial keys to all fungal species from both handbooks; and an updated partially illustrated glossary. The main purpose of this handbook is to help facilitate the survey, collection, and handling of potential ROD-listed fungal species by USDA Forest Service and USDI Bureau of Land Management employees.

Important Revisions of the ROD That Pertain to Fungi

In January 2001, amendments to the “survey and manage,” protection buffer, and other mitigation measures, standards, and guidelines were published in which ROD species were placed in categories (A, B, C, D, E, and F) rather than in the original strategies. Table 1 lists the fungal species, their original ROD strategies, and their new categories. Following is a brief explanation of the categories, excerpted from the above-mentioned document:

Category A. Rare, predisturbance surveys practical

Species are included in category A when (1) there is a high concern for persistence, (2) the species occurs rarely or is sparsely distributed within the range of the Northwest Forest Plan, (3) all known sites or populations are likely to be necessary to provide reasonable assurance of persistence, and (4) predisturbance surveys are practical. Only one fungus species, *Bridgeoporus nobilissimus*, is placed in category A.

Category B. Rare, predisturbance surveys not practical

Species are included in category B when (1) there is a high concern for persistence, (2) the species occurs rarely or is sparsely distributed within the range of the Northwest Forest Plan, (3) all known sites or populations are likely to be necessary to provide reasonable assurance of persistence, and (4) predisturbance surveys are not practical. The majority of fungi are placed in category B.

Category C. Uncommon, predisturbance surveys practical

Species are included in category C when (1) there is not a high concern for persistence, (2) it is likely that not all known sites or populations throughout the species' range in the Northwest Forest Plan area are necessary for reasonable assurance of persistence, (3) the species is uncommon, as opposed to rare, and (4) predisturbance surveys are practical. No fungal species are placed in category C.

Category D. Uncommon, predisturbance surveys not practical or not necessary

Species are included in category D when (1) there is not a high concern for persistence, (2) it is likely that not all known sites or populations throughout the species' range in the Northwest Forest Plan area are necessary for reasonable assurance of persistence, (3) the species is uncommon, as opposed to rare, and (4) predisturbance surveys are not practical or necessary. Surveys of habitat across the landscape are likely to be more effective at finding sites needed for long-term persistence than focusing in areas proposed for projects. Ten species of fungi are placed in category D.

Category E. Rare, status undetermined

Species are included in category E when (1) the number of known sites indicates the species is rare, and (2) information is insufficient to determine whether survey and manage basic criteria are met, or to determine what management is needed for a reasonable assurance of the species' persistence. Three fungal species are placed in category E.

Category F. Uncommon or concern for persistence unknown, status undetermined

Species are included in category F when (1) the total number of known sites indicates the species is uncommon rather than rare, and (2) information is insufficient to determine whether survey and manage basic criteria are met, or to determine what management is needed for a reasonable assurance of the species' persistence. Six fungal species are placed in category F.

Keys and Glossary

A revised key to all ROD fungal species is included in this handbook. The numbers in parentheses after species' names in the key designate the page number of each species' description; underlined numbers indicate that the species' description is included in the first handbook, and nonunderlined numbers refer to the page of our current handbook of the species' description. An updated glossary, including terminology used in describing the taxonomic features of fungi, is included.

Collection Sheets

Updated collection sheets are included in appendix 2. Use the site and collection forms provided when submitting fungal collections to the survey and manage team.

Table 1—Fungal species included in survey and manage standards and guidelines (January 2001)

ROD species name	Preferred name	Original strategy	New category	Handbook volume
<i>Albatrellus avellaneus</i>	<i>Albatrellus avellaneus</i>	1,3	B	1
<i>Albatrellus caeruleoporus</i>	<i>Albatrellus caeruleoporus</i>	1,3	B	1
<i>Albatrellus ellisii</i>	<i>Albatrellus ellisii</i>	3	B	2
<i>Albatrellus flettii</i>	<i>Albatrellus flettii</i>	3	B	2
<i>Aleuria rhenana</i>	<i>Sowerbyella rhenana</i>	1,3	B	1
<i>Aleurodiscus farlowii</i>	<i>Acanthophysium farlowii</i>	1,3	B	1
<i>Alpova alexsmithii</i>	<i>Alpova alexsmithii</i>	1,3	B	1
<i>Alpova olivaceotinctus</i>	<i>Alpova olivaceotinctus</i>	1,3	B	1
<i>Alpova</i> sp. nov. #Trappe 1966	<i>Fevansia aurantiaca</i>	1,3	B	1
<i>Alpova</i> sp. nov. #Trappe 9730	<i>Rhizopogon ellipsosporus</i>	1,3	B	1
<i>Arcangeliella crassa</i>	<i>Arcangeliella crassa</i>	1,3	B	1
<i>Arcangeliella lactarioides</i>	<i>Arcangeliella lactarioides</i>	1,3	B	1
<i>Arcangeliella</i> sp. nov. #Trappe 12359 & 12382	<i>Arcangeliella camphorata</i>	1,3	B	1
<i>Asterophora lycoperdoides</i>	<i>Asterophora lycoperdoides</i>	3	B	2
<i>Asterophora parasitica</i>	<i>Asterophora parasitica</i>	3	B	2
<i>Baeospora myriadohylla</i>	<i>Baeospora myriadohylla</i>	3	B	2
<i>Balsamia nigrens</i>	<i>Balsamia nigrens</i>	1,3	B	1
<i>Boletus haematinus</i>	<i>Boletus haematinus</i>	1,3	B	1
<i>Boletus piperatus</i>	<i>Chalciporus piperatus</i>	3	D	2
<i>Boletus pulcherrimus</i>	<i>Boletus pulcherrimus</i>	1,3	B	1

Table 1—Fungal species included in survey and manage standards and guidelines (January 2001) (continued)

ROD species name	Preferred name	Original strategy	New category	Handbook volume
<i>Bondarzewia montana</i>	<i>Bondarzewia mesenterica</i>	1,2,3	B	1
<i>Bryoglossum gracile</i>	<i>Bryoglossum gracile</i> ¹	1,3	B	1
<i>Cantharellus cibarius</i>	<i>Cantharellus formosus</i> gp. ¹	1,3	B	1
<i>Cantharellus subalbidus</i>	<i>Cantharellus subalbidus</i>	3,4	D	2
<i>Cantharellus tubaeformis</i>	<i>Craterellus tubaeformis</i>	3,4	D	2
<i>Catathelasma ventricosa</i>	<i>Catathelasma ventricosa</i>	3	B	2
<i>Chamonixia pacifica</i> sp. nov. #Trappe 12768	<i>Chamonixia caespitosa</i>	1,3	B	1
<i>Choiromyces alveolatus</i>	<i>Choiromyces alveolatus</i>	1,3	B	1
<i>Choiromyces venosus</i>	<i>Choiromyces venosus</i>	1,3	B	1
<i>Chroogomphus loculatus</i>	<i>Chroogomphus loculatus</i>	1,3	B	1
<i>Chrysomphalina grossula</i>	<i>Chrysomphalina grossula</i>	3	B	2
<i>Clavariadelphus ligula</i>	<i>Clavariadelphus ligula</i>	3,4	B	2
<i>Clavariadelphus pistillaris</i>	<i>Clavariadelphus occidentalis</i>	3,4	B	2
<i>Clavariadelphus sachalinensis</i>	<i>Clavariadelphus sachalinensis</i>	3,4	B	2
<i>Clavariadelphus subfastigiatus</i>	<i>Clavariadelphus subfastigiatus</i>	3,4	B	2
<i>Clavariadelphus truncatus</i>	<i>Clavariadelphus truncatus</i>	3,4	B	2
<i>Clavulina ornatipes</i>	<i>Clavulina castaneopes</i> v. <i>lignicola</i>	3,4	B	2
<i>Clitocybe senilis</i>	<i>Clitocybe senilis</i>	1,3	B	1
<i>Clitocybe subditopoda</i>	<i>Clitocybe subditopoda</i>	1,3	B	1
<i>Collybia bakerensis</i>	<i>Collybia bakerensis</i>	1,3	B	1
<i>Collybia racemosa</i>	<i>Collybia racemosa</i>	3	B	2
<i>Cordyceps capitata</i>	<i>Cordyceps capitata</i>	3	B	2
<i>Cordyceps ophioglossoides</i>	<i>Cordyceps ophioglossoides</i>	3	B	2
<i>Cortinarius azureus</i>	<i>Cortinarius barlowensis</i>	3	B	2
<i>Cortinarius boulderensis</i>	<i>Cortinarius boulderensis</i>	1,3	B	1
<i>Cortinarius canabarda</i>	<i>Cortinarius umidicola</i>	1,3	B	1
<i>Cortinarius cyanites</i>	<i>Cortinarius cyanites</i>	3	B	2
<i>Cortinarius magnivelatus</i>	<i>Cortinarius magnivelatus</i>	1,3	B	1
<i>Cortinarius olympianus</i>	<i>Cortinarius olympianus</i>	1,3	B	1
<i>Cortinarius speciosissimus</i>	<i>Cortinarius rainierensis</i>	1,3	B	1
<i>Cortinarius spilomius</i>	<i>Cortinarius depauperatus</i>	3	B	2
<i>Cortinarius tabularis</i>	<i>Cortinarius tabularis</i> ²	3	B	2
<i>Cortinarius valgus</i>	<i>Cortinarius valgus</i>	3	B	2
<i>Cortinarius variipes</i>	<i>Cortinarius variipes</i>	1,3	B	1
<i>Cortinarius verrucisporus</i>	<i>Cortinarius verrucisporus</i>	1,3	B	1
<i>Cortinarius wiebeae</i>	<i>Cortinarius wiebeae</i>	1,3	B	1
<i>Cudonia monticola</i>	<i>Cudonia monticola</i>	3	B	2
<i>Cyphellostereum laeve</i>	<i>Cyphellostereum laeve</i>	3	E	2
<i>Dermocybe humboldtensis</i>	<i>Dermocybe humboldtensis</i>	1,3	B	1
<i>Destuntzia fusca</i>	<i>Destuntzia fusca</i>	1,3	B	1
<i>Destuntzia rubra</i>	<i>Destuntzia rubra</i>	1,3	B	1
<i>Dichostereum granulosum</i>	<i>Dichostereum boreale</i>	1,3	B	1
<i>Elaphomyces anthracinus</i>	<i>Elaphomyces anthracinus</i>	1,3	B	1
<i>Elaphomyces</i> sp. nov. #Trappe 1038	<i>Cystangium maculatam</i> ¹	1,3	N/A	1
<i>Elaphomyces subviscidus</i>	<i>Elaphomyces subviscidus</i>	1,3	B	1
<i>Endogone acrogena</i>	<i>Endogone acrogena</i>	1,3	B	1
<i>Endogone oregonensis</i>	<i>Endogone oregonensis</i>	1,3	B	1
<i>Fayodia gracilipes</i>	<i>Fayodia bisphaerigera</i>	3	B	2
<i>Galerina atkinsoniana</i>	<i>Galerina atkinsoniana</i>	3	E	2

Table 1—Fungal species included in survey and manage standards and guidelines (January 2001) (continued)

ROD species name	Preferred name	Original strategy	New category	Handbook volume
<i>Galerina cerina</i>	<i>Galerina cerina</i>	3	E	2
<i>Galerina heterocystis</i>	<i>Galerina heterocystis</i>	3	E	2
<i>Galerina sphagnicola</i>	<i>Galerina sphagnicola</i>	3	E	2
<i>Galerina vittiformis</i>	<i>Galerina vittaeformis</i>	3	E	2
<i>Gastroboletus imbellus</i>	<i>Gastroboletus imbellus</i>	1,3	B	1
<i>Gastroboletus ruber</i>	<i>Gastroboletus ruber</i>	1,3	B	1
<i>Gastroboletus</i> sp. nov. #Trappe 2897, 7515	<i>Gastroboletus vividus</i>	1,3	B	1
<i>Gastroboletus subalpinus</i>	<i>Gastroboletus subalpinus</i>	1,3	B	1
<i>Gastroboletus turbinatus</i>	<i>Gastroboletus turbinatus</i>	3	B	2
<i>Gastrosuillus</i> sp. nov. #Trappe 9608	<i>Gastrosuillus amaranthii</i>	1,3	F	1
<i>Gastrosuillus</i> sp. nov. #Trappe 7516	<i>Gastrosuillus umbrinus</i>	1,3	B	1
<i>Gautieria magnicellaris</i>	<i>Gautieria magnicellaris</i>	1,3	B	1
<i>Gautieria otthii</i>	<i>Gautieria otthii</i>	1,3	B	1
<i>Gelatinodiscus flavidus</i>	<i>Gelatinodiscus flavidus</i>	1,3	B	1
<i>Glomus radiatum</i>	<i>Glomus radiatum</i>	1,3	B	1
<i>Gomphus bonarii</i>	<i>Gomphus bonarii</i>	3	B	2
<i>Gomphus clavatus</i>	<i>Gomphus clavatus</i>	3	F	2
<i>Gomphus floccosus</i>	<i>Gomphus floccosus</i> ³	3	D	2
<i>Gomphus kauffmanii</i>	<i>Gomphus kauffmanii</i>	3	B	2
<i>Gymnomyces</i> sp. nov. #Trappe 1690,1706,1710, 4703, 5052, 5576, 7545; <i>Martellia</i> sp. nov. #Trappe 311, 1700, 5903	<i>Gymnomyces abietis</i>	1,3	B	1
<i>Gymnopilus punctifolius</i>	<i>Gymnopilus punctifolius</i>	1,3	B	1
<i>Gyromitra californica</i>	<i>Gyromitra californica</i>	3,4	E	2
<i>Gyromitra esculenta</i>	<i>Gyromitra esculenta</i>	3,4	F	2
<i>Gyromitra infula</i>	<i>Gyromitra infula</i>	3,4	E	2
<i>Gyromitra melaleucooides</i>	<i>Gyromitra melaleucooides</i>	3,4	E	2
<i>Gyromitra montana</i> (syn. <i>G. gigas</i>)	<i>Gyromitra montana</i>	3,4	F	2
<i>Hebeloma olympianum</i>	<i>Hebeloma olympianum</i>	1,3	B	1
<i>Helvella compressa</i>	<i>Helvella compressa</i> ¹	1,3	N/A	1
<i>Helvella crassitunicata</i>	<i>Helvella crassitunicata</i>	1,3	B	1
<i>Helvella elastica</i>	<i>Helvella elastica</i>	1,3	B	1
<i>Helvella maculata</i>	<i>Helvella maculata</i>	1,3	B	1
<i>Hydnotrya</i> sp. nov. #Trappe 787,792	<i>Hydnotrya inordinata</i>	1,3	B	1
<i>Hydnotrya subnix</i> sp. nov. #Trappe 1861	<i>Hydnotrya subnix</i>	1,3	B	1
<i>Hydnum repandum</i>	<i>Hydnum repandum</i> ¹	N/A	N/A	N/A
<i>Hydnum umbilicatum</i>	<i>Hydnum umbilicatum</i>	3	B	2
<i>Hygrophorus caeruleus</i>	<i>Hygrophorus caeruleus</i>	1,3	B	1
<i>Hygrophorus karstenii</i>	<i>Hygrophorus saxatilis</i>	3	B	2
<i>Hygrophorus vernalis</i>	<i>Hygrophorus vernalis</i>	1,3	B	1
<i>Hypomyces luteovirens</i>	<i>Hypomyces luteovirens</i>	3	B	2
<i>Leucogaster citrinus</i>	<i>Leucogaster citrinus</i>	1,3	B	1
<i>Leucogaster microsporus</i>	<i>Leucogaster microsporus</i>	1,3	B	1

Table 1—Fungal species included in survey and manage standards and guidelines (January 2001) (continued)

ROD species name	Preferred name	Original strategy	New category	Handbook volume
<i>Macowanites chlorinosmus</i>	<i>Macowanites chlorinosmus</i>	1,3	B	1
<i>Macowanites lymanensis</i>	<i>Cystangium lymanensis</i>	1,3	B	1
<i>Macowanites mollis</i>	<i>Macowanites mollis</i>	1,3	B	1
<i>Marasmius applanatipes</i>	<i>Marasmius applanatipes</i>	1,3	B	1
<i>Martellia fragrans</i>	<i>Martellia fragrans</i>	1,3	B	1
<i>Martellia idahoensis</i>	<i>Martellia idahoensis</i>	1,3	B	1
<i>Martellia monticola</i>	<i>Gymnomyces monticola</i> ¹	3	N/A	N/A
<i>Martellia</i> sp. nov. #Trappe 649	<i>Gymnomyces nondistincta</i>	1,3	B	1
<i>Mycena hudsoniana</i>	<i>Mycena hudsoniana</i>	1,3	B	1
<i>Mycena lilacifolia</i>	<i>Chromosera cyanophylla</i>	3	B	2
<i>Mycena marginella</i>	<i>Hydropus marginellus</i>	3	B	2
<i>Mycena monticola</i>	<i>Mycena monticola</i>	1,3	B	1
<i>Mycena overholtsii</i>	<i>Mycena overholtsii</i>	1,3	B	1
<i>Mycena quinaultensis</i>	<i>Mycena quinaultensis</i>	1,3	B	1
<i>Mycena tenax</i>	<i>Mycena tenax</i>	3	B	2
<i>Mythicomyces corneipes</i>	<i>Mythicomyces corneipes</i>	3	B	2
<i>Neolentinus adherens</i>	<i>Neolentinus adhaerens</i>	1,3	B	1
<i>Neolentinus kauffmanii</i>	<i>Neolentinus kauffmanii</i>	1,3	B	1
<i>Neournula pouchetii</i>	<i>Neournula pouchetii</i>	1,3	B	1
<i>Nivatogastrium nubigenum</i>	<i>Nivatogastrium nubigenum</i>	1,3	B	1
<i>Octavianina macrospora</i>	<i>Octavianina macrospora</i>	1,3	B	1
<i>Octavianina papyracea</i>	<i>Octavianina papyracea</i>	1,3	B	1
<i>Octavianina</i> sp. nov. #Trappe 7502	<i>Octavianina cyanescens</i>	1,3	B	1
<i>Otidea leporina</i>	<i>Otidea leporina</i>	3	B	1
<i>Otidea onotica</i>	<i>Otidea onotica</i>	3	F	1
<i>Otidea smithii</i>	<i>Otidea smithii</i>	1,3	B	1
<i>Oxyporus nobilissimus</i>	<i>Bridgeoporus nobilissimus</i>	1,2,3	A	1
<i>Phaeocollybia attenuata</i>	<i>Phaeocollybia attenuata</i>	3	D	2
<i>Phaeocollybia californica</i>	<i>Phaeocollybia californica</i>	1,3	B	1
<i>Phaeocollybia carmanahensis</i>	<i>Phaeocollybia oregonensis</i> ¹	1,3	N/A	N/A
<i>Phaeocollybia dissiliens</i>	<i>Phaeocollybia dissiliens</i>	1,3	B	1
<i>Phaeocollybia fallax</i>	<i>Phaeocollybia fallax</i>	3	D	2
<i>Phaeocollybia gregaria</i>	<i>Phaeocollybia gregaria</i>	1,3	B	1
<i>Phaeocollybia kauffmanii</i>	<i>Phaeocollybia kauffmanii</i>	1,3	D	1
<i>Phaeocollybia olivacea</i>	<i>Phaeocollybia olivacea</i>	3	B	2
<i>Phaeocollybia oregonensis</i>	<i>Phaeocollybia oregonensis</i>	1,3	B	1
<i>Phaeocollybia piceae</i>	<i>Phaeocollybia piceae</i>	1,3	B	1
<i>Phaeocollybia pseudofestiva</i>	<i>Phaeocollybia pseudofestiva</i>	3	B	2
<i>Phaeocollybia scatesiae</i>	<i>Phaeocollybia scatesiae</i>	1,3	B	1
<i>Phaeocollybia sipei</i>	<i>Phaeocollybia sipei</i>	1,3	B	1
<i>Phaeocollybia spadicea</i>	<i>Phaeocollybia spadicea</i>	3	B	2
<i>Phellodon atratum</i>	<i>Phellodon atratus</i>	3	B	2
<i>Phlogiotis helvelloides</i>	<i>Tremiscus helvelloides</i>	3,4	B	2
<i>Pholiota albivelata</i>	<i>Stropharia albivelata</i>	1,3	B	1
<i>Phytoconis ericetorum</i>	<i>Omphalina ericetorum</i> ¹	3,4	N/A	N/A
<i>Pithya vulgaris</i>	<i>Pithya vulgaris</i>	1,3	D	1
<i>Plectania latahensis</i>	<i>Sarcosoma latahense</i>	1,3	B	1
<i>Plectania melastoma</i>	<i>Plectania melastoma</i>	3	F	2
<i>Plectania milleri</i>	<i>Plectania milleri</i>	1,3	B	1

Table 1—Fungal species included in survey and manage standards and guidelines (January 2001) (continued)

ROD species name	Preferred name	Original strategy	New category	Handbook volume
<i>Podostroma alutaceum</i>	<i>Podostroma alutaceum</i>	3	B	2
<i>Polyozellus multiplex</i>	<i>Polyozellus multiplex</i>	1,3	B	1
<i>Pseudaleuria quinaultiana</i>	<i>Pseudaleuria quinaultiana</i>	1,3	B	1
<i>Ramaria abietina</i>	<i>Ramaria abietina</i>	3	B	2
<i>Ramaria amyloidea</i>	<i>Ramaria amyloidea</i>	1,3	B	1
<i>Ramaria araiospora</i>	<i>Ramaria araiospora</i>	1,3	B	1
<i>Ramaria aurantiisiccescens</i>	<i>Ramaria aurantiisiccescens</i>	1,3	B	1
<i>Ramaria botryis</i> var.				
<i>aurantiiramosa</i>	<i>Ramaria botryis</i> var. <i>aurantiiramosa</i>	1,3	B	1
<i>Ramaria celerivirescens</i>	<i>Ramaria celerivirescens</i>	1,3	B	1
<i>Ramaria claviramulata</i>	<i>Ramaria celerivirescens</i>	1,3	B	1
<i>Ramaria concolor</i> f. <i>marrii</i>	<i>Ramaria concolor</i> f. <i>marrii</i>	1,3	B	1
<i>Ramaria concolor</i> f. <i>tsugina</i>	<i>Ramaria concolor</i> f. <i>tsugina</i>	3	B	2
<i>Ramaria conjunctipes</i> var.				
<i>sparsiramosa</i>	<i>Ramaria fasciculata</i> var. <i>sparsiramosa</i>	1,3	B	1
<i>Ramaria coulterae</i>	<i>Ramaria coulterae</i>	3	B	2
<i>Ramaria cyaneigranosa</i>	<i>Ramaria cyaneigranosa</i>	1,3	B	1
<i>Ramaria gelatiniaurantia</i>	<i>Ramaria gelatiniaurantia</i>	1,3	B	1
<i>Ramaria gracilis</i>	<i>Ramaria gracilis</i>	1,3	B	1
<i>Ramaria hilaris</i> var. <i>olympiana</i>	<i>Ramaria hilaris</i> var. <i>olympiana</i>	1,3	B	1
<i>Ramaria largentii</i>	<i>Ramaria largentii</i>	1,3	B	1
<i>Ramaria lorithamnus</i>	<i>Ramaria lorithamnus</i>	1,3	B	1
<i>Ramaria maculatipes</i>	<i>Ramaria maculatipes</i>	1,3	B	1
<i>Ramaria rainierensis</i>	<i>Ramaria rainierensis</i>	1,3	B	1
<i>Ramaria rubella</i> var. <i>blanda</i>	<i>Ramaria rubella</i> var. <i>blanda</i>	1,3	B	1
<i>Ramaria rubribrunnescens</i>	<i>Ramaria rubribrunnescens</i>	1,3	B	1
<i>Ramaria rubrievanescens</i>	<i>Ramaria rubrievanescens</i>	1,3	B	1
<i>Ramaria rubripermanens</i>	<i>Ramaria rubripermanens</i>	1,3	B	1
<i>Ramaria spinulosa</i>	<i>Ramaria spinulosa</i> var. <i>diminutiva</i>	1,3	B	1
<i>Ramaria stuntzii</i>	<i>Ramaria stuntzii</i>	1,3	B	1
<i>Ramaria suecica</i>	<i>Ramaria suecica</i>	3	B	2
<i>Ramaria thiersii</i>	<i>Ramaria thiersii</i>	1,3	B	1
<i>Ramaria verlotensis</i>	<i>Ramaria verlotensis</i>	1,3	B	1
<i>Rhizopogon abietis</i>	<i>Rhizopogon abietis</i>	3	B	2
<i>Rhizopogon atrovioleaceus</i>	<i>Rhizopogon atrovioleaceus</i>	3	B	2
<i>Rhizopogon brunneiniger</i>	<i>Rhizopogon brunneiniger</i>	1,3	B	1
<i>Rhizopogon evadens</i> var.				
<i>subalpinus</i>	<i>Rhizopogon evadens</i> var. <i>subalpinus</i>	1,3	B	1
<i>Rhizopogon exiguus</i>	<i>Rhizopogon exiguus</i>	1,3	B	1
<i>Rhizopogon flavofibrillosus</i>	<i>Rhizopogon flavofibrillosus</i>	1,3	B	1
<i>Rhizopogon inquinatus</i>	<i>Rhizopogon inquinatus</i>	1,3	B	1
<i>Rhizopogon</i> sp. nov.				
#Trappe 9432	<i>Rhizopogon chamaleontinus</i>	1,3	B	1
<i>Rhizopogon</i> sp. nov.				
#Trappe 1692, 1698	<i>Rhizopogon parskii</i> ^l	1,3	N/A	1
<i>Rhizopogon truncatus</i>	<i>Rhizopogon truncatus</i>	3	D	2
<i>Rhodocybe nitida</i>	<i>Entoloma nitidum</i>	1,3	B	1
<i>Rhodocybe speciosa</i>	<i>Rhodocybe speciosa</i>	1,3	B	1
<i>Rickenella setipes</i>	<i>Rickenella swartzii</i>	3	B	2
<i>Russula mustelina</i>	<i>Russula mustelina</i>	3	B	2
<i>Sarcodon fuscoindicum</i>	<i>Sarcodon fuscoindicus</i>	3	B	2

Table 1—Fungal species included in survey and manage standards and guidelines (January 2001) (continued)

ROD species name	Preferred name	Original strategy	New category	Handbook volume
<i>Sarcodon imbricatum</i>	<i>Sarcodon imbricatus</i>	3	B	2
<i>Sarcosoma mexicana</i>	<i>Sarcosoma mexicana</i> ⁴	3	F	1
<i>Sarcosphaera eximia</i>	<i>Sarcosphaera coronaria</i>	3	B	2
<i>Sedecula pulvinata</i>	<i>Sedecula pulvinata</i>	1,3	B	1
<i>Sparassis crispa</i>	<i>Sparassis crispa</i>	3	D	2
<i>Spathularia flavida</i>	<i>Spathularia flavida</i>	3	B	2
<i>Stagnicola perplexa</i>	<i>Stagnicola perplexa</i>	1,3	B	2
<i>Thaxterogaster pingue</i>	<i>Thaxterogaster pingue</i> ¹	3	N/A	N/A
<i>Thaxterogaster</i> sp. nov. #Trappe 4867, 6242, 7427, 7962, 8520	<i>Thaxtoerogaster pavelekii</i>	1,3	B	1
<i>Tricholoma venenatum</i>	<i>Tricholoma venenatum</i>	1,3	B	1
<i>Tricholomopsis fulvescens</i>	<i>Tricholomopsis fulvescens</i>	1,3	B	1
<i>Tuber</i> sp. nov. #Trappe 2302	<i>Tuber asa</i>	1,3	B	1
<i>Tuber</i> sp. nov. #Trappe 12493	<i>Tuber pacificum</i>	1,3	B	1
<i>Tylopilus pseudoscaber</i>	<i>Tylopilus porphyrosporus</i>	1,3	D	1

¹ Removed from list (January 2001)² Does not occur in North America³ Removed from list in Oregon and Washington (January 2001)⁴ Removed from list in Oregon, except for Curry and Josephine Counties (January 2001)

Methodology

The methodology section from the first handbook is reproduced here to facilitate the collection and handling of fungal specimens. No new information is included.

Voucher Specimens

Collection of voucher specimens of fungi is requisite to document species' occurrence. In general, specimens should be annotated with appropriate information on species' identity, location, date, habitat, and collector, and sent to a recognized herbarium for long-term storage (see app. H2 for forms). All collections of suspected or confirmed ROD-listed fungal species should be sent for verification to the regional mycologist (3200 SW Jefferson Way, Corvallis, OR 97331). Except in the case of multiple collections of extremely common species from the same locality in a narrow timeframe, all collections should have a voucher. The one exception is *Bridgeoporus nobilissimus*, which should have only a small portion of the sporocarp cut from the specimen for vouchering. Large collections of common species do not provide additional useful information, particularly for a location where collection has occurred previously. One to five representative specimens (depending on size) of each of the common species per collecting period are adequate to document presence over time. Most, if not all, specimens of rare or uncommon species should be carefully harvested, dried, and sent to a herbarium, as these may yield additional morphological information or represent incompletely known taxa. Remember, sporocarps are like apples from a tree; if you are careful not to disturb the substrate, then minimal damage will be done to the actual organism itself.

Some fungi can be reliably identified with few or no notes; others require at least some notes for identification to species. *For the novice collector and identifier, notes are critical.* Some of the important characters to record include the surface texture, fresh colors and odors, subsequent color after exposure and handling (after 10-20 minutes and again after 2-3 hours or the next day after storage in a refrigerator), color after drying, whether the specimens exude latex from a cut surface, or the cut surface of a specimen changes color. Use the appropriate field form (app. H2) to record fresh characters. The date, specific location, and notes on the plant community, particularly the large woody plants, are important in reporting on the ecology of these fungi. Note whether the specimens were found on the soil surface (epigeous), were emergent, or were completely below the surface of the ground (hypogeous). Note whether they were found solitary, in groups of two or more, or in clusters. See the field forms (app. H2) for location and ecological data that should be recorded. Until processed, fungal specimens are best kept in cool conditions in waxed paper sandwich bags or loosely rolled up in waxed paper or aluminum foil. Never use plastic wrap or closed "air-tight" containers, because they lead to anaerobic conditions that stimulate resident bacteria and other microorganisms that can quickly degrade the condition of the sporocarp(s).

Specimens should be described and then dried as soon as possible, preferably within 1 day from collection. If specimens of some species are in prime condition when collected, and if they are handled properly and stored correctly, they can be kept for several days before drying. Once begun, deterioration proceeds rapidly, and much of a specimen's value for later study is lost.

Rapid drying by using moving air at relatively low temperatures is the most successful process to preserve most fungi. A food dryer set at about 30 to 40 °C works well. Good air circulation is critical to rapidly dry specimens. Specimens can deteriorate quickly when heat alone is used. When electricity is not available, there are alternative methods to dry specimens. If specimens are not large (<2 cm wide), they should be thinly sliced, ±2 mm in thickness, and placed in a sealed, airtight container with predried silica gel (4 to 5 times as much gel as specimens by volume). Carefully pack the specimens closely in the silica gel. Specimens should not touch each other within the container.

Airspace within the container should be kept to a minimum to ensure the effectiveness of this method. No more than one collection should be put in a container because, when dried, species often can be difficult to identify by macroscopic characters. Specimens will dry sufficiently in 1 to 2 days if the volume of silica gel is adequate for the quantity of specimens. Use the indicator crystals to tell when the gel is wet. Specimens dried by silica gel should be transferred to a more conventional dryer at the first opportunity to ensure that they dry completely. You can redry the silica gel in the field in a frying pan over a low fire. Keep well-dried specimens in sealed plastic bags to prevent rehydrating until you get them to the herbarium.

In circumstances where silica gel is unavailable or impractical because of size or number of specimens, specimens can be strung together with waxed dental floss and a large needle and suspended over a campfire. Carefully space the thin slices to allow air movement between them and adjust to the right height above the heat to prevent cooking while encouraging drying. Alternatively, lightweight frames covered with a fine-mesh aluminum screen can be used. The screens can be suspended over the campfire or a fueled camp stove (set low) or exposed to a steady but not forceful breeze. Again, care is needed when using heat to prevent cooking while encouraging drying.

Special Considerations

Mushrooms—Notes on fresh characteristics, particularly colors, are critical to aid identification. A spore print from mushrooms is also important to aid identification. Cut off the stem of a fresh specimen and place the cap with the gills or pores facing down on a piece of black and white striped paper (see app. H2) for 8-12 hours to capture a spore print on both dark and light surfaces. Wrap in aluminum foil or place in a container to prevent drying. Do not place specimens in the refrigerator or expose them to heat before setting up a portion of the collection to capture a spore print. For purposes other than obtaining a spore print, well-dried specimens are much easier to work with later than those preserved in liquid.

Sequestrate specimens—Information on colors is useful but usually not necessary for all species. When in doubt, take some notes on fresh characters. Each sporocarp should be cut at least in half to hasten drying; cut large specimens (those over 2-3 cm in diameter) into several vertical slabs of ± 5 mm thickness. Many sequestrate species have leathery, somewhat impermeable peridia (outer skins) that are slow drying. Other sequestrate species dry to the hardness of bone, and any attempt to break open the sporocarp to access spores results in disintegration of the sporocarp. A cut cross section can readily be rehydrated with water or potassium hydroxide (5 percent KOH) and sectioned with a razor blade. Many sequestrate species resemble one another on the surface but differ strikingly in the interior. Examining the interior reduces the chance of including more than one species in a single collection. Nearly all sequestrate fungi fruit below the litter, and some fruit well within the mineral soil layer.

Collecting Protocols

It is difficult to recommend a specific protocol to collect fungi. Each protocol has strengths and weaknesses, and the appropriateness of any one protocol is determined by the constraints of the project.

Most forests contain diverse microhabitats. Even in “uniform” plantations, the microtopography varies with localized wet and dry soil conditions. Distribution of woody debris is also variable, and the debris can be patchy, buried, or exposed. Some fungi are associated with or found in rotten wood, e.g., some *Ramaria* spp., *Gymnopilus punctifolius*, *Radiigera* spp., and *Hydnotrya variiformis*. The patchiness of ground cover and shrub and herb layers also can dramatically affect the microclimate in restricted areas. Sites with heavy ground cover will be more difficult to search for specimens because of obstruction of view and difficulty in laying out plots. Slope and aspect will have an important effect on water relations and temperature. In the Pacific Northwest, south-facing, steep slopes tend to be the driest, and north-facing, gentle slopes the wettest. All these variables must be accounted for when designing sampling procedures for each sampling objective.

Fungal sporocarp production is relatively clustered (Fogel 1981, States and Gaud 1997). Fungi also differ in their sporocarp abundance and size. A major difficulty with using sporocarps to determine presence is the lack of data on the correlation between the presence of the thallus and sporocarp production. Some species produce sporocarps irregularly or infrequently.

Use of a relatively small number (with respect to the selected stand area) of random quadrants may not effectively sample the selected area. A large number of randomly distributed plots is necessary but impractical to achieve a well-dispersed sample pattern. Alternatively, systematic placement of fewer plots will achieve the best coverage for unit area sampled.

Sampling Protocols

Methodology used in vegetation surveys is not completely adequate for use in fungal surveys because of the need for repeated sampling of often cryptic populations.

Protocol implementation should be supervised by personnel trained in its use and in fungal identification. Before sampling, personnel should familiarize themselves with the general biology, ecology, habitat associations, and specific morphological features of target species. This will aid identification in the field and use field search time most efficiently.

Fungi can fruit any time of the year depending on weather and substrate. Some species fruit in the middle of the drought season in or on buried rotten wood or near streams or standing water. For the most part, fungi should be sampled in the warm, rainy season, e.g., in lowland areas, mid-October through December and April through June. Some fungi are restricted in sporocarp formation to a particular season (see seasonality data in species descriptions). Freezing weather truncates or delays the maturation of sporocarps, and high temperatures may accelerate drying of substrate and specimen, thus curtailing fruiting. When sampling across an elevational gradient, one should visit low-elevation, south-facing slopes first in the spring but last in the autumn and high-elevation, north-facing slopes last in the spring and first in the autumn (Luoma 1988).

Periodicity

Each area surveyed should be visited every 2 to 3 weeks during the fruiting season(s). Surveys should be conducted for a minimum of 3, and preferably 5, years to increase the likelihood of detection (Arnolds 1981, Fogel 1981, Lange 1978, Luoma 1991, Luoma and others 1991, O'Dell and others 1992, Richardson 1970). Three to 4 days of lab work should be anticipated for each successful day of field work.

In general, fungi form sporocarps during a restricted portion of the year, some only in the spring, some in winter, still others in the autumn. The cryptic nature of sequestrate fungus sporocarps makes them more difficult to detect than epigeous sporocarps.

Survey Methods

The three survey methods of choice are line transects, randomized plots, or plotless transects. All can be implemented as permanent or temporary (moving) plots. Once a clear objective is identified and a full understanding of the resources available for sampling assessed, the best method can be selected to meet objectives with the available resources.

Line transects—This method has plots located along a line, which may or may not be straight. These plots should be widely dispersed in a stand and intercept a wider variety of microsites than a single circular plot of the same area (Luoma and others 1996). This method is particularly useful when the exact habitat requirements of the target species are unknown. One method uses twenty-five 4-m² plots that comprise the

sample. On slopes, the upper, mid, and lower slope strata contain transects of eight, nine, and eight plots, respectively. Plots may be placed every 6 m along the 50 m (Luoma and others 1996). A “collection” is defined as those sporocarps of the same species from a particular 4-m² plot. A total area of 100 m² per 5- to 15-ha stand in twenty-five 4-m² circular plots gives a reasonable sample for a particularly small stand. Plots are marked with a flag or stake to avoid resampling the same area in a future sampling period. Another approach is to space plots 25 m apart on transects in the horizontal direction (along contour) and space transects 75 to 150 m apart in the vertical direction (across contour). A statistician should be consulted before sampling. Of course, any time the target species is encountered outside the plots, it should be collected and recorded.

Randomized plots—Although statistically sound, this method is logistically difficult to implement owing to the inordinate amount of resources needed.

Plotless transects (time-constrained search)—Before conducting the search, plan the search route to give an extensive reconnaissance-level approach to the entire area of interest. The most likely habitats should be identified and located on the landscape. Likely habitat should be intensively searched, but other less likely habitat should not be ignored. Use moving rules to designate how much time will be spent in each designated area within the overall interest area.

Time of search applies only to time spent actively searching for sporocarps. When moving to a new site or collecting specimens that were found, the collector stops the timer. The time needed is unknown for any particular stand and will depend on size of the stand, accessibility, objectives, and available resources. Because of the uncertainty of fruiting, the site must be repeatedly sampled in any one year and over 3 to 5 years to be considered adequately assessed.

Special Considerations for Sequestrate Species

In season, a good indicator of sequestrate fungus fruiting is the presence of fresh, small animal digs, 5 to 8 cm in diameter. Small animals, such as squirrels, mice, and voles, commonly unearth sequestrate fungi one at a time as they mature, leaving a small pit 2 to 8 cm deep. These small animal digs can sometimes be hard to distinguish from other types of holes such as diggings for seeds or insects or from hoof prints. Sometimes only a portion of the specimen has been eaten and a portion remains at the bottom of the small pit. Many sequestrate fungi fruit in clusters, so further exploration within a radius of 30 to 60 cm around a suspected fruiting spot often reveals additional specimens. It is best to rake into the soil to the depth of the nearby small animal dig. Needles, leaf fragments, and other debris or spider webs in a small animal dig indicate that it is not fresh. Further exploration, however, may yet reveal specimens, particularly if there are fresh digs scattered about in the habitat.

Plotless transects also can be useful in habitat with compacted soil or where the humus layer is thin. Under such circumstances, even small specimens form small humps at the soil surface that look detectable to the trained observer. Larger specimens oftentimes are emergent from these small humps. Campgrounds, abandoned roads, road banks, and used or abandoned walking trails are sites where this method is sometimes successful.

Some caution is needed in repeated sampling for sequestrate fungal species. The nature of the sampling procedure for sequestrate fungi is disruptive. The disturbance of the microhabitat may adversely impact the microhabitat and render it uninhabitable by the rare fungus that once was resident. This is particularly evident in habitat such as coarse woody debris that is dismantled in sampling. Woody debris thus sampled does not rapidly, if ever, return to its former structure. It is our experience in low-elevation forests in western Oregon that soil substrate and concomitant herbs and forbs return to predisturbance levels 1 to 2 years after sampling.

Remarks About Using the Keys

The keys that follow contain all species currently listed in the 2001 ROD. The number following a species' name refers to the page number where that species' description is found within the handbooks. Species' information for numbers that are underlined is contained in the first handbook, whereas species' information for numbers without underlining is contained in this handbook. There are a few species of *Ramaria* keyed that are not included in either handbook. These are, for the most part, varieties of similar species, and it was thought that including them will help discriminate among varieties.

Arriving at a species' determination should serve only to direct the reader to the species' description within one of the handbooks. In particular, the reader's attention should then be directed to the distinguishing-features section for that species. If the characters of the specimen fit exactly the characters listed in the description, the specimen has a high likelihood of being that species. For the most part, verification of specimens should be done by an accomplished mycologist, as there often are non-ROD-listed species that are quite similar and difficult to distinguish.

Additional pictures of the species contained in this handbook can be found on the World Wide Web at: <http://www.fs.fed.us/pnw/mycology/survey>.

Keys to taxa

(see Glossary for terms)

- A. Sporocarp with a cap and (usually) a stem, the underside of the cap with radially arranged bladelike gills **Gilled mushrooms**
- B. Sporocarp with a cap and stem, the underside of the cap with a layer of tubes often easily separated from cap, tube layer over 0.5 cm thick at maturity **Boletes**
- C. Sporocarp crustlike, sheetlike or cushionlike, smooth or lacking a cap and stem smooth or poroid **Resupinate polypores and fungal parasites**
- D. Sporocarp with a cap and a stem, spore-bearing tissue made up of repeatedly forking, blunt ridges **Chanterelles**
- E. Sporocarp erect, unbranched (clubs) or branched corallike from a common base, cap lacking **Corals and clubs**
- F. Sporocarp erect, unbranched, yellow with a differentiated flattened, rounded head **Earth tongues and allies**
- G. Sporocarp cup, disc, or bowl shaped, stem present or absent **Cups and allies**
- H. Sporocarp with cap and stem, the cap saddle shaped or irregularly lobed (brainlike) **Elfin saddles and false morels**
- I. Sporocarp with the appearance of a distorted agaric or bolete or resembling a potato, interior solid, with gills, or irregular chambers, if gills present they are covered by a persistent veil **Sequestrate fungi**
- J. Sporocarp with a cap and stem, tough or leathery, the underside of the cap with a layer of tubes, tube layer less than 0.5 cm thick at maturity **Stalked polypores and toothed fungi**

A. Key to gilled mushrooms

1. Gills contorted and fused **see sequestrate fungi**
1. Gills more or less radial and bladelike **2**
2. Spores deposit white, yellow, or pink **3**
2. Spores deposit red-brown, brown, or black **30**
3. Gills decurrent and waxy, may fruit in spring or near melting snow **4**
3. Gills decurrent and nonwaxy **6**
4. Cap yellow-brown when young, becoming tinged with bright pale vinaceous colors in age, spores 11-15.5 x 5.5-7 μm **see *Hygrophorus vernalis* (61)**
4. Cap blue, pink-tan to pale tan, cream colored, spores <11 μm long **5**
5. Cap cream to blue, spores 7-9 x 4-5 μm **see *Hygrophorus caeruleus* (60)**
5. Cap pale pink-tan to pale tan, spores 7.0-10.4 x 5.2-5.9 μm **see *Hygrophorus saxatilis* (78)**
6. Sporocarps large, cap >70 (up to 380) mm in diameter, stem 25-60 mm in diameter, membranous partial veil present **see *Catathelasma ventricosa* (41)**
6. Sporocarps smaller, caps always <110 mm in diameter, stem < 25 mm in diameter, partial veil absent **7**
7. Cap and gills yellow to green-yellow, stem hollow **see *Chrysomphalina grossula* (44)**
7. Cap and gills without green tones, stem not hollow **8**

8. Gills serrate and spores inamyloid 9
8. Gills not serrate, if gills serrate then spores amyloid 10
9. Cap and stem with red-brown resinous coating see *Neolentinus adhaerens* (75)
9. Cap dry, white to pale pink-yellow or vinaceous see *Neolentinus kauffmanii* (76)
10. Stem with numerous side branches up to 5 mm long see *Collybia racemosa* (51)
10. Stem without side branches 11
11. Stem slender, fragile; cap conic to campanulate, margin striate 12
11. Stem not slender, or if slender then more tough and wiry; margin usually not striate 21
12. Cap dark blue to blue black see *Rhodocybe nitida* (130)
12. Cap not blue 13
13. Spores 2.7-4.2 x 2.0-3.0 μm , cap with violet tones see *Baeospora myriadophylla* (39)
13. Spores > 5 μm long, cap with non-violet tones 14
14. Cap pink to red, gill edges and faces white; cheilocystidia with long projections
(over 3 μm) that occasionally branch see *Mycena monticola* (72)
14. Cap some other color 15
15. Cap gray, base of stem fuzzy, vernal fruiter, usually near melting snow see *Mycena overholtsii* (73)
15. Cap not gray, or if gray fruiting in fall, base of stem not fuzzy 16
16. Gills brown, pruinose, spores 6.0-7.5 x 3.0-4.5 μm see *Hydropus marginellus* (77)
16. Gills white, gray to pale lilac or yellow-brown, spores larger 17
17. Spores globose 8-9 μm in diameter see *Fayodia bisphaerigera* (61)
17. Spores ellipsoid 18
18. Cap pale yellow to yellow-brown or olive-tan, cystidia absent see *Chromosera cyanophylla* (43)
18. Cap without yellow, cystidia present. 19
19. Cap brown-black, cheilocystidia and pleurocystidia long pedicellate without spines
..... see *Mycena quinaultensis* (74)
19. Cap gray to black, cheilocystidia and pleurocystidia long pedicellate with or without spines 20
20. Cap gray to black, margin pale gray to white, cheilocystidia and pleurocystidia clavate with short spines
..... see *Mycena hudsoniana* (71)
20. Cap fuscous to dark gray, cheilocystidia with long diverticula, pleurocystidia without spines
..... see *Mycena tenax* (80)
21. Cap white, often with pink tints, on conifer logs, cheilocystidia of two types: cylindric to broadly clavate and
obtuse and irregularly cylindric to nodulose to lobed see *Collybia bakerensis* (22)
21. Cap not white with pink, or cheilocystidia otherwise 22
22. Cap 10-18 mm, brown to dark red-brown, and with garlic odor see *Marasmius applanatipes* (67)
22. Cap with other characteristics and no garlic odor 23

23. Cap tan to honey-brown, stem pale yellow to yellow-orange, fibrillose streaked, spores pink to pink-brown in deposit, angular, spores subglobose to obovoid, slightly angular see *Rhodocybe speciosa* (131)
23. Cap not tan and scaly or spores not pink in deposit and not angular 24
24. Cap white with gray to tan scales, gills sinuate, attached, white spore print
..... see *Tricholoma venenatum* (137)
24. Cap some other color, gill attachment otherwise 25
25. Cap orange-yellow to yellow-tan, with tawny fibrils near margin, gills adnate, spores broadly ellipsoid
..... see *Tricholomopsis fulvescens* (138)
25. Cap some other color or gill attachment otherwise 26
26. Spore print yellowish white, if spore print white, then gills decurrent 27
26. Spore print yellow, brown, purple-brown, black, gills not decurrent 30
27. Gills adnate to adnexed see *Russula mustelina* (98)
27. Gills decurrent 28
28. Cystidia absent 29
28. Cystidia present on cap, stem, and gills see *Rickenella swartzii* (97)
29. Cap, stem, and gills gray, cap fibrillose matted, stem with white basal rhizomorphs
..... see *Clitocybe senilis* (20)
29. Cap, stem, and gills gray-brown to gray-buff, cap glabrous, rhizomorphs lacking
..... see *Clitocybe subditopoda* (21)
30. Spores black, up to 30 μm long, gill often contorted and fused, cap orange and fibrillose, partial veil present see
..... *Chroogomphus loculatus* (19)
30. Spores brown, rusty brown to purple-brown 31
31. Spore print purple-brown, spores 6-8.5 x 4-5.5 μm see *Mythicomycetes corneipes* (81)
31. Spore print brown 32
32. Stem not deeply rooting 33
32. Stem deeply rooting 51
33. Stem <25 mm thick 34
33. Stem >25 mm thick 38
34. Clamps absent see *Galerina heterocystis* (64)
34. Clamps present 35
35. Pleurocystidia and pileocystidia present, spores 11-15 x 6-9 see *Galerina atkinsoniana* (62)
35. Either pleurocystidia or pileocystidia absent; caulocystidia present, spores smaller 36
36. Stem 50-120 mm long, spores 9-11 x 6-8 μm see *Galerina sphagnicola* (65)
36. Stem only up to 30 mm long 37
37. Spores amygdaliform and noncalyptrate see *Galerina vittaeformis* (66)
37. Spores calyptrate see *Galerina cerina* (63)

38. Cap viscid, violet to pale lilac, becoming white with a yellow disc, stem with marginate base, KOH on cap turns pink to red immediately see *Cortinarius olympianus* (25)
38. Cap or gill colors different, cap not reacting to KOH 39
39. Spores 4.5-6 x 3-3.5 μm see *Stagnicola perplexa* (104)
39. Spores >6 μm long 40
40. Veil red or pink 41
40. Veil lacking, but if present not red 42
41. Cap dull to violaceous brown, spores ellipsoid, 7-8 x 4-5.5 μm see *Cortinarius boulderensis* (23)
41. Cap gray brown, spores subglobose to broadly ellipsoid, 7.4-8.9 x 5.6-7.0 μm
..... see *Cortinarius depauperatus* (56)
42. Cap a variable blend of green, blue, and yellow, basal mycelium lavender, on well-rotted wood
..... see *Gymnopilus punctifolius* (52)
42. Cap with other colors, basal mycelium lacking 43
43. Cap dull cinnamon, viscid, veil faintly fibrillose see *Hebeloma olympianum* (53)
43. Cap not dull cinnamon, or dry or lacking persistent veil 44
44. Cap orange, with yellow veil remnants on stem and dark scales on cap
..... see *Cortinarius rainierensis* (26)
44. Cap and veil different 45
45. Cap with enrolled margin and gray gills see *Cortinarius variipes* (28)
45. Cap with margin not enrolled or gills not gray 46
46. Young gills olive-yellow, cap surface and flesh olive-yellow to dingy brown, cap surface turning purple-brown with application of KOH see *Dermocybe humboldtensis* (31)
46. Young gills or cap some other color 47
47. Spores 4-5.5 μm in diameter with an apical pore, cap vinaceous brown, stem with membranous annulus, on litter
..... see *Stropharia* (as *Pholiota*) *albivelata* (93)
47. Spores 5.5-7.0 (-7.8) μm in diameter lacking apical pore 48
48. Sporocarp with violet to blue tones and strong red coloration of stem context see *Cortinarius cyanites* (55)
48. Sporocarp without blue tones or no red reaction of stem context 49
49. Gills violet to blue-violet see *Cortinarius barlowensis* (54)
49. Gills non-violet to blue-violet 50
50. Cap gray-brown with violaceous margin, spores ellipsoid 8-10 x 5.5-6 μm see *Cortinarius umidicola* (27)
50. Cap yellow-brown to brown with olive tones, spores ellipsoid to subglobose 7.4-8.9 x 5.6-6.7 μm
..... see *Cortinarius valgus* (57)
51. Spores < 8 μm long 52
51. Spores > than 8 μm long 54
52. Clamp connections present see *Phaeocollybia dissiliens* (86)

52. Clamp connections absent (or infrequent) 53
53. Stem stuffed, cheilocystidia cylindric, 24-34 x 3-6 μm see *Phaeocollybia oregonensis* (89)
53. Stem hollow, cheilocystidia clavate, 30-40 x 7-9 μm see *Phaeocollybia sipei* (92)
54. Caps with some green coloration 55
54. Caps without green coloration 57
55. Cheilocystidia clavate 56
55. Cheilocystidia capitulate, lageniform to tibiiform see *Phaeocollybia pseudofestiva* (85)
56. Stem hollow, cap up to 65 mm in diameter see *Phaeocollybia fallax* (83)
56. Stem stuffed, cap 40-110 mm in diameter see *Phaeocollybia olivacea* (84)
57. Cheilocystidia cylindrical to clavate 58
57. Cheilocystidia lageniform to tibiiform 61
58. Cap typically greater than 80 mm in diameter see *Phaeocollybia kauffmanii* (88)
58. Cap less than 70 mm in diameter 59
59. Spores 7-8.5 x 5-5.5 μm see *Phaeocollybia attenuata* (82)
59. Spores larger 60
60. Cap bright orange to red-orange see *Phaeocollybia piceae* (90)
60. Cap gray-brown see *Phaeocollybia gregaria* (87)
61. Stem stuffed see *Phaeocollybia spadicea* (86)
61. Stem hollow 62
62. Sporocarps in loose bundles, cap yellow-brown to orange-brown
..... see *Phaeocollybia californica* (85)
62. Sporocarps densely fasciculate, cap yellow-brown to brown-black
..... see *Phaeocollybia scatesiae* (91)

B. Key to boletes

1. Sporocarps small, cap <70 mm in diameter, bright yellow mycelium at base, taste peppery to acrid
..... see *Chalciporus piperatus* (42)
1. Sporocarps large, cap >70 mm in diameter, yellow mycelium absent from base, taste not peppery or acrid 2
2. Tubes yellow in youth, becoming green-yellow to olive see *Boletus haematinus* (10)
2. Tubes red to dark brown to black 3
3. Tubes dark brown to black, tubes bruising blue see *Tylopilus porphyrosporus* (141)
3. Tubes dark red to red-brown see *Boletus pulcherrimus* (11)

C. Key to resupinate polypores and fungal parasites

1. On rotting mushrooms 2
1. Not on rotting mushrooms, instead on dead wood or twigs 4

2. Sporocarps a crustlike covering on Russulaceae mushrooms, yellow to yellow-green to green-black see *Hypomyces luteovirens* (79)
2. Sporocarps fruiting from rooting Russulaceae mushrooms, with a stem and cap 3
3. Chlamydospores smooth, fusoid, 12-17 x 9-11 μm see *Asterophora parasitica* (38)
3. Chlamydospores ornamented, globose, subglobose to ovoid, 11-20 x 10-18 μm see *Asterophora lycoperdoides* (37)
4. Sporocarps small (<5 mm) cushion to disc shaped, pale yellow-brown hymenial surface on twigs, spores smooth see *Acanthophysium farlowii* (1)
4. Sporocarps resupinate with irregularly warty hymenial surface, ochraceous-buff hymenial surface, spores ornamented, on dead conifer wood see *Dichostereum boreale* (34)

D. Key to chanterelles

1. Cap dark blue to black, hymenium concolorous, odor mildly pungent see *Polyozellus multiplex* (96)
1. Cap white, yellow, orange-yellow, yellow-brown, brown or yellow-olive 2
2. Cap white to off-white, handling yellow, spores 7-9 x 5-5.5 μm see *Cantharellus subalbidus* (40)
2. Cap yellow, orange-yellow, yellow-brown, brown or yellow-olive, spores longer 3
3. Cap distinct, stem hollow and flabby, compressed or furrowed see *Craterellus tubaeformis* (58)
3. Cap indistinct mostly an extension of the stem, stem solid, thick 4
4. Cap brown to yellow-olive, hymenium violaceous see *Gomphus clavatus* (69)
4. Cap orange to orange-yellow to orange-brown, hymenium white to brown 5
5. Sporocarps in often caespitose clusters, spores 10-12 (-14) x 5-6 μm see *Gomphus bonarii* (68)
5. Sporocarps not in caespitose clusters, spores 11.9-17.5 x 5.7-7.8 μm see *Gomphus kauffmanii* (70)

E. Key to corals and clubs

1. Sporocarps clublike, sparsely branched or with ribbonlike or leafy lobes 2
1. Sporocarps usually with numerous branches see genus *Ramaria* key below
2. Sporocarps with some branches or ribbonlike or leafy lobes 3
2. Sporocarps clublike 4
3. Sporocarps with ribbonlike or leafy lobes see *Sparassis crispa* (102)
3. Sporocarps with a distinct stem clothed with fascicles, spore-bearing tissue palmate with a few branches see *Clavulina castaneopes* var. *lignicola* (50)
4. Spores 8-10 x 5-6 μm , sporocarps tinged with red see *Clavariadelphus subfastigiatus*
4. Spores larger, sporocarps without red 5
5. Spores <17 μm long 6
5. Spores 18-24 μm long see *Clavariadelphus sachalinensis* (47)
6. Spores 3.5-4.5 μm in diam see *Clavariadelphus ligula* (45)

6. Spores >5.0 µm in diam 7
7. Sporocarp with flattened apex, staining red with KOH, spore print white
..... see *Clavariadelphus truncatus* (49)
7. Sporocarp clavate shaped, not with flattened apex, KOH negative, spore print white to pale yellow
..... see *Clavariadelphus occidentalis* (46)

Owing to the difficulty in working with *Ramaria* species, we present both a traditional dichotomous key and a synoptic key. We suggest that the novice try both to build skills in working with this troublesome genus. These keys contain all the *Ramaria* species from the ROD including the strategy 3 species. We hope this helps in identifying the closely related species that are slightly more common than the strategy 1 species.

Key to subgenera of *Ramaria*

(after Marr and Stuntz 1973)

1. Spores striate ornamented, flesh usually amyloid **Subgenus *Ramaria***
1. Spores smooth, warted or spiny, not striate, flesh in most species inamyloid (except species of the *R. subbotrytis* complex) 2
2. Sporocarps terricolous, spores smooth or warted, flesh and rhizomorphs monomitic
..... **Subgenus *Laeticolora***
2. Sporocarps with one or more of the following characters: (1) lignicolous or duff habit, (2) spiny spores, (3) skeletal hyphae 3
3. Spores echinulate or echinulate-verrucose, with duff habit; rhizomorphs extensively developed, monomitic
..... **Subgenus *Echinoramaria***
3. Spores smooth or warted, not spiny, lignicolous or duff habit, rhizomorphs extensively developed, dimitic in most species (except *R. apiculata*) **Subgenus *Lentoramaria***

General descriptions of the subgenera in *Ramaria*

Subgenus *Ramaria*

Sporocarps generally large, profusely branched, entirely white, pale yellow, alutaceous, or upper branches orange, red to violet; spores ornamented with cyanophilic striae sometimes subreticulate or subverruculose, flesh usually amyloid.

Subgenus *Laeticolora*

Sporocarps generally large, profusely branched, terrestrial, often brightly colored in yellow, orange, and red shades, a few species cream, violaceous, or brown; spores of most species warted, ornamentation consisting of fine to coarse, irregularly shaped, cyanophilic raised areas, in a few spores smooth, flesh and rhizomorphs monomitic, hyphae with or without clamp connections.

Subgenus *Echinoramaria*

Sporocarps generally small, in a few species of medium to large size, growing on twig litter, cones, needle duff, or leaf mold, rhizomorphic strands commonly conspicuous, and a well-developed felty basal tomentum or mycelial mat usually present; sporocarps cream, yellow, olive, green, or with brown shades, sometimes changing color where bruised; hyphae thin walled, monomitic, clamp connections frequently of the loop type or clamp cell vesiculate; spores echinulate or subechinulate, spines 0.2-3 µm tall.

Subgenus *Lentoramaria*

Sporocarps generally small to medium sized, habitat lignicolous or sublignicolous (growing from twig and leaf litter), rhizomorphic strands commonly conspicuous, and a well-developed felty basal tomentum or mycelial mat sometimes present; sporocarps cream, yellow, green, or with brown shades, sometimes quickly changing color where bruised; hyphae thin or thick walled, monomitic or dimitic, clamp connections present; spores smooth or finely warted.

Key to species of the subgenus *Ramaria*

1. Upper branches pale orange to brown, stem opaque white, bruising pale yellow to gray-orange, spores 12-16 x 4-6 μm see *R. botrytis* var. *aurantiiramosa* (101)
1. Upper branches with red tones 2
2. Red color of terminal branches evanescent at maturity, upper branches' axils U-shaped, somewhat divergent, forked to multiforked near apices, stem milk-white discoloring yellow, bruising brown-violet, spores 11-13 x 4.5-5 μm , striae closely spaced see *R. rubrievanescens* (116)
2. Red color of terminal branches persists at maturity, upper branches with axils mostly acute to subacute, forked to multiforked near apices, stem milk-white to yellow-white and do not bruise red to violet brown, spores 8-13 x 3.5-4.5 μm , striae oblique to longitudinal see *R. rubripermanens* (117)

Key to species of the subgenus *Laeticolora*

1. Basidia with clamp connections at base or clamp connections frequent in the subhymenium and flesh of the branches or both 2
1. Basidia without clamp connections at base, true clamp connections rare in the subhymenium and flesh of the branches 5
2. Stem flesh amyloid when fresh 3
2. Stem flesh inamyloid when fresh 4
3. Lower branches distinctively staining red, interior flesh does not react with 10 percent $\text{Fe}_2(\text{SO}_4)_3$, spores 9-11 x 4-5 μm with warts in subspirals see *R. maculatipes* (112)
3. Lower branches occasionally bruised violet-gray, interior flesh reacts instantly blue-green with 10-percent $\text{Fe}_2(\text{SO}_4)_3$, spores 7-10 x 3-4 μm with fine warts in lines see *R. amyloidea* (98)
4. Stem white bruising strongly red brown, branches white to pale yellow with pale green-yellow apices, spores 11.6-15.8 x 4-5 μm with discrete low warts; spring fruiting see *R. thiersii* (120)
4. Stem white to pale yellow not bruising red-brown, branches pale orange with intense orange apices, spores 11-15 x 3.5-5 μm with distinctive, irregularly shaped warts in subspirals; autumn fruiting see *R. largentii* (110)
5. Spores finely warted or smooth 6
5. Spores distinctively warted 7
6. Stem medium sized, single and slender, white to orange-white, stem and lower branches staining dark red, flesh fleshy-fibrous without a brown fan-shaped area when cut longitudinally, fall fruiting, spores 10-14 x 3.5-5 μm , smooth to finely ornamented see *R. rubribrunnescens* (115)
6. Stem large to massive, single white to off-white, slowly stains pale purple-gray where handled, flesh watery off-white, usually with brown band, spring fruiting, spores 8-13 x 3-4 μm , smooth to a few ill-defined, small, low warts see *R. coulterae* (92)
7. Flesh amyloid 8
7. Flesh inamyloid 9
8. Branches scarlet in youth, fading to pale orange-red when mature and with apices intensely colored, stem white to pale orange, interior flesh without a brown band and no reaction with 10-percent $\text{Fe}_2(\text{SO}_4)_3$, spores 7-10 x 3-5 μm with small warts see *R. stuntzii* (119)

8. Branches pale to pale orange with sunflower yellow apices, stem yellow-white covered with subareolate patches of brown to red-brown superficial hyphae, interior flesh with a brown band and reacts blue-green with 10-percent $\text{Fe}_2(\text{SO}_4)_3$, spores 8-11 x 4-6 μm with coarse warts and prominent apiculus see *R. celerivirescens* (102)
9. Sporocarps typically fasciculate or caespitose 10
9. Sporocarps not fasciculate or caespitose 13
10. Flesh gelatinous when fresh 11
10. Flesh rubbery, fibrous, or cartilaginous 12
11. Apices deep orange and not bruising dull violet, gleoplerous hyphae absent, spores 8-11 x 3.5-5 μm see *R. gelatiniaurantia* var. *gelatiniaurantia* (107)
11. Apices apricot-yellow, bruising dull violet, gleoplerous hyphae distinctive in stem, spores 8-11 x 3.5-5 μm *R. gelatiniaurantia* var. *violetingens* (not in handbooks)
12. Sporocarps white, branches salmon to peach with pale to maize-yellow branch tips, sometimes bruising pale violet in some areas, spores 6-10 x 4-6.5 μm see *R. fasciculata* var. *sparsiramosa* (106)
12. Sporocarps white with small surface spots of red present, branches pale yellow to yellow, not bruising violet, spores 7.9-9.4 x 4.7-5.8 μm see *R. lorithamnus* (111)
13. Flesh gelatinous when fresh 14
13. Flesh fibrous 15
14. Sporocarps stout, cauliflowerlike, broadly obovate to broadly pyriform in outline with abortive branchlets, branches pale yellow to pale orange, spores 9-11.2 x 4.5-6 μm see *R. verlotensis* (121)
14. Sporocarps broadly fusiform to broadly obconic in outline without abortive branchlets, branches bright yellow to pallid salmon, spores 9.4-11.2 x 4-5 μm see *R. hilaris* var. *olympiana* (109)
15. Sporocarps dark orange-brown to brown overall, branches brown to violaceous brown, apices violaceous brown when young, concolorous with branches at maturity, spores 7.2-10.1 x 4.7-6.1 μm see *R. spinulosa* var. *diminutiva* (118)
15. Sporocarps yellowish, brown-white, red to salmon, branches not showing violaceous tints 16
16. Basidia with masses of cyanophilic granules 17
16. Basidia without masses of cyanophilic granules 19
17. Apices pale yellow to yellow 18
17. Apices pale red, never yellow, spores 8-10 x 4-5 μm *R. cyaneigranosa* var. *elongata* (not in handbooks)
18. Branches intensely red; yellow apices, spores 8-15 x 4-6 μm see *R. cyaneigranosa* var. *cyaneigranosa* (105)
18. Branches peach or salmon with minutely yellow apices, spores 7-11 x 3.5-6 μm *R. cyaneigranosa* var. *persicina* (not in handbooks)
19. Branches and apices intensely yellow orange, spores 8.5-14 x 3-5 μm see *R. aurantiiscescens* (100)
19. Branches magenta, red, yellow-orange, brown-salmon 20

20. Branches red in youth fading to pale red at maturity, apices maize-yellow or pale to deep orange when mature, spores 8-13 x 3-4.5 μm see *R. araiospora* var. *araiospora* (99)
20. Branches intensely magenta red with blue tones, fading to pale red, apices magenta in mature specimens, spores 8-14 x 3-5 μm *R. araiospora* var. *rubella* (not in handbooks)

Key to species of the subgenus *Lentoramaria* and *Echinoramaria*

- 1 Spores distinctly spiny see *R. abietina* (90)
1. Spores smooth or warted, not spiny 2
2. Spores small, 5-6.5 x 3.5-4 μm , skeletal hyphae strongly cyanophilic, resembles *Ramariopsis kunzei* see *R. gracilis* (108)
2. Spores large, 6.5-11 x 3.5-6 μm , skeletal hyphae not cyanophilic, does not resemble *Ramariopsis kunzei* 3
3. Generative hyphae with inflated clamp connections, up to 13 μm in diameter, coarsely ornamented, spores 7-11 x 4.4-6 μm , cyanophilic warts in subspirals see *R. rainierensis* (113)
3. Generative hyphae without ornamentation 4
4. Sporocarps with pink-cinnamon coloration 5
4. Sporocarps with brown coloration 6
5. Rhizomorphs white, changing to bright pink in 10 percent KOH *R. rubella* f. *rubella* (not in handbooks)
5. Rhizomorphs white, unchanging in 10 percent KOH see *R. rubella* f. *blanda* (114)
6. Sporocarps up to 7 cm tall, stem indistinct to short often branched at the base, branches few and erect, pallid ochre to pink-brown, axils concolorous without green coloration see *R. suecica* (93)
6. Sporocarps up to 14 cm tall, stem distinct, branches dull brown to orange-brown, axils concolorous or green 7
7. Branches open and lax, curved ascending, axils without green coloration see *R. concolor* f. *marrii* (104)
7. Branches crowded and erect, axils with green coloration see *R. concolor* f. *tsugina* (91)

Synoptic key to *Ramaria* species contained in the ROD

- | | |
|---|--|
| 1. <i>R. abietina</i> | 17. <i>R. hilaris</i> var. <i>olympiana</i> |
| 2. <i>R. amyloidea</i> | 18. <i>R. largentii</i> |
| 3. <i>R. araiospora</i> var. <i>araiospora</i> | 19. <i>R. lorithamnus</i> |
| 4. <i>R. aurantiisiccescens</i> | 20. <i>R. maculatipes</i> |
| 5. <i>R. botrytis</i> var. <i>aurantiiramosa</i> | 21. <i>R. ochraceovirens</i> |
| 6. <i>R. celerivirescens</i> | 22. <i>R. rainierensis</i> |
| 7. <i>R. concolor</i> f. <i>marrii</i> | 23. <i>R. rubella</i> f. <i>blanda</i> |
| 8. <i>R. concolor</i> f. <i>tsugina</i> | 24. <i>R. rubribrunnescens</i> |
| 9. <i>R. fasciculata</i> var. <i>sparsiramosa</i> | 25. <i>R. rubrievanescentis</i> |
| 10. <i>R. coulterae</i> | 26. <i>R. rubripermanens</i> |
| 11. <i>R. cyaneigranosa</i> var. <i>cyaneigranosa</i> | 27. <i>R. spinulosa</i> var. <i>diminutiva</i> |
| 12. <i>R. cyaneigranosa</i> var. <i>elongata</i> | 28. <i>R. stuntzii</i> |
| 13. <i>R. cyaneigranosa</i> var. <i>persicina</i> | 29. <i>R. suecica</i> |
| 14. <i>R. gelatiniaurantia</i> var. <i>gelatiniaurantia</i> | 30. <i>R. thiersii</i> |
| 15. <i>R. gelatiniaurantia</i> var. <i>violeitingens</i> | 31. <i>R. verlotensis</i> |
| 16. <i>R. gracilis</i> | |

Macroscopic characteristics

(Underlined numbers from species list above indicate that species occurs within more than one character.)

Stem color

Yellow: 2, 3, 5, 13, 14, 16, 17, 21, 22, 24, 25, 30

Orange: 1, 15, 16, 19, 21, 22, 23, 27, 30

Pink tones: 22

Red to magenta: 20, 31

Olive tones: 31

White to cream: 1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23, 24, 25, 26, 27, 29, 30

Brown: 1, 2, 5, 6, 20, 22, 26

Red-brown: 28

Tan to gray-orange (this could be just tan): 7, 15, 21

Branch color

Green: 18, 20, 31

Yellow: 3, 7, 8, 12, 14, 15, 16, 18, 21, 22, 24, 29, 30, 31

Orange: 1, 3, 5, 8, 11, 12, 13, 14, 15, 16, 17, 19, 21, 22, 23, 24, 25, 27, 29, 30

Pink tones: 1, 2, 8, 9, 10, 11, 15, 18, 19, 22, 23, 24, 25, 28, 30

Red to magenta: 2, 27

Red-brown: 9, 28

White to cream: 4, 9, 15, 21, 24, 29

Gray to violet: 1, 7, 26

Brown: 6, 7, 11, 22, 23, 26

Tan-gray: 6, 15, 21

Branch tip color

Green: 20, 29

Yellow: 1, 2, 3, 5, 6, 8, 10, 12, 14, 15, 16, 18, 19, 21, 23, 29, 30, 31

Orange: 1, 2, 3, 4, 7, 11, 12, 13, 16, 17, 21, 23, 27, 30

Pink tones: 1, 2, 9, 10, 11, 24, 25, 28, 30

Red to magenta: 2, 19, 24, 25, 27

White to cream: 6, 7, 15, 21, 22, 24, 25, 28

Violet to gray: 1, 26

Brown: 1, 9, 26

Tan to gray-orange: 6, 15, 21

Stem flesh

White to cream: 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 19, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31

Yellow: 2, 3, 16, 22

Orange: 21, 22, 23, 27

Brown: 26

Green tones: 20

Tan to gray-orange: 5

Stem flesh with brown band

Present: 1, 5, 9

Absent: 2, 3, 4, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31

Branch flesh

Yellow: 1, 2, 3, 5, 8, 10, 12, 13, 14, 16, 19, 23, 29, 30, 31

Orange: 1, 2, 3, 5, 8, 11, 12, 17, 19, 21, 23, 24, 27, 29, 30

Red to magenta: 2, 27

White to cream: 4, 6, 7, 9, 13, 15, 17, 18, 21, 22, 24, 25, 26, 27, 28, 29

Green tones: 20

Tan to gray-orange: 5

Base of stem a rusty color

Present: 1, 5, 9, 27

Absent: 2, 3, 4, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 28, 29, 30, 31

Yellow band on branch exterior

Present: 3, 12, 13, 15, 30

Absent: 1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 14, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 31

Color of surface bruising

Vinaceous: 7, 8, 9, 18

Red: 18, 19, 22, 23, 24

Violet: 1, 8, 9, 14, 24

Brown: 6, 7, 9, 18, 24, 26, 29

Yellow or orange or tan: 3, 4

Blue-green or green: 20, 31

Not bruising: 2, 5, 10, 11, 12, 13, 15, 16, 17, 21, 25, 27, 28, 30

Context of stem

Fleshy: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 31

Base gelatinous: 13, 14, 16, 30

Context of branch

Fleshy or non-gelatinous: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 31

Gelatinous: 13, 14, 16, 30

Rhizomorphs

Present: 6, 7, 15, 20, 21, 22, 28, 31

Absent: 1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 13, 14, 16, 17, 18, 19, 23, 24, 25, 26, 27, 29, 30

Habitat

Terrestrial: 1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 13, 14, 16, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27, 28, 29, 30

Decayed wood: 6, 7, 15, 22, 31

Season

Spring: 9, 25, 29, 31

Autumn: 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 27, 28, 30, 31

Microscopic characteristics**Spore ornamentation**

Spiny: 20, 31

Striate: 4, 24, 25

Warts: 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23, 26, 27, 28, 29, 30

Smooth or nearly so: 8, 23

Spore length

Maximum spore length $>7 \mu\text{m}$, $\leq 10 \mu\text{m}$: 1, 6, 7, 8, 9, 11, 15, 18, 20, 21, 22, 26, 27, 28, 30, 31

Maximum spore length $>10 \mu\text{m}$, $\leq 15 \mu\text{m}$: 2, 3, 4, 5, 11, 10, 12, 13, 14, 16, 17, 19, 23, 24, 25, 27, 30

Maximum spore length $>15 \mu\text{m}$: 4, 29

Spore width

Spore width (maximum) $\leq 4 \mu\text{m}$: 1, 7, 9, 15, 28

Spore width (maximum) $>4 \mu\text{m}$, $=5 \mu\text{m}$: 2, 3, 6, 7, 11, 13, 14, 15, 16, 17, 19, 20, 23, 24, 25, 26, 27, 28, 29, 30, 31

Spore width (maximum) $>5 \mu\text{m}$, $=6 \mu\text{m}$: 4, 5, 10, 12, 18, 21, 22, 24, 26, 27, 28, 30

Spore width (maximum) $>6 \mu\text{m}$: 8, 30

Cyanophilic granules in basidia

Present: 1, 10, 11, 12, 21, 23, 24, 25, 27, 30

Absent: 2, 30, 31

Unknown: 3, 4, 5, 6, 7, 8, 9, 13, 14, 15, 16, 17, 18, 19, 20, 22, 26, 28, 29

Clamps in basidia or trama

Present: 1, 4, 6, 7, 15, 17, 19, 20, 21, 22, 24, 25, 28, 29, 31

Absent: 2, 3, 5, 8, 9, 10, 11, 12, 13, 14, 16, 18, 23, 26, 27, 30

Gleoplerous hyphae

Present: 1, 2, 3, 4, 5, 10, 11, 12, 13, 14, 17, 18, 19, 20, 22, 23, 24, 25, 27, 28, 29, 30

Absent: 2, 3, 5, 6, 7, 8, 9, 15, 16, 20, 21, 22, 23, 26, 31

Macrochemical test on sporocarp flesh**Melzer's reagent**

Reactive turning flesh dark purple or blue-black: 1, 4, 5, 19, 24, 25, 27

Non-reactive or some shade of brown but not dark brown or purple: 2, 3, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21, 22, 23, 26, 28, 29, 30, 31

Ferric sulfate

Reactive turning flesh blue-green to green: 1, 5, 9, 31

Non-reactive: 2, 3, 4, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30

F. Key to earth tongues and allies

1. Basidia present, sporocarps small, white, spatulate, with mosses see *Cyphellostereum laeve* (60)
1. Asci present 2
2. Sporocarps attached to sequestrate (truffles) sporocarps with soil 3
2. Sporocarps not attached to sequestrate (truffles) sporocarps 4
3. Sporocarp capitate, partospores cylindrical to subfusoid see *Cordyceps capitata* (52)
3. Sporocarp clavate, partospores truncate see *Cordyceps ophioglossoides* (53)
4. Sporocarps cylindrical to clavate, spores obtusely fusoid, 2.5-4 x 4.5-5.5 μm
..... see *Podostroma alutaceum* (89)
4. Sporocarps capitate 5
5. Spore-bearing tissue pink-cinnamon, stem brown to gray-purple brown, spores globose 18-24 μm in diam
..... see *Cudonia monticola* (59)
5. Spore-bearing tissue bright orange to pale orange, stem creamy white, spores fusiform to cylindrical
9-13 x 2-3 μm see *Bryoglossum gracile* (14)

G. Key to cups and allies

1. Cup yellow, red, or orange 2
1. Cup gray, dark brown to purple or black 5
2. Cup with well-developed stem in youth, fruiting in fall see *Sowerbyella rhenana* (135)
2. Cup without stem, or fruiting in spring 3
3. Fruiting on twigs or foliage of *Chamaecyparis nootkatensis*, usually near melting snow
..... see *Gelatinodiscus flavidus* (48)
3. Fruiting on some other substrate, cup bright orange 4
4. Cups 5 to 35 mm diam., on soil see *Pseudaleuria quinaultiana* (97)
4. Cups 1-1.5 mm diam., on twigs or foliage of *Abies* sp., usually near melting snow
..... see *Pithya vulgaris* (94)
5. Interior of sporocarp gelatinized 6
5. Interior of sporocarp not gelatinized 7
6. Spores capsule shaped, sporocarp with olive tones, interior not highly gelatinized
..... see *Sarcosoma latahense* (132)
6. Spores ellipsoidal, interior highly gelatinized, sporocarp lacking olive tones
..... see *Sarcosoma mexicana* (133)
7. Sporocarps flat or cup shaped, lacking a stem 8
7. Sporocarp erect, ear shaped or stipitate and urnulate or enclosed when young 10
8. Spores capsule shaped, spores 24-38 x 9-12 μm see *Sarcosoma latahense* (132)
8. Spores ellipsoidal, spores shorter 9
9. Spores 21-24 x 8-10 μm ; sporocarps with orange granules see *Plectania melastoma* (88)
9. Spores (24.4-) 26.3-27.6 (-28.9) x 10.5-12.5 μm see *Plectania milleri* (95)

- 10. Sporocarps with urnulate spore-bearing tissue 11
- 10. Sporocarps erect and ear shaped 12
- 11. Spores 23-32 x 8-10.5 μm , with low ridges and warts see *Neournula pouchetii* (77)
- 11. Spores 15-22 x 7-9 μm , smooth to minutely verrucose see *Sarcosphaera coronaria* (101)
- 12. Sporocarp sessile, brown to deep purple-brown see *Otidea smithii* (84)
- 12. Sporocarp somewhat stipitate, yellow, pale brown-orange to brown-yellow 13
- 13. Sporocarps pale yellow, pale brown-orange to dull yellow, with pink tinges on spore-bearing tissue
..... see *Otidea onotica* (83)
- 13. Sporocarps yellow-brown to red-brown, without pink tinges on spore-bearing tissue
..... see *Otidea leporina* (82)

H. Key to elfin saddles and false morels

- 1. Cap saddle shaped, lobed or cupshaped 2
- 1. Cap irregularly convoluted or wrinkled 5
- 2. Cap in youth with margins uplifted, abhymenial surface distinctly pubescent 3
- 2. Cap margins never distinctly uplifted, abhymenial surface glabrous 4
- 3. Stem round in cross section, hymenial surface dark gray-brown, even see *Helvella compressa* (54)
- 3. Stem ridged, hymenial surface gray-brown, mottled see *Helvella maculata* (57)
- 4. Cap saddle shaped, stem round in cross section see *Helvella elastica* (56)
- 4. Cap cup shaped, stem with deep ribs, ribs rounded see *Helvella crassitunicata* (55)
- 5. Spores 12-14 μm long see *Gyromitra melaleucooides* (74)
- 5. Spores >15 μm long 6
- 6. Stem ribbed, flushed with pink tinges, spores 16.1-20.3 x 8.4-10.7 μm see *Gyromitra californica* (71)
- 6. Stem not ribbed, pink tinge absent, occasionally pink-tan, spores ≥ 20 μm long 7
- 7. Spores large (21.4-) 24.3-35.8 (-37.5) x 10.7-15.8 μm see *Gyromitra montana* (75)
- 7. Spores smaller 8
- 8. Spores (17-) 20-23 (-26) x 7-10 μm , cap forked see *Gyromitra infula* (73)
- 8. Spores 20-26 x 10-13 μm , cap not forked see *Gyromitra esculenta* (72)

I. Key to sequestrate fungi

- 1. Sporocarp surface more or less evenly covered with round to angular warts (use hand lens) **Ascomycetes**
- 1. Sporocarp surface not warty 2
- 2. Sporocarp solid in cross section (use hand lens) 3
- 2. Sporocarp with one to many empty or spore-filled canals or chambers 4
- 3. Sporocarp interior gelatinous or exuding a sticky fluid **Basidiomycetes and Zygomycetes**
- 3. Sporocarp interior firm to crisp, not exuding a sticky fluid **Ascomycetes**
- 4. Chambers single to many, >3 mm broad **Ascomycetes**

- | | | |
|----|--|---------------------------------------|
| 4. | Chambers or canals <3 mm broad | 5 |
| 5. | Sporocarp with a stem or stemlike tissue in vertical cross section | Basidiomycetes |
| 5. | Sporocarp lacking a stem or stemlike tissue in vertical cross section | 6 |
| 6. | Sporocarp with rhizomorphs at base or appressed on surface | Basidiomycetes |
| 6. | Sporocarp lacking rhizomorphs | 7 |
| 7. | Sporocarp interior with long, meandering canals | Ascomycetes |
| 7. | Sporocarp interior with rounded to slightly elongate or irregular chambers | 8 |
| 8. | Sporocarp flesh soft, white to yellow or brown | Basidiomycetes and Zygomycetes |
| 8. | Sporocarp flesh firm to crisp, gray to brown or purple | Ascomycetes |

II. Key to sequestrate Ascomycetes

(Spore measurements exclude ornamentation.)

- | | | |
|----|--|---|
| 1. | Sporocarp with one to many empty or spore-filled chambers or canals | 2 |
| 1. | Sporocarp solid, often marbled with veins | 6 |
| 2. | Peridium >3 mm thick, chambers one or a few, often broader than 3 mm | 3 |
| 2. | Peridium <2 mm thick, chambers or canals many, generally less than 3 mm broad | 4 |
| 3. | Peridium smooth, pale colored, spores 14-23 μm | see <i>Elaphomyces subviscidus</i> (36) |
| 3. | Peridium finely warty, nearly black, spores 21-25 μm | see <i>Elaphomyces anthracinus</i> (35) |
| 4. | Sporocarp surface coarsely and sharply verrucose | see <i>Balsamia nigrens</i> (9) |
| 4. | Sporocarp surface not coarsely verrucose but may be minutely roughened | 5 |
| 5. | Spores with crowded, flexuous tapered spines 2-3 (-4) μm tall | see <i>Hydnотrya inordinata</i> (58) |
| 5. | Spores with crowded mucilage-embedded spines ± 1 μm tall | see <i>Hydnотrya subnix</i> (59) |
| 6. | Gleba brown to black brown marbled with narrow, white veins | 7 |
| 6. | Gleba white to pale yellow marbled with narrow, yellow-brown to brown veins | 8 |
| 7. | Asci thin walled, mature gleba dark gray-brown marbled with off-white veins | see <i>Tuber asa</i> (139) |
| 7. | Asci thick walled, mature gleba brown to black-brown marbled with white veins
..... | see <i>Tuber pacificum</i> (140) |
| 8. | Spores minutely pitted like a golf ball | see <i>Choiromyces alveolatus</i> (17) |
| 8. | Spores with irregular, spines and rods, 3-6 μm tall | see <i>Choiromyces venosus</i> (18) |

II. Key to sequestrate Basidiomycetes and Zygomycetes

(Spore measurements exclude ornamentation.)

- | | | |
|----|---|---------------------------------------|
| 1. | Spores ornamented | 2 |
| 1. | Spores smooth | 25 |
| 2. | Spore ornamentation of ridges | 3 |
| 2. | Spore ornamentation of cones, rods, warts, or reticulation | 4 |
| 3. | Sporocarp staining blue, spores 13-22 x 10-16 μm | see <i>Chamonixia caespitosa</i> (16) |

3. Sporocarps not staining blue, spores 17-24 x 8-12 μm , locules large see *Gautieria magnicellaris* (46)
3. Sporocarps not staining blue, spores 13-18 x 5-7 μm , locules small see *Gautieria othii* (47)
4. Spores amyloid 5
4. Spores inamyloid 15
5. Sporocarp exuding latex from cut surface 6
5. Sporocarp not exuding latex from cut surface 8
6. Peridium orange-red, odor distinctly sweet of maple sugar see *Arcangeliella camphorata* (6)
6. Peridium not orange-red, odor pleasant, not of maple sugar 7
7. Peridium with nests of large sphaerocysts with thickened walls see *Arcangeliella crassa* (7)
7. Peridium without sphaerocysts see *Arcangeliella lactarioides* (8)
8. Sporocarp somewhat agaric in form or shape 9
8. Sporocarp without distinct stem-columella, usually more or less potato shaped 11
9. Spores globose 10-15 μm , gleba white to tan see *Macowanites mollis* (66)
9. Spores ellipsoid, gleba with orange tones 10
10. Spores 8-9.5 x 6.5-7.5 μm , gleba orange-brown, odor of chlorine see *Macowanites chlorinosmus* (64)
10. Spores 7-13 x 7-12 μm , no chlorine odor see *Cystangium* (as *Macowanites*) *lymanensis* (65)
11. Spores globose, 7-9 μm see *Gymnomyces nondistincta* (51)
11. Spores ellipsoid 12
12. Peridial epicutis an epithelium see *Cystangium* (as *Martellia*) *maculata* (70)
12. Peridial epicutis not an epithelium 13
13. Macrocystidia present see *Cystangium* (as *Martellia*) *idahoensis* (69)
13. Macrocystidia absent 14
14. Odor of vanilla, peridium with a turf of dermatocystidia see *Gymnomyces* (as *Martellia*) *fragrans* (68)
14. Odor not distinctive, peridium without dermatocystidia see *Gymnomyces abietis* (50)
15. Spores colorless in KOH 16
15. Spores brown in KOH 17
16. Sporocarps yellow, trama lacks inflated cells, spores 8-11 x 8-9 μm see *Leucogaster citrinus* (62)
16. Sporocarps white with yellow stains, spores 6-10 x 5-6 μm see *Leucogaster microsporus* (63)
17. Spores globose 18
17. Spores ellipsoid 19
18. Spores 13-18 μm , with cones up to 5 μm tall, peridium staining blue see *Octavianina cyanescens* (79)
18. Spores 14-17 μm , spines up to 3 μm tall, peridium not staining see *Octavianina papyracea* (81)
19. Spores 17-23 x 12-16 μm with spines up to 1.5 μm tall see *Octavianina macrospora* (80)
19. Spores smaller, ornamentation up to 1 μm tall 20

20. Sporocarps agariclike, with a persistent veil 21
20. Sporocarps potatolike, veil absent 24
21. Spores large 14-18 x 9-10 μm see *Thaxterogaster pavelekii* (136)
21. Spores not longer than 13 μm 22
22. Sporocarp pale brown to yellow-brown, spores with coarse warts
..... see *Cortinarius verrucisporus* (29)
22. Sporocarp white to tan, spore ornamentation not coarse 23
23. Basidia small 17-22 x 5.5-7 μm see *Cortinarius wiebeae* (30)
23. Basidia large 27-40 x 7-10 μm see *Cortinarius magnivelatus* (24)
24. Sporocarps not staining pink, basidia four spored see *Destuntzia fusca* (32)
24. Sporocarps staining pink, basidia one spored see *Destuntzia rubra* (33)
25. Spores large >40 μm in diameter or basidia absent 26
25. Spores smaller <30 μm in length or diameter or basidia present 28
26. Spores 77-150 x 44-120 μm , walls 5-7 μm in diameter see *Endogone oregonensis* (38)
26. Spores less than 100 μm in diameter or length 27
27. Spores 60-110 x 48-75 μm , walls 4-8 μm thick see *Glomus radiatum* (49)
27. Spores 15 x 30-80 x 59 μm , walls ≤ 5 μm thick see *Endogone acrogena* (37)
28. Spores honey-colored, smokey black or dark brown in KOH 29
28. Spores colorless in KOH 31
29. Spores 7.5-9 x 5.5-6.3 μm , with a apical pore see *Nivatogastrium nubigenum* (78)
29. Spores ≥ 19 μm long, without a apical pore 30
30. Gleba powdery, at maturity spores 23-26 x 13-16 μm see *Sedecula pulvinata* (134)
30. Gleba lamellate-loculate, not powdery, at maturity spores 19-30 x 6-9 μm
..... see *Chroogomphus loculatus* (19)
31. Sporocarp boletelike with a distorted or reduced stem 32
31. Sporocarp potatolike without a reduced stem but sometimes with a sterile base 37
32. Peridium and stem pale buff to pale olive buff see *Gastroboletus subalpinus* (42)
32. Peridium gray-yellow, rose to red-brown, bright yellow or dark sordid brown 33
33. Stem with glandular dots, spores 7-10 x 3.5-4 μm see *Gastrosuillus umbrinus* (45)
33. Stem without glandular dots 34
34. Sporocarps bright yellow and red, staining red, spores 13-18 x 6-7 μm see *Gastroboletus vividus* (43)
34. Sporocarps not bright yellow, if with red tones then staining blue 35
35. Sporocarps gray-yellow with dark olive tints, spores 7-10 x ± 2.5 μm see *Gastroboletus imbellus* (40)
35. Sporocarps with shades of rose to red-brown, spores wider 36

36. Spores 9-15 x 4-6 μm see *Gastroboletus ruber* (41)
36. Spores 13-18 x 6.5-9.5 μm see *Gastroboletus turbinatus* (67)
37. Spores amyloid 38
37. Spores inamyloid but sometimes dextrinoid 39
38. Spores 6-9 x 3-5 μm , basidia 7-9 μm in diameter, tamal hyphae 4-7 μm in diameter
..... see *Rhizopogon chamaleontinus* (123)
38. Spores 7-9 x 3-4 μm , basidia 5-7 μm in diameter, tramal hyphae 2-3 μm in diameter
..... see *Rhizopogon atroviolaceus* (95)
39. Gleba pink 40
39. Gleba olive to brown or yellow-brown 42
40. Sporocarps yellow to vivid yellow, spores 7-9 x 3-5 μm see *Rhizopogon truncatus* (96)
40. Sporocarps not vivid yellow, spores larger or smaller 41
41. Spores 5-7 x 3-4 μm see *Alpova alexsmithii* (4)
41. Spores 10-13 x 4-5 μm see *Fevansia aurantiaca* (39)
42. Peridium staining red 43
42. Peridium not staining red 45
43. Peridium staining red then inky-fuscous, with amyloid globules in peridium, spores 3-3.5 μm in diameter
..... see *Rhizopogon inquinatus* (128)
43. Peridium without amyloid globules 44
44. Peridium staining pink to vinaceous, spores 7.5-13 x 3-5 μm see *Rhizopogon abietis* (94)
44. Peridium staining ochraceous then red, spores 6.5-7.5 x 2 μm
..... see *Rhizopogon evadens* var. *subalpinus* (125)
45. Peridium with yellow when fresh; a shade of red in KOH; spores 5.5-6.5 x 2.5-2.8 μm
..... see *Rhizopogon flavofibrillosus* (127)
45. Peridium without yellow; not a shade of red in KOH; spores longer or broader 46
46. Spores ≥ 7 μm long 47
46. Spores ≤ 6.5 μm long 48
47. Spores 7-8 x 5-5.5 μm see *Rhizopogon exiguus* (126)
47. Spores 8-10 x 3-4 μm see *Alpova olivaceotinctus* (5)
48. Spores 5-6.5 x 1.8-2.3 μm see *Rhizopogon brunneiniger* (122)
48. Spores 4.5-6 x 3-4 μm see *Rhizopogon elliposporus* (124)

J. Key to stalked polypores and toothed fungi

1. Sporocarps on wood 2
1. Sporocarps on soil 5
2. Sporocarps stipitate with spatulate spore-bearing tissue see *Spathularia flavida* (103)
2. Sporocarps conklike or flabby or rubbery, with pink tinges 3

3. Sporocarps flabby or rubbery, spore-bearing tissue smooth to slightly wrinkled, pink tinged see *Tremiscus helvelloides* (105)
3. Sporocarp woody or tough fibrous, conklike 4
4. Cap yellow-orange, purple-brown in age or on drying, amyloid spores with warts or ridges see *Bondarzewia mesenterica* (12)
4. Cap often large (>50 cm), surface extremely shaggy, on or near dead *Abies* spp. see *Bridgeoporus nobilissimus* (13)
5. Sporocarps with pores 6
5. Sporocarps with spines 9
6. Spores 8-11 x 5-8 μm see *Albatrellus ellisii* (35)
6. Spores <7 μm long 7
7. Spores 3.5-4 x 2.5-3 μm see *Albatrellus fletti* (36)
7. Spores larger and wider 8
8. Cap purple-brown, becoming orange to tan with dark scales, spores 4.8-6 x 3.4-4.5 μm see *Albatrellus avellaneus* (2)
8. Cap surface and pores gray to blue, maturing to pale gray-brown, spores 4-6 x 3-5 μm see *Albatrellus caeruleoporus* (3)
9. Sporocarps blue-black to black, spores 3.8-4.2 x 3.3-3.8 μm see *Phelledon atratus* (87)
9. Sporocarps yellow, orange-yellow, tan, brown, red-brown or nearly black, if nearly black then spores >6 μm long and >5 μm wide 10
10. Sporocarps pale yellow to orange, spores 9-10 μm long see *Hydnum umbilicatum* (76)
10. Sporocarps tan to red-brown to nearly black, spores <8 μm long 11
11. Sporocarps tan to red-brown see *Sarcodon imbricatus* (100)
11. Sporocarps nearly black see *Sarcodon fuscoindicum* (99)

Species Information

Continued

Acknowledgments

We first and foremost thank the following contractors who provided expertise to compile much of the information and data used in this handbook: Dennis Desjardin, San Francisco State University, Lorelei Norvell, University of Washington, Ron Petersen, University of Tennessee, James Trappe, Oregon State University, and Nancy Weber, Oregon State University. Photographs are used with permission of Joseph Ammirati, Catherine Ardrey, David Arora, Tim Baroni, George L. Barron, Michael Beug, Howard Bigelow (deceased), Eugene Butler, Wes Colgan, III, Eric Danell, Robert Fogel, Gro Gulden, Janet Lindgren, Dan Luoma, Currie Marr, Steve Miller, Lorelei Norvell, Thom O'Dell, Eric Peterson, David Pilz, Daniel Powell, Scott Redhead, Maggie Rogers, Freeman Rowe, Herb Saylor (deceased), Michele Seidl, Harry Thiers (deceased), James Trappe, Steve Trudell, and James Weber (deceased). The following contributed helpful comments on various portions of the handbook: James Eblin, Sarah Jovan, Daniel Luoma, Randy Molina, Eduardo Nouhra, David Pilz, Dan Powell, Jane Smith, James Trappe, and Sarah Uebel. We received many helpful comments from field personnel who used the first handbook.

English Equivalent

When you know:	Multiply by:	To find:
Micrometers (μm)	3.9×10^{-5}	Inches
Millimeters (mm)	0.039	Inches
Centimeters (cm)	0.39	Inches
Meters (m)	3.281	Feet
Kilometers (km)	0.625	Miles
Celsius	1.8 and add 32	Fahrenheit
Liters	1.057	Quart

Literature Cited

- Arnolds, E. 1981.** Ecology and coenology of macrofungi in grasslands and moist heathlands in Drenthe, The Netherlands. Vaduz, Germany: J. Cramer. 410 p.
- Castellano, M.A.; Trappe, J.M.; Maser, Z.; Maser, C. 1989.** Key to spores of the genera of hypogeous fungi of north temperate forest with special reference to animal mycophagy. Arcata, CA: Mad River Press. 186 p.
- Fogel, R.M. 1981.** Quantification of sporocarps produced by hypogeous fungi. In: Wicklow, D.T.; Carroll, G.C., eds. The fungal community, its organization and role in the ecosystem. New York: Marcel Dekker: 553–568.
- Kendrick, B. 1992.** The fifth kingdom. 2nd ed. Sidney, BC: Mycologue Publications. 406 p.
- Lange, M. 1978.** Fungus flora in August: ten years observations in a Danish beech wood district. Botanisk Tidskrift. 73: 21-54.
- Luoma, D.L. 1988.** Biomass and community structure of sporocarps formed by hypogeous ectomycorrhizal fungi within selected forest habitats of the H.J. Andrews Experimental Forest, Oregon. Corvallis, OR: Oregon State University. 173 p. Ph.D. dissertation.
- Luoma, D.L. 1991.** Annual changes in seasonal production of hypogeous sporocarps in Oregon Douglas-fir forests. In: Ruggiero, L.F.; Aubry, K.B.; Carey, A.B.; Huff, M.H., tech. coords. Wildlife habitat relationships in old-growth Douglas-fir forests. Gen. Tech. Rep. PNW-GTR-285. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station: 83-89.
- Luoma, D.L.; Frenkel, R.E.; Trappe, J.M. 1991.** Fruiting of hypogeous fungi in Oregon Douglas-fir forests: seasonal and habitat variation. Mycologia. 83: 335-353.
- Luoma, D.L.; Eberhart, J.L.; Amaranthus M.P. 1996.** Response of ectomycorrhizal fungi to forest management treatments—sporocarp production. In: Azcon-Aguilar, C.; Barea, J.M., eds. Mycorrhizas in integrated systems: from genes to plant development: Proceedings of the 4th European symposium on mycorrhizas. Brussels, Belgium: European Commission, Directorate-General XII, Science Research and Development: 553–556.
- Marr, C.D.; Stuntz, D.E. 1973.** *Ramaria* of western Washington. Bibliotheca Mycologica. 38: 1-232.
- O'Dell, T.G.; Trappe, J.M.; Weber, N.J.; Schreiner, E.G. 1992.** Fungal diversity in Olympic National Park. Northwest Environmental Journal. 8: 170-172.
- Richardson, M.J. 1970.** Studies on *Russula emetica* and other agarics in a Scots pine plantation. Transactions of the British Mycological Society. 55: 217-229.
- States, J.S.; Gaud, W.S. 1997.** Ecology of hypogeous fungi associated with ponderosa pine. I. Patterns of distribution and sporocarp production in some Arizona forests. Mycologia. 89: 712-721.

Appendix 1

Helpful Hints to Working With the Synoptic Key to *Ramaria* Species

A synoptic key to the ROD-listed *Ramaria* species, in addition to a dichotomous key, is provided. Although learning to use a synoptic key requires patience and persistence, synoptic keys often are easier to use than dichotomous keys, particularly for the novice. Species identification with a synoptic key requires evaluating a sequence of characters to continually narrow the list of potential species, thereby allowing comparison of morphological similarities between species. Synoptic keys are easily expanded and less likely to lead the user astray than dichotomous keys (Castellano and others 1989).

Each species in a synoptic key is assigned a number and arranged in alphabetical order. In addition to ROD-listed *Ramaria* species, a few additional *Ramaria* species have been included in our key to facilitate accurate identification of those in the ROD. The key is divided into two sections: macroscopic and microscopic characters. Each section contains many categories of characters, such as stem, branch, and flesh colors. Each character is followed by a list of numbers corresponding to *Ramaria* species with that character. The number is underlined if the character is variable and thus is found under more than one character state. Multiple tallies per character indicate a range of characters, or a character and its modifier, or weak characters that may be present or absent.

Ramaria species identification requires precise microscopic examination. To observe the necessary features, it is necessary to mount a thin piece of sporocarp tissue in a drop of Melzer's reagent or KOH on a microscope slide. A mount too thick will result in frustration and unnecessary time spent focusing up and down through the material. A sharp razor blade is essential for producing thin mounts, especially with fresh or dried gelatinized material. The ability to distinguish between similar characters microscopically, such as slightly rounded versus rod-shaped spore ornamentation, initially is difficult and requires practice. Success with microscopy requires familiarity with a properly adjusted and calibrated microscope. An improperly adjusted microscope can distort the image of spores or tissue measurements by as much as 10 percent. Such imprecision could lead to the selection of an incorrect set of characters and result in incorrect species identification.

Categorizing color variation is subjective and therefore difficult. Because *Ramaria* spp. often change color with age, specimens may be described differently at different phenological stages. A minimal list of color headings, common to *Ramaria* species, is provided.

Appendix 2

Collection, Preservation, and Mailing: Tips, Suggestions, and Data Forms

Collecting Tips

It is important to collect the entire specimen. Some ROD species like *Phaeocollybia* have an extremely long, radicate stem that can extend more than 0.3 m into the soil. Others like *Cortinarius* have bulbous bases. And still others, such as *Ramaria*, can have multiple bases, mycelial mats, and rhizomorphs that can be important in identification. *Cordyceps* grow from a buried larvae or truffle, and the ROD-listed *Asterophora lycoperdoides* and *Collybia racemosa* grow on other rotting mushrooms.

It is best to use some sort of digging tool when excavating specimens to preserve integrity and fragile characters such as veil remnants and cortina.

Collect individuals of all ages when possible, particularly *Cortinarius* and *Ramaria* whose colors fade rapidly with maturation.

It is important to know the substrate: wood, litter-duff, moss, soil, rotten fungi. Along with color notes, this is best noted at the time of collection. Use the field tag provided.

It is critical to describe the colors present on ALL fresh specimens! Detailed notes are needed for *Ramaria* and all agarics, particularly *Phaeocollybia* and *Cortinarius*. Color guides can be helpful. Be as detailed as possible. Use other colors as modifiers; for example, red-brown, pale salmon with yellow tints, drab olive with violet tones, bright yellow, chalk white, slightly darker than ivory, dusty tan, etc.

Place specimens into heavyweight foil, wax bags, or plastic boxes. Some moisture must be preserved, but plastic bags will cause the fungus to rot quickly. We prefer using foil for larger fungi because when packaged loosely, it protects the specimen better than paper.

We have found that plastic tackle and craft boxes with movable dividers work well for collecting small fungi and also allow ready storage in the refrigerator.

Place individually wrapped specimens into a sturdy container such as a 5-gallon bucket or basket to avoid squashing them.

Do not mix collections when collecting and storing specimens. Regularly clean your collecting materials (stray spores can hinder identification).

Spores must be mature when measured for species determination. Sometimes spore maturation in ascomycetes can be induced by placing a damp paper towel in the container with the specimen in the refrigerator. Allow a few days or even a week or two, checking regularly for decay, for maturation to occur.

What to Send and How to Send It

The survey and manage interagency taxa expert should verify all collections made. We accept vouchers of any fungus species from table C-3 of the ROD. Because of the ephemeral nature of fungi and the unsettled nature of fungal taxonomy, we must have a physical specimen for it to be recorded as a known site.

Even professional mycologists make errors in determining fungi in the field. It is important to send us collections for verification.

If possible, take a photo (preferably a slide) of the fungus before drying it. A photographic record can be extremely useful in making species determinations as well as for educational use. The optimal setup is to use a macro lens and ring flash with 64 ISO film (or 200 if nothing else is available) with a neutral gray background and something for scale.

Specimens must be sent completely dried, unless prior arrangements are made.

Use a food dehydrator that has a fan, at low to medium temperature (32.2-51.7 °C). Cut at least one specimen in half, particularly truffles. It is preferable to cut large specimens such as *Ramaria*, *Gomphus*, *Phaeocollybia*, *Bondarzewia*, etc., to facilitate dehydration and storage.

Package dried specimens individually, then package securely by using some sort of packing material, and mail in cardboard boxes. **Do not send fungi in unpadded envelopes.** Include your determination, the site form, maps, and descriptive notes on a field tag or one of the seven fungi description forms.

Each specimen should be accompanied by complete location data, habitat information, notes describing the specimen when fresh (color, texture, taste, odor), collection date, unique collection number, and person to contact. **Without this information specimens will be extremely difficult to identify, and it will be hard to relocate sites.**

Please try to make a preliminary determination. **When you make your determination, note on the field tag accompanying each specimen what characters led you to this conclusion.** Was it spore length or shape? Colored granules on the abhymenium? Cap color? Hairs on the hymenium? These notes help us with the verification process. They also help us track mistakes so we can be better teachers. If you have doubts or have a particularly rare species, please use one of the seven fungi description forms to describe it in greater depth.

Collections will be accessioned into the herbarium at Oregon State University. On request, a portion can be returned to you if you maintain an herbarium. An optimal collection would consist of multiple specimens both young and mature, properly dried with at least one specimen cut in half. Even if you have only one specimen, send it anyway.

Completing the Site Form

This form provides locality and habitat data for each collection site as well as documentation for ROD species found during your survey. Use this form similarly to a threatened and endangered species plant sighting form and any time specimens of potential interest are collected. **You need to fill out only one form per site; list all the fungi collected from that site.**

Fill out the form completely. Our team cannot personally visit every site, and we lack the expert knowledge that you have of the areas where you work.

Instructions are found on the back of the form. A “site” is (1) at least 100 m away or (2) from a different habitat/ecotype within a forested area (for example, a sale unit). Likewise, if you are confident with your field recognition, it is not absolutely necessary to collect a specimen every time it is encountered at a site; once or twice per site is adequate. Differences in habitat or substrate per species should be noted on the field tag.

Completing the Field Tag

Field tags are useful while foraging or surveying. They are designed to fit into our collection boxes. Complete one per collection.

The main function of the tag is to ensure that critical data such as location, substrate, and color notes are not lost in the bustle of a field day.

The field tag is used in addition to the site form; it is not a substitute.

The following are the fields on the field tag with an explanation of the information asked for.

Taxon: Tentative identification of fungus

Date: Collection date

Collector: Collector of the specimen

Collection number: Collection identification number (please be brief, like a license plate):
Eblin 4756 or M.M2-12-98-a, etc.

County and state where collection was made:

Land owner: Name of federal agency and subunit: Siuslaw NF, Alsea RD, etc.

Location and T.R.S.: A geographical place name, road number, as specific as possible

Substrate: Circle appropriate category. If necessary, gently excavate the base of the specimen to determine the substrate.

Habitat: Dominant trees, herbs, and shrubs and related notes

Notes: Fresh specimen notes: color, taste, odor, shape, detail of habitat or substrate, or other site and specimen information. Use the back as necessary.

Field Tags (to be cut up)

Taxon: _____ Date: _____
Collector(s): _____ Coll. # _____
WA - OR - CA - County: ____ Land owner: _____
Location and TRS: _____

Wood - Moss - Litter - Soil - Fungus Habitat: _____

Notes (color, taste, odor, shape, etc.): _____

Taxon: _____ Date: _____
Collector(s): _____ Coll. # _____
WA - OR - CA - County: ____ Land owner: _____
Location and TRS: _____

Wood - Moss - Litter - Soil - Fungus Habitat: _____

Notes (color, taste, odor, shape, etc.): _____

Taxon: _____ Date: _____
Collector(s): _____ Coll. # _____
WA - OR - CA - County: ____ Land owner: _____
Location and TRS: _____

Wood - Moss - Litter - Soil - Fungus Habitat: _____

Notes (color, taste, odor, shape, etc.): _____

Taxon: _____ Date: _____
Collector(s): _____ Coll. # _____
WA - OR - CA - County: ____ Land owner: _____
Location and TRS: _____

Wood - Moss - Litter - Soil - Fungus Habitat: _____

Notes (color, taste, odor, shape, etc.): _____

Taxon: _____ Date: _____
Collector(s): _____ Coll. # _____
WA - OR - CA - County: ____ Land owner: _____
Location and TRS: _____

Wood - Moss - Litter - Soil - Fungus Habitat: _____

Notes (color, taste, odor, shape, etc.): _____

Taxon: _____ Date: _____
Collector(s): _____ Coll. # _____
WA - OR - CA - County: ____ Land owner: _____
Location and TRS: _____

Wood - Moss - Litter - Soil - Fungus Habitat: _____

Notes (color, taste, odor, shape, etc.): _____

Taxon: _____ Date: _____
Collector(s): _____ Coll. # _____
WA - OR - CA - County: ____ Land owner: _____
Location and TRS: _____

Wood - Moss - Litter - Soil - Fungus Habitat: _____

Notes (color, taste, odor, shape, etc.): _____

Taxon: _____ Date: _____
Collector(s): _____ Coll. # _____
WA - OR - CA - County: ____ Land owner: _____
Location and TRS: _____

Wood - Moss - Litter - Soil - Fungus Habitat: _____

Notes (color, taste, odor, shape, etc.): _____

Completing the Fungal Lot Form

This form is used by the Corvallis survey and manage team to track specimens in a database. Some field users have found it useful for their own records as well.

Separate collections into taxa groups as follows. Use separate forms for each taxa group (electronic forms are available from the survey and manage team). Circle the appropriate taxa group at the top of the page. Please leave the “final determination” field blank; we will fill that in and return the form to you when identifications are complete. You can use one set of site forms per taxa group.

Collection date: Use the DAY-MONTH-YEAR format with month spelled out. Examples: 05APRIL2001; 10SEPT2000.

Collector’s name: Your name.

Collection number: Your tracking number for each specimen. Often formatted as a number and letter system using the collector’s name, initials, collection number, or date. Examples: Fondrick-232; JS04May98-1. HINT: Long collection numbers may lead to confusion and frustration. Be as brief as possible; “license-plate” format works well.

Substrate: Soil, wood, moss, or litter.

Tentative determination: Your determination of what the species is, or at least a general description of the specimen. Examples: *Ramaria* spp.; *Craterellus tubaeformis*; black cup with orange granules; or chunky orange-brown polypore with no stem.

TAXA GROUPS:

Gilled Fungi

Mushrooms

Use separate form for *Cortinarius*

Cortinarius

Rusty spored with veil

Ascomycete Fungi

Elfin saddles (*Gyromitra*, *Helvella*)

Cup fungi

Earth tongues (*Spathularia*, *Cudonia*)

Nongilled Fungi

Clublike (*Clavariadelphus*)

Cantharellaceae (chanterelles)

Toothed (*Hydnum*, *Sarcodon*)

Jelly fungi (*Tremiscus*)

Boletes

Polypores (*Bondarzewia*, *Albatrellus*)

Coral Fungi

Ramaria

Sequestrate Fungi

Form underground fruiting body

Directions for Survey and Manage Fungi Site Form

Fill out one site form per site (at least 100 m apart or different habitat)

CVS plot number/site ID: For field crews to complete.

Collectors: List collector(s).

Date: Date collection(s) were made.

Land ownership: Select: Bureau of Land Management (BLM), USDA Forest Service (USFS), state, or private.

Land allocation: Specify if this location is in a late-successional reserve, managed late-successional area, matrix, adaptive management area, area of critical environmental concern, research natural area, botanical special interest area, riparian reserve, wilderness, or describe others.

Forest/district/resource area: Specify which national forest and district or BLM district and resource area.

State and county: Specify, please do not abbreviate county.

Quad name: Write quad name and circle appropriate map scale. Please do not abbreviate.

TRS: Township, range, section, sixteenth of the quarter section, quarter.

Meridian: Found on USGS and forest map. Willamette is western Washington and Oregon, Humboldt is northwest California, Mount Diablo is northeast California; circle the appropriate one.

Complete one of the following, either latitude and longitude or UTM:

Latitude and longitude: Please record in decimal form. Please record to 4 decimal places.

Universal Transverse Mercator (UTM): Please use datum NAD27. Record UTM E (Easting), then UTM N (Northing).

Location/directions to site: Provide a geographical place name such as Icicle River campground, Salmon Berry wayside, Hart Mountain, Johnny Creek trail. Also provide clear, detailed directions sufficient for someone unfamiliar with the area to relocate site. Include road numbers, mileage from road junctions and distance and azimuth from road. Map the location on the appropriate topographic map and label with quad name, township, range, section, sixteenth, and quarter. Give approximate distance in miles from nearest municipality or ranger station.

Elevation, slope, and aspect: Please be as accurate as possible, specify units where appropriate.

Topography: Circle the appropriate categories or briefly describe area.

Habitat: List dominant overstory trees, indicator shrub and herb species. Use full species name (*Pinus ponderosa*), not acronym (PIPO). Note and describe plant association and successional stage if possible. Note general amount, size, and decay class of coarse woody debris. Describe any interesting or unusual observations of habitat. Note substrate if appropriate.

List species collected: List names of species collected at site; tentative determinations are OK.

Survey and Manage Fungi Site Form

Complete one site form per site.

CVS plot #/site ID number _____

Multiple specimens at the same site need only one site form.

Collector(s): _____ Date: _____

Land ownership: **BLM USFS State Private** Land allocation: _____

Forest/district/resource area: _____

State: _____ County: _____ Quad name: _____ 7.5 min/ 15 min

T: ___ R: ___ Sec. ___ 1/16 ___ 1/4 ___ Meridian: Willamette Mount Diablo Humboldt

Latitude (4 decimal places): _____ Longitude (4 decimal places): _____

UTM E

UTM N

Location/directions to site: _____

Elevation: _____ feet meters Slope: _____ Aspect: _____

Topography: ridge upper slope mid slope lower slope valley swale bench trail roadside

Describe: _____

Habitat: *dominant trees*: _____

shrubs: _____

herbs: _____

stand structure: _____

coarse woody debris: _____

List species collected with collection number: _____

Completing the Fungus Description Forms

These forms (boletoid and polyporus fungi, coral fungi, *Cortinarius*, gilled fungi, nongilled fungi, and sequestrate fungi) are used to take notes on freshly collected specimens, particularly on rare species, or if you really have no idea where to begin. **It is extremely difficult to determine dried specimens without notes on fresh characters.**

Descriptive notes of fresh specimens are important for identifying fungi when they are dry. Notes on fresh color, texture, size, taste, and odor are crucial. **Detail is critical when describing the color variations of fungi.**

In general, those characters used in the keys for the group of fungi you are working with are the characters that you should give the most attention to describing or measuring.

If you have the capability, measure spore size and note spore shape, ornamentation under oil immersion at 1000x magnification. This is a microscopic character commonly used in specific descriptions.

If you have additional questions concerning these forms, please contact:

Tina Dreisbach: Survey and Manage Mycology Team, USDA Forest Service, PNW Forestry Sciences Lab, 3200 SW Jefferson Way, Corvallis, OR 97331. Telephone (541) 750-7404; FAX (541) 758-7760

Electronic communication: tdreisbach@fs.fed.us

Survey and manage team: Telephone (541) 750-7489; FAX (541) 750-7329

Electronic communication:

Bryan Fondrick: bfondrick@fs.fed.us

Jim Eblin: jeblyn@fs.fed.us

Dan Powell: dpowell@fs.fed.us

Sarah Uebel: suebel@fs.fed.us

Survey and Manage Boletoid and Polyporous Fungi Description Form

Provide notes and circle as many of the characters from grouped character sets as appropriate.

Genus/species: _____ Mycology team collection number: _____

Other collector's number: _____ Date: _____

Collected by: _____

Ecology:

Dominant trees and shrubs: _____

Growth habit: single scattered caespitose grouped

Age of specimens: immature mature old mixed

Substrate (circle one): On duff: pine cone leaves needles twig litter

On soil: mineral humus

On wood: conifer hardwood Species: _____

General characters (write range of dimensions in mm for multiple specimens)

Sporocarp type: bolete polypore

Height of entire specimen: _____ Length of stem: _____

Width of cap: _____ Width of stem at apex: _____ Widest width of stem: _____

Taste (don't swallow): mild strong pleasant unpleasant peppery

Other: _____

Color (note color gradations, spots, streaks, bruising reactions, changes with age or drying)

Cap surface: _____ Bruising color: _____

Cap flesh: _____ Bruising color: _____

Pore layer: _____ Bruising color: _____

Stem surface: _____ Bruising color: _____

Stem flesh: _____ Bruising color: _____

Cap characters:

Surface texture: dry greasy sticky slimy

Surface ornamentation: smooth pubescent fibrillose cracked wrinkled scaly granular velvety

Cap shape: convex plane uplifted irregular centrally depressed *Other* _____

Flesh consistency: fleshy brittle spongy *Other* _____

Stem characters:

Stem shape: equal ventricose tapered at apex tapered at base clavate bulbous

Surface texture: viscid sticky dry polished glabrous fibrillose punctate

Surface ornamentation: glandular dotted pruinose (lightly powdered) scabrous scaly fibrillose
finely reticulated (netted) coarsely reticulate

Location of reticulum: apex only top 1/2 of stem entire stem *Other:* _____

Color of ornamentation: _____

Annulus present: N Y **Annulus color:** _____

Annulus structure: membranous fibrillose cottony-cortina slimy

Survey and Manage Cortinarioid Description Form

Use this form for specimens with rusty-colored spores and a veil or cortina.

Provide notes and circle as many of the characters from grouped character sets as appropriate.

Genus/species: _____ Mycology team collection number: _____

Other collector's number: _____ Date: _____

Collected by: _____ Photo number(s): _____

Ecology:

Dominant trees and shrubs: _____

Growth habit: single scattered caespitose gregarious grouped

Age of specimens: immature mature old mixed

Substrate (circle one): **On duff:** pine cone leaves needles twig litter

On soil: mineral humus

On wood: conifer hardwood Species: _____

General characters (write range of dimensions in mm for multiple specimens)

Color of spore print: _____

Height of entire specimen: _____ Length of stem: _____

Width of cap: _____ Height of cap at center: _____

Width of stem at apex: _____ Widest width of stem: _____

Cap flesh thickness _____

Odor: mild strong pleasant unpleasant *Other:* _____

Taste (don't swallow): mild strong bitter pleasant unpleasant peppery *Other:* _____

Color (note color gradations, spots, streaks, bruising reactions, changes with age or drying)

Cap surface (young): _____

Cap surface (mature): _____

Hygrophanous (watery appearance when wet; changes color when losing moisture): N Y

First becomes hygrophanous near: margin disc

Cap flesh: _____

Gills (young): _____

Gills (mature): _____

Gill edge: concolorous darker lighter

Stem surface: _____

Stem flesh: _____

Partial veil/cortina: _____

Universal veil remnants (if present, can be hard to see): _____

Cap characters:

Surface texture: dry viscid sticky glutinous *Other:* _____

Surface ornamentation: smooth silky fibrillose radially fibrillose scaly tomentose
glittering veil remnants Describe: _____

Shape: convex conic plane depressed umbilicate funnel mammilate umbonate
Other: _____

Margin shape: straight uplifted recurved inrolled incurved *Other:* _____

Contours of margin: striate even wavy irregular appendiculate *Other:* _____

Flesh consistency: fleshy brittle spongy tough chalky *Other:* _____

Stem characters:

Stem shape: equal ventricose tapered at apex tapered at base radicate (rooted) clavate
bulbous twisted *Other:* _____

Surface texture: viscid sticky dry polished smooth fibrillose punctate

Surface ornamentation: smooth pruinose (powdered at apex) scaly fibrillose tomentose
Other: _____

Stem consistency: cartilaginous fibrous chalky *Other:* _____

Flesh texture: solid stuffed hollow *Other:* _____

Gill characters:

Attachment to stem: free adnexed adnate sinuate decurrent *Other:* _____

Edge shape: entire scalloped wavy serrate eroded *Other:* _____

Spacing of gills: crowded close subdistant distant

Number of short gills between complete gills: _____

Veil:

Any veil or veil remnants present: N Y If yes, complete the following:

Partial veil structure: persistent sparse fibrillose slimy Describe: _____

General position of annulus: apical central basal Describe: _____

Universal veil: N Y **Universal veil structure:** slimy thin cottony filmy

Chemical characters: (Important for the genus *Cortinarius*)

KOH on cap surface _____ **Melzer's reagent of cap surface** _____

KOH on cap flesh _____ **Melzer's reagent on cap flesh** _____

KOH on partial veil _____

Notes/Sketch:

Survey and Manage Gilled Fungi Description Form

Provide notes and circle as many of the characters from grouped character sets as appropriate.

Genus/species: _____ Mycology team collection number: _____

Other collector's number: _____ Date: _____

Collected by: _____ Photo number(s): _____

Ecology:

Dominant trees and shrubs: _____

Growth habit: single scattered caespitose grouped

Age of specimens: immature mature old mixed

Substrate (circle one):

- On duff:** pine cone leaves needles twig litter
- On soil:** mineral humus
- On wood:** conifer hardwood Species: _____
- Other:** fungus insect

General characters (write range of dimensions in mm for multiple specimens)

Color of spore print: _____

Height of entire specimen: _____ **Length of stem:** _____

Width of cap: _____ **Height of cap at center:** _____

Width of stem at apex: _____ **Widest width of stem:** _____

Odor: mild strong pleasant unpleasant *Other:* _____

Taste (don't swallow): mild strong pleasant unpleasant peppery *Other:* _____

Color (note color gradations, spots, streaks, bruising reactions, changes with age or drying)

Cap surface: _____

Hygrophanous (watery appearance when wet; changes color when losing moisture): N Y

Cap flesh: _____

Gills: _____ **Gill edge:** concolorous darker lighter

Stem surface: _____

Stem flesh: _____

Cap characters:

Latex: N Y **Latex color:** _____

Surface texture: dry greasy sticky slimy

Surface ornamentation: smooth pubescent fibrillose cracked wrinkled scaly granular warty

Shape: convex conic bell-shaped plane depressed umbilicate funnel mammilate umbonate

Other: _____

Margin shape: straight uplifted recurved inrolled incurved

Contours of margin: striate even wavy irregular appendiculate **Other:** _____

Flesh consistency: fleshy brittle spongy tough chalky **Other:** _____

Stem characters:

Stem shape: equal ventricose tapered at apex tapered at base radicate (rooted) clavate bulbous twisted

Other: _____

Surface texture: viscid sticky dry polished smooth fibrillose punctate

Surface ornamentation: smooth pruinose (powdered at apex) scaly fibrillose tomentose

Other: _____

Stem consistency: cartilaginous fibrous chalky **Other:** _____

Flesh texture: solid stuffed hollow **Other:** _____

Gill characters:

Attachment to stem: free adnexed adnate sinuate decurrent **Other:** _____

Edge shape: entire scalloped wavy serrate eroded **Other:** _____

Veil:

Any veil or veil remnants present: N Y If yes, complete the following:

Partial veil: N Y **Veil color:** _____

Veil structure: membranous fibrillose cortina slimy

Annulus: N Y **General position of annulus:** apical central basal

Annulus type: single double **Annulus color:** _____

Universal veil: N Y **Volva shape:** saccate collared sheathing concentric zones

Volva color: _____

Remnants present on cap: N Y **Color of remnant:** _____

Chemical characters: (Important for the genus *Cortinarius*)

KOH on cap surface _____ **Melzer's reagent of cap surface** _____

KOH on cap flesh _____ **Melzer's reagent on cap flesh** _____

KOH on partial veil _____

Notes/Sketch:

Survey and Manage Ascomycete Fungi Description Form Elfin Saddles and Cups

Provide notes and circle as many of the characters from grouped character sets as appropriate.

Genus/species: _____ Mycology team collection number: _____

Other collector's number: _____ Date: _____

Collected by: _____ Photo number(s): _____

Ecology:**Dominant trees and shrubs:** _____**Growth habit:** single scattered caespitose grouped**Age of specimens:** immature mature old mixed**Substrate (circle one):****On duff:** pine cone leaves needles twig litter**On soil:** mineral humus**On wood:** conifer hardwood Species: _____**General characters** (write range of dimensions in mm for multiple specimens)**Sporocarp type:** morel types elfin saddles cups**Height of entire specimen:** _____ **Length of stem:** _____**Width of cap:** _____ **Cap flesh thickness:** _____**Odor:** mild strong fragrant farinaceous *Other:* _____**Taste** (do not swallow): mild strong sweet bitter hot *Other:* _____**Sporocarp shape:** cup disk cushion rabbit-ear truncate club spatulate saddle-stipitatebrain-stipitate pitted-stipitate *Other:* _____**Flesh consistency** (in cross section): gelatinous fleshy brittle tough rubbery spongy**Flesh color and bruising:** _____**Hymenium color** (spore-bearing surface): _____**Abhymenium color** (opposite spore-bearing surface): _____**Abhymenium texture:** smooth pubescent scaly granular warty fibrillose greasy sticky dry

silky hygrophanous (changing color when losing moisture)

Stem characters (if present, use cross-section for measurement):

Stem present: N Y (if yes, then continue)

Length (mm): _____ **Width at widest point (mm):** _____ **Width at base (mm):** _____

Shape: equal ventricose tapered at apex tapered at base compressed

Other: _____

Stem flesh texture: gelatinous firm solid stuffed hollow

Flesh color: _____ **Surface color:** _____

Surface character: dry moist viscid smooth tomentose ribbed scaly folded grooved

wrinkled fibrillose *Other:* _____

Stem present: N Y (if yes, then continue)

Length (mm): _____ **Width at widest point (mm):** _____ **Width at base (mm):** _____

Shape: equal ventricose tapered at apex tapered at base compressed

Other: _____

Stem flesh texture: gelatinous firm solid stuffed hollow

Flesh color: _____ **Surface color:** _____

Surface character: dry moist viscid smooth tomentose ribbed scaly folded grooved
wrinkled fibrillose *Other:* _____

Color of flesh in cross section:**Tips:** _____**Branches:** _____**Stem:** _____**Rusty root present** (pale brown band in lower stem when cross-sectioned): N Y**Branch and stem characters:****Stem form:** massive chunky slender single fused fascicled**Stem flesh consistency** (one or more): solid hollow fleshy-fibrous brittle rubbery-cartilaginous firm-cartilaginous slimy-cartilaginous marbled-gelatinous *Other:* _____**Branch consistency:** fragile firm fleshy-fibrous cartilaginous brittle rubbery firmly-gelatinous slimy-gelatinous) *Notes:* _____**Rhizomorphs present** (white threads at base): N Y**Reaction of Melzer's reagent on interior stem flesh** (optional): amyloid dextrinoid none**Reaction of $\text{Fe}_2(\text{SO}_4)_3$ on interior stem flesh** (optional): green none

Survey and Manage Sequestrate Fungi Description Form

Provide notes and circle as many of the characters from grouped character sets as needed.

Genus/species: _____ Mycology team collection number: _____

Other collector's number: _____ Date: _____

Collected by: _____ Photo number(s): _____

Ecology:

Dominant trees and shrubs: _____

Growth habit: single scattered grouped

Age of specimens: immature mature old mixed

Substrate (circle one): **In duff:** pine cone leaves needles twig litter

In soil: mineral humus

On wood: conifer hardwood Species: _____

General characters (write range of dimensions in mm for multiple specimens)

Height (mm) _____ **Width** (mm): _____

Shape: globose subglobose irregular top-shaped

Overall consistency: tough crisp rubbery friable hard powdery inside

Odor: mild strong pleasant unpleasant *Describe:* _____

Peridium (outer surface):

Color immediately upon collection: _____

Color changes or bruising: _____

Texture: warty smooth tomentose wrinkled folded crusty

Color change with KOH 5% (when available): _____

Separable from gleba (inner portion): N Y **Thickness** (mm): _____

Rhizomorphs present: N Y If yes, attachment: at base along sides overall

Rhizomorph color and changes: _____

Gleba (inner portion: describe when cut in half):**Arrangement:** solid veined gilled convoluted chambered**Texture:** powdery cottony marbled gelatinous waxy**Color:** _____**Color changes and bruising after 5 minutes:** _____**Latex present:** N Y **Latex color:** _____**Columella present** (sterile tissue): N Y If yes: single robust joins apex of peridium dendroid**Columella color:** translucent opaque *Other:* _____**Stem present:** N Y If yes, as: basal pad distinct stem

Glossary

abhymenial surface—opposite the spore-bearing surface

acanthophyses—clavate or cylindrical hyphae with pinlike outgrowths near the apex

acrid—sharp

acrogenous—borne at the apex

aculeate—having narrow spines

acute—less than a right angle

acyanophilic—not staining blue when mounted in cotton blue

adnate—gills attached to the stem

adnexed—gills attached narrowly to the stipe

agaricoid—having the overall features of a gilled mushroom

agglutinated—stuck together as if with glue

allantoid—slightly curved with rounded ends

alutaceous—the color of buff leather

alveolae—honeycomblike hollows

alveolate—marked with honeycomblike hollows

amorphous—having no definite form

ampulliform—flasklike in form

amygdaliform—almond shaped

amyloid—staining blue or black with application of Melzer's reagent

anastomose—fusion between hyphae

anise—smell of licorice

annulus—a ringlike partial veil, around the stipe after expansion of the cap

ANO—aniline oil (1:1 aqueous mixture)

ANW—alpha naphthol (5-percent aqueous solution)

apiculate—having an apiculus

apiculus—a short projection at one end, also called a hilar appendage

apobasidium—a basidium with nonapiculate spores, borne symmetrically on the sterigmata and not forcibly discharged

apothecium—a cup or saucerlike sporocarp in which the hymenium is exposed at maturity

appendiculate—the edge of the expanded cap fringed with toothlike remains of the veil

applanate—flattened

arcuate—arclike

areoles—cracks or divisions

Ascomycete(s)—phylum level of classification for ascus-containing fungi

ascus(i)—saclike structure that contains ascospores

aseptate—lacking septa

astringent—bitter

asymmetrical—not symmetrical

attenuation—narrowing

autolysis—self-digestion of a cell

avellaneous—pale yellow brown

bacilliform—rodlike in form

basal collar—collar located at the base of the spore

basal pad—sterile tissue located at point of attachment

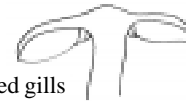
basal scar—scar located at point of attachment of spore to basidium



acanthophyses



adnate gills



adnexed gills



annulus



two shapes of asci

basidium(a)—cell that produces spores externally on sterigmata

basidiole—a sterile basidiumlike hymenial cell

Basidiomycete(s)—phylum level of classification for basidia containing fungi

bifid—forked

biguttulate—having two oillike drops within the spore

boletoid—resembling bolete in structure

brachybasidole(s)—short basidioles

brunnescent—becoming brown

bryophilous—fungi growing on mosses or liverworts

bulbous—bulblike; a stem with a swelling at the base

caespitose—in groups or tufts, gregarious

calyptrate—hooded

campanulate—bell shaped

cap cuticle—the outer layer of cells on a cap

cap cuticle—the outer layer of the pileus

capillitium—sterile, threadlike elements in among the spores

capitate—having a well-formed head

cartilaginous—firm and tough but readily bent

caulocystidia—cystidia found on the stipe

centipetally—toward the center

cheilocystidia—cystidia found on the edge of the lamella

chlamydospore—an asexual 1-celled spore

chrysocystidia—smooth, thin walled cystidia with highly staining contents

circumferentially aligned—aligned along the perimeter of a circle

clamp connections—a hyphal outgrowth that at cell division makes a connection between the resulting two cells by fusion

clavate—clublike; narrowing in the direction of the base

claviform—clublike; see clavate

cleft—partially split or divided

coagulated—congealed or clotted

coalesced—grown together

columella—a sterile central axis within a mature sequestrate sporocarp

concave—hollowed inward; similar to a bowl

concolorous—of one color

confluent—coming together

conic—shaped like a cone

conidium(a)—asexual spores

connate—born together

context—tramal tissue

convex—broadly obtuse

copious—abundant

coral—corallike fleshy fungi in the family Ramariaceae

coriaceous—leatherlike in texture

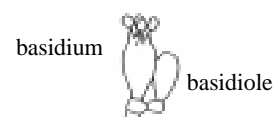
corneous—hornlike in texture

cortex—a more or less thick outer covering

cortical tissue—tissue from the cortex

cortina—a weblike partial veil covering the gills

crenate—having the edge toothed with rounded teeth



basidium

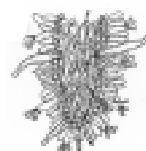
basidiole



bulbous stem base



campanulate cap



cheilocystidia



clavate cells



two types of columellae



conic cap



corallike sporocarps



cortina

crenulate—edged with delicate rounded teeth

cristate—crested

crozier—a hook of an ascogenous hypha before ascus development

cruciate—in the form of a cross

crustose—a hard surface layer

crystalloid—resembling crystals

cup—a Discomycete, particularly in the Pezizales or Leotiales

cutis—outer layer, consisting of compressed hyphae

cyanophilic—readily absorbing cotton blue

cystidium(a)—a sterile, distinctively shaped cell

cystidoid—cystidialike

cytoplasm—the protoplasm of a cell

decurrent—running down the stipe

dendroid—treelike in form

denticulate—toothed

dermatopseudocystidia—cystidialike structures on the edge of the pileus

dextrinoid—staining red or red-brown in Melzer's reagent

dichophyses—modified terminal hyphae in the hymenium

dichotomous—dividing into two parts

dimitic—having hyphae of two kinds

disc—the round, platelike or curved spore-producing part of an Ascomycete sporocarp

discoïd—resembling a disk

distally—situated away from the center of the sporocarp

divaricate—divergent at right angles

diverticulum(a)—a pocketlike side branch

earth tongue—sporocarps of the genus *Geoglossum*

eccentric—not circular

echinate—having sharply pointed spines

ectal excipulum—the outer layer such as in the peridium

eguttulate—without guttules

ellipsoid—shaped like an ellipse

emergent—rising out of

encrusted—overlain with a crust

endophytic—living within another

enrolled margin—rolled within

ental excipulum—the inner layer such as in the peridium

ephemeral—lasting a short time

epicuticular—outer layer of tissue

epicutis—outer layer of tissue

epigeous—growing aboveground

epiphytic—living on the surface of another

epithelium—the outer layer of tissue

esulent—of use as food, edible

ETOH—ethanol

euhymenium—containing a palisade of basidia

evanescent—having a short existence

excrecence—an abnormal outgrowth



crenulate gills



cup-shaped sporocarps

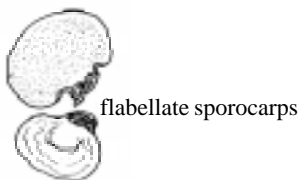


decurrent gills



enrolled margin

- extracellular**—outside the cell
- fabaceous**—resembling a bean
- farinaceous**—smells like cornmeal
- farinose**—like meal in form
- fascicle**—a little group or bundle
- fasciculate**—growing in fascicles
- fawn**—pale gray-brown
- FCL**—ferric chloride (10-percent aqueous solution)
- ferruginous**—resembling iron rust in color
- Fe₂(SO₄)₃**—ferric sulfate (10-percent aqueous solution)
- fibrillose**—with fine hairs or fibers
- fibrils**—small fibers
- filamentose**—threadlike
- filiform**—threadlike
- fimbriate**—delicately toothed, fringed
- flabellate**—shaped like a fan
- flabelliform**—shaped like a fan
- flaccid**—limp or not stiff
- flexuous**—elastic
- floccose**—cottony
- flocculose**—delicately cottony
- friable**—easily crumbled
- FSW**—ferric sulfate 10-percent aqueous
- fulvous**—pale brown-yellow
- furcate**—forked
- furfuraceous**—covered with flaky particles
- fuscous**—brown-gray
- fusoid**—tapering towards each end
- gametangium(a)**—cell containing gametes or gametic nuclei
- gelatinized**—jellylike
- gelatinous**—jellylike
- generative hyphae**—hyphae that are branched, septate, with or without clamp connections, thin or thick walled, and of unlimited growth
- germ pore**—a differentiated, frequently apical area in a spore wall
- glabrescent**—smooth
- glabrous**—smooth
- glandular dot**—a dot due to the presence of a gland
- gleba**—spore-bearing tissue in sequestrate fungi
- gleocystidia**—thin walled, usually irregular cystidia with yellow or highly refractive contents
- gleoplerous hyphae**—hyphae with long cells, with many oil drops
- globose**—sphaerical
- gluten**—a substance that is sticky when wet
- glutinous**—covered with gluten
- granulated**—covered with small particles
- granule**—a small particle
- granulose**—roughened with granules
- gregarious**—in groups but not joined together



flabellate sporocarps



glandular dots on stem

GUA—tincture of guaiac (saturated solution of gum guaiac in 95-percent ethyl alcohol)

guttules—oil-like drops

hemispheric—one of two half-spheres

heteromerous—having sphaerocyst nests among filamentose hyphae

hirsute—having long hairs

hyaline—colorless

hygrophanous—having a water-soaked appearance when wet

hymenium—the spore-bearing layer of tissue

hyphae—one of the filaments of a mycelium

hyphoid—like hyphae in form

hypogeous—growing belowground

IKI—Melzer's reagent

imbricate—scales partly covering one another like roof tiles



incurved margin

inamyloid—not reacting to Melzer's reagent

incurved—curved inward

inoperculate—opening by an irregular apical split to discharge spores



intervenose connections

internodes—the interval between nodes

intervenose—condition where veins are found in the spaces between gills

isodiametric—having equal diameters

ixocutis—a slimy cuticle

ixotrichoderm(ium)—a trichodermium composed of gelatinized hyphae

KOH—(as mounting medium): potassium hydroxide (2- to 5-percent aqueous solution)

KOH—(as macrochemical reagent): potassium hydroxide (10-percent aqueous solution)

labyrinthine—structure of complex paths

lacerate—to tear roughly

lactiferous hyphae—hyphae which secrete a milky juice

lacunose—having a hole or hollow

lageniform—swollen at the base and narrow at the tip

lamella(ae)—hymenium-covered vertical plates on the underside of the cap

lamellar—of lamellae

lamellulae—a small lamella

lamine—composed of layers

latex—a milklike juice

lattice—cross-barred; like a network



leptocystidia

leptocystidia—a thin-walled smooth cystidia

lignicolous—occurring on wood

limoniform—lemonlike in form

loculate—divided into locules

locules—a cavity

lunate—like a new moon

macrocystidia—cystidia that arise from deep within the hymenium

macrofungi—fungi with sporocarps large enough to be seen without a hand lens

matrix—the substrate in or on which an organism is living

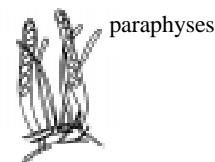
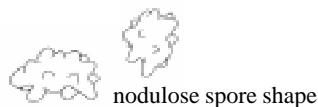
mediostratum—the middle layer

medullary excipulum—tissue below the generative layer in an apothecium

Melzer's reagent—an iodine reagent

membranaceous—like a thin skin

- metuloid**—an encrusted cystidium thick walled at maturity
- microfungi**—fungi with small sporocarps that are seen only with a hand lens
- moniliform**—having swellings at regular intervals
- monochromatic**—consisting of one color or hue
- monomitic**—consisting of a single kind of hyphae
- monosporus**—one spored
- mottled**—having patches of different colors or shades
- mottling**—to be mottled
- mucilage**—a gelatinous substance
- mucilaginous**—sticky or viscid
- mucronate**—an abrupt sharp terminal point
- multifid**—divided into a number of parts or lobes
- multiguttulate**—having more than two guttules
- mushroom**—an enlarged, epigeous, fleshy sporocarp of a fungus
- mycelium**—a mass of hyphae
- mycophilic**—lover of fungi
- mycorrhiza(e)**—a mutually beneficial symbiotic association of plant roots and fungi
- napiform**—turniplike in form
- naviculate**—boatlike in form
- nodulose**—having broad-based, blunt, wartlike structures
- NOH**—ammonium hydroxide (10-percent aqueous solution)
- obclavate**—inversely clavate
- obconic**—inversely conic
- oblique**—not at a 45-degree angle
- obovoid**—ovoid with the broad end towards the apex
- obpyramidal**—the reverse of pyramid shaped
- obpyriform**—the reverse of pear shaped
- obtuse**—rounded or blunt
- ochraceous**—somewhat ocherlike in color
- ochre**—a red-yellow color
- oleiferous**—containing a refractive substance
- olivaceous**—somewhat olive colored
- opaque**—unable to be seen through
- operculate**—opening by an apical lid to discharge spores
- orbicular**—circular
- ostioles**—the pore from which spores emerge
- palisade**—a layer of columnar cells
- pallid**—pale
- palmate**—having lobes extending from a common center
- papilla**—a small rounded process
- papillate**—having papilla
- paraphysis**—a sterile upward growing, basally attached hyphal element in an Ascomycete hymenium
- partial veil**—a layer of tissue, developed from the stem, that joins the stem to the cap edge during hymenium development
- part spores**—one of the 1-celled spores resulting from the breakup of a 2- or more-celled ascospore
- pedicellate**—having a small stalk
- pellucid-striate**—having a somewhat transparent top so that the gills can be seen from above



pendant—hanging down

percurrent—extending throughout the entire length

periclinal—curved in the direction of the surface

peridium—the outer membrane of a sequestrate sporocarp

perisporal sac—a wall that forms a loose envelope around a spore

perithecium(a)—a subglobose or flasklike Ascomycete sporocarp

PHN—phenol (2-percent aqueous solution)

pileate—having a cap

pileipellis—the cellular cortical layers

pileocystidia—cystidia found on cap

pileus—the umbrella-shaped (cap) structure of a mushroom

pip-shaped—shaped like an apple seed

plage—a smooth, colorless spot on a surface

plano-convex—flat on one side and convex on the other

pleurocystidia—cystidia found on the side of the structure

pluridigitate—multidigitate; many fingerlike structures

plurinodulose—with multiple nodulose elements

polychotomous—having an apex dividing into more than two branches

polypore—a macrofungus with a pored hymenium

pore—a small opening

pruinose—having a frostlike or flourlike surface

pseudocystidia—cells that appear like cystidia but are not cystidia

pseudoparenchymatous—inflated cells in the peridium or trama of certain fungal groups

pseudorhiza—rootlike structure of the lower stem

pseudosclerotium—a compacted mass of intermixed substratum held together by mycelium

pubescent—having soft hairs

puffball(s)—species in the order Lycoperdales

pulvinate—cushionlike in form

punctate—marked with small spots

pungent—having a strong smell

PYR—pyrogallol (10-percent aqueous solution of pyrogallol acid)

pyriform—pearlike in form

radicate—spreading from a center

raphanoid—radishlike

recalcitrant—not easily changed

recurved—curved backward or inward

refractive—not translucent

refractive hyphae—hyphae with contents that are colored

refringent—not translucent

reniform—kidney shaped

repand—having a waved edge which is turned back

repent—prostrate

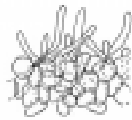
resupinate—found with the hymenium upward and little sterile tissue

reticulum—like a net

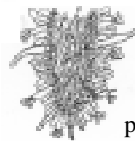
rhizomorph(s)—a rootlike aggregation of hyphae having a well-defined apical meristem

rhizomorphic—rhizomorphlike

rimose—having small cracks



pileocystidia on cap



pleurocystidia



resupinate sporocarp



reticulate ornamentation



rhizomorph attached at base

rimose-rugulose—having small cracks or delicately wrinkled

rostrate—beaked

rugose—wrinkled

rugulose—having small wrinkles

saccate—like a sack



saccate ascus

salmon—yellow-pink

salmonaceous—somewhat yellow-pink

saprophyte—living on dead material

sarcodimitic—long, thick-walled, inflated hyphae

scabrous—rough

scurfy—flakes or scales that adhere to the surface

seceded—withdrawn

sepia—brown-gray to dark olive-brown

septum(a)—a dividing wall in fungal cells

sequestrate—sporocarps that normally retain their spores within until they decay in place or are eaten

sessile—without a stem

sheen—shiny or glossy appearance

silica gel—colloidal silica

sinuate—notched

skeletal hyphae—hyphae that are thick walled, aseptate, of limited length, with thin-walled apices, usually unbranched

sordid—a dull or muddy color

spathulate—like a spoon in form

sphaerocysts—globose cells

sphaeropedunculate—

spherical—having the form of a sphere

spinule—a small spine

sporiferous—bearing spores

sporocarp—a general term for a spore-bearing organ

squamule—a small scale

squamulose—having small scales

stalactiform—having the general form of a stalactite

sterigmal attachment—the attachment point for the spore on the basidium

sterigma—the structure that attaches the spore to the basidium

stipitate—having a stem

stipitipellis—layer of tissue making up the stem

stipitipith—the tissue within the context of the stem

stratum—a layer of tissue

striate—marked by lines, grooves, or ridges

striatulate—marked by small lines, grooves, or ridges

strigose—rough with sharp-pointed hairs

sub—prefix for approximating

subglobose—not quite globose

sublacrimiform—like a tear drop

sulcate—grooved

suprahilar—the area above the sterigmal attachment

suprapellis—the topmost cortical layer



squamulose cap



sterigmata on basidium

SYR–syringaldazine in ethanol

tawny–brown-orange to pale brown

terete–cylindrical but narrowing at one end

terrestrial–growing on soil

terricolous–growing on the ground

tibiiform–shaped like a tibia bone

tomentose–a covering of soft, matted hairs

tomentum–a covering of tangled or matted wooly hairs

tortuous–with repeated twists, bends, or turns

torulose–cylindrical but with swellings at intervals

trama–the layer directly beneath the subhymenium

trichodermium–the outer layer composed of hairlike elements projecting from the surface

truffle(s)–sequestrate Ascomycota, Basidiomycota, and Zygomycota

truncate–ending abruptly

tuberculate–wartlike processes

tubulose–having the form of a tube

turbinate–in the shape of a top

turf–a distinct layer

TYR–l-tyrosine

umbilicate–have a small hollow; cap of a pileus having a hollow on the top above the stipe

umbo–a rounded elevation

umbonate–having a rounded elevation

undulate–rising and falling as in waves

ungulate–a hoofed animal

uniseptate–with a single septa

uniseriate–in a single series

urnulate–shaped like an urn

veil–a ringlike tissue on the stipe after sporocarp expansion

velutinous–covered with a silky pubescence

venae externae–veins of pale colored tissue that reach the outer surface within sequestrate ascomycota

venae internae–dark-colored, spore-bearing tissues that do not reach the outer surface within sequestrate ascomycota

ventricose–swelling in the middle or on one side

verrucose–small rounded warts

versiform–changing form with age

vesicle–a bladderlike sac

vesicular–vesiclelike

vesiculose–full of vesicles

villose–covered with long soft hairs

vinaceous–the color of wine

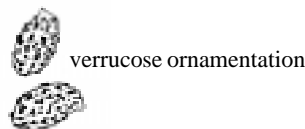
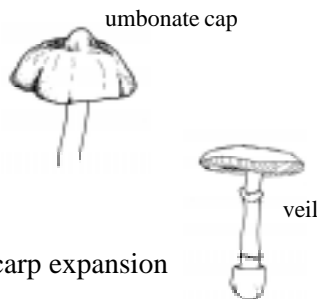
violaceous–the color violet

viscid–slimy, sticky, or viscous

volva–the cup-like lower part of the universal veil, around the stipe base

Zygomycete(s)–the class of fungi having zygosporangia

zygosporangia–the formation of spores by the fusion of gametangia



This page has been left blank intentionally.

This page has been left blank intentionally.

This page has been left blank intentionally.

The **Forest Service** of the U.S. Department of Agriculture is dedicated to the principle of multiple use management of the Nation's forest resources for sustained yields of wood, water, forage, wildlife, and recreation. Through forestry research, cooperation with the States and private forest owners, and management of the National Forests and National Grasslands, it strives—as directed by Congress—to provide increasingly greater service to a growing Nation.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, or marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD).

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence Avenue SW, Washington, DC 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal opportunity provider and employer.

Pacific Northwest Research Station

Web site	http://www.fs.fed.us/pnw
Telephone	(503) 808-2592
Publication requests	(503) 808-2138
FAX	(503) 808-2130
E-mail	pnw_pnwpubs@fs.fed.us
Mailing address	Publications Distribution Pacific Northwest Research Station P.O. Box 3890 Portland, OR 97208-3890