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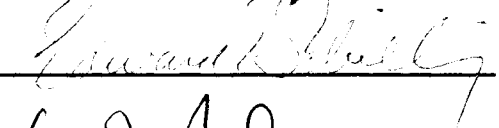
I am submitting herewith a dissertation written by Gregory Michael Mueller entitled "The Genus Laccaria in North America Excluding Mexico." I have examined the final copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Botany.

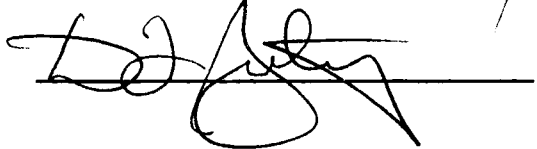


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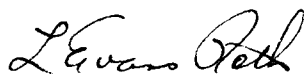
We have read this dissertation
and recommend its acceptance:







Accepted for the Council:



Vice Chancellor
Graduate Studies and Research

THE GENUS LACCARIA IN NORTH AMERICA
EXCLUDING MEXICO

A Dissertation
Presented for the
Doctor of Philosophy
Degree
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Gregory Michael Mueller

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ABSTRACT

The genus Laccaria comprises an important part of the North American mushroom flora north of Mexico. Nineteen species of Laccaria were recognized from the study area. Of these, seven are new to science, one is a comb. nov., and one is reported for the first time from the geographical range.

Data obtained through detailed morphological examinations of basidiocarps and somatic culture mat studies were included in the numerical taxonomic analyses in order to objectively develop a classification scheme based on overall phenetic similarities. Although additional analyses, undertaken to investigate the effect of using differing sets of characters were attempted, satisfactory results were obtained only when cultural data along with macro- and micro-morphological data were included. This emphasized the importance of cultural characters for the accurate circumscription of species.

In addition to an examination of North American material, an attempt was made to examine all extant type specimens, including designation of neotypes or representative material when type specimens did not exist or were unavailable. Descriptions of all of these collections are offered. To facilitate further work on the genus, a tentative key to the world taxa of Laccaria is presented.

TABLE OF CONTENTS

CHAPTER	PAGE
I. INTRODUCTION	1
Taxonomic and Nomenclatural History.	4
History of the Genus in North America.	6
II. MATERIALS AND METHODS.	8
Classical Taxonomic Studies.	8
Culture Mat Analysis	13
Taxometric Procedures.	15
Electrophoretic Analysis of Total Proteins	15
III. DISCUSSION OF TAXONOMIC CHARACTERS	17
Macromorphological Characters.	17
Micromorphological Characters.	23
Cultural Characters.	44
Cultural Induction of Basidiocarps	49
Electrophoretic Characters	52
IV. TAXOMETRIC ANALYSIS.	53
Taxometric Procedures.	54
Results.	57
Additional Analyses.	62
V. NORTH AMERICAN TAXA.	68
Key to <i>Laccaria</i> for North America Excluding Mexico . .	69
<u><i>Laccaria altaica</i></u>	73
<u><i>Laccaria amethysteo-occidentalis</i></u>	78
<u><i>Laccaria amethystina</i></u>	82
<u><i>Laccaria bicolor</i></u>	85
<u><i>Laccaria glabripes</i></u>	89
<u><i>Laccaria laccata</i></u>	92
<u><i>Laccaria lateritia</i></u>	103
<u><i>Laccaria lavendipes</i></u>	105
<u><i>Laccaria microspora</i></u>	110
<u><i>Laccaria moelleri</i></u>	113
<u><i>Laccaria montana</i></u>	116
<u><i>Laccaria nobilis</i></u>	119
<u><i>Laccaria oblongospora</i></u>	123
<u><i>Laccaria ochropurpurea</i></u>	127
<u><i>Laccaria proxima</i></u>	132
<u><i>Laccaria tortilis</i></u>	136
<u><i>Laccaria trichodermophora</i></u>	141
<u><i>Laccaria trullisata</i></u>	145
<u><i>Laccaria vinaceo-brunnea</i></u>	148

CHAPTER

PAGE

VI. TENTATIVE KEY TO <u>LACCARIA</u> FOR THE WORLD.	152
VII. TYPE STUDIES	159
<u>Laccaria tetraspora</u> var. <u>aberrans</u>	160
<u>Laccaria laccata</u> var. <u>affinis</u>	161
<u>Agaricus alpestris</u>	162
<u>Laccaria altaica</u>	163
<u>Laccaria amethysteo-occidentalis</u>	164
<u>Agaricus amethystinus</u>	165
<u>Laccaria laccata</u> var. <u>anglica</u>	167
<u>Agaricus bellus</u>	169
<u>Laccaria laccata</u> var. <u>bicolor</u>	169
<u>Laccaria masonii</u> var. <u>brevispinosa</u>	172
<u>Laccaria bullulifera</u>	174
<u>Laccaria calospora</u>	175
<u>Agaricus (Laccaria) canaliculata</u>	176
<u>Laccaria laccata</u> var. <u>carbonicola</u>	177
<u>Laccaria chibinensis</u>	178
<u>Laccaria laccata</u> var. <u>chilensis</u>	179
<u>Clitocybe laccata</u> var. <u>decurrens</u>	180
<u>Agaricus demissus</u>	182
<u>Agaricus echinospermus</u>	182
<u>Agaricus (Clitocybe) echinosporus</u>	183
<u>Agaricus (Clitocybe?) fallacious</u>	184
<u>Laccaria flavo-brunnea</u>	184
<u>Agaricus flavo-fuscus</u>	185
<u>Laccaria fibrillosa</u>	185
<u>Agaricus fraternus</u>	187
<u>Laccaria galerinoides</u>	188
<u>Laccaria laccata</u> var. <u>gibba</u>	190
<u>Laccaria glabripes</u>	191
<u>Agaricus (Clitocybe) glaucipes</u>	193
<u>Naucoria goossensiae</u>	193
<u>Clitocybe tortilis</u> var. <u>gracilis</u>	194
<u>Agaricus grumatus</u>	196
<u>Agaricus (Clitocybe) incongruus</u>	196
<u>Laccaria laccata</u> var. <u>intermedia</u>	197
<u>Agaricus laccatus</u>	199
<u>Russulopsis laricina</u>	202
<u>Laccaria lateritia</u>	202
<u>Laccaria lavendipes</u>	204
<u>Laccaria lilacina</u>	207
<u>Clitocybe laccata</u> f. <u>lilipuntuana</u>	208
<u>Russulopsis lineata</u>	208
<u>Agaricus (Clitocybe) laccata</u> var. <u>lutea</u>	209
<u>Agaricus (Clitocybe) laccata</u> var. <u>[pileo]</u> <u>luteoviolaceo</u>	209

CHAPTER

PAGE

<u>Hygrophorus maritimus</u>	209
<u>Laccaria masonii</u>	210
<u>Laccaria microspora</u>	211
<u>Clitocybe (Laccaria) nana</u> var. <u>microspora</u>	212
<u>Laccaria laccata</u> f. <u>minuta</u>	212
<u>Laccaria laccata</u> var. <u>moelleri</u>	213
<u>Laccaria laccata</u> var. <u>montana</u>	215
<u>Laccaria montana</u>	216
<u>Laccaria murina</u>	218
<u>Laccaria nana</u>	218
<u>Laccaria nigra</u>	219
<u>Russuliopsis nigricans</u>	220
<u>Laccaria nobilis</u>	221
<u>Laccaria oblongospora</u>	223
<u>Agaricus (Clitocybe) ochro-purpureus</u>	226
<u>Agarius ohiensis</u>	227
<u>Agaricus orbisporus</u>	228
<u>Agaricus pachophyllus</u>	228
<u>Clitocybe laccata</u> var. <u>pallidifolia</u>	229
<u>Laccaria ohiensis</u> var. <u>paraphysata</u>	230
<u>Laccaria lateritia</u> var. <u>paraphysata</u>	232
<u>Laccaria tetraspora</u> var. <u>peladae</u>	232
<u>Agaricus (Clitocybe) laccatus</u> var. <u>perpusillus</u>	233
<u>Laccaria tetraspora</u> var. <u>peullensis</u>	233
<u>Agaricus (Clitocybe) porphyrellus</u>	235
<u>Laccaria proxima</u>	236
<u>Laccaria proximella</u>	237
<u>Clitocybe pruinosa</u>	239
<u>Laccaria pumila</u>	239
<u>Laccaria purpureo-badia</u>	240
<u>Russuliopsis laccata</u> var. <u>rosella</u> f. <u>pusilla</u>	242
<u>Laccaria laccata</u> f. <u>retispora</u>	242
<u>Agaricus (Clitocybe) rubro-tinctus</u>	242
<u>Agaricus (Clitocybe) laccatus</u> var. <u>rufo-carnea</u>	243
<u>Laccaria trullisata</u> f. <u>rugulospora</u>	243
<u>Agaricus demissis</u> var. <u>sadicius</u>	244
<u>Laccaria tetraspora</u> var. <u>scotica</u>	245
<u>Agaricus sevocatus</u>	246
<u>Agaricus (Clitocybe) spodophorus</u>	247
<u>Clitocybe laccata</u> var. <u>striatula</u>	247
<u>Laccaria laccata</u> var. <u>subalpina</u>	249
<u>Laccaria laccata</u> var. <u>tatrensis</u>	250
<u>Laccaria tetraspora</u>	252
<u>Agaricus tortilis</u>	253
<u>Russuliopsis thymiphila</u>	255
<u>Laccaria trichodermophora</u>	255
<u>Agaricus (Clitocybe) trullissatus</u>	258

CHAPTER

PAGE

<u>Laccaria tetraspora</u> var. <u>valdiviersis</u>	260
<u>Laccaria</u> <u>vinaceoavellanea</u>	261
<u>Laccaria</u> <u>vinaceo-brunnea</u>	262
<u>Agaricus</u> (<u>Clitocybe</u>) <u>laccatus</u> var. [obscure] <u>violacea</u>	264
<u>Laccaria</u> <u>violaceo-niger</u>	264
<u>Laccaria</u> <u>laccata</u> var. <u>vulcania</u>	265
<u>Laccaria</u> <u>tetraspora</u> var. <u>xena</u>	267
VIII. EXCLUDED TAXA	270
<u>Clitocybe</u> <u>gruberi</u>	270
<u>Laccaria</u> <u>kalosperma</u>	270
<u>Agaricus</u> (<u>Clitocybe</u>) <u>holoporphyrus</u>	270
<u>Agaricus</u> (<u>Clitocybe</u>) <u>porphyrodes</u>	271
<u>Clitocybe</u> <u>puiggarii</u>	271
<u>Clitocybe</u> <u>pulchella</u>	272
<u>Agaricus</u> (<u>Clitocybe</u>) <u>rudis</u>	272
<u>Agaricus</u> (<u>Clitocybe</u>) <u>sublaccatus</u>	273
LITERATURE CITED	274
APPENDICES	285
A. SPECIMENS EXAMINED	286
B. ILLUSTRATIONS OF REPRESENTATIVE BASIDIOSPORES FROM <u>LACCARIA</u> TYPE SPECIMENS OR REPRESENTATIVE MATERIAL	318
C. ILLUSTRATIONS OF "BOXPLOTS" SHOWING MEAN, MEDIAN, RANGE, AND STANDARD DEVIATION OF BASIDIOSPORE MEASUREMENTS FOR <u>LACCARIA</u> TYPE AND REPRESENTATIVE SPECIMENS	327
D. PHOTOGRAPHS OF REPRESENTATIVE NORTH AMERICAN TAXA OF <u>LACCARIA</u>	332
E. PHOTOGRAPHS OF FOUR-WEEK-OLD SOMATIC CULTURE MATS OF THE 10 <u>LACCARIA</u> TAXA WHICH WERE SUCCESSFULLY CULTURED DURING THIS STUDY	336
F. SCANNING ELECTRON MICROGRAPHS OF REPRESENTATIVE BASIDIOSPORES FOR NORTH AMERICAN TAXA OF <u>LACCARIA</u>	338
VITA	340

LIST OF FIGURES

FIGURE	PAGE
1. Representative Basidiospores for North American Taxa of <u>Laccaria</u> : Globose, Moderately Ornamented	24
2. Representative Basidiospores for North American Taxa of <u>Laccaria</u> : Large and Globose, Coarsely Ornamented	24
3. Representative Basidiospores for North American Taxa of <u>Laccaria</u> : Broadly Elliptical to Elliptical, Finely Ornamented.	24
4. Representative Basidiospores for North American Taxa of <u>Laccaria</u> : Subfusiform to Fusiform, Appearing Smooth to Finely Roughened under Light Microscope	24
5. Representative Cheilocystidia for North American Taxa of <u>Laccaria</u>	24
6. Representative Tetrastrophic Basidia of North American Taxa of <u>Laccaria</u>	26
7. Representative Bisporic Basidia of North American Taxa of <u>Laccaria</u>	26
8. Representative Pileipellis Arrangements Occurring in North American Taxa of <u>Laccaria</u> : Trichodermium	28
9. Representative Pileipellis Arrangements Occurring in North American Taxa of <u>Laccaria</u> : Interwoven and Undifferentiated.	28
10. Representative Pileipellis Arrangements Occurring in North American Taxa of <u>Laccaria</u> : Interwoven with Scattered $\pm$ Perpendicular Fascicles of Hyphae	28
11. "Boxplots" Illustrating the Mean, Median, Range, and Standard Deviation of the Basidiospore Length-Width Ratio for Each of the North American Taxa of <u>Laccaria</u>	31
12. "Boxplots" Illustrating the Mean, Median, Range, and Standard Deviation of Basidiospore Length for Each of the North American Taxa of <u>Laccaria</u>	34
13. "Boxplots" Illustrating the Mean, Median, Range, and Standard Deviation of Basidiospore Width for Each of the North American Taxa of <u>Laccaria</u>	36

FIGURE	PAGE
14. "Boxplots" Illustrating the Mean, Median, Range, and Standard Deviation of Basidiospore Ornamentation Length for Each of the North American Taxa of <u>Laccaria</u>	38
15. Hyphal Modifications Observed During Micromorphological Analysis of 6 Week Old Somatic Culture Mats of <u>Laccaria</u> Taxa: Typical Undifferentiated Hyphae.	50
16. Hyphal Modifications Observed During Micromorphological Analysis of 6 Week Old Somatic Culture Mats of <u>Laccaria</u> Taxa: Chlamydospores	50
17. Hyphal Modifications Observed During Micromorphological Analysis of 6 Week Old Somatic Culture Mats of <u>Laccaria</u> Taxa: Coralloid Hyphae	50
18. Hyphal Modifications Observed During Micromorphological Analysis of 6 Week Old Somatic Culture Mats of <u>Laccaria</u> Taxa: Subcoralloid Hyphae.	50
19. Hyphal Modifications Observed During Micromorphological Analysis of 6 Week Old Somatic Culture Mats of <u>Laccaria</u> Taxa: Irregular Swollen Hyphae	50
20. Phenogram Produced by UPGMA Cluster Analysis of 44 OTU's of <u>Laccaria</u> Using 30 Characters (Table 2, Page 55) and Gower's Coefficient of Similarity	58
21. Graph of 44 OTU's of <u>Laccaria</u> Along First Two Axes Determined by Principal Coordinant Analysis Using 30 Characters (Table 2, Page 55)	58
22. Phenogram Produced by UPGMA Cluster Analysis of 44 OTU's of <u>Laccaria</u> Using 15 Characters (See Text) and Gower's Coefficient of Similarity	64
23. Bottom Part of a Phenogram Produced by UPGMA Cluster Analysis of 126 OTU's of <u>Laccaria</u> Using 15 Characters (See Text) and Gower's Coefficient of Similarity. . . .	64
24. Representative Basidiospores from Holotype of <u>Laccaria tetraspora</u> var. <u>aberrans</u>	318
25. Representative Basidiospores from Holotype of <u>Laccaria laccata</u> var. <u>affinis</u>	318

FIGURE	PAGE
26. Representative Basidiospores from Holotype of <u>Laccaria</u> <u>altaica</u>	318
27. Representative Basidiospores from Representative Material of <u>Laccaria</u> <u>amethystinus</u>	318
28. Representative Basidiospores from Holotype of <u>Laccaria</u> <u>amethysteo-occidentalis</u>	318
29. Representative Basidiospores from Holotype of <u>Laccaria</u> <u>laccata</u> var. <u>anglica</u>	318
30. Representative Basidiospores from Representative Material of <u>Laccaria</u> <u>laccata</u> var. <u>bicolor</u>	318
31. Representative Basidiospores from Holotype of <u>Laccaria</u> <u>masonii</u> var. <u>brevispinosa</u>	318
32. Representative Basidiospores from Holotype of <u>Laccaria</u> <u>calospora</u>	318
33. Representative Basidiospores from Holotype of <u>Agaricus</u> (<u>Laccaria</u>) <u>canaliculata</u>	318
34. Representative Basidiospores from Holotype of <u>Laccaria</u> <u>chibinensis</u>	318
35. Representative Basidiospores from Holotype of <u>Laccaria</u> <u>laccata</u> var. <u>chilensis</u>	318
36. Representative Basidiospores from Holotype of <u>Clitocybe</u> <u>laccata</u> var. <u>decurrens</u>	318
37. Representative Basidiospores from Holotype of <u>Agaricus</u> (<u>Clitocybe</u>) <u>echinosporus</u>	318
38. Representative Basidiospores from Holotype of <u>Laccaria</u> <u>fibrillosa</u>	319
39. Representative Basidiospores from Holotype of <u>Agaricus</u> <u>fraternus</u>	319
40. Representative Basidiospores from Holotype of <u>Laccaria</u> <u>galerinoides</u>	319
41. Representative Basidiospores from Holotype of <u>Laccaria</u> <u>laccata</u> var. <u>gibba</u>	319

FIGURE	PAGE
42. Representative Basidiospores from Holotype of <u>Laccaria glabripes</u>	319
43. Representative Basidiospores from Holotype of <u>Naucoria goossensiae</u>	319
44. Representative Basidiospores from Holotype of <u>Clitocybe tortilis</u> var. <u>gracilis</u>	321
45. Representative Basidiospores from Holotype of <u>Laccaria laccata</u> var. <u>intermedia</u>	321
46. Representative Basidiospores from Authentic Material of <u>Laccaria lateritia</u>	321
47. Representative Basidiospores from Holotype of <u>Laccaria lavendipes</u>	321
48. Representative Basidiospores from Holotype of <u>Laccaria lilacina</u>	321
49. Representative Basidiospores from Representative Material of <u>Laccaria laccata</u>	321
50. Representative Basidiospores from Holotype of <u>Laccaria masonii</u>	321
51. Representative Basidiospores from Holotype of <u>Laccaria microspora</u>	321
52. Representative Basidiospores from Holotype of <u>Laccaria laccata</u> var. <u>minuta</u>	321
53. Representative Basidiospores from Holotype of <u>Laccaria laccata</u> var. <u>moelleri</u>	321
54. Representative Basidiospores from Holotype of <u>Laccaria laccata</u> var. <u>montana</u>	321
55. Representative Basidiospores from Holotype of <u>Laccaria montana</u>	321
56. Representative Basidiospores from Holotype of <u>Laccaria nana</u>	321
57. Representative Basidiospores from Holotype of <u>Laccaria nigra</u>	321

FIGURE	PAGE
58. Representative Basidiospores from Holotype of <u>Laccaria nobilis</u>	321
59. Representative Basidiospores from Holotype of <u>Laccaria oblongospora</u>	321
60. Representative Basidiospores from holotype of <u>Agaricus ochro-purpureus</u>	321
61. Representative Basidiospores from Holotype of <u>Agaricus ohiensis</u>	322
62. Representative Basidiospores from Holotype of <u>Clitocybe laccata</u> var. <u>pallidifolia</u>	322
63. Representative Basidiospores from Holotype of <u>Laccaria ohiensis</u> var. <u>paraphysata</u>	322
64. Representative Basidiospores from Holotype of <u>Laccaria tetraspora</u> var. <u>peladae</u>	324
65. Representative Basidiospores from Holotype of <u>Laccaria tetraspora</u> var. <u>peullensis</u>	324
66. Representative Basidiospores from Neotype of <u>Laccaria proxima</u>	324
67. Representative Basidiospores from Holotype of <u>Laccaria proximella</u>	324
68. Representative Basidiospores from Holotype of <u>Laccaria purpureo-badia</u>	324
69. Representative Basidiospores from Holotype of <u>Laccaria trullisata</u> f. <u>rugulospora</u>	324
70. Representative Basidiospores from Holotype of <u>Laccaria tetraspora</u> var. <u>scotica</u>	324
71. Representative Basidiospores from Holotype of <u>Clitocybe laccata</u> var. <u>striatula</u>	324
72. Representative Basidiospores from Holotype of <u>Laccaria laccata</u> var. <u>subalpina</u>	324
73. Representative Basidiospores from Holotype of <u>Laccaria laccata</u> var. <u>tatrensis</u>	324

FIGURE	PAGE
74. Representative Basidiospores from Holotype of <u>Laccaria tetraspora</u>	324
75. Representative Basidiospores from Neotype of <u>Laccaria tortilis</u>	324
76. Representative Basidiospores from Holotype of <u>Laccaria trichodermophora</u>	324
77. Representative Basidiospores from Lectotype of <u>Agaricus trullissatus</u>	324
78. Representative Basidiospores from Holotype of <u>Laccaria tetraspora</u> var. <u>valdiviensis</u>	324
79. Representative Basidiospores from Holotype of <u>Laccaria vinaceo-brunnea</u>	324
80. Representative Basidiospores from Holotype of <u>Laccaria vinaceoavellanea</u>	324
81. Representative Basidiospores from Holotype of <u>Laccaria violaceo-niger</u>	325
82. Representative Basidiospores from Holotype of <u>Laccaria laccata</u> var. <u>vulcanica</u>	325
83. Representative Basidiospores from Representative Material of <u>Laccaria laccata</u> var. <u>xena</u>	325
84. "Boxplots" Illustrating the Mean, Median, Range and Standard Deviation of Basidiospore Length-Width Ratios for Each <u>Laccaria</u> Type or Representative Specimen . . .	327
85. "Boxplots" Illustrating the Mean, Median, Range, and Standard Deviation of Basidiospore Ornamentation Length for Each <u>Laccaria</u> Type or Representative Specimen.	330
86. Photograph of "Typical <u>Laccata</u> " Macromorphology: <u>Laccaria proxima</u>	332
87. Photograph of <u>L. nobilis</u>	332
88. Photograph of "Typical" 2-Sterigmate <u>Laccaria</u> : <u>L. altaica</u>	332
89. Photograph of <u>L. bicolor</u>	332

FIGURE	PAGE
90. Photograph of <u>L. amethystina</u>	334
91. Photograph of <u>L. amethysteo-occidentalis</u>	334
92. Photograph of <u>L. ochropurpurea</u>	334
93. Photograph of <u>L. trullisata</u>	334
94. Photograph of Four-Week-Old Somatic Culture Mats of <u>L. laccata</u>	336
95. Photograph of Four-Week-Old Somatic Culture Mats of <u>L. altaica</u>	336
96. Photograph of Four-Week-Old Somatic Culture Mats of <u>L. trichodermophora</u>	336
97. Photograph of Four-Week-Old Somatic Culture Mats of <u>L. lavendipes</u>	336
98. Photograph of Four-Week-Old Somatic Culture Mats of <u>L. oblongospora</u>	336
99. Photograph of Four-Week-Old Somatic Culture Mats of <u>L. proxima</u>	336
100. Photograph of Four-Week-Old Somatic Culture Mats of <u>L. bicolor</u>	336
101. Photograph of Four-Week-Old Somatic Culture Mats of <u>L. nobilis</u>	336
102. Photograph of Four-Week-Old Somatic Culture Mats of <u>L. ochropurpurea</u>	336
103. Photograph of Four-Week-Old Somatic Culture Mats of <u>L. amethysteo-occidentalis</u>	336
104. Scanning Electron Micrograph of <u>L. tortilis</u> Basidiospores	338
105. Scanning Electron Micrograph of <u>L. altaica</u> Basidiospores	338
106. Scanning Electron Micrograph of <u>L. oblongospora</u> Basidiospores	338
107. Scanning Electron Micrograph of <u>L. trullisata</u> Basidiospores	338

CHAPTER I

INTRODUCTION

Laccaria Berkeley and Broome is a cosmopolitan genus of mushrooms (Agaricales, Tricholomataceae) collected frequently throughout North America. It is distinguished from other members of the Tricholomataceae by having attached, generally thick, waxy-appearing, flesh-colored to violet lamellae, globose to elliptical, rarely subfusiform, echinulate or rarely finely roughened, inamyloid basidiospores, and clamp connections at nearly every septum.

Laccaria makes up a sizeable part of the world mushroom flora, having been reported from every continent except Antarctica. In some habitats (e.g., a secondary pine growth and pine plantations), it is often the dominant or occasionally exclusive mushroom found fruiting in the area (personal observations).

The genus has been reported to form ectomycorrhizal associations with numerous tree species including several that are economically important [e.g., Pinus echinata Mill. and P. taeda L. in the east, and Pseudotsuga menziesii (Mirb.) Franco and Tsuga heterophylla (Raf.) Sarg. in the west] (Trappe, 1962).

In direct contrast to the vast majority of ectomycorrhizal fungi, all stages of the Laccaria life cycle have reportedly been obtained in the laboratory (Stack et al., 1975; Fries, 1977, 1978; Molina, 1980).

Several members of the genus are currently being used in mycorrhizal synthesis experiments (e.g., Bryan and Zak, 1961; Marx and Zak, 1965; Molina, 1977), reforestation studies (Trappe, 1977, personal communication), containerized seedling application (Molina, 1980; Shaw and Molina, 1980) and nutrient uptake studies (Littke, 1982). Thus, Laccaria appears to be a logical choice for initial studies on the biology of ectomycorrhizal fungi.

Additionally, Singer and Moser (1965) and Watling (1977) have reported that some taxa of Laccaria can act as pioneer species. In these cases, Laccaria, growing saprophytically, becomes established in disturbed or barren areas, thereby, allowing tree species that require a mycorrhizal associate to be able to grow on the site. Thus Laccaria, at least in some situations, plays an important role in primary and secondary succession. This process may prove valuable in reforestation projects.

Because of Laccaria's floristic, ecological, and potential economic importance, stabilization of the taxonomy of the genus would have applied implications in addition to adding to our basic knowledge of the fungi.

Although most modern systematists consider Laccaria to be an autonomous genus, easily segregated from other members of the family Tricholomataceae (McNabb, 1972; Singer, 1975), delimitation of infrageneric taxa is difficult in many instances. Much of this problem is due to the inherent variability of certain Laccaria species, especially those which have a wide geographic range. This, together with the lack of type specimens for certain taxa, adds to the

difficulty of circumscribing and stabilizing taxonomic and nomenclatural concepts of infrageneric taxa.

In addition, previously described morphological characters are open to interpretation. For example, it is sometimes unclear whether or not basidiospore measurements included ornamentation (Singer, 1967; McNabb, 1972). Such ambiguity, added to changes in basidiocarp appearance upon drying for preservation, make identification of certain species difficult.

Because of these various factors, a large discrepancy has existed in the number of recognized taxa in the genus. Although 72 species epithets have been used for Laccaria taxa worldwide, Singer (1975) recognized only 17 clearly defined species while McNabb (1972) indicated that there may be as many as 43 species worldwide. Additionally, there has been much confusion concerning the circumscription of several taxa (Malencon, 1966; Lahaie, 1981).

This study was undertaken in an attempt to develop a stable and more "natural" classification scheme for the genus Laccaria in North America excluding Mexico. Because of the problems stated above, it was necessary to examine all extant type collections, when possible, to designate neotypes, when applicable, or representative specimens, when material suitable for neotypification was not available, and to critically examine characters from various stages of the life cycle. An operational approach using techniques of numerical taxonomy to discover discontinuities by which taxa were recognized was used to classify species.

Taxonomic and Nomenclatural History

The name Laccaria was first proposed by Berkeley and Broome in 1883 to accommodate the species of Agaricus subgenus Clitocybe which produced white globose basidiospores that often formed a white pulverulescence on the thick, attached lamellae. Proposed for transfer to the new genus were Agaricus laccatus Scopoli, A. bellus Persoon and several unnamed species from Ceylon and Europe. No new combinations were made until the following year, however, when Cooke (1884) formally transferred eight species to the genus.

Over the intervening century, the presence of clamp connections, spore shape and ornamentation have assumed high priorities as important characters in the modern generic concept of Laccaria (Singer, 1975).

The pre-Friesian history of the taxa involved can be summarized as follows. Scopoli (1772), describing fungi from the Tyrol of southern Austria, was the first to use a binomial, A. laccatus, for a member of the eventual genus Laccaria. Two more species, A. amethystinus and A. farinaceus, were described in 1778 by Hudson from the environs of London. Hudson put A. laccatus in synonymy with A. farinaceus and thus A. farinaceus is a superfluous name. Agaricus tortilis was described from Halifax by Bolton (1788). Finally, Persoon (1801) named A. bellus and two varieties of A. farinaceus: var. rosellus and var. tortilis.

Fries (1821) placed A. laccatus and A. bellus in Tribe VIII Clitocybe, Subtribe 4 Oseypii. He further divided A. laccatus into variety "a" ("Pileo rufo l. carneo, sicco subochraceo") and variety

"b" ("Pileo amethystino, sicco canescente"). Additionally, he listed A. tortilis and A. pachyphyllus Fries (1815) as species which needed to be further examined.

Between 1821 and 1884, a number of workers described new species (e.g., Fries, 1836-1838, 1874; Berkeley, 1845, 1856; Montagne, 1856; Berkeley and Curtis, 1859; Berkeley and Broome, 1871; Ellis, 1874; Karsten, 1876; Spegazzini, 1880; Boudier, 1881) destined later to be incorporated in Laccaria.

The genus Russuliopsis was proposed by Schroeter (1889) for all the taxa previously included in Laccaria. Because Laccaria and its included taxa were validly published, Russuliopsis is a latter typonym and thus a superfluous name.

Laccaria was recognized by both Fayod (1889) and Patouillard (1900) in their attempts to develop a more natural classification system for the Hymenomycetes. Peck (1912) was the first worker in the U.S. to recognize the genus and one of the first in the world to publish a paper exclusively on the group.

It was not until Singer (1943a, 1949, 1962, 1965, 1967, 1972, 1977) became interested in the genus, however, that any attempt was made to organize and formulate a coherent classification scheme for Laccaria based on the world flora. To date, Singer's publications on the genus are by far the most comprehensive and most influential. His classification scheme has been the starting point for this study and for most other taxonomic research on the genus since the 1940's.

Singer's latest taxonomic treatment for Laccaria (1975) divided the genus into four supraspecific groupings (stirps):

(1) Trullisata--smooth to slightly roughened, elongate, large basidiospores, (2) Amethystina--echinate, white or light amethyst basidiospores; lamellae violaceous to dull livid pink, (3) Laccata--echinate, white basidiospores; lamellae pinkish flesh color, and (4) Galerinoides--echinate, short basidiospores; lamellae pale ochraceous-isabelline. Additionally, Singer (1967, 1977) has designated 19 varieties of L. laccata and L. tetraspora Singer in an attempt to more fully describe and compartmentalize the variation observed in these phenotypically plastic taxa [refer to the discussion under L. laccata (Chapter V)].

In addition to Singer's comprehensive work, numerous floristic studies which include Laccaria have been published by various authors for most areas of the world. Some of these publications include: Rea (1922), Kuhner and Romagnesi (1953), Dennis et al. (1960), Orton (1960), Moser (1968) for Europe; Malencon and Bertault (1975) for North Africa; Heinemann (1964, 1966), Pegler (1977) for East Africa; Binyamini (1973, 1976) for Israel; Stevenson (1964), McNabb (1971) for New Zealand; Imai (1938), Hongo (1957, 1959, 1971) for Japan; Singer (1952, 1953), Singer and Digilio (1952), Singer and Moser (1965) for South America; Moller (1945), Lange (1955), Koboyasi (1967), Miller et al. (1982) for the Arctic.

History of the Genus in North America

Schweinitz (1822, 1834) was the first major American mycologist to publish on the North American fungus flora. In his list of all of the then known fungi from America, Schweinitz (1822) included

Agaricus (Omphalia) bellus and A. (Omphalia) farinaceus. In 1834 he included A. (Clitocybe) laccatus, A. (Clitocybe) amethystinus and A. (Clitocybe) bellus. Several Americans, including Curtis, Lea, Sullivant and Wright sent specimens and notes on American fungi to various workers in Europe, especially Berkeley, and several new species (e.g., A. ohiensis Montagne, and A. ochro-purpureus Berkeley) were discovered and published in this manner.

Ellis (1874) described A. (Clitocybe) trullisatus from the sand dunes of New Jersey, and thus became the first American to designate a new species in this group. Charles H. Peck was the first North American worker who studied and published on the group in some detail (Peck, 1890, 1893, 1895, 1897, 1903, 1907, 1912). Laccaria amethystina (Hudson) Cooke, L. laccata, L. ochropurpurea (Berkeley) Peck, L. striatula Peck, and L. tortilis (Bolton) Cooke were included in the North American Flora (Murrill, 1914). These same taxa were included in a study of Laccaria in North Carolina (Coker and Beardslee, 1922).

There has been no comprehensive treatment of the genus for North America. Between six and twelve species have generally been recognized from North America north of Mexico. Recently, however, several modern floristic studies have been carried out. Mueller and Sundberg (1981) and Lahaie (1981) have undertaken floristic treatments of southern Illinois and the Boreal forests of Ontario, respectively. Lahaie's work (1981) represents the first formal study of the genus for Canada. Singer (1954) and Aguirre-Acosta and Perez-Silva (1978) are the major publications on Laccaria for Mexico.

CHAPTER II

MATERIALS AND METHODS

Classical Taxonomic Studies

This study comprised an examination of material collected by the author and dried specimens on loan from cooperating herbaria. Fresh specimens were collected in the following regions of the United States and Canada: southeastern U.S. (Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia); midwestern U.S. (Illinois, Minnesota, Missouri, and Ohio); mountain states (Colorado and Wyoming); northwestern U.S. (Idaho, Oregon, and Washington); eastern Canada (Nova Scotia); and western Canada (British Columbia).

Herbaria and their respective curators which made specimens available for study were the following: Botanischer Garden und Botanisches Museum Berlin-Dahlem, BRD (B); Dept. of Biological Sciences, University of Buenos Aires, Argentina (BAFC); Jardin Botanique National de Belgique, Belgium (BR); Botanical Museum and Herbarium, Denmark (C); Plant Pathology Herbarium, Cornell University (CUP); National Mycological Herbarium, Biosystematics Research Institute, Ottawa, Canada (DAOM); Royal Botanic Garden, Edinburgh (E); Field Museum of Natural History, Chicago (F); Farlow Herbarium of Cryptogamic Botany, Harvard University (FH); Herbarium, Dept. of Botany, University of Florida (FLAS); Conservatoire et Jardin Botaniques, Geneve (G); The Herbarium, Royal Botanic Gardens,

Kew (K); Rijksherbarium, Leiden (L); Los Angeles County Museum of Natural History, Los Angeles (LAM); V. L. Komarov Botanical Institute of the Academy of Sciences of the U.S.S.R., Leningrad (LE); Instituto de Botanica C. Spegazzini, La Plata, Argentina (LPS); University of Maine Herbarium, University of Maine, Orono (MAINE); Herbarium of the University of Massachusetts, Amherst (MASS); Herbarium of the University of Michigan, Ann Arbor (MICH); Institut de Botanique, Universite de Montpellier, Montpellier (MPU); University of North Carolina Herbarium, Chapel Hill (NCU); Tulane University Herbarium, New Orleans (NO); Herbarium, The New York Botanical Garden, Bronx, (NY); Herbarium, New York State Museum, Albany (NYS); Herbarium, Dept. of Botany and Plant Pathology, Oregon State University, Corvallis (OSC); Museum National d'Histoire Naturelle, Laboratoire de Cryptogamie, Paris (PC); Auckland Plant Diseases Division, Dept. of Scientific and Industrial Research, New Zealand (PDD); Herbarium, University of San Francisco, San Francisco (SAFU); Laboratory of Plant Taxonomy and Ecology, Botanical Institute, Faculty of Agriculture, Hokkaido University, Sapporo (SAP); Museo Nacional de Historia Natural, Santiago (SGO); Southern Illinois University Herbarium, Dept. of Botany, Carbondale (SIU); University of Tennessee Herbarium, Knoxville (TENN); Herbarium, Dept. of Biology, Virginia Polytechnic Institute and State University, Blacksburg (VPI); Herbarium, Dept. of Botany, University of Washington, Seattle (WTU). The abbreviations used for herbaria are taken from Holmgren and Keuken (1974). Additionally, the following individuals lent specimens

from their private herbaria: T. Hongo--Herbarium of T. Hongo (=HH); P. E. Kempton--Wells/Kempton Herbarium (=WK).

Collections were made and assembled using standard techniques (Smith, 1949; Largent, 1977). Descriptions of morphological characters were taken for each collection along with notes on habitat and phanerogamic affinities. Additionally, color photos (Kodachrome 25) were taken on representative specimens. Descriptive terms employed were taken from Snell and Dick (1971) and Largent (1977). In order to more precisely indicate color and to standardize terminology, both author generated color names and those derived by comparisons with standard color manuals were employed. Unless otherwise noted, color names within parentheses and quotation marks are from Ridgway (1912) while colors from Maerz and Paul (1930) are noted by (page number/column letter/row number) and names outside of parentheses are author-generated.

After morphological notes were taken, carpophores were preserved by warm-air drying and deposited in TENN. Standard techniques were used for the analysis of micromorphological characters (e.g., Smith, 1949; Largent et al., 1977). Examinations were made using a Nikon Model S-Kt research microscope equipped with both bright field and phase contrast optics. Illustrations of micromorphological characters were made with the aid of a Sankei drawing tube. Dried material was rehydrated by placing the dried tissue in 95% ETOH and then in distilled water. The material was then blotted dry and either free-hand sectioned using razor blades and elderberry pith or placed

directly on a microscope slide and squashed. All measurements and observations were taken on material mounted in 3% KOH and under phase contrast. Iodine reactions were determined in Melzer's reagent and the cyanophilic reaction was determined in cotton blue (Kotlaba and Pouzar, 1964; Singer, 1972; Largent et al., 1977). Descriptive terminology used was taken from Snell and Dick (1971) and Largent et al. (1977).

Micromorphological data used in species descriptions were based on a complete, detailed examination of at least four (when possible) representative collections per species. The number of collections examined was dependent upon the availability of material and the amount of variability encountered within the species. All specimens listed in Specimens Examined (Appendix A) were examined and any deviations from the norm noted. Measurements and observations were taken from several basidiocarps per collection to check for uniformity. At least 10 randomly sampled cheilocystidia, pleurocystidia, and terminal cells of cuticular hyphae and 15 randomly sampled basidia and basidiospores were measured for each collection used. At least 30 basidiospores were measured from type specimens. Basidiospore size data is always given without ornamentation and hilar appendage, with the hilar appendage in profile. Additionally, in order to treat all specimens equally, all basidiospore measurements were taken from hymenial tissue and not from spore prints. Width and diameter measurements of other elements were taken at the widest point. Cuticular arrangement was observed both in radial and scalp sections.

To give some indication of data reliability, the number of elements measured and utilized for compilation of range, length-width ratios, and means are given in parentheses before size data for cuticular hyphae, cheilocystidia, pleurocystidia, and basidia. For basidiospores, the number of collections examined are included in brackets with spore size data (Bas, 1974). Within the brackets, the first figure represents the number of spores measured and the second figure the number of collections examined.

Data from these examinations were then entered into the computer for further analysis.

Because of the importance of basidiospore size, shape and ornamentation for species circumscription, "box plots" illustrating the range, median, mean, and standard deviation are presented for comparative purposes (see Appendix C). The length of the central line designates the range, while the bottom and top of the box delimit the 25% and 75% quantiles, respectively. The width of the box represents the standard deviation of the mean. The mean is labelled with a solid square and the median is demarked by a line terminated with solid circles. These plots are presented for both type material and for composite descriptions of taxa found in North America.

For scanning electron microscopy (SEM), basidiospores from either spore prints or from fragmented hymenial tissue were mounted on specimen stubs with double-sided adhesive tape and subsequently gold plated. In both cases, the spores were not fixed or critical

point dried. The samples were then examined with an ETEC Autoscan scanning electron microscope.

Culture Mat Analysis

The following procedure was employed to obtain dikaryotic tissue cultures of Laccaria. Fresh pilei were carefully torn, exposing the sterile trama. Using sterile finely pointed forceps, small pieces of trama tissue excised from the pileus-stipe interface were aseptically placed on modified Melin Norkrans Medium (=MNM) medium plus benomyl (10 mg/l) in disposable test tubes (Marx, 1969; Molina and Palmer, 1982). The benomyl was added in order to reduce ascomycetous contamination. Initial experimentation with the inclusion of various antibiotics to the medium indicated that the antibiotics had little effect on bacterial contamination but occasionally did inhibit the growth of Laccaria. Antibiotics, therefore, were not used subsequently. Six to ten replicates were taken for each collection utilized. After 2-3 weeks at room temperature, each tube was examined and, if required, subcultured to isolate the fungal hyphae from contaminants. Subsequent subculturing of each isolate continued until a pure culture was obtained. After the isolate was free of contamination, it was transferred to a glass test tube containing modified MNM and stored in the dark at 4 C. Voucher herbarium material of all specimens used for tissue cultures were described and deposited in TENN (Ammirati, 1979).

Culture mat analyses were based on the classic work of Nobles (1948, 1965). In order to standardize the physiological age of the

cultures employed, 90 mm plastic petri plates containing 20-25 ml of Malt Extract Agar (=ME) (Nobles, 1948) were inoculated with mycelium of the isolates being examined and incubated in the dark at 25 C for 2 weeks. After this, a 5 mm round plug of agar containing hyphal tips taken from the advancing zone of each of the "stock" plates was transferred to the edge (mycelium side down) of a petri plate containing 30 ml of either MNM, ME, or Potato Dextrose Agar (=PDA). Seven replicates of each medium for each isolate were inoculated and placed in a dark incubator at 24 C. Macromorphological descriptions were taken during the third and the sixth weeks. Photographs of representative isolates were taken during the fourth week, and micromorphological characters were examined during the sixth week.

Macromorphological characters noted included (a) radius of the culture mat, (b) form and character of the advancing zone, (c) mat color and topography, and (d) the presence or absence of exudates. Terminology used was taken from Nobles (1948, 1958b, 1965).

Micromorphological characters were observed by mounting hyphae from the advancing zone, mat, and plug of each isolate in 3% KOH and examining the slide under phase contrast. Micromorphological characters examined included (a) the presence or absence of modified hyphae, (b) the presence or absence of chlamydospores, oidia, etc., and (c) the possible occurrence of basidiocarp formation or hymenial structures, basidia or cystidia, along the mat surface. Nobles (1948, 1965) was used as the source for descriptive terminology.

Extracellular oxidase activity of each isolate was tested using both the Bavendamm (Davidson et al., 1938) and gum guaic (Nobles, 1958a, 1965) tests. For the Bavendamm test, approximately 4 mm cubes of agar with mycelium taken from 3-week-old stock cultures were transferred, mycelium down, to two petri plates containing Gallic Acid Agar (Davidson et al., 1938). After 7 days of incubation in diffuse light, growth of each isolate was measured, and the plates were examined for the presence or absence of a brown diffusion zone. Size and intensity of the diffusion zone, and thus enzyme concentration and activity, respectively, were recorded using the system of Davidson et al. (1938). For the gum guaic test, a drop of alcoholic gum guaic (0.05 g gum guaic in 30 ml of 95% ETOH) was placed on the surface of the advancing zone, inoculation plug, and mid-portion of 4-week-old cultures on ME (Nobles, 1958a). Any ensuing color changes were observed and recorded using the same scoring method employed in describing results of the Bavendamm test. Observations were made after 2-3 minutes and then again at 1 hour.

Taxometric Procedures

Refer to Chapter IV for a discussion of techniques employed for data handling, descriptive statistics and numerical taxonomic analysis.

Electrophoretic Analysis of Total Proteins

Due to the submerged growth form of Laccaria isolates grown on agar media and the related difficulties in extracting protein from

the hyphal agar combination, it was necessary to grow the isolates in liquid culture. Isolates were grown in 125 ml Erlenmeyer flasks with 30 ml of either MNM or ST medium (Schisler and Volkoff, 1977).

Proteins were extracted by grinding 0.5 g of mycelium in 2 ml of either 0.05 M TRIS-Glycine pH 8.3 or 0.1 M TRIS pH 7.2. Grinding was done in a chilled mortar and pestel with sand. This mixture was subsequently centrifuged in a clinical centrifuge for 5 minutes at the fastest speed and the supernatant frozen for future use.

Disc electrophoresis was carried out within 2 weeks using slightly modified techniques of Davis (1964). One hundred to 150 μ l of protein, determined by the modified Lowry method (Lowry et al., 1951), of each isolate was layered directly on top of the spacer gel. The stacking gel consisted of 13% Acrylamide. A tracking dye (Bromo Phenol Blue) was placed in one tube. The apparatus was placed in a refrigerator at 4 C, and the proteins were electrophoresed at three milliamps per tube until the tracker dye or the lowest visible protein band came to within 1 cm from the base.

The gels were then removed and stained in Coomassie Blue for 12 hours. They were then destained in repeated changes of 7% acetic acid. After the gels were sufficiently destained (2-3 days), they were photographed and read through a Beckman model 2400 DU Spectrophotometer gel scanner.

CHAPTER III

DISCUSSION OF TAXONOMIC CHARACTERS

Superficially, a majority of Laccaria taxa appear macro-morphologically very similar. Closer examination, however, of the observable macromorphological variation, when correlated with micromorphological and cultural data allows for the segregation of taxa from this phenotypically variable group. The following discussion on the delimiting characters within Laccaria is restricted to North American taxa of which 18 of the 19 North American taxa have been collected, photographed, and described macromorphologically during the course of this study.

Macromorphological Characters

Variation in macromorphological characters are illustrated by photographs of representative taxa in Appendix D.

Color. As in many, if not most genera of agarics, basidiocarp and lamellar color are among the most diagnostic macromorphological characters. Because all members of the genus are hygrophanous, especially those taxa with violaceous to purple basidiocarps, it is important to note the color of the pileus both when fresh and in successive stages of fading. This is most important in L. amethystina, L. amethysteo-occidentalis sp. nov. and L. vinaceo-brunnea sp. nov. Fruitbodies of all three are bright violet to purple when young and fresh but differ markedly in their color changes associated with age.

Laccaria amethystina soon fades to ochraceous-buff color while L. amethysteo-occidentalis fades to a light vinaceous or vinaceous brown color and only becomes buff colored in very old specimens. Laccaria vinaceo-brunnea on the other hand soon becomes a dark vinaceous to reddish-brown color. As in the case of the other two taxa, it eventually becomes buff colored.

Most Laccaria fruitbodies are some shade of orange brown to flesh color. This includes all the North American taxa but L. ochropurpurea and L. trullisata (Ellis) Peck, which are brown to buff color at maturity. Due to the large amount of color variation found within these taxa (from light buff to a strong orange brown or red brown), basidiocarp color can rarely be used to delimit taxa in this large group.

A color variant of L. oblongospora sp. nov. which exhibited vinaceous to avellaneous colors was found widely scattered within large populations of typically pigmented (orange brown) specimens. Whether this difference in color was due to age, edaphic factors, or other microenvironmental parameters was not determined. Because intermediate color forms (vinaceous pilei with orange brown stipes, etc.) were found and no accompanying micromorphological or cultural differences existed, these color variants were not segregated from the species, pending additional information.

In all but rare cases (e.g., L. glabripes McNabb whose stipes are often darker than the pileus), the stipe is concolorous or slightly lighter in color than the pileus.

Lamellar color is of prime importance in the taxonomy of Laccaria. Species of Laccaria exhibit either pinkish flesh color to buff color or violaceous to purple lamellae. All of the taxa with violaceous to purple basidiocarps plus L. ochropurpurea and L. trullisata have dark, bright violet to purple lamellae, while L. bicolor (Maire) Orton shows light vinaceous lamellae that occasionally fade to a pinkish color with age. All other North American taxa have flesh colored lamellae. In some instances, the lamellae of large, older specimens may develop a vinaceous appearance (e.g., L. nobilis sp. nov., L. moelleri comb. nov.) but an examination of younger specimens should alleviate any confusion that this may cause.

In addition to basidiocarp and lamellae color, the color of the mycelium at the base of the stipe (=basal mycelium) is of extreme importance in the classification of Laccaria. The basal mycelium can be either violet or white with white being much more common. The primary macromorphological character separating L. lavendipes sp. nov. from L. laccata is the presence of a violet basal mycelium in the former. Because of the often scant amount of the basal mycelium and the ephemeral nature of this character in L. lavendipes (the color is strongly hygrophanous and often fades white), Lahaie (1981) did not distinguish between the two taxa. Striking somatic culture mat differences (Appendix E) and differences in basidiospores size and shape, however, are more than adequate to support separation of the taxa, using basal mycelium color as a

field character. In addition to L. lavendipes, all of the taxa with violet lamellae consistently have a violet basal mycelium. In both L. amethystina and L. bicolor, however, the basal mycelium occasionally fades white with age. A small number of collections of L. trichodermophora sp. nov., L. oblongospora and L. proxima were found which had a violaceous-tinged basal mycelium. The cause of these infrequent occurrences remains unclear, but as in the case of the vinaceous-colored L. oblongospora, they were not segregated from their respective taxa due to the lack of additional unique characters.

Basidiocarp size. Although often highly variable due to differences in age and environmental conditions, the size of the basidiocarp can be diagnostic in some instances. Most taxa have mature basidiocarps of moderate size (pileus mostly 20-50 mm broad, stipe mostly up to 60 mm long), so those taxa which consistently have larger or smaller basidiocarps are noteworthy. Laccaria altaica Singer, L. lateritia Malencon, and L. tortilis (=the 2-spored taxa) along with L. montana Singer are characterized by being very small to small (pileus rarely up to 30 mm broad) while L. amethysteo-occidentalis, L. nobilis, L. moelleri, L. ochropurpurea, and L. trullisata often have pilei > 60 mm broad.

The stature of the basidiocarp can also be taxonomically important. Laccaria ochropurpurea and L. trullisata are usually robust to very robust (stipe diameter occasionally > 10 mm at apex),

while the 2-spored taxa, L. montana and L. glabripes, are generally gracile (stipe diameter ≤ 4 mm at apex).

Stipe and pileus texture characteristics are often associated with size. Most of the small taxa appear glabrous to finely fibrillose when fresh while taxa such as L. nobilis and L. moelleri often have pilei which become scaly to squamulose due to cuticular diffraction. Additionally, these large fruitbodies frequently have stipes clothed in pronounced longitudinal striations which can even form reticulations, or become scaly near the stipe apex (e.g., L. amethysteo-occidentalis, L. moelleri, L. nobilis, L. ochropurpurea, and L. trullisata).

Basidiospore color in mass. Except for L. amethystina and L. ochropurpurea, which can have either white or light violet spore deposits, all North American taxa have white spore prints. The color of the print will occasionally yellow with age so it is important to read the spore print color soon after it is taken.

Additional macromorphological characteristics. Although generally not of great taxonomic importance, several of the following characteristics, in conjunction with others, occasionally are taxonomically significant. The type and degree of pileus striations can vary from strongly translucent-striate in L. glabripes, to strongly plicate-striate in the 2-spored taxa and L. montana, to variously striate in L. amethystina and L. laccata, to non-striate in the larger sized taxa. Fruitbody surfaces in L. amethysteo-

occidentalis will occasionally become translucent-striate when faded but the striations are ephemeral.

Both the shape of the pileus and pileus margin varied little between species. In virtually all cases, the pilei started out convex and became plane to uplifted with time. The margin usually was incurved to decurved, often becoming plane, and entire to undulate, occasionally becoming eroded in age.

The depth, thickness, distance between, and attachment of the lamellae usually varied greatly within a species, often within an individual collection. Since a diagnostic character of the genus is the relatively thick and waxy appearance of the lamellae, when a Laccaria specimen is said to have thin lamellae, it is in relation to other members of the genus and not to the agarics in general.

Little taxonomically important information could be obtained from the pileus and stipe context. The pileus context was always thin, resilient, tapering markedly to the margin, and concolorous to subconcolorous with the pileus. Little variation could be detected in the taste or smell of specimens. All specimens had a fungoid to slightly musty odor and a very mild, non-distinctive taste. Smith (unpublished manuscript) separated out several putative taxa partially by smell (e.g., L. pisciodorus was said to smell of fresh fish while L. sphagnicola smelled of garlic). These odors were not detected in this study, but this may be due to my non-discriminating olfactory sense.

In summary, except for color and, in some instances, size, one is required to use non-macromorphological characters to differentiate species in Laccaria.

Micromorphological Characters

Line drawings illustrating the observed variation in micromorphological characters are presented in Figures 1-10: basidiospores (Figures 1-4), cheilocystidia (Figure 5), basidia (Figures 6-7), and pileipellis (Figures 8-10).

Basidiospores. After color of the basidiocarp and lamellae, the primary diagnostic characters utilized in the taxonomy of Laccaria are basidiospore size, shape, and ornamentation (Figures 1-4).

Basidiospore shape is of critical importance in designating species. The spore shapes used in this study are based on Bas (1969). Spore shape can be described in terms of length-width ratios ($=L/W$): globose = 1.0 - 1.05, subglobose = 1.06 - 1.14, broadly elliptical = 1.15 - 1.29, elliptical to amygdaliform = 1.3 - 1.54, oblong = 1.55 - 2.0, cylindrical > 2.0 . In order to determine the statistical significance of these ranges, t-tests were performed on selected pairs of taxa. The results of these analyses are presented in Table 1. As can be seen, statistically significant differences exist between each pair of means.

Most North American taxa have basidiospores which are normally subglobose to broadly elliptical (Figure 11). Those species

Figure 1. Representative basidiospores for North American taxa of Laccaria: globose, moderately ornamented.

Figure 2. Representative basidiospores for North American taxa of Laccaria: large and globose, coarsely ornamented.

Figure 3. Representative basidiospores for North American taxa of Laccaria: broadly elliptical to elliptical, finely ornamented.

Figure 4. Representative basidiospores for North American taxa of Laccaria: subfusiform to fusiform, appearing smooth to finely roughened under light microscope.

Figure 5. Representative cheilocystidia for North American taxa of Laccaria. Note that all are filamentous and relatively undifferentiated.

NOTE: Reference line = 20 μ m.

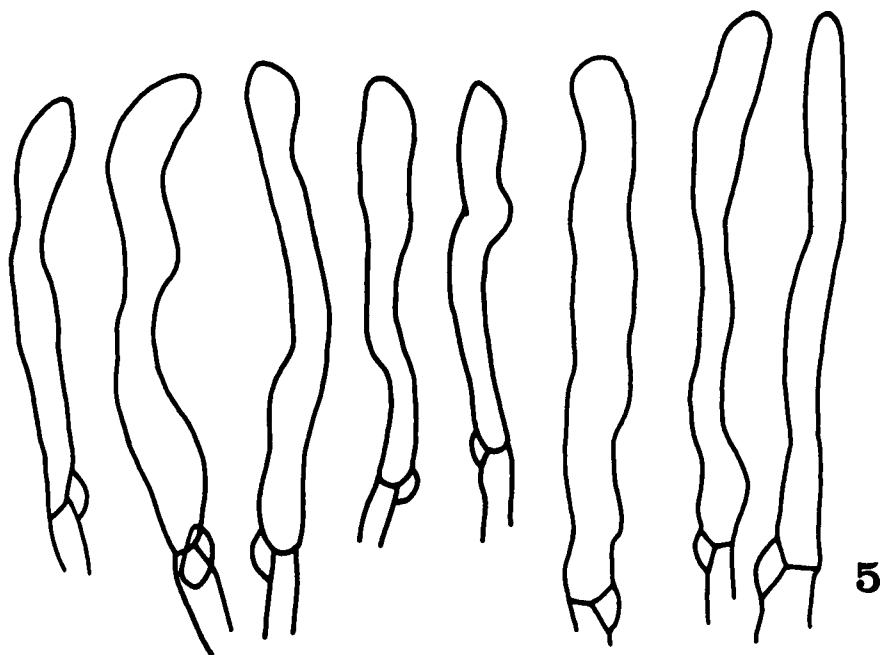
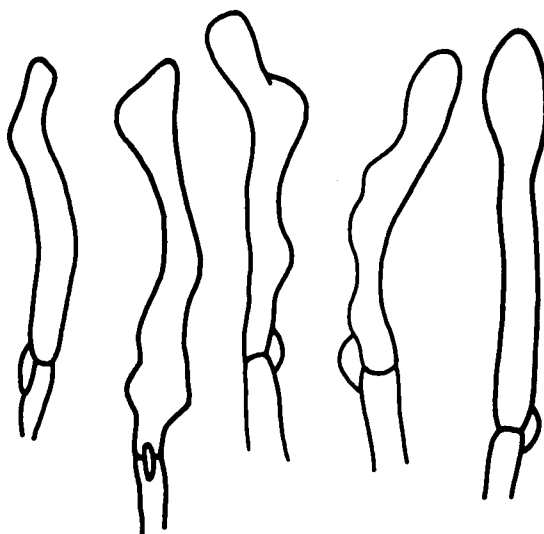
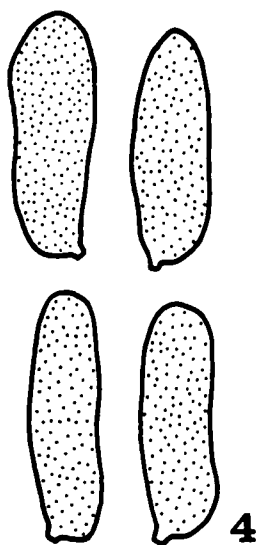
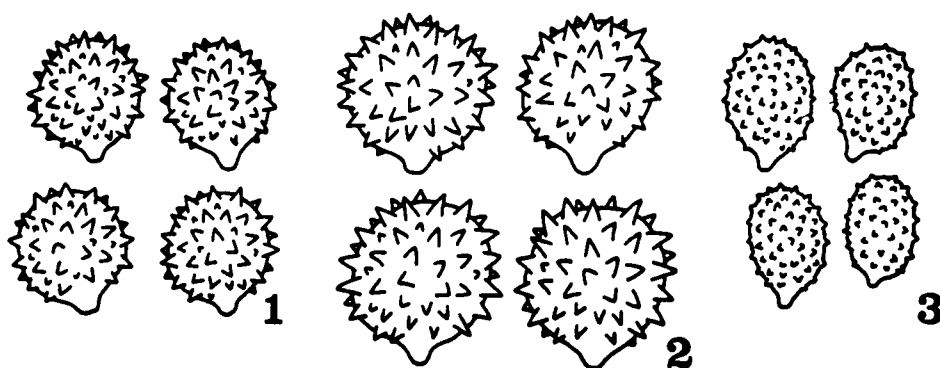


Figure 6. Representative tetrasporic basidia of North American taxa of Laccaria. Note that all are elongate, clavate and have a terminal clamp connection.

Figure 7. Representative bisporic basidia of North American taxa of Laccaria. Note the similarities with the basidia in Figure 6.

NOTE: Reference line = 20 μm .

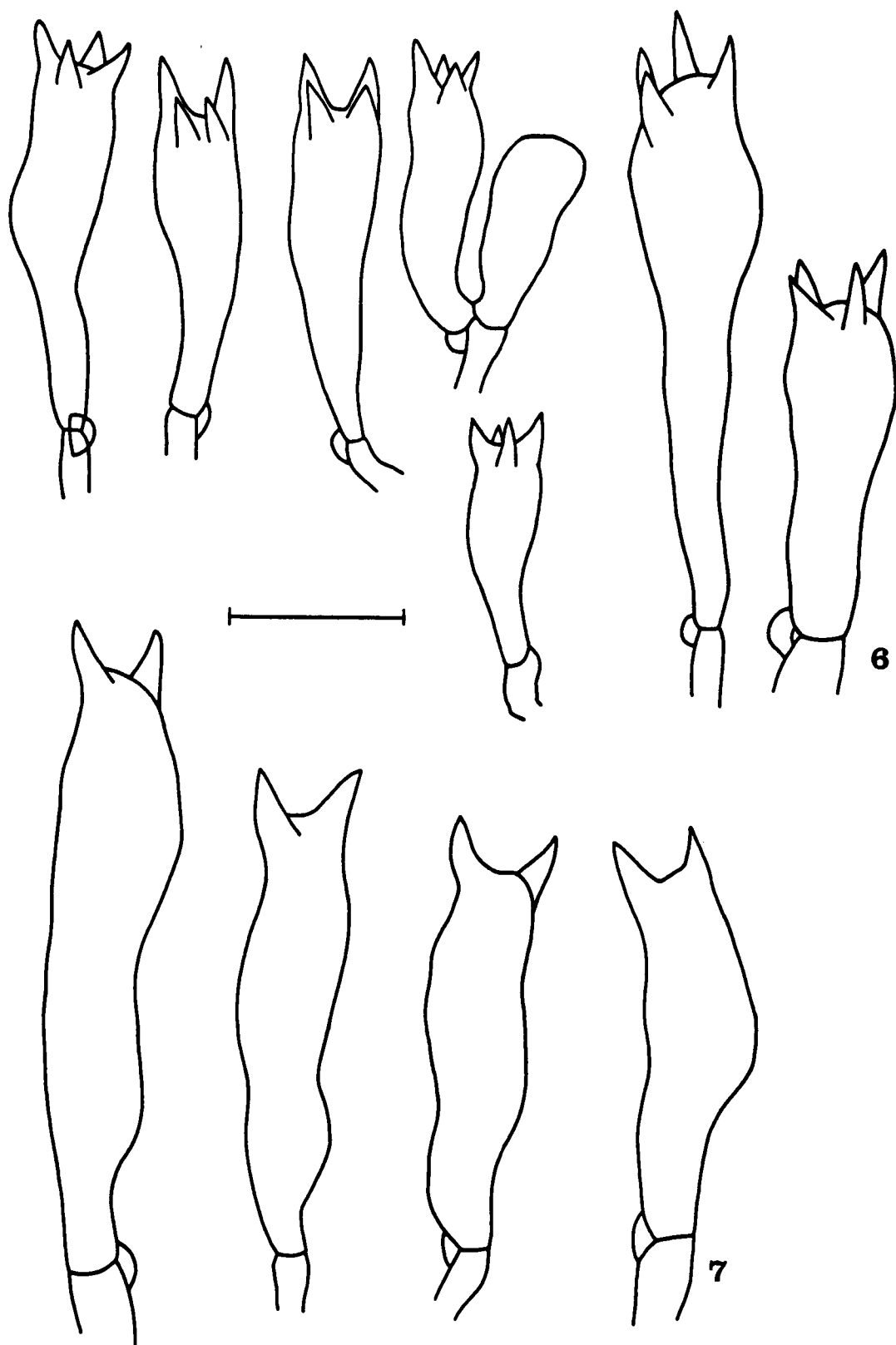


Figure 8. Representative pileipellis arrangements occurring in North American taxa of Laccaria: trichodermium.

Figure 9. Representative pileipellis arrangements occurring in North American taxa of Laccaria: interwoven and undifferentiated.

Figure 10. Representative pileipellis arrangements occurring in North American taxa of Laccaria: interwoven with scattered $\pm$ perpendicular fascicles of hyphae.

NOTE: Reference line = 20 μ m.

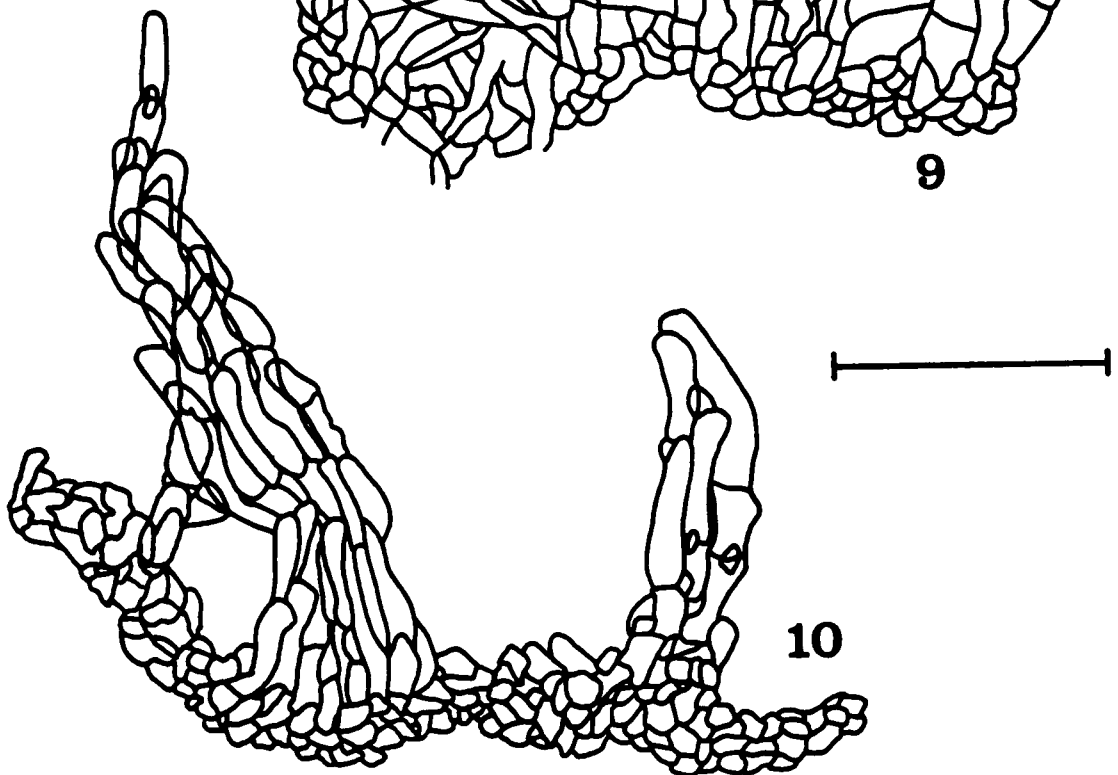
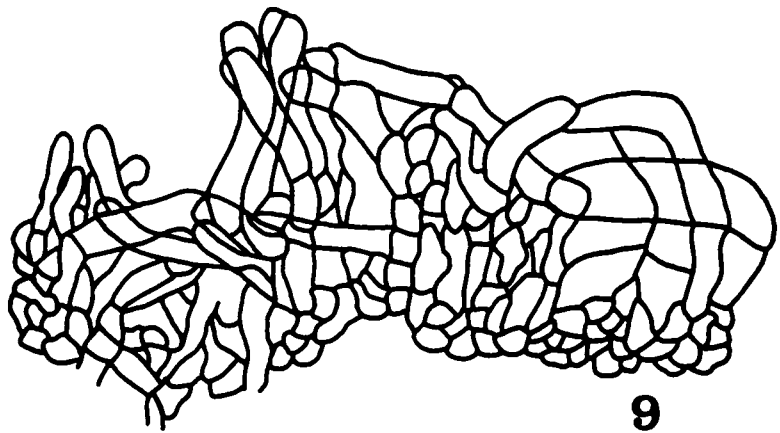
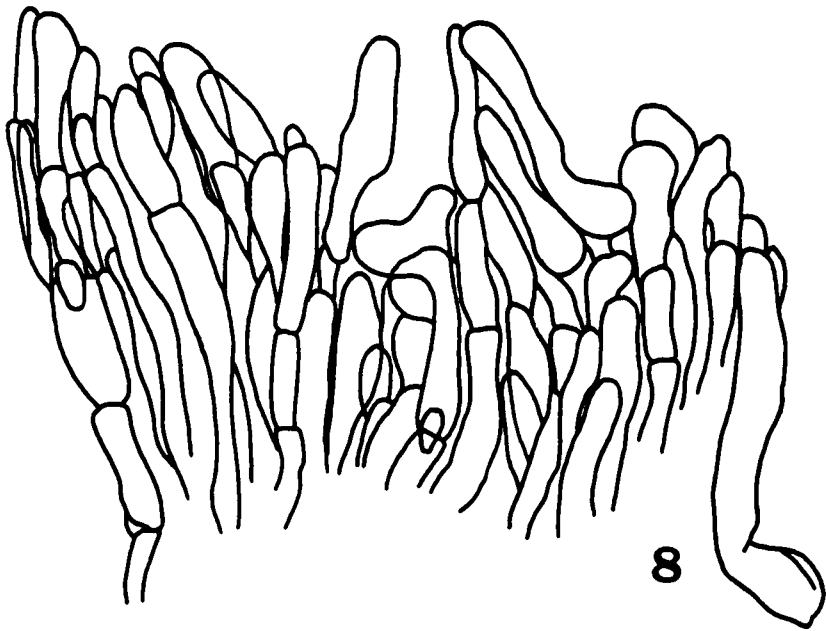


Table 1. Comparison of Laccaria basidiospore shapes utilizing a t-test on mean basidiospore length/width ratios of selected taxa. If $t < 0.05$ then a significant difference exists between the two means.

Taxa	Mean	Variances	t	DF	PROB > [t]
<u>L. laccata</u>	1.04	unequal ¹	0.0380	40	0.0042
<u>L. amethystina</u>	1.01				
<u>L. laccata</u>	1.04	equal	- 3.1925	41	0.0027
<u>L. altaica</u>	1.14				
<u>L. oblongospora</u>	1.51	equal	12.3021	9	0.0001
<u>L. altaica</u>	1.14				
<u>L. proxima</u>	1.29	equal	- 5.2890	20	0.0001
<u>L. oblongospora</u>	1.51				
<u>L. trullisata</u>	2.43	equal	23.0780	8	0.0001
<u>L. oblongospora</u>	1.51				

¹If variances were unequal, an approximate t-statistic was computed.

Figure 11. "Boxplots" illustrating the mean, median, range, and standard deviation of the basidiospore length-width ratio for each of the North American taxa of Laccaria. The length of the central line designates the range, while the bottom and top of the box delimit the 25% and 75% quantiles, respectively. The width of the box represents the standard deviations of the mean. The mean is labelled with a solid square and the median is demarked by a line terminated with solid circles. The letters represent the different taxa:

- a. L. altaica
- b. L. amethystina
- c. L. amethysteo-occidentalis
- d. L. bicolor
- e. L. glabripes
- f. L. laccata
- g. L. lateritia
- h. L. lavendipes
- i. L. microspora
- j. L. moelleri
- k. L. montana
- l. L. nobilis
- m. L. oblongospora
- n. L. ochropurpurea
- o. L. proxima
- p. L. tortilis
- q. L. trichodermophora
- r. L. trullisata
- s. L. vinaceo-brunnea

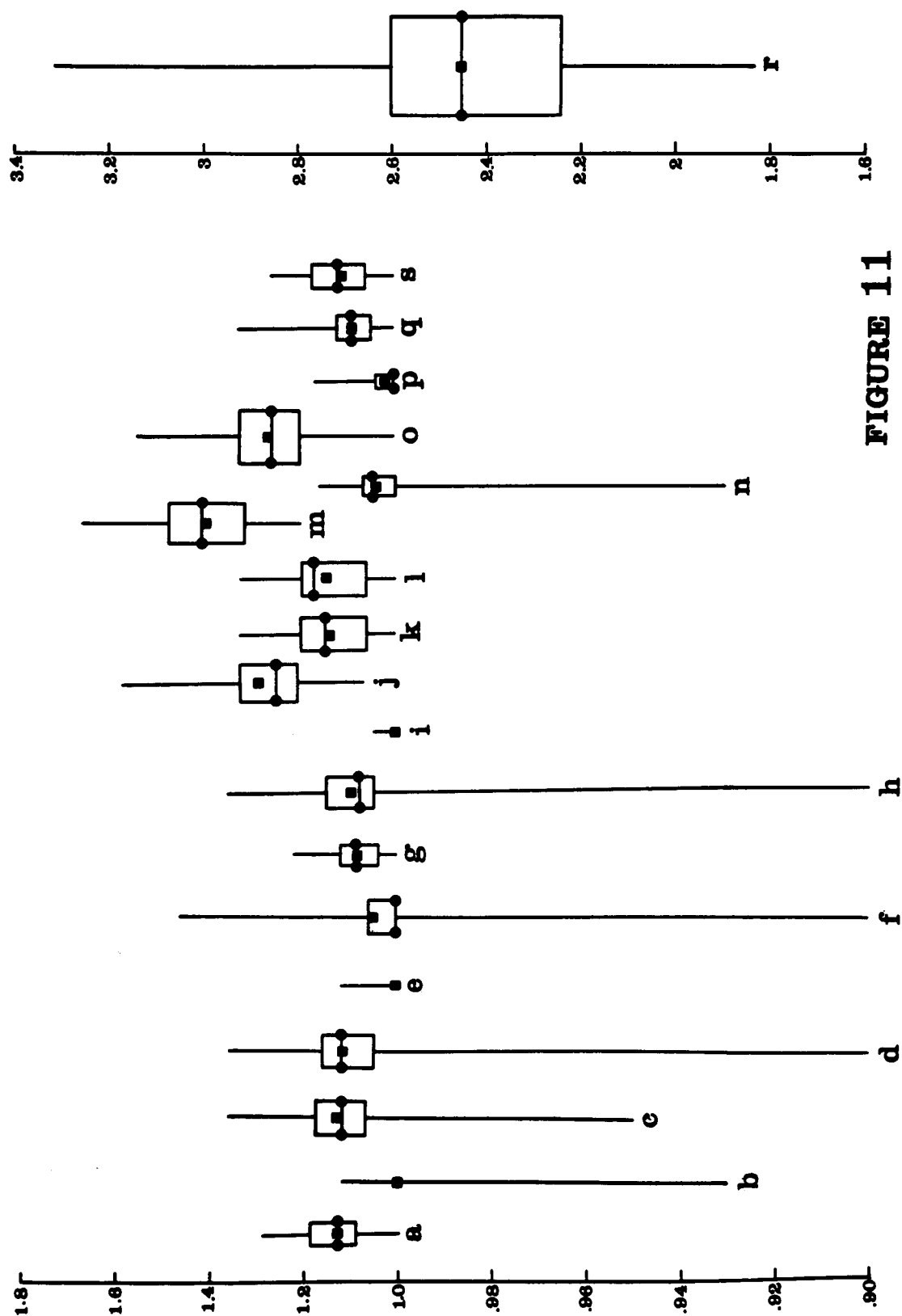


FIGURE 11

with globose to subglobose spores are L. amethystina, L. glabripes, L. laccata, L. microspora sp. nov., L. ochropurpurea, and L. tortilia. At the other end of the spectrum are those taxa with elliptical to oblong or cylindrical basidiospores: elliptical = L. moelleri and L. proxima; elliptical often oblong = L. oblongospora; and cylindrical (subfusiform to fusiform-elliptical) = L. trullisata (Figure 11).

Basidiospore size is an important taxonomic character in some instances (Figures 12-13). Most taxa have overall mean basidiospore lengths of 8.2 - 9.3 μm . Two taxa, L. lavendipes and L. microspora, have smaller overall mean lengths, 7.6 and 6.9 μm , respectively. All of the 2-spored taxa, L. altaica, L. lateritia, and L. tortilis have larger spores (overall mean length 13 μm , 9.7 μm , and 12 μm , respectively). Only two 4-spored taxa had basidiospores larger than the majority of species, L. montana (overall mean length = 10.8 μm) and L. trullisata (overall mean length = 16.4 μm).

Except for L. trullisata which has smooth to finely roughened basidiospores, all species of Laccaria have echinulate basidiospores. A close association appears to exist between the degree of basidiospore elongation and height of spore ornamentation. The more elongate the basidiospore the shorter the spore ornamentation. The longest ornamentation in North American taxa occurs in the globose-spored L. tortilis (up to 3.7 μm long) with L. trullisata lacking distinct ornamentation (Figure 14). All of the globose to subglobose taxa except for L. ochropurpurea have an overall mean spine length $\geq 1.4 \mu\text{m}$, while all of the subglobose to broadly

Figure 12. "Boxplots" illustrating the mean, median, range, and standard deviation of basidiospore length for each of the North American taxa of Laccaria. Refer to Figure 11 for further explanation.

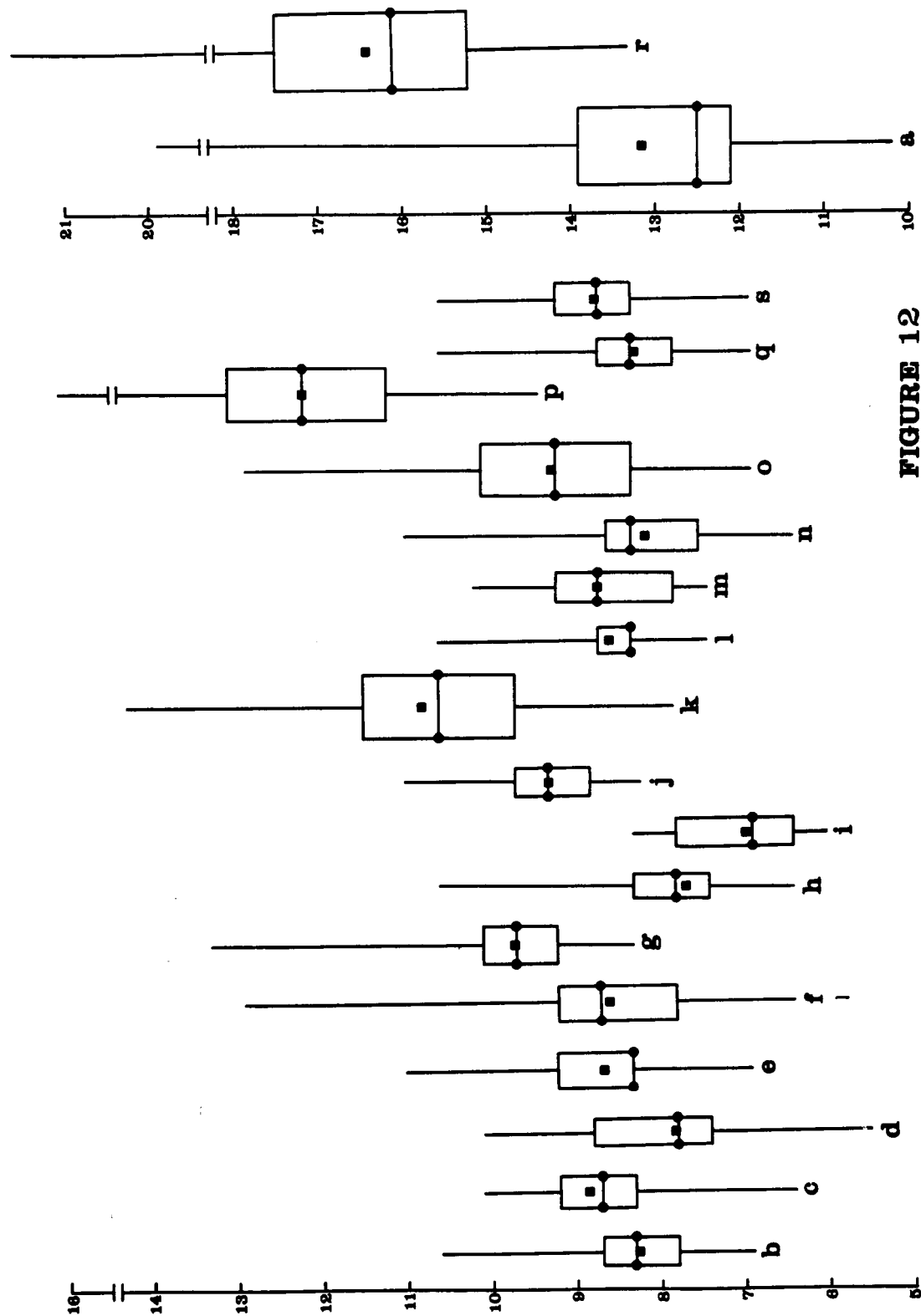


FIGURE 12

Figure 13. "Boxplots" illustrating the mean, median, range, and standard deviation of basidiospore width for each of the North American taxa of Laccaria. Refer to Figure 11 for further explanation.

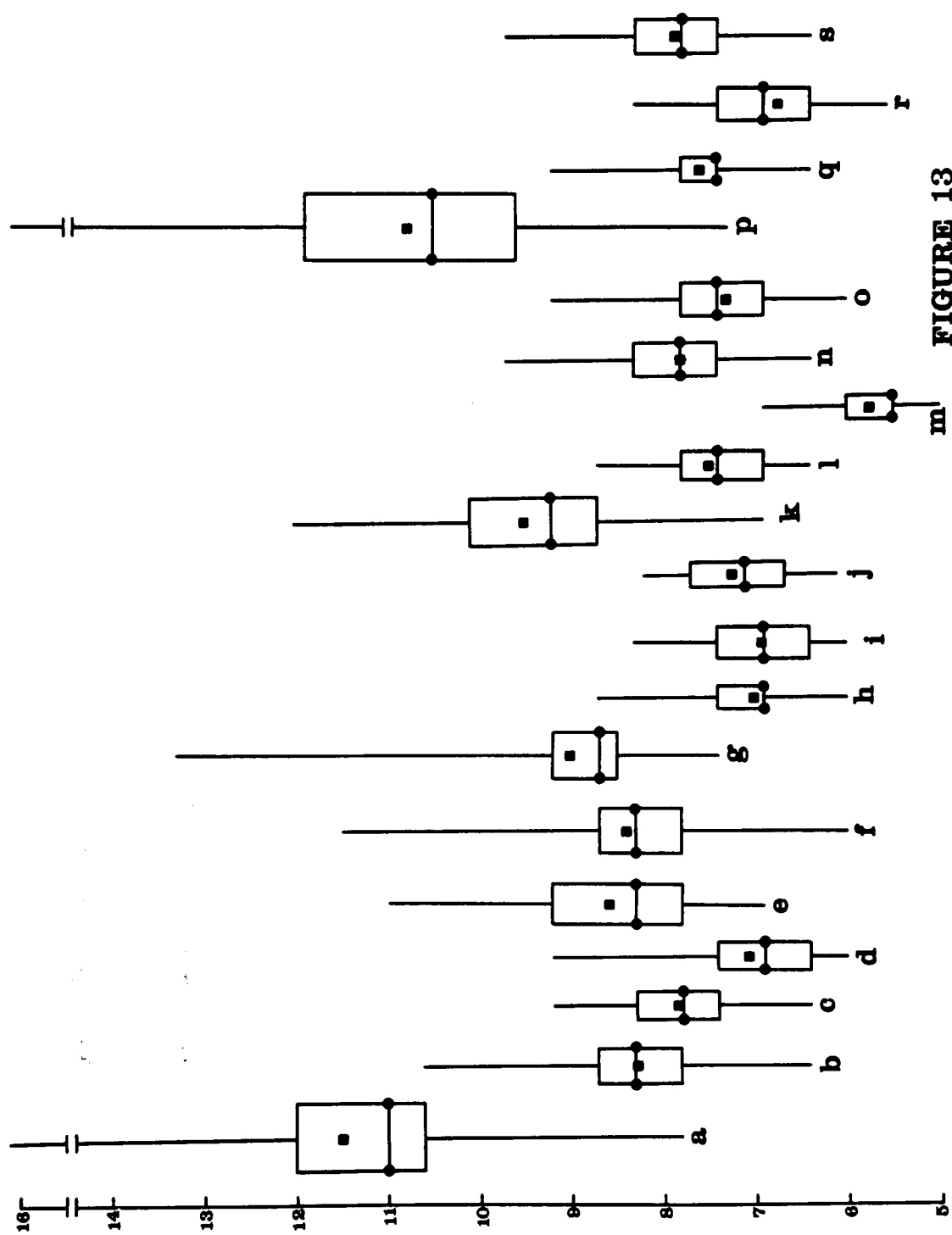


Figure 14. "Boxplots" illustrating the mean, median, range, and standard deviation of basidiospore ornamentation length for each of the North American taxa of Laccaria. Refer to Figure 11 for further explanation.

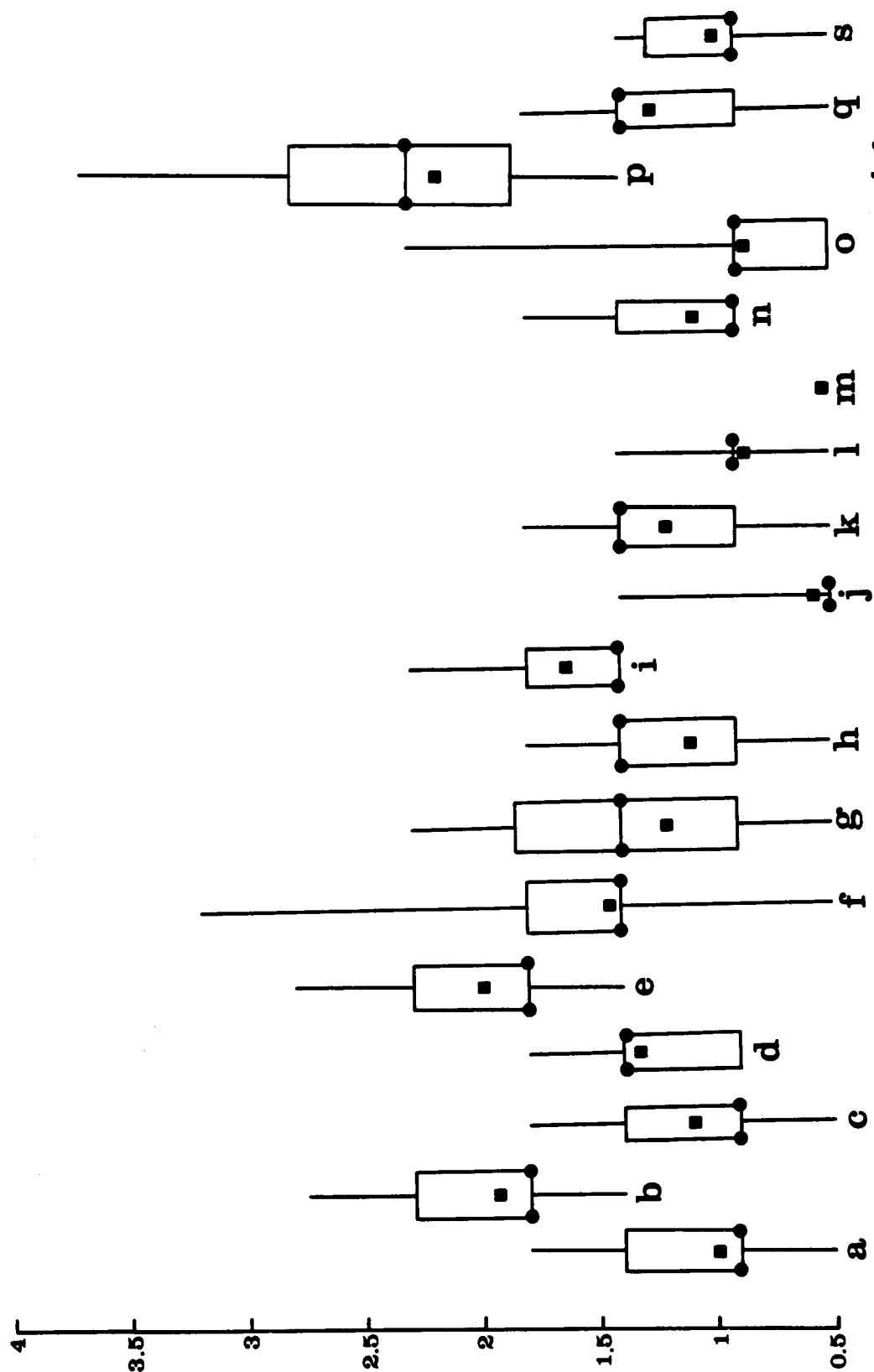


FIGURE 14

elliptical-spored taxa have overall mean spine lengths of 0.9 - 1.3 μm . The elliptical- to oblong-spored have overall mean spine lengths of 0.5 - 0.9 μm (Figure 14). In the elliptical- to oblong-spored taxa, there are often one or two longer spines (up to 2.3 μm long) at the basidiospore apex. The width of the spine base appears to be associated with spine length, i.e., the longer the spine the wider the spine base. Lahaie (1981) stated that spine width was a more stable and diagnostic character than spine length, but my data do not support this distinction.

Electron microscopic examination of the basidiospores by surface replication (Bigelow and Rowley, 1968; Pegler and Young, 1969), transmission electron microscopy (= TEM) (Besson and Kuhner, 1971), and SEM (Pegler and Young, 1971; Mueller, 1978; Mueller and Sundberg, 1981; and in this paper, Appendix F) have shown in greater detail the surface and ornamentation characteristics. Mueller (1978) and Mueller and Sundberg (1981) mentioned the presence of reticulations at the base of the spines. At that time, we were uncertain whether the reticulations were part of the spore wall morphology or were artifacts. The SEM work done in this study supports the conclusion that the reticulations were artifacts.

The basidiospores in all taxa are non-amyloid and acyanophyllic.

Basidia. The number of spores born per basidium is of great taxonomic significance in Laccaria (Figures 6-7, page 26). Although many other genera of agarics have species with varying number of

sterigmata in one basidiocarp (e.g., Smith, 1934; Hesler and Smith, 1963), the character appears to be very consistent in Laccaria. In all of the material examined, the vast majority of the basidia observed in a mount would have the prescribed number of sterigmata. Laccaria altaica, L. lateritia, L. tortilis were 2-spored, very rarely 1 or 3 and never 4-spored. All the rest of the North American taxa had basidia which bore four spores per basidium. As mentioned above, larger spore size was associated with the bisporic condition. Whether this is due only to increased cytoplasmic material or possibly due to a binucleate or diploid state is not known. No attempt was made to stain the basidiospores for counting nuclei. Additionally, because the basidiospores of these taxa have never been germinated, no genetic analysis has been undertaken. Also associated with the bisporic condition is a tendency for longer and stouter sterigmata. No other basidial characters appeared to have taxonomic significance. As can be seen in Figures 6-7 (page 26), all of the basidia were elongate and clavate. Additionally, there was always a basal clamp connection.

Pileipellis. Three basic types of cuticular arrangement were found in Laccaria: completely interwoven (Figure 9, page 28) represented by L. ochropurpurea and some L. trullisata; interwoven with scattered nearly perpendicular fascicles of hyphae (Figure 10, page 28); and a trichodermium (Figure 8, page 28) found in L. microspora and L. trichodermophora. In large basidiocarps of

L. trichodermophora, a complete trichodermium can only be found at the disc. Due to expansion of the pileus, the trichodermium becomes broken up into very numerous, long fascicles. In longitudinal section, they still appear close to a trichodermium, but in a scalp section, individual fascicles can be detected. A variation on this type of cuticular arrangement was found in L. vinaceo-brunnea, in which the cuticle was interwoven but had very numerous, long, nearly perpendicular individual hyphae. If the hyphae were closer together, they could be considered a palisadoderm.

The hyphae were often incrustated with a light to moderate yellowish brown pigment. In young specimens of L. amethystina, L. amethysteo-occidentalis and L. vinaceo-brunnea, the hyphae occasionally appeared vinaceous brown in mass.

Although data on the size of the terminal cells¹ are presented in the species description, the size and shape of these cells appear to have little taxonomic significance, except in L. vinaceo-brunnea (see above). Additionally, in all cases, the underlying tramal layer is undifferentiated and yields no taxonomically significant data.

Cheilocystidia. Unlike many other genera which have highly distinctive cystidia (e.g., Marasimius, Pluteus, etc.) (Singer, 1975), the cheilocystidia of Laccaria are little more than elongate,

¹Technically, since there is nuclear continuity between hyphal segments through the septum, each of these segments should be termed a hyphal element and not cell. For the sake of avoiding confusion, however, the term cell is used throughout this paper.

undifferentiated hyphae which extend beyond the basidia and basidioles (Figure 5, page 24). Laccaria altaica, L. glabripes, L. lateritia, L. montana, L. nobilis, L. tortilis, L. trichodermophora, and L. trullisata either lack or have scarce cheilocystidia. Most taxa have cheilocystidia which are normally undifferentiated to slightly swollen (up to 9 μm wide). Laccaria moelleri had filamentous cheilocystidia (overall mean width = 3.9 μm), while the taxa with violet basidiocarps normally had large (overall mean dimensions up to 58 x 10 μm), very abundant cheilocystidia. The uniqueness and relatively consistent presence of these large cheilocystidia in these three taxa are a good diagnostic character when dealing with herbarium material that lack macromorphological notes.

Pleurocystidia were not seen in any North American material of the genus.

Additional micromorphological characters. The constant occurrence of clamp connections at virtually every septum along with a parallel or rarely subparallel lamellar trama are important generic characters of Laccaria. Additionally, all hyphae were non-amyloid and, unless otherwise specified, hyaline in KOH.

The hyphae comprising the basal mycelium proved not to have any diagnostic value. In all cases, they were tightly interwoven, and either undifferentiated or swollen. Occasionally the cells became barrel-shaped. The diameter of these hyphae appeared to vary as much within a species as between species.

Cultural Characters

In an attempt to obtain taxonomic data based on a non-fruitbody stage of the life cycle, somatic culture mat studies based on the classic work of Nobles (1948, 1958b, 1965) were undertaken. Although becoming almost routine in studies of the wood-rotting Aphyllophorales (e.g., Nobles, 1948, 1958b, 1965; Stalpers, 1978), such studies are rare in the Agaricales (e.g., Miller, 1971; Campbell and Petersen, 1975; Farr, 1981; Lahaie, 1981) and virtually absent in the ectomycorrhizal Basidiomycetes. A major factor limiting the usefulness of such studies in the ectomycorrhizal fungi has been the difficulty in obtaining tissue cultures. Most of the ectomycorrhizal fungi have not been cultured.

The following discussion of culture mat morphology is based on 59 isolates of Laccaria comprising 10 species. The number of isolates per species varied from one each of L. altaica and L. amethysteo-occidentalis to 10 isolates of L. laccata. The isolates included 44 that I obtained during this study along with an 15 additional isolates sent to me from the Forestry Sciences Laboratory, Pacific Northwest Forest and Range Experiment Station, U.S. Forest Service, Corvallis, Oregon.

Macromorphological characters. The two primary diagnostic characters were the color of the culture mat on MNM and PDA (all isolates were white on ME) along with the rate of growth (expressed as the radius of the culture mat at week III and week VI) on each of

the three media employed. Photographs of representative isolates are presented in Appendix E.

The only taxa that had white culture mats on all three media were L. laccata and L. altaica. This is highly significant because several taxa have been separated out of L. laccata based on rather tenuous characteristics [e.g., L. lavendipes (= L. farinacea sensu Singer) and L. bicolor have been separated from L. laccata primarily on basal mycelium color, and L. ohiensis (= L. tetraspora Singer) separated from L. laccata primarily on basidiospore differences]. In these cases, culture mat characteristics, especially color, have been among the major factors utilized in my taxonomic decisions. Because L. lavendipes and L. bicolor have unique culture mats, while specimens referable to L. ohiensis have culture mats very similar to L. laccata, the former taxa were treated as distinct species while the latter was put into synonymy with L. laccata.

Among the isolates that formed violet culture mats on PDA and MNM when young, the rate and degree of color loss was important. Only the isolates of L. amethysteo-occidentalis, most L. bicolor, and L. proxima retained their dark violet color on PDA throughout the 6 weeks. All of the other isolates faded to a light orange brown color. By week VI, the violet color was often restricted to a relatively narrow band near the margin. Whether this "fading" was due to dispersal of the pigment over a larger area, or due to oxidation of the purple pigment with time is not known. On MNM, the culture mats were light to moderate violet and normally faded to very light violet or white by week VI.

The mat color becomes masked by a pruinose layer of short, light grayish violet hyphae in most taxa (L. bicolor, L. lavendipes, L. nobilis, L. oblongospora, and L. proxima). Additionally, in some L. laccata isolates a cottony to felty aerial layer forms over the inoculation plug and surrounding mat.

The color on PDA of the inoculation plug and the mat surrounding it on PDA was sometimes important. In some isolates of L. laccata, this region turned a dark olive brown to light chocolate color. In most taxa, it became the same orange brown color as the rest of the mat. An exception to this phenomenon was L. amethysteo-occidentalis which retained its bright violet color. Except in L. laccata and L. altaica, the margin color on PDA and MNM was always light violet to white and thus did not constitute a diagnostic taxonomic character.

Although a slight bleaching of color was often noted on the reverse, no significant color changes occurred. Additionally, no exudates were apparent.

Along with color, the rate of growth was the major taxonomic character. Most taxa grew at a moderate rate on all three media (mostly 20-50 mm on PDA, 30-70 mm on MNM, and 40-70 mm on ME--all at week VI). Laccaria amethysteo-occidentalis, most L. laccata, and L. ochropurpurea grew more slowly, while L. altaica, one isolate of L. laccata (TENN 42964), and one isolate of L. trichodermophora (TENN 42705) grew very rapidly (covering the agar surface by week III on all three media).

Terminology used in discussing mat and margin texture were from Nobles (1948, 1965).

Except for the pruinose, aerial layer of hyphae (see above), all of the isolates grew submerged. Mat thickness, therefore, was a relative term. The transparency of the culture mat was an outcome of the thickness and intricacy of the interwoven mat. All isolates exhibited a felty, thick culture mat on PDA. The mat texture on both MNM and ME varied from silky to subfelty to felty. Often the mat was thickest near the inoculation plug. In most cases, the mats of single taxa were uniform, but in other taxa there would be variously distributed thicker areas. These thicker zones could be scattered, small sectors (e.g., some L. lavendipes isolates on MNM and L. bicolor on ME), 2-3 concentrically arranged bands (e.g., L. altaica on MNM and L. amethysteo-occidentalis on ME), radially arranged pie-shaped or dendritic, sectors radiating away from the inoculation plug (e.g., L. trichodermophora on PDA). Because of the infrequent and random occurrence of the isolates with non-uniformly thick culture mats, this character has little taxonomic significance. In L. bicolor and L. proxima, the culture mat surrounding the inoculation plug often became furrowed because of buckling and infolding of the culture mat.

When describing the margin texture and color, I refer to the advancing zone of the culture mat. This zone is generally somewhat thinner than the rest of the mat and can be either a discrete, easily recognizable area or not well differentiated. On all three

media, this zone was always silky to subfelty and thus presented little taxonomic data.

All of the isolates on all three media had the same musty odor.

Two tests were performed to determine the presence of extracellular oxidases (refer to Chapter II, p. 16). No growth or diffusion zone was obtained on gallic acid agar with any of the isolates. The gum guaic drop test, however, yielded useful results. The following taxa had negative reactions: L. altaica, L. laccata, L. lavendipes, and L. oblongospora. An immediate reaction was obtained in L. bicolor (except TENN 42608 which was negative), while a reaction observed after 1 hour was obtained in L. amethysteo-occidentalis and one isolate each of L. laccata and L. proxima. Nobles (1958a) stated that to be a positive test for the extracellular enzymes, the reaction must be immediate. In some cases in Laccaria, the color reaction took up to 1 hour to develop, and whether this indicates the presence of extracellular oxidases was not ascertained. The difference in reaction time appeared to have some taxonomic value so it was used here.

The fact that any Laccaria, a mycorrhizal fungus, gave a positive reaction to the extracellular oxidases is of interest, and opens up the question of why these enzymes would be present.

Micromorphology. Although it would be expected that the micromorphological culture characters would be at least as diagnostic as the macromorphological characters (Nobles, 1948; 1965), this did

not appear to be the case in Laccaria. As can be seen in Figures 15-19, there was little hyphal differentiation observed. This matches the conclusions by Campbell and Petersen (1975) on cultures of Amanita spp.

In all isolates except L. altaica, the vast majority of hyphae were undifferentiated (Figure 15) with occasionally widely scattered irregular swollen hyphae (Figure 19) or subcoralloid to coralloid hyphae (Figures 17-18). Laccaria altaica was unique by having the majority of its hyphae being swollen to very swollen, often barrel-shaped to almost spherical. As in all isolates, however, all septa had clamp connections. All hyphae were hyaline in KOH, except where noted.

The term chlamydospore is used for localized, slightly thicker walled swellings along the hyphae (Figure 12, page 34). No evidence for these structures serving as asexual reproductive organs exist. These chlamydospores could either be terminal or intercalary and could be found in chains of 2-4. Occasionally, they were found associated with septa. Depending on the medium and particular isolate, they could be absent to very abundant. The only taxon that completely lacked chlamydospores was the one isolate of L. altaica.

Cultural Induction of Basidiocarps

Davis and Jong (1976) reported the formation of L. laccata basidiocarps in axenic culture. After repeated attempts to duplicate their success with my cultures, I purchased their isolate (ATCC 24509). Utilizing their techniques and isolate, basidiocarp

Figure 15. Hyphal modifications observed during micromorphological analysis of 6 week old somatic culture mats of Laccaria taxa: typical undifferentiated hyphae. Note the presence of clamp connections and the regular branching pattern.

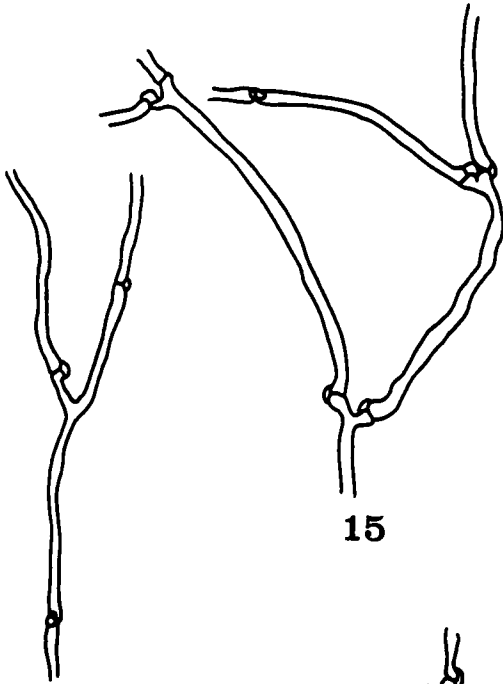
Figure 16. Hyphal modifications observed during micromorphological analysis of 6 week old somatic culture mats of Laccaria taxa: chlamydospores. Note their position on the hyphae--either terminal, intercalary or in chains.

Figure 17. Hyphal modifications observed during micromorphological analysis of 6 week old somatic culture mats of Laccaria taxa: coralloid hyphae. Note the numerous, short, intertwining branches.

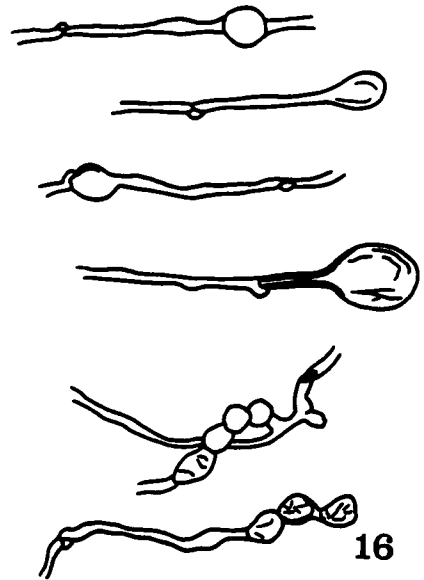
Figure 18. Hyphal modifications observed during micromorphological analysis of 6 week old somatic culture mats of Laccaria taxa: subcoralloid hyphae.

Figure 19. Hyphal modifications observed during micromorphological analysis of 6 week old somatic culture mats of Laccaria taxa: irregular swollen hyphae.

NOTE: Reference line = 20 μ m.



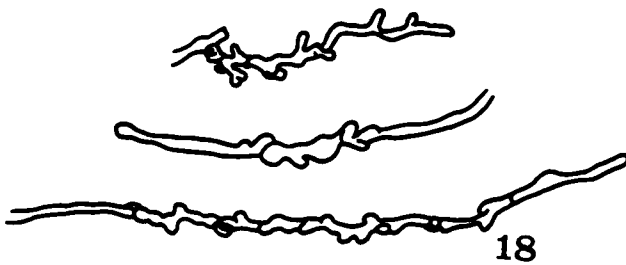
15



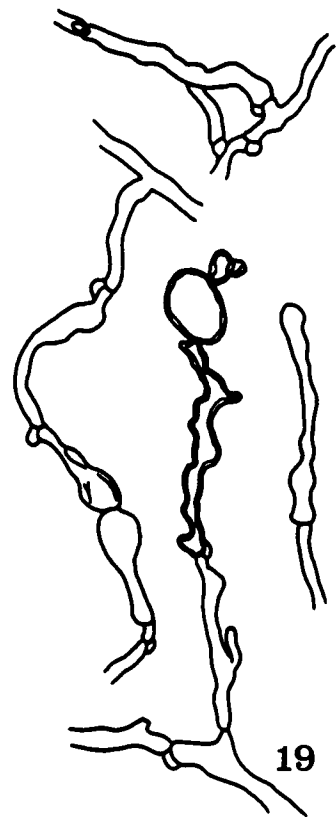
16



17



18



19

production was readily obtained. An examination of the resulting basidiocarps revealed, however, that Davis and Jong's isolate was not a Laccaria. As reported by Lahaie (1982), because of the smooth basidiospores and siderophyllous basidia, ATCC 24509 is a Lyophyllum.

Electrophoretic Characters

Preliminary electrophoretic analysis of total proteins utilizing disc electrophoresis on extracts of eight isolates representing four species derived from cultures grown under identical conditions proved to have more intraspecific variation than interspecific variation. In order to obtain taxonomically useful data, therefore, it will be necessary to examine specific enzyme systems.

CHAPTER IV

TAXOMETRIC ANALYSIS

As discussed in the introductory chapter, a major problem in delimiting stable and natural taxa within Laccaria has been the paucity of good, stable, diagnostic characters. Because of this, it was judged advantageous to critically examine characters from various stages of the life cycle.

A consequence of examining cultural characters along with a large number of basidiocarp morphological characters has been the generation of large amounts of data. In order to analyze objectively and efficiently these data, several techniques of numerical analysis were employed. These techniques included data handling and descriptive statistics and numerical taxonomic procedures.

In Basidiomycete taxonomy, taxometric analysis has been utilized in only a few instances (e.g., Kendrik and Weresub, 1966; Parker-Rhodes and Jackson, 1969; Machol and Singer, 1971, 1977; Mazzer, 1976; Mueller and Sundberg, 1981; Wolf, 1981). With the exception of Mazzer (1976) and Mueller and Sundberg (1981), all of these studies have dealt with taxonomy or identification at the suprageneric level. Mazzer's (1976) is unique among these works in that his study resulted in a cladistic classification as opposed to one based solely on phenetic similarity.

Taxometric Procedures

Each collection (=OTU, operational taxonomic unit) was measured or scored for 30 morphological and cultural characters (Table 2). This set of characters consisted of all of the characters for which I had data that were not redundant or superfluous. The coefficient of Gower, a coefficient of resemblance, was calculated between each of the OTU's (=individual collections). The coefficient of Gower was used because the data set contained multistate level, quantitative, and binary data.

The resulting correlation matrix was then analyzed to reveal evidence of the underlying taxonomic structure. Two methods were employed: (1) UPGMA (=unweighted pair-group arithmetic average) cluster analysis and (2) Principal Coordinate Analysis (=PCA). UPGMA is a sequential technique which starts with each OTU separate and then lumps (clusters) similar ones together in successive steps. PCA is an ordination technique (a simultaneous versus sequential procedure) which creates a multi-dimensional graph of the multi-dimensional data while keeping the OTU's in the same relative position. This allows for visualization of the relative position of each OTU in taxonomic space.

A detailed discussion of the theories associated with and techniques employed in such an analysis can be found in Sneath and Sokal (1973). Computations were performed on the DEC system--10 Model 1090 located in The University of Tennessee Computing Center (UTCC) using The University of Tennessee System for Analysis of Taxonomic Data written by Dr. Edward E. Schilling.

Table 2. Characters and character states employed for the numerical taxonomical analyses.

Characters	Coded Character States ¹
1. Pileus color	flesh to orange=1, violaceous=2, buff=3, vinaceous=4, reddish brown=5, violet-brown=6
2. Lamella color	flesh color=1, violet=2, grayish=3, yellow-brown=4
3. Basal mycelium color	white=1, violet=2
4. Pileus striations	none=0, plicate=1, normal=2, translucent=3
5. Pileus texture	glabrous=1, pruinose=2, fibrillose=3, fibrillose-scaly=4, scaly=5
6. Stipe striations	none=1, slight=2, moderate=3, pronounced=4
7. Lamella broadness	narrow=1, narrow to moderate=2, moderately broad=3, broad=4, very broad=5
8. Pileus diameter	range data
9. Stipe L/W	range data
10. Pileus/Stipe ratio	range data
11. Spore length	range data
12. Spore width	range data
13. Spore L/W	range data
14. Spine length	range data
15. Basidia length	range data
16. Basidia L/W	range data
17. Number of sterigmata	2-spored=1, 4-spored=2

Table 2 (Continued)

Characters	Coded Character States ¹
18. Cheilocystidia L/W	range data
19. Cuticular arrangement	interwoven=1, fascicles=2, pallisade=3, row of individual hyphae=4
20. Cuticle hyphae L/W	range data
21. Radius on ME	range data
22. Mat texture on ME	subfelty=1, silky=2, subfelty to silky=3, cottony=4, felty=5
23. Radius on MNM	range data
24. Mat texture on MNM	subfelty=1, silky=2, subfelty to silky=3, cottony=4, felty=5
25. Mat color on MNM	white=1, light violet=2, moderate violet=3, dark violet=4, brown=5
26. Radius on PDA	range data
27. Mat color on PDA	white=1, light violet=2, moderate violet=3, dark violet=4, brown=5
28. Plug color on PDA	white=1, violet=2, light orange to light brown=3, dark brown=4
29. Thickness uniformity	not uniform=0, uniform=1
30. Extracellular oxidase	none=1, slow=2, immediate=3

¹All measurement data were mean values.

Data handling and descriptive statistics were performed using The Statistical Analysis System (SAS) on the IBM 370/3031's in UTCC.

Results

Preliminary analyses were performed on several different sets of data. Comparisons were made between analyses run with varying sets of characters and different numbers of OTU's in order to determine the optimum number of characters to be used in the final analysis. The final set of analyses were performed on 44 OTU's, the number of collections on which all of the necessary data were available, utilizing the 30 characters listed in Table 2 (Figures 20-21).

Both cluster analysis and PCA yielded comparable results. Ten distinct clusters of OTU's were identified by the author (Figure 20). Each of these clusters were given the rank of species. The primary difference between the phenogram (Figure 20) and the graph from PCA (Figure 21) is that, although distinct in the phenogram, L. nobilis (=Taxon D) is not segregated in the PCA graph. This apparent contradiction is probably due to the way the two methods of analysis work. Cluster analysis is generally more discerning within closely related groups while ordination techniques will yield a more accurate interpretation of arrangement between groups with larger phenetic differences (Sneath and Sokal, 1973). Inclusion of additional axes from PCA might further clarify the groupings, but these axes are not shown in order to simplify the discussion.

The placement of OTU's 4 and 21 need special comment. Both of these collections are the only representatives of their respective

Figure 20. Phenogram produced by UPGMA cluster analysis of 44 OTU's of Laccaria using 30 characters (Table 2, page 55) and Gower's coefficient of similarity. The letters represent the putative taxa: L. lavendipes = A, L. bicolor = B, L. proxima = C, L. nobilis = D, L. trichodermophora = E, L. amethysteo-occidentalis = F, L. oblongospora = G, L. laccata = H, L. ochropurpurea = I, L. altaica = J.

Figure 21. Graph of 44 OTU's of Laccaria along first two axes determined by principal coordinant analysis using 30 characters (Table 2, page 55). The letters represent the putative taxa (see Figure 20).

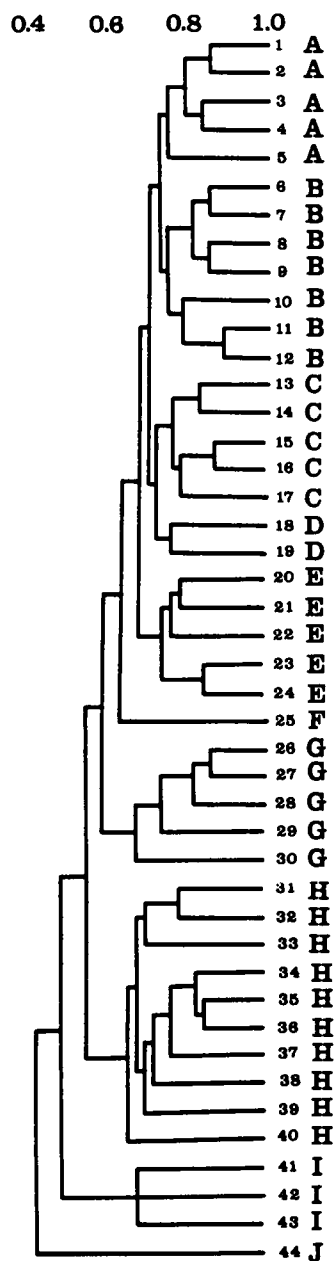


FIGURE 20

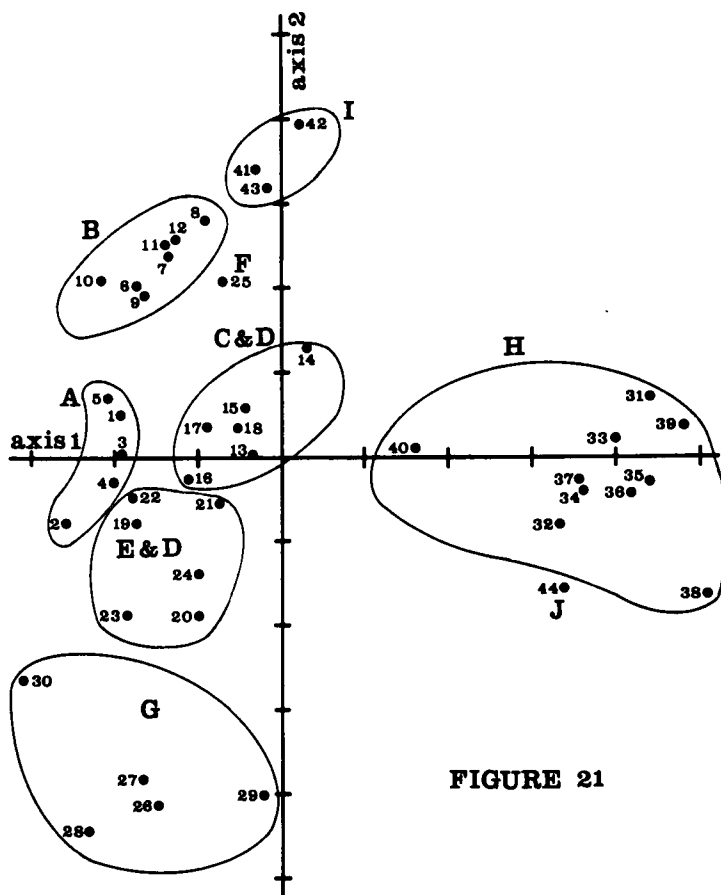


FIGURE 21

taxa (L. lavendipes and L. trichodermophora) from western North America. Whether these two collections represent disjunct populations or are in reality unique taxa is difficult to determine based on the available data. For now, because of their placement in the phenogram and PCA graph, they will be tentatively treated as disjunct populations.

The decision of which clusters of OTU's to recognize taxonomically is to a certain degree arbitrary. No accepted automatic algorithm exists for this purpose (Sneath and Sokal, 1973). Subjectively made taxonomic decisions, therefore, still enter into the taxonomic process. These decisions were made based on my knowledge of the morphology of the putative taxa. The species recognized from these analyses are discussed below.

L. lavendipes. The OTU's of L. lavendipes form a single cluster in the phenogram (Figure 20) and are segregated in the PCA graph (Figure 21). This taxon (as L. farinacea (Hudson) Singer) has occasionally been lumped with L. laccata (Taxon H) (e.g., Lahaie, 1981). As can be seen by its position in both the graph and phenogram, it is quite distinct from L. laccata. The relatively high similarity value ($R = 0.744$) at which L. lavendipes and L. bicolor (Taxon B) cluster indicates they are phenetically close. However, based on distributional data and an overall difference in macro-morphological and cultural characters, sufficient evidence is available to differentiate the two species.

L. bicolor. The OTU's of L. bicolor are well segregated in both the phenogram and graph (Figures 20-21).

L. proxima. The placement of all of the OTU's of L. proxima in one cluster and segregated group on the PCA graph supports its position as a distinct species (Figures 20-21).

L. nobilis. The two OTU's of L. nobilis are clustered to L. proxima at a relatively high correlation value ($R = 0.740$) (Figure 20). Although this suggests a close overall phenetic relationship, sufficient morphological characters exist to support their separation into two distinct species. As stated above, the fact that the two OTU's of L. nobilis appear separated from each other in the graph from PCA (Figure 21) is probably due to the method.

L. trichodermophora. The placement of the OTU's of L. trichodermophora in a distinct cluster in the phenogram and location on the graph supports the segregation of this taxon from L. laccata (Figures 20-21).

L. amethysteo-occidentalis. The one OTU of L. amethysteo-occidentalis is well separated from all other OTU's (Figures 20-21).

L. oblongospora. The OTU's of L. oblongospora are well separated in the PCA graph (Figure 21) and tightly clustered in the phenogram (Figure 20). This arrangement supports the segregation of this taxon from L. proxima.

L. laccata. As expected, the analyses (Figures 20-21) indicated that L. laccata is the most variable North American species of Laccaria. There is a large amount of variation in this taxon as shown by the linking of several of the clusters at relatively low correlation values. The morphological variation, however, appears to form a continuum, and no distinct subgroups are evident.

L. ochropurpurea. The OTU's of L. ochropurpurea form a uniform and highly distinctive group (Figures 20-21).

L. altaica. The one OTU of L. altaica, the only 2-spored taxon in the analyses, was well segregated from all of the other OTU's. This indicates that there is a large overall phenetic difference between this taxon and the 4-spored taxa.

Additional Analyses

The analyses described above were limited to those OTU's for which a complete set of data (macro- and micromorphological along with cultural characters) is available. With currently available techniques of obtaining tissue cultures, a majority of collections could not be utilized in the above analysis (e.g., of the approximate 1000 collections obtained in this study, only 44 collections met the above requirements).

In an attempt to determine the similarity of results utilizing only data obtained from herbarium material (both with and without complete macromorphological notes), two additional sets of analyses were performed on the same 44 OTU's. The first analysis in this set (not figured because of similarity to Figure 20) was based on the 20 macro- and micromorphological characters used in the previous analyses (Table 2, page 55, character numbers 1-20). Without culture mat data, the distinctiveness of several of the taxa decreases. Concurrently, L. laccata is separated into two distinct and separate groups (OTU's 34, 35, 36, 37, 40, versus OTU's 31, 32, 33, 38, 39).

This is most likely due to the fact that it is the uniformity of cultural characters that helps tie this morphologically plastic species together.

The taxa which were no longer shown to be distinctive by this analysis were L. lavendipes, L. bicolor, and L. nobilis. One L. lavendipes (OTU 5) and one L. bicolor (OTU 9) ended up in a cluster of the other taxon. The two collections of L. nobilis (OTU 18, 19) were widely separated. This was expected based on the previous analyses (Figures 20-21) which suggested that L. lavendipes and L. bicolor were phenetically similar and that the OTU's of L. nobilis were not completely segregated. These results again show the necessity of including culture mat data in the analysis to obtain accurate results.

The majority of specimens obtained from herbaria, however, also lack macromorphological notes. The results of an analysis performed on the same 44 OTU's based only on the 15 characters normally available from a good herbarium specimen (Table 2, page 55, character numbers 1, 2, 11-20, plus coded size data--very small = 1, small = 2, moderate = 3, large = 4; coded stipe length--short = 1, moderate = 2, long = 3; and stature--gracile = 1, moderate = 2, moderately robust = 3, robust = 4) are shown in Figure 22-23. As can readily be seen, most of the differences between taxa are lost when utilizing such a small set of characters. Only those taxa which are very distinct, L. amethysteo-occidentalis, L. ochropurpurea, and L. altaica, retained their distinctiveness. Therefore, in many

Figure 22. Phenogram produced by UPGMA cluster analysis of 44 OTU's of Laccaria using 15 characters (see text) and Gower's coefficient of similarity. The letters represent the putative taxa: L. lavendipes = A, L. bicolor = B, L. proxima = C, L. nobilis = D, L. trichodermophora = E, L. amethysteo-occidentalis = F, L. oblongospora = G, L. laccata = H, L. ochropurpurea = I, L. altaica = J.

Figure 23. Bottom part of a phenogram produced by UPGMA cluster analysis of 126 OTU's of Laccaria using 15 characters (see text) and Gower's coefficient of similarity. The letters represent the putative taxa: L. altaica = J, L. tortilis = K, L. lateritia = L, L. ochropurpurea = I, L. amethysteo-occidentalis = F, L. calospora = W, L. vinaceo-brunnea = O, L. trullisata = P.

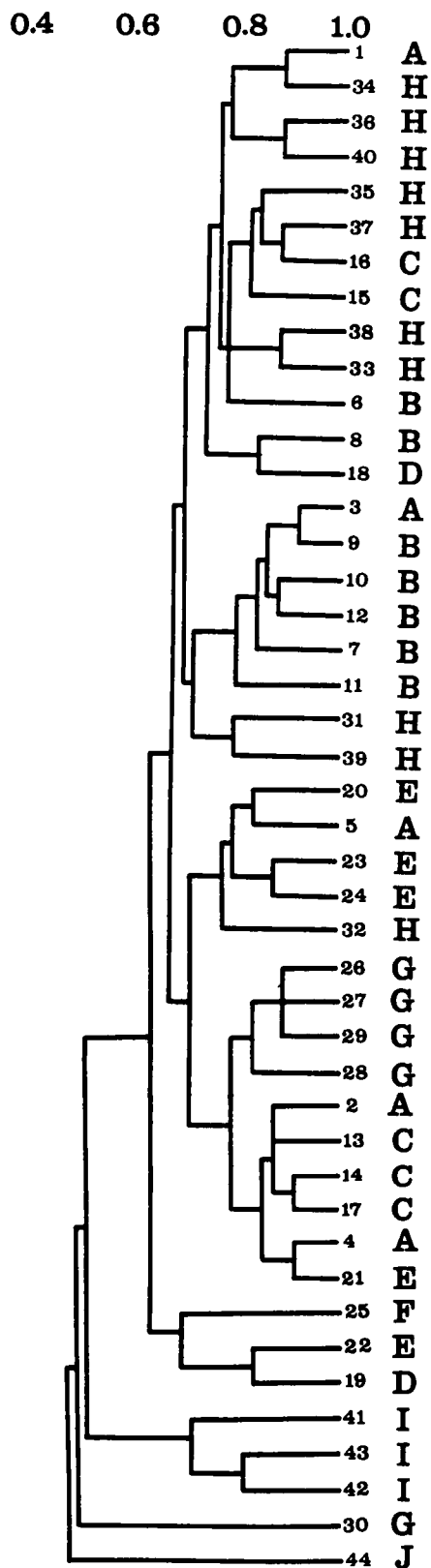


FIGURE 22

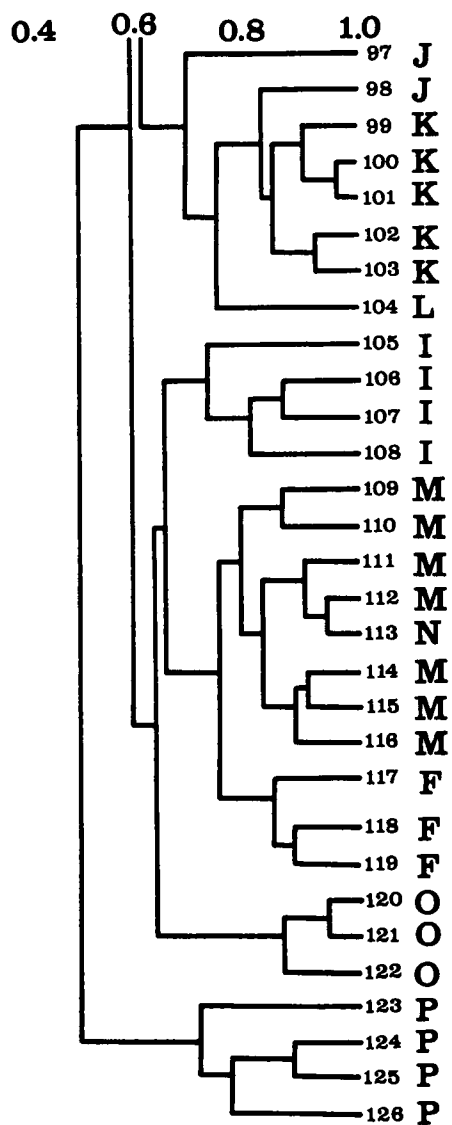


FIGURE 23

instances it will be difficult to identify properly herbarium collections of Laccaria lacking macromorphological notes.

Aware of the limitations discussed in the preceding paragraph, an analysis of 126 OTU's, representing each of the North American taxa, utilizing the same 15 characters was carried out. The lower portion of the resulting phenogram (OTU's 97-126) is illustrated in Figure 23. As in the last analysis discussed (Figure 22), the upper portion of the phenogram (OTU's 1-96) shows little agreement with species recognized using a full data set (Figure 23), as OTU's of the various putative taxa are intermingled with each other. The importance of having macromorphological and cultural data was again emphasized. In contrast, the taxa in the lower section of the phenogram have retained their individuality, thus indicating that they are distinct, even when utilizing only 15 characters.

Four major groupings (supraspecific) are apparent (Figure 23): (1) the 2-spored taxa [L. altaica (=J), L. tortilis (=K), and L. lateritia (=L)], (2) the taxa with violaceous lamellae, excluding L. trullisata [L. ochropurpurea (=I), L. amethystina (=M), L. calospora (=N), L. amethysteo-occidentalis (=F), and L. vinaceo-brunnea (=O)], (3) L. trullisata (=P), and (4) the "laccata-complex" [A-E, G, and H]. Except for the separation of the 2-spored taxa from the "laccata"-complex, this superspecific arrangement is identical with that of singer (1975) (refer to Chapter I). A formal designation of supraspecific groups (= subgenera or sections) will be deferred until an examination of additional non-North American specimens has been completed.

In summary then, it appears that both morphological and cultural data are necessary to develop an accurate, stable, and presumably "natural" classification scheme for many taxa in Laccaria. Although most specimens which have macromorphological notes can be properly identified, the diagnostic morphological characters were, in some cases, not sufficient to circumscribe taxa without the additional information provided by the somatic culture mat analysis. Fortunately, most of the taxa that have not been successfully cultured have sufficient morphological differences to be easily circumscribed without data from other stages of their life cycle.

CHAPTER V

NORTH AMERICAN TAXA

Laccaria Berkeley and Broome. 1883. Ann. Mag. Nat. Hist. 12: 370.

= Russuliopsis Schroeter. 1889. Die Pilze Schlesiens.
pp. 622-623.

Pileus convex to plane, glabrous, finely-fibrillose to fibrillose- scaly or scaly to squarrose, astriate to plicate-scriate or pellucid-striate, hygrophanous, orange brown to pinkish flesh color or buff or dark violaceous to vinaceous; lamellae moderate to very broad, thick, waxy-appearing, sinuate to sub-decurrent, close to distant, light flesh pink color or violaceous; stipe, equal to subclavate, glabrous to coarsely fibrillose, often longitudinally striate; basal mycelium white or violet; spores in mass white, rarely light violet; pileipellis undifferentiated and interwoven, or fasciculate or a trichodermium; basidia 2- or 4-sterigmate, clavate; pleurocystidia very rare; cheilocystidia absent to abundant, undifferentiated to clavate or subcapitate; basidiospores globose to oblong and echinulate or very elongate and smooth to finely roughened; clamp connections at nearly all septa; basidiospores and all elements inamyloid, not dextrinoid, and acyanophyllic. Terrestrial, cosmopolitan.

Key to Laccaria for North America Excluding Mexico

1. Lamellae violaceous to purple when young and fresh 2
1. Lamellae flesh color to pinkish when fresh 8
 2. Basidiospores large, 13.5-22 x 5.5-8.3 μm , strongly elongate (mean L/W = 2.43), smooth to finely roughened, not echinulate; lamellae dark purple; in sand or very sandy soil; North Central and eastern N.A. . . L. trullisata
 2. Basidiospores smaller (< 10.5 μm long), less elongate (mean L/W $\leq$ 1.51), echinulate. 3
3. Basidiocarps bright violaceous or purple when young and fresh. 4
3. Basidiocarps orange brown, pinkish flesh color, wine color, avellaneous, or buff color 6
4. Western N.A.; basidiocarps large (pilei up to 9 cm broad), fading in age to vinaceous color
 L. amethysteo-occidentalis
4. Eastern N.A.; basidiocarps smaller (pilei rarely up to 5 cm broad), fading in age to buff color or reddish brown . . . 5
5. Cuticle interwoven with scattered fascicles of perpendicular hyphae; basidiospores globose, rarely subglobose (mean L/W = 1.0); spore ornamentation mean length = 1.9 μm ; basidiocarps fading in age to buff color. L. amethystina
5. Cuticle interwoven with very numerous, large, individual perpendicular hyphae; basidiospores subglobose to broadly elliptical (mean L/W = 1.11); spore ornamentation mean length = 1.0 μm ; basidiocarps becoming reddish brown when mature L. vinaceo-brunnea

10. Pileus cuticle interwoven with scattered small, to moderate sized, perpendicular fascicles of hyphae12
11. Basidiospores (excluding ornamentation) 6-7.8 x 6-7.8 μm , globose, rarely subglobose (mean L/W = 1.01); basidiocarps vinaceous-brown; basal mycelium white. L. microspora
11. Basidiospores (excluding ornamentation) 7-10 x 6.4-9 μm , subglobose to broadly elliptical (mean L/W = 1.09); basidiocarps orange brown; basal mycelium usually white, occasionally violet. L. trichodermophora
12. Basal mycelium violaceous when fresh13
12. Basal mycelium white when fresh.14
13. Western N.A.; lamellae light vinaceous, occasionally fading to a pinkish color when older; basal mycelium copious; basidiocarps usually pinkish flesh color. L. bicolor
13. Eastern N.A.; lamellae flesh-colored to pinkish flesh color when fresh; basal mycelium scant, hygrophanous; basidiocarps usually orange brown L. lavendipes
14. Basidiospores (excluding ornamentation) 9-13.5 x 8.3-11.5 μm (mean dimensions = 10.8 x 9.5 μm); pilei up to 35 mm broad, striate to (often) strongly striate; restricted to arctic, boreal, or alpine habitats L. montana
14. Basidiospores smaller (mean dimensions $\leq$ 8.6 x 8.6 μm); pilei either up to 40 mm or up to 77 mm, not striate or occasionally finely striate, some translucent-struate. . .15
15. Pilei up to 77 mm broad, scaly; stipes robust (up to 10 μm broad at apex), strongly striate to reticulate, occasionally

- scaly; basidiospores (excluding ornamentation) 7.4-10 x 6.4-8.7 μm , subglobose to broadly elliptical, occasionally elliptical (mean L/W = 1.15). L. nobilis
15. Pilei up to 40 mm broad, not scaly; stipes not robust, not striate or finely striate, not scaly; basidiospores globose to subglobose (mean L/W $\leq$ 1.04) 16
16. Stipes gracile, 1-4 mm broad at apex, glabrous, not striate, darker than the pilei; pilei strongly translucent-striate; basidiospore ornamentation mean length = 2 μm ; in wet moss, eastern N.A. L. glabripes
16. Stipes more robust, up to 8 mm broad at apex, fibrillose, not striate to finely striate, concolorous with pilei; pilei not striate to striate, rarely slightly translucent-striate; basidiospore ornamentation mean length = 1.4 μm ; cosmopolitan L. laccata
17. Basidiospores elliptical to oblong (mean L/W = 1.51), 7.8-10 x 5-6.5 μm (excluding ornamentation); basal mycelium normally white, occasionally violet; southern Mississippi under Pinus palustris. L. oblongospora
17. Basidiospores broadly elliptical to elliptical (mean L/W $\leq$ 1.29); basal mycelium white; broad distribution 18
18. Pilei up to 85 mm broad; stipes with prominent dark striations; cheilocystidia numerous, long, filamentous; eastern N.A. L. moelleri

18. Pilei rarely up to 50 mm broad; stipes lacking prominent striations; cheilocystidia absent or not filamentous; cosmopolitan L. proxima
19. Basidiospores (excluding ornamentation) 8.3-11 x 7.5-10.5 μm L. lateritia
19. Basidiospores large, most > 11 μm (excluding ornamentation). .20
20. Basidiospores (excluding ornamentation) 11-17 x 10-14.5 μm , subglobose to broadly elliptical (mean L/W = 1.14); spore ornamentation mean length = 1 μm L. altaica
20. Basidiospores (excluding ornamentation) 10-15 x 10-15 μm , globose to occasionally subglobose (mean L/W = 1.02); spore ornamentation mean length = 2.2 μm L. tortilis

Laccaria altaica Singer. 1967. Bull. Soc. Mycol. France 83: 122.

Type specimen (HOLOTYPE): LE - Singer A439; USSR; Kuraika.

31.VII.1937. [!]

SPECIES SYNOPSIS: Pileus very small to small (rarely up to 30 mm broad), often strongly striate, subglabrous, brownish orange. Lamellae pinkish flesh color. Stipe subconcolorous with pileus; basal mycelium white. Basidia 2-sterigmate. Cheilocystidia usually lacking. Basidiospores large (up to 15 μm long excluding ornamentation), subglobose to broadly elliptical, echinulate; spines mostly 0.5-1.4 μm long. Predominantly in alpine, arctic, or boreal habitats.

MACROMORPHOLOGY: BASIDIOMA: Pileus 3-27 (-40) mm broad, convex to plane, occasionally uplifted, often depressed, usually

strongly translucent-striate when fresh, glabrous to finely fibrillose, occasionally becoming fibrillose-scaly with age, hygrophanous, red brown to orange brown ("Hay's Russet" to "Burnt Sienna" to "Sanford's Brown"), fading lighter (near "Xanthine Orange" to "Flesh-Ocher" to "Salmon-Buff"); margin incurved to decurved, often becoming plane, entire to undulate, occasionally becoming eroded; context thin, concolorous. Lamellae up to 8 mm broad, thick to very thick, waxy, sinuate to arcuate, moderately distant to very distant, pinkish flesh color ("Flesh Color" to "Pale Flesh Color"). Stipe 4-61 (-100) x 2-5 (-9) mm, equal to subclavate, often slightly bulbous, occasionally caespitose, dry, fibrillose, longitudinally striate, subconcolorous with pileus, fading to ochraceous buff ("Amber Brown" to "Flesh-Ocher" to "Apricot Buff"). Basal mycelium white. Spores white in mass.

MICROMORPHOLOGY: PILEUS: Cuticle interwoven with widely scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 10-25 hyphae; terminal cells of fascicular hyphae ($n = 20$) 36.5-64 x 7.8-16 μm , undifferentiated to subclavate to clavate; walls up to 0.5 μm thick, light to moderate yellowish brown, often encrusted with pigment; contents hyaline to light yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel to subparallel; hyphae mostly (3.2-) 5.5-18 μm diam., thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia ($n = 58$) 37.5-64.5 x 10.6-16 μm , mean L/W =

4.05 $\pm$ 0.59, clavate, elongate, hyaline; sterigmata 2 (-4), up to 13.8 μ m long. Pleurocystidia lacking. Cheilocystidia (n = 8) 27.6-46 x 3.2-5 μ m, mean L/W = 9.56 $\pm$ 2.63, found in one collection only, undifferentiated to subclavate, scarce, extending well beyond basidia and basidioles, hyaline. Basidiospores (excluding ornamentation) [86/6] (10-)11-16.6(-19.8) x (7.8-)10-14.7(-16) μ m (mean dimensions = 13 $\pm$ 1.8 x 11.5 $\pm$ 1.4 μ m), L/W = 1-1.29 (mean L/W = 1.14 $\pm$ 0.06), subglobose to broadly elliptical, occasionally globose or elliptical to amygdaliform, hyaline, echinulate; spines < 0.5-1.4 (-1.8) μ m long (mean length = 1 $\pm$ 0.35), crowded; hilar appendage 1.3-2 μ m long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 3.7-19.3 μ m diam., tightly interwoven, hyaline; cells long, undifferentiated to barrel-shaped.

CULTURE MAT ANALYSIS: MACROMORPHOLOGY (n = 1); PDA: Radius at week III 90 mm (agar surface covered), week VI same; mat felty, moderately thick to thick, tightly interwoven, submerged, not translucent, white to light buff color; margin not distinct--growing up side of plate; plug concolorous. MNM: Radius at week III 85-90 mm, week VI agar surface covered; mat felty, relatively thick, tightly interwoven, submerged, occasionally becoming iarinaceous some distance from plug, often with concentric bands 2-3 mm wide, not translucent, white; margin 3-4 mm broad, subfelty to silky, thin, entire, white; plug concolorous. ME: Radius at week III 90 mm (agar surface covered), week VI same; mat felty, relatively thick,

tightly interwoven, not translucent, white; margin not distinct--
growing up side of plate; plug white. EXTRACELLULAR OXIDASE:
Reaction negative.

CULTURE MAT ANALYSIS: MICROMORPHOLOGY: PDA: Hyphae mostly
swollen to very swollen, barrel-shaped to almost spherical, clamps at
every septum, many highly vacuolated, hyaline; chlamydospores absent.
MNM: Hyphae same as in PDA; chlamydospores absent. ME: Hyphae
undifferentiated to barrel-shaped to almost spherical; chlamydospores
absent.

HABITAT AND DISTRIBUTION: Scattered to gregarious, occasionally
caespitose; restricted to arctic, boreal, and montane regions, common.

OBSERVATIONS: Laccaria altaica appears very similar in the
field to L. lateritia, L. montana, L. tortilis, and small striate
forms of L. laccata. It can easily be distinguished, however, by its
2-sterigmate basidia which bear large, subglobose to broadly
elliptical, short-spined basidiospores.

The above description of culture mat morphology was based on
a single isolate, TENN 42547. Because of the small size of this
species' basidiocarps, it is very difficult to excise a large
enough mass of tramal tissue to successfully initiate hyphal growth.
To my knowledge, this is the first report of successful culturing of
any of the small Laccaria taxa. This single isolate showed similar-
ties to the isolates of L. laccata, especially TENN 42964, the only
examined isolate of L. laccata from western N.A. Laccaria altaica
and Laccaria laccata are the only taxa examined which have white
culture mats on all three media (Appendix E).

The major distinguishing character between L. altaica and L. montana is that the latter has 4-sterigmate basidia. Both are restricted to arctic, subarctic, alpine and boreal habitats and can be found growing sympatrically. Singer (1977) mentioned that L. altaica may only be a two-spored form of L. montana and thus the two might possibly be conspecific. Lahaie (1981) and my findings, however, have supported separation of these taxa at the species rank. In all the specimens examined for this study, no basidiocarps were found which had both 2- and 4-sterigmate basidia, and Lahaie (1981) only reported one collection with mixed sterigma numbers. Until sexual incompatibility studies and further cultural work has been completed, therefore, the two taxa should remain separate.

Laccaria altaica appears to be the dominant, if not the exclusive, 2-sterigmate Laccaria found in the arctic, and the most common 2-sterigmate Laccaria in the mountains of western U.S. Lange (1955) and Kobayasi et al. (1967) reported L. tortilis occurring in the arctic; however, the descriptions and illustrations of both indicate that the collections are probably L. altaica. Additionally, Favre (1955) reported collecting L. laccata var. pumila (Fayod) Favre from 12 localities in the subalpine zone. As in the preceding cases, his description and illustrations indicate that the collections were probably L. altaica. Favre (1955) discussed and illustrated a collection with very broad lamellae which very closely resembles material that I collected in Colorado (TENN 1193).

For a list of specimens examined, refer to Appendix A.

Laccaria amethysteo-occidentalis Mueller. sp. nov.

Pileo 10-65 (-89) mm lato, haud striato, purpureo-violaceo, siccando vinaceo vel pallidus. Lamellis concolor. Stipite 18-115 X 3-12 mm, fortites striatus, concolor. Basidiis tetrasporis. Cheilocystidis grandis, abundus. Sporis plerumque 7.4-10.6 X 6.4-9.2 μ m sine ornamentatione, plerumque subglobosis vel late ellipticis; spinae curta vel moderata.

Type specimen (HOLOTYPE): TENN - TENN 42526; Canada: British Columbia, near Squamish, Alice Lake Prov. Park campground. 3.X.1981. [!]

SPECIES SYNOPSIS: Pileus mostly 10-65 mm broad, not striate, hygrophanous, bright purple when fresh, becoming vinaceous, eventually fading to buff. Lamellae purple, becoming vinaceous. Stipe up to 1.15 mm long, strongly striate, concolorous with pileus. Basidia 4-sterigmate. Cheilocystidia large (often up to 65 X 15 μ m), subclavate to clavate, often very abundant. Basidiospores 7-10.5 X 6.5-9 μ m, usually subglobose to broadly elliptical, echinulate; spines mostly 0.5-1.4 μ m long. Western North America.

MACROMORPHOLOGY: BASIDIOMA: Pileus 10-65 (-89) mm broad, obtuse to convex to plane, occasionally becoming plane, often depressed, not striate when fresh, occasionally becoming slightly translucent-striate upon fading, finely fibrillose to fibrillose to fibrillose-scaly, hygrophanous, deep purple when fresh ("Taupe Brown" to "Dull Indian Purple" to "Dusky Dull Violet 1" to "Dark Hyssop Violet" to "Slate-Violet"), fading to vinaceous ("Dark

Vinaceous-Drab" to "Dark Vinaceous-Gray" to near "Wood Brown"), finally becoming buff colored (near "Pale Ochraceous-Salmon"); margin inrolled to decurved, becoming plane, entire to eroded; context thin, concolorous ("Dark Slate-Violet") with lighter gray purple to white areas intermixed ("Pale Bluish Lavender"). Lamellae narrow to broad, thick to very thick, occasionally waxy, sinuate to arcuate, subdistant to distant, dark violaceous ("Deep Slate Violet" to "Slate-Violet"), fading to (near "Lavender"). Stipe 18-115 x 3-12 mm, equal to subclavate, occasionally slightly bulbous, dry strongly longitudinally striate, occasionally with recurved scales, purple ("Dark Slate-Purple" to "Dark Vinaceous Brown" to "Hay's Brown"), often with lighter violet to white scattered sectors ("Pale Bluish Lavender"); context solid, concolorous with pileus context. Basal mycelium violet ("Dark Slate-Purple" to "Deep Slate-Violet" to "Light Dull Bluish Violet"). Spores white in mass.

MICROMORPHOLOGY: PILEUS: Cuticle tightly interwoven with scattered fascicles of $\pm$ perpendicular hyphal fascicles usually composed of 15-30 hyphae, long; terminal cells of fascicular hyphae ($n = 30$) 28.5-73.5 x 6.9-16 μm , undifferentiated to clavate, occasionally broadly clavate; walls up to 0.5 μm thick, vinaceous brown; contents hyaline to light vinaceous brown. Trama tightly interwoven, undifferentiated, hyaline, light vinaceous brown toward cuticle. LAMELLA: Trama parallel; hyphae mostly 3-11.5 μm diam., thin-walled, hyaline to light vinaceous brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia ($n = 45$) 34-56.5 x

9.7-14.7 μm , mean L/W = 3.87 ± 0.42 , clavate, elongate, hyaline, in young specimens, vinaceous brown in mass; sterigmata 4, up to 9.2 μm long. Pleurocystidia lacking. Cheilocystidia (n=10) 36.5-66.5 x 12-18.4 μm , mean L/W = 7.15, subclavate to clavate, often very abundant, extending well beyond basidia and basidioles, thin-walled, hyaline. Basidiospores (excluding ornamentation) [81/6] (6.4-)7.4-10.6 x 6.4-9.2 μm (mean dimensions = $8.8 \pm 0.78 \times 7.8 \pm 0.6 \mu\text{m}$), L/W = (0.95-)1-1.24(-1.36) (mean L/W = 1.13 ± 0.08), subglobose to broadly elliptical, occasionally globose or elliptical to amygdaliform, echinulate; spines < 0.5-1.4(-1.8) μm long (mean length = $1 \pm 0.3 \mu\text{m}$), crowded, hilar appendage 1.3-2 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 2.7-7.5 μm diam, hyaline, undifferentiated, long-celled.

CULTURE MAT ANALYSIS: MACROMORPHOLOGY (n=1): PDA: Radius at week III < 3 mm, week VI 12-14 mm; mat felty, moderately thick, tightly interwoven, submerged, not translucent, dark violet; margin up to 3 mm broad, subfelty, abruptly thinner than mat, entire, light violet; plug dark violet. MNM: Radius at week III 14-22 mm, week VI 24-32 mm; mat felty, moderately thick, tightly interwoven, thicker near plug, submerged, not translucent, moderate violet color, darker near plug, becoming lighter outward; margin 1-2 mm broad, subfelty to silky, not well differentiated from mat, even to serrate, light violet; plug moderate violet color. ME: Radius at week III 14-17 mm, week VI 23-27 mm; mat subfelty, moderately thick and interwoven with a narrow (3 mm) thicker band at midpoint, submerged, slightly translucent,

white; margin 1-2 mm broad, subfelty, not well differentiated, entire to somewhat serrate, white; plug white. EXTRACELLULAR OXIDASE: Reaction moderate blue color after 1 hr.

CULTURE MAT ANALYSIS: MICROMORPHOLOGY: PDA: Hyphae mostly undifferentiated with a few scattered subcoralloid hyphae in some plates; chlamydospores absent. MNM: Hyphae same as in PDA; chlamydospores moderately abundant, often associated with a septum. ME: Hyphae undifferentiated; chlamydospores abundant, occasionally in chains of 2-3, occasionally associated with a septum.

HABITAT AND DISTRIBUTION. Scattered to gregarious; under conifers (often Douglas Fir); western North America.

OBSERVATIONS: Laccaria amethysteo-occidentalis can easily be distinguished from the other two "purple" Laccaria taxa found in North America, L. amethystina and L. vinaceo-brunnea, by the large size and deeper purple coloring of the basidiocarps when fresh. Additionally, it differs from L. amethystina by having non-globose, short-spined basidiospores and from L. vinaceo-brunnea by its cuticular arrangement. All three taxa often have large cheilocystidia which form almost a sterile layer along the lamella margin. This character can be used in many cases to separate herbarium material lacking macromorphological notes of L. amethysteo-occidentalis from L. bicolor.

The above description of culture mat morphology was based on a single isolate, TENN 42526, although numerous attempts were made to culture from basidiocarps of this species. The slow rate of

growth and dark purple color of the culture mat on PDA was similar to the growth of L. ochropurpurea (Appendix E).

Laccaria amethysteo-occidentalis can be found commonly in the coniferous forest of the northwestern U.S. and western Canada. In contrast, within the range of this study, L. amethystina appears to be restricted to the mixed conifer-hardwood forests of eastern North America.

For a list of specimens examined, refer to Appendix A.

Laccaria amethystina (Hudson) Cooke. 1884. Grevillea 12: 69-70.

[= Agaricus amethystinus Hudson. 1778. Flora Anglica p. 612, nom. deval.]

= Collybia amethystina (Hudson) Quelet. 1888. Flore Mycologique. p. 237.

= Clitocybe amethystina (Hudson) Peck. 1897. Annual Rep. New York State Bot. 50: 128.

= Laccaria calospora Singer. 1973. Sydowia 7: 7-8. [!]

= Agaricus laccatus var. violacea Fries. 1836-1838. Epicr. syst. mycol. p. 79.

Type specimen lacking.

SPECIES SYNOPSIS: Pileus mostly 5-32 mm broad, strongly hygrophanous, bright grayish purple when fresh, fading to buff. Lamellae purple. Stipe concolorous; basal mycelium violet, fading white. Basidia 4-sterigmate. Cheilocystidia large (often up to 60 x 12 μ m), undifferentiated to clavate, often very abundant.

Basidiospores mostly 7-10 μm diam (excluding ornamentation), globose, echinulate; spines 1.4-2.8 μm long. Eastern North America.

MACROMORPHOLOGY: BASIDIOMA: Pileus 5-32 (-53) mm broad, convex to plane, often depressed, not striate or striate, occasionally translucent-striate when fresh, finely pruinose to fibrillose, occasionally becoming finely fibrillose-scaly, strongly hygrophanous, bright grayish purple when fresh (near "Heliotrope-Slate" to "Dark Slate-Violet 1"), fading to buff ("Vinaceous-Gray" to "Pale Ochraceous-Buff" to "Light Buff"); margin inrolled to decurved, entire to undulate, occasionally becoming eroded; context up to 3 mm thick at disc, tapering quickly to margin, concolorous to surface. Lamellae up to 5 mm broad, thick, sinuate to arcuate, subdistant to distant, subconcolorous with pileus ("Heliotrope-Slate" to "Vinaceous-Drab"). Stipe 6-58 (-70) x 1-7 mm, equal, rarely subclavate, occasionally slightly bulbous, dry, fibrillose, longitudinally striate, concolorous with pileus. Basal mycelium hygrophanous, violet becoming white. Spores white or very pale violet in mass.

MICROMORPHOLOGY: PILEUS: Cuticle interwoven with numerous scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 10-20 hyphae; terminal cells of fascicular hyphae ($n=80$) 23-73.5 x 6.4-17 μm , undifferentiated to clavate, occasionally broadly clavate or capitate or ventricose-rostrate, walls up to 0.5 μm thick, vinaceous brown in young specimens, light yellowish brown in mature specimens; contents concolorous with hyphal wall.

Trama tightly interwoven, undifferentiated, hyaline to light yellowish brown or vinaceous brown. LAMELLA: Trama parallel to sub-parallel; hyphae mostly 3.7-16 μm diam, thin-walled, hyaline to light yellowish brown or vinaceous brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=125) 30-64.5 x 8.5-13.8 μm , L/W = 3.79 ± 0.54 , clavate, elongate, hyaline; sterigmata (2-)4, up to 9.7 μm long. Pleurocystidia lacking. Cheilocystidia (n=96) 25.5-64(-92) x 4.2-12 μm , mean L/W = 6.86 ± 1.63 , undifferentiated to clavate, occasionally broadly clavate or ventricose-rostrate, very abundant, extending well beyond basidia and basidioles, thin-walled, hyaline. Basidiospores (excluding ornamentation) [160/11] 7-10 (-10.6) x (6.4-)7-10(-10.6) μm (mean dimensions = $8.3 \pm 0.7 \times 8.2 \pm 0.7 \mu\text{m}$), L/W = (0.93-)1-1.07(-1.12) (mean L/W = 1 ± 0.02), globose, rarely subglobose, hyaline, echinulate; spines 1.4-2.8 μm long (mean length = $1.9 \pm 0.4 \mu\text{m}$), crowded; hilar appendage 1.3-2 μm , prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 3.2-12 μm diam, tightly interwoven, hyaline; cells long, undifferentiated to barrel-shaped.

HABITAT AND DISTRIBUTION. Solitary to scattered, occasionally caespitose; primarily under hardwoods or mixed woods, eastern North America.

OBSERVATIONS: Laccaria amethystina can readily be distinguished from the other North American purple Laccaria (L. amethysteoccidentalis and L. vinaceo-brunnea) by its generally small size and stature and bright grayish purple basidiocarps which fade directly

to buff color. Additionally, it differs by having globose spores with long spines.

No tissue cultures of L. amethystina were obtained during this study. Lahaie (1981) described one isolate of L. amethystina grown on M3N (a modification of MNM) and ME: growth fast (on M3N agar surface covered within 15 days), silky to subfelty, pure white, with a strong odor of marzipan. Not having seen his specimens or isolates, I can make no further comments or comparisons.

There has been some controversy in the literature as to the correct name for this taxon. Most workers use the name L. amethystina, however, Murrill (1914), Dennis et al. (1960) and others have used L. amethystea (Bull.) Murrill for this species. Hudson's name is the earlier of the two, 1778 versus 1791, and thus, it is the accepted name for this taxon.

For a list of specimens examined, refer to Appendix A.

Laccaria bicolor (Maire) Orton. 1960. Trans. Brit. Mycol. Soc. 43: 177.

≡ Laccaria laccata var. bicolor Maire. 1937. Pub. Inst. Bot. Barcelona 3: 84. [!]

[≡ Laccaria proxima var. bicolor (Maire) Kuhner and Romagnesi. 1935. Flore Analytique des Champignons Superieurs. p. 131. nom. invalidum, Art. 33: 2 ICBN

Type specimen (HOLOTYPE): MPU - Maire; Spain: Catalonia, Collado de Tosses. 7.X.1933. [!]

SPECIES SYNOPSIS: Pileus up to 70 mm broad, not striate, fibrillose to fibrillose-scaly, pinkish flesh color. Lamellae light vinaceous, fading to light pinkish flesh color. Stipe up to 132 mm long, longitudinal-striate, concolorous with pileus; basal mycelium violet, fading white, often copious. Basidia 4-sterigmate. Cheil-cystidia up to $55 \times 8 \mu\text{m}$, undifferentiated to subclavate, often abundant. Basidiospores mostly $7-9 \times 6-8 \mu\text{m}$, subglobose to broadly elliptical, echinulate; spines $1-1.8 \mu\text{m}$ long. Western North America.

MACROMORPHOLOGY: BASIDIOMA: Pileus 8-70 mm broad, convex to plane, often depressed, not striate, finely fibrillose to fibrillose-scaly, occasionally becoming scaly, hygrophanous, pinkish flesh color ("Walnut Brown" to "Onion-skin Pink" or "Kaiser Brown" to "Cinnamon-Rufous," fading to "Flesh Ocher" to "Salmon-Buff"), eventually becoming buff color (near "Pale Salmon Color"); margin decurved to plane, entire to undulate, often becoming eroded; context thin, tapering quickly to margin, light vinaceous ("Pale Brownish Vinaceous" to "Hydrangea Pink"). Lamellae moderately broad to broad, moderately thick to thick, adnate to arcuate, subdistant to distant, light vinaceous, fading to light pinkish flesh color ("Pale Purplish Vinaceous" to "Pale Vinaceous-Drab" or "Pinkish Vinaceous" to "Hydrangea Pink"), fading to pinkish flesh color ("Light Congo Pink" to "Shell Pink"), eventually to light flesh color ("Pale Flesh Color" to "Pale Salmon Color"). Stipe (23-)30-132 x 3-10(-16) mm, equal to subclavate, often slightly to moderately bulbous, dry, fibrillose, longitudinally striate, concolorous with pileus;

striations occasionally slightly darker. Basal mycelium copious, hygrophanous, violet when fresh ("Dull Lavender" to "Pale Vinaceous-Lilac"), becoming white.

MICROMORPHOLOGY: PILEUS: Cuticle interwoven with numerous large fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of (15-)25-30 or more hyphae; terminal cells of fascicular hyphae (n=120) 27.5-76 x 6-18.5 μm , subclavate to clavate, rarely subcapitate; walls up to 0.5 μm thick, light to moderate yellowish brown; contents hyaline to light yellowish brown. Trama parallel; hyphae mostly 2.3-13.8 μm diam, thin-walled, hyaline to light yellowish brown; cells long, undifferentiated to barrel-shaped. Subhymenium undifferentiated. Basidia (n=195) 28.5-55 x 7.4-13 μm , mean L/W = 3.56 ± 0.45 , clavate, elongate, hyaline; sterigmata 4, up to 8.7 μm long. Pleurocystidia lacking. Cheilocystidia (n=120) 24.5-55 x 2.3-7.8 μm , L/W = 11.06 ± 2.63 , undifferentiated to subclavate, abundant, extending well beyond basidia and basidioles, thin-walled, hyaline. Basidiospores (excluding ornamentation) [195/13] (5.5-)6.9-8.7(-10) x 6-7.8(-9.2) μm (mean dimensions = $7.8 \pm 0.6 \times 7 \pm 0.6 \mu\text{m}$), L/W = 1-1.26(-1.36) (mean L/W = 1.11 ± 0.09), subglobose to broadly elliptical, occasionally globose or elliptical to amygdaliform, hyaline, echinulate; spines 0.9-1.8 μm long (mean length = $1.3 \pm 0.3 \mu\text{m}$), crowded; hilar appendage 1.3-2 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 3.2-15.5 μm diam, tightly interwoven, hyaline; cells long, undifferentiated to barrel-shaped.

CULTURE MAT ANALYSIS: MACROMORPHOLOGY (n=10): PDA: Radius at week III 11-32 mm, week VI 18-40(-54) mm; mat felty, moderately thick to thick, tightly interwoven, submerged, with time forming pruinose aerial layer away from plug, occasionally becoming furrowed due to irregular infolding near plug, not translucent, dark, bright violet, some fading to light orange brown, most remaining bright violet; aerial hyphae light grayish violet, often covering most of mat by week VI masking mat color; margin 3-4 mm broad, subfelty, thin, light violet to white; plug dark violet at first, becoming light orange brown. MNM: Radius at week III 22-41 mm, week VI (31-)40-63 mm; mat felty, occasionally silky to subfelty, relatively thin or moderately thick, loosely interwoven or tightly interwoven, occasionally with three to four narrow concentric thicker bands, submerged, translucent or not translucent, at first light to moderate violet, soon becoming buff, by week III violet color usually restricted to thicker bands and near margin; margin 2-4 mm broad, silky to subfelty, thin, loosely interwoven, even to serrate, light violet; plug light violet. ME: Radius at week III 19-43 mm, week VI 30-52 mm, TENN 42529 68-76 mm; mat subfelty becoming felty, moderately thick to thick, moderately to tightly interwoven, occasionally with small scattered thicker sectors, submerged, only slightly translucent, white; margin 2-3 mm broad, subfelty, not well differentiated, often very uneven, white; plug white. EXTRACELLULAR OXIDASE: Reaction moderate blue color immediately, negative in TENN 42608.

CULTURE MAT ANALYSIS: MICROMORPHOLOGY: PDA: Hyphae mostly undifferentiated with scattered irregular swollen hyphae, violet in

mass, pigment intracellular; chlamydospores abundant to very abundant, often in chains. MNM: Hyphae undifferentiated, occasionally with a few scattered irregular swollen hyphae; chlamydospores lacking to common to abundant. ME: Hyphae undifferentiated, occasionally with a few scattered irregular swollen hyphae; chlamydospores common to abundant.

HABITAT AND DISTRIBUTION. Scattered, occasionally caespitose; under conifers; western North America.

OBSERVATIONS: Laccaria bicolor can be distinguished from L. lavendipes, the other member of the L. laccata complex which normally produces violet basal mycelium, by the L. bicolor's larger size, violaceous lamellae when fresh, more copious basal mycelium, and western North American distribution. As discussed in the Observations under L. lavendipes, the two taxa appear to be closely related.

Laccaria bicolor is one of the most common Laccaria taxa found in the coniferous forests of western North America. I have not seen material from northern Alaska and presumably it is also not found in northern Canada.

For a list of specimens examined, see Appendix A.

Laccaria glabripes McNabb. 1972. New Zealand J. Bot. 10: 477-478.

Type specimen (HOLOTYPE): PDD - McNabb PDD 29640; New Zealand: Nelson, Lake Daniels track. 25.IV.1969. [!]

SPECIES SYNOPSIS: Pileus most 8-30 mm broad, strongly translucent-striate, reddish brown to orange brown. Lamellae pinkish flesh color. Stipe often up to 70 mm long, gracile, glabrous, not

stiate, appearing cartilaginous when fresh, often somewhat darker than pileus; basal mycelium white. Basidia 4-sterigmate. Cheilocystidia lacking. Basidiospores mostly 7-10 X 7-10 μm (excluding ornamentation), globose, echinulate; spines 1.4-2.8 μm long. Eastern North America, often in wet moss.

MACROMORPHOLOGY: BASIDOMA: Pileus (2-)8-30(-36) mm broad, convex, occasionally becoming plane, often, depressed, strongly translucent-striate when fresh, occasionally plicate-striate, finely fibrillose, some finely fibrillose-scaly near disc, hygrophanous, reddish brown to orange brown ("Hazel" to "Cinnamon-Rufous" to "Vinaceous-Rufous") soon fading lighter ("Salmon Color" to "Seashell Pink" or "Pinkish Buff"); disc occasionally slightly darker ("Hay's Russet"); margin incurved to decurved, becoming plane, entire to undulate; context very thin, concolorous. Lamellae relatively narrow to broad, thin to thick, sinuate to adnate, close to subdistant to distant, pinkish flesh color ("Flesh-Ocher" to "Pale Flesh Color"). Stipe (8-)20-70(-103) x 1-4(-8) mm, equal, occasionally slightly bulbous, glabrous, appearing cartilaginous when fresh, reddish brown, concolorous with disc or darker ("Kaiser Brown" to "Hazel" to "Cinnamon-Rufous" or "Onion-skin Pink"). Basal mycelium white.

MICROMORPHOLOGY: PILEUS: Cuticle interwoven with scattered to numerous small fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 5-15 hyphae; terminal cells of fascicular hyphae (n=40) 33-85 x 6-18.5 μm , undifferentiated to subclavate to clavate, few subcapitate or ventricose-rostrate, occasionally strangulate;

walls up to $0.5\ \mu\text{m}$ thick, hyaline to light yellowish brown; contents hyaline to light yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae $2.3\text{--}11(-27)\ \mu\text{m}$ diam, thin-walled, hyaline to light yellowish brown; cells long, undifferentiated to barrel-shaped. Subhymenium undifferentiated. Basidia ($n=77$) $30\text{--}59.5 \times 7.8\text{--}14.3\ \mu\text{m}$, mean $L/W = 3.92 \pm 0.55$, clavate, elongate, hyaline; sterigmata 4, up to $9.2\ \mu\text{m}$ long. Pleurocystidia lacking. Cheilocystidia lacking. Basidiospores (excluding ornamentation) $[115/8]$ $7\text{--}10(-11) \times 7\text{--}10(-11)\ \mu\text{m}$ (mean dimensions - $8.6 \pm 0.8 \times 8.6 \pm 0.8\ \mu\text{m}$), $L/W = 1(-1.12)$ (mean $L/W = 1 \pm 0.02$), globose, rarely subglobose, very rarely broadly elliptical, hyaline, echinulate; spines $1.4\text{--}2.8\ \mu\text{m}$ long (mean length = $2 \pm 0.4\ \mu\text{m}$ long), up to $1.8\ \mu\text{m}$ wide at base, crowded; hilar appendage $1.3\text{--}2\ \mu\text{m}$ long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly $2.3\text{--}12.4\ \mu\text{m}$ diam, tightly interwoven, hyaline; cells long, undifferentiated to barrel-shaped.

HABITAT AND DISTRIBUTION. Scattered to gregarious; often in wet moss, Appalachians Mts. and maritime Canada, abundant.

OBSERVATIONS: Laccaria glabripes is easily recognizable by its strongly translucent-striate pileus; long, gracile, glabrous, reddish-brown stipe; and relatively small, globose, strongly ornamentated basidiospores. One collection from Nova Scotia, TENN 42766 differed from the norm by having somewhat larger basidiospores.

This taxon is abundant in wet mossy areas in the mountains of Georgia, North Carolina, South Carolina, Tennessee, and in Nova

Scotia. Due to the difficulty of interpreting dried herbarium material lacking macromorphological notes, it is difficult to determine if it is common in the rest of eastern North America. No material of this species was seen west of the Appalachian Mountains.

To my knowledge this is the first report of this taxon from the U.S. or Canada. The only other report from the western hemisphere was by Aguirre-Acosta and Perez-Silva (1978) from Mexico.

For a list of specimens examined, refer to Appendix A.

Laccaria laccata (Scopoli:Fries) Berkeley & Broome. 1883. Ann. Mag. Nat. Hist. 12: 370.

= Agaricus laccatus Scopoli:Fries. 1821. Systema Mycologica. 1: 107.

[= Agaricus laccatus Scopoli. 1772. Flora Carniolica 2: 444, nom. devalid]

= Clitocybe laccata (Scopoli:Fries) Kummer. 1871. Führer in die Pilzkunde. p. 122.

= Omphalia laccata (Scopoli:Fries) Quelet. 1886. Enchiridion Fungorum. p. 2C.

= Collybia laccata (Scopoli:Fries) Quelet. 1888. Flore Mycologique. p. 237.

= Agaricus carneus Schaeffer. 1774. Fungorum Bavaria 4: 71, Fig. 304.

= Agaricus rubellus Schaeffer. 1774. Fungorum Bavaria 4: 71, Fig. 305.

- = Agaricus farinaceus Hudson. 1778. Flora Anglica. p. 616.
 - ≡ Laccaria farinacea (Hudson) Singer in Singer and Moser. 1965. Mycopath. Mycol. 26: 149.
- = Agaricus rosellus Batch. 1786. Elench. Fung., contin. prima p. 121, Fig. 99.
 - ≡ Russuliopsis laccata var. rosellus Schroeter. 1889. Die pilze Schesiens. p. 623.
- = Agaricus subcarneus Batsch. 1786. Elench. Fung. contin. prima. p. 121, Fig. 100.
- = Agaricus amethysteus Bulliard. 1791. Histoire des Champignons, p. 559.
 - ≡ Laccaria amethystea (Bulliard) Murrill. 1914. North Amer. Flora. X: 1.
- = Agaricus ohiensis Montagne. 1856. Syll. Crypt. p. 100. [!]
 - ≡ Clitocybe ohiensis (Montagne) Saccardo. 1887. Sylloge Fung. V. p. 181.
 - ≡ Laccaria ohiensis (Montagne) Singer. 1946. Mycologia 38: 688.
- = Laccaria tetraspora Singer. 1946. Mycologia 38: 689-690. [!]
- = Clitocybe laccata var. pallidifolia Peck. 1890. Ann. Rept. N.Y. State Bot. 43: 38. [!]
- = Clitocybe laccata var. striatula (Peck) Peck. 1894. Ann. Rept. N.Y. State Bot. 48: 244. [!]
 - ≡ Laccaria striatula Peck. 1912. Ann. Rept. N.Y. State Bot. 1911. 157: 93.

- = Laccaria laccata var. decurrens Peck. 1912. Ann. Rept. N.Y. State Bot. 1911. 157: 92. [!]
- = Laccaria laccata var. affinis Singer. 1967. Bull. Soc. Mycol. France 83: 111-112. [!]
- = Laccaria laccata var. anglica Singer. 1967. Bull. Soc. Mycol. France 83: 110-111. [!]
- = Laccaria laccata var. carbonicola Singer. 1967. Bull. Soc. Mycol. France 83: 110.
- = Laccaria laccata var. chilensis Singer. 1967. Bull. Soc. Mycol. France 83: 109. [!]
- = Laccaria laccata var. gibba Singer. 1969. Beih. Nova Hedwigia, Beih. 29: 27. [!]
- = Laccaria laccata var. intermedia Singer. 1977. Plant Syst. Evol. 126: 368-369. [!]
- = Laccaria laccata var. subalpina Singer. 1977. Plant Syst. Evol. 126: 365. [!]
- = Laccaria laccata var. tatrensis Singer. 1977. Plant Syst. Evol. 126: 367-368. [!]
- = Laccaria laccata var. vulcanica Singer ex Veselsky & Singer. 1977. Plant Syst. Evol. 126: 362-363. [!]
- = Clitocybe tortilis var. gracilis Peck. 1902. Ann. Rep. N.Y. State Museum 67: 36. [!]
- = Laccaria tetraspora var. aberrans Singer. 1967. Bull. Soc. Mycol. France 83: 116. [!]
- = Laccaria tetraspora var. pelade Singer. 1967. Bull. Soc. Mycol. France 83: 117. [!]

- = Laccaria tetraspora var. peullensis Singer. 1967. Bull. Soc. Mycol. France 83: 113-114. [!]
- = Laccaria tetraspora var. scotica Singer. 1967. Bull. Soc. Mycol. France 83: 114. [!]
- = Laccaria tetraspora var. valdiviensis Singer. 1967. Bull. Soc. Mycol. France 83: 113. [!]
- = Laccaria tetraspora var. xena Singer. 1967. Bull. Soc. Mycol. Soc. Mycol. France 83: 116. [!]
- = Russuliopsis laccata var. rosellus f. pusilla Schroeter. 1889. Die Pilze Schesiens. p. 623.
- = Laccaria laccata f. minuta Imai. 1938. J. Fac. Sci. Hokkaido. Imp. Univ., Ser. 5, Bot. 18: 90. [!]
- = Laccaria laccata var. minuta (Imai) Hongo. 1959. Mem. Shig. Univ. 9: 58.

Type specimen lacking.

SPECIES SYNOPSIS: Pileus mostly 10-45 mm broad, astrate to striate, orange brown when fresh, becoming buff. Lamellae pinkish flesh color. Stipe mostly 20-65 mm long, often finely striate, concolorous with pileus; basal mycelium white. Pileipellis interwoven with scattered fascicles of $\pm$ perpendicular hyphae. Basidia 4-sterigmate. Cheilocystidia 23-55 X 2.5-7.5 μ m, undifferentiated to subclavate, absent to abundant. Basidiospores mostly 7.5-10 X 7-10 μ m (excluding ornamentation), globose to subglobose, occasionally broadly elliptical, echinulate; spines mostly 1-2.3 μ m long. Cosmopolitan.

MACROMORPHOLOGY: BASIDIOMA: Pileus (3-)10-45(-60) broad, obtuse to convex, often becoming plane to uplifted, often depressed, striate to not striate, occasionally strongly striate to plicate-striate, sometimes translucent-striate when fresh, finely fibrillose to fibrillose-scaly, infrequently slightly scaly, hygrophanous, orange brown when fresh, becoming buff color ("Sanford's Brown" to "Orange Rufous" or "Hazel" to "Cinnamon-Rufous" or "Pinkish Cinnamon" to "Light Vinaceous-Cinnamon"), fading lighter ("Apricot Buff" to "Salmon Color" or "Light Pinkish Cinnamon" to "Pinkish Buff"), finally to buff ("Pale Ochraceous Buff"); disc occasionally darker, orange brown to red brown ("Hay's Russet" or "Ochraceous Tawny" to "Buckthorn Brown"); margin incurved to decurved, becoming plane to uplifted, entire to undulate, occasionally becoming eroded in age; context thin, tapering quickly to margin, concolorous. Lamellae moderately broad to broad, occasionally relatively narrow or very broad, relatively thin to thick, rarely very thick, sinuate to adnate to arcuate, rarely decurrent, close to distant, pinkish flesh color ("Flesh Color" to "Salmon-Buff" to "Pale Salmon Color" or "Flesh-Pink" or "Light Vinaceous-Cinnamon"), some becoming slightly vinaceous with age (near "Light Grayish-Vinaceous"). Stipe (12-)20-65(-106) mm, equal to subclavate or tapering basipitally, occasionally slightly bulbous, dry, fibrillose, not striate to finely longitudinally striate, rarely with pronounced striations, concolorous with stipe; context stuffed, becoming hollow, concolorous with pileus context. Basal mycelium sparse to copious, always white. Spores white in mass.

MICROMORPHOLOGY: PILEUS: Cuticle interwoven with widely scattered (some relatively abundant) fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 5-15(-30) hyphae; terminal cells of fascicular hyphae (n=311) 6-101 x 2.8-37.5 μm , undifferentiated to subclavate to clavate, occasionally broadly clavate or subcapitate or ventricose-rostrate; walls up to 0.5 μm thick, light to moderate yellowish brown; contents hyaline to light yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae mostly 2.3-17.5 μm diam, thin-walled, hyaline to light yellowish brown; cells long, undifferentiated to barrel-shaped. Subhymenium undifferentiated. Basidia (n=533) 27.5-55 x 7.4-13.5(-16.5) μm , mean L/W = 3.61 ± 0.58 , clavate, elongate, hyaline; sterigmata (2-)4, up to 9.7 μm long. Pleurocystidia lacking. Cheilocystidia (n=175) 23-55 x 2.3-7.4 μm , mean L/W = 10.23 ± 2.74 , undifferentiated to subclavate, occasionally strangulate, absent or scattered to abundant, extending beyond basidia and basidioles, thin-walled, hyaline. Basidiospores (excluding ornamentation) [591/40] (6.4-)7.4-10(-13) x (6-)7-10(-11.5) μm (mean dimensions = $8.6 \pm 0.9 \times 8.2 \pm 1 \mu\text{m}$), L/W = (0.9-)1-1.13(-1.46) (mean L/W = 1.04 ± 0.08), globose to subglobose, occasionally broadly elliptical, rarely elliptical to amygdaliform, hyaline, echinulate; spines (< 0.5-)0.9-2.3(-3.2) μm long (mean length = $1.4 \pm 0.4 \mu\text{m}$), relatively narrow to wide at base, relatively scarce to crowded; hilae appendage 1.3-2.2 μm long, prominent, truncate; plage present; contents occasionally uniguttulate or biguttulate. BASAL MYCELIUM:

Hyphae mostly 2.8-20.5 μm diam, tightly interwoven, hyaline; cells long, undifferentiated to barrel-shaped.

CULTURE MAT ANALYSIS: MACROMORPHOLOGY (n=11): PDA: Radius at week III 7-23 mm or 62-73 mm, week VI 18-27 or 90 mm (agar surface covered); mat felty, moderately thick to thick, tightly interwoven, some appearing almost crustose, submerged, occasionally forming cottony to felty serial layer away from plug, not translucent, white, in some becoming dark olive brown or light chocolate color away from plug; margin narrow to moderately broad, silky to subfelty, thin, white, entire to slightly undulate; plug occasionally covered with cottony white hyphae or with long serial aggregations of hyphae growing away from top of plug, white, often becoming dark olive brown or light chocolate color. MNM: Radius at week III 13-19 mm or (25-) 29-52 mm, week VI 26-45 mm or 75 mm to covering agar surface; mat subfelty to felty or silky, moderately thick, moderately interwoven or slightly interwoven and appearing combed, in one isolate (TENN 42964) with several radially arranged pie-shaped thicker sectors, submerged, translucent to slightly translucent, white; margin narrow, silky to subfelty, not well differentiated, even to undulate, occasionally somewhat serrate, white; plug white. ME: Radius at week III 12-33 mm or 53-62 mm, week VI 23-54 mm or covering agar surface; mat silky to subfelty, thin to moderate, appearing combed to loosely interwoven, occasionally becoming thicker near plug, submerged, translucent to somewhat translucent, white; margin not well differentiated, thin, entire to slightly serrate, white; plug white.

EXTRACELLULAR OXIDASE: Reaction negative, in TENN 42964 moderate blue color after 1 hr.

CULTURE MAT ANALYSIS: MICROMORPHOLOGY: PDA: Hyphae undifferentiated, rarely with a few scattered irregular swollen hyphae; chlamydospores absent or scattered, rarely abundant. ME: Hyphae undifferentiated; chlamydospores absent or scattered to abundant.

HABITAT AND DISTRIBUTION: Solitary to gregarious, occasionally caespitose; cosmopolitan; abundant.

OBSERVATIONS: Laccaria laccata can be distinguished from other members of the "laccata complex" by its small to moderate size, orange brown basidiocarp color, pinkish flesh color lamellae, striate stipe, white basal mycelium, interwoven cuticle layer with widely scattered small fascicles, tetrasporic basidia, and globose to broadly elliptical, moderately sized, short- to relatively long-spined basidiospores. Additionally, the species is held together by having a very unique culture mat morphology. It is the only taxon in the genus, besides L. altaica, that has a white culture mat color on all three media employed (Appendix E). Lahaie (1981) reported two distinct culture mat morphologies for L. laccata. One of them matched that obtained in this study; the other one exhibited a faster growth rate and violet coloration. This major difference between our reports may well be due to the fact that Lahaie did not differentiate between carpophores with white basal mycelium and those with violet basal mycelium (= L. lavendipes). The violet culture mats may in fact be L. lavendipes isolates and thus, normal for that taxon. I have not seen his specimens or cultures so this is only conjecture on my part.

At present, and quite possibly for a long time to come, this name will remain as the repository for collections which do not fit anywhere else in the genus, and are not distinct enough to merit varietal or specific rank. As presently circumscribed, L. laccata is still a highly variable taxon.

As can be seen from the lengthy list of synonymy, numerous names have been proposed for this taxon. Fries (1821) lists A. amethysteus Bulliard with A. laccatus and A. carneus, A. farinaceus, A. rosellus, A. rubellus, and A. subcarneus as synonyms of A. laccatus var. "a." Additionally, type specimens do not exist for any of these names and their descriptions are very brief. With little to taxonomize upon, therefore, they were treated as synonyms of L. laccata in this paper.

Laccaria ohiensis has incorrectly been considered a 2-sterigmate taxon (e.g., Singer, 1946, 1949, 1975, 1977). An examination of the type specimens of A. ohiensis, C. laccata var. striatula Peck. and L. tetraspora has shown them to all be tetrasporic and contaxic (see Chapter VII and Lahaie, 1981).

Singer (1946, 1967, 1977) separated L. tetraspora from L. laccata primarily on basidiospore characteristics. Laccaria tetraspora was said to have globose or rarely subglobose basidiospores, which were normally over 10 μ m in diameter (including ornamentation) with ornamentation >1.2 μ m high. Laccaria laccata had subglobose to broadly elliptical, rarely globose or elliptical basidiospores which were normally <10.3 μ m long (including ornamentation) with ornamentation rarely >1.3 μ m high. Additionally, L. tetraspora basidiocarps

were small to moderate sized while L. laccata basidiocarps were usually moderate sized. With these distinctions in mind, Singer (1967, 1977) designated 7 varieties of L. tetraspora (reduced to 6 in 1977) and 12 varieties of L. laccata. These varieties were based on a small number of specimens from around the world. Singer (1977) stated that he segregated out these varieties only in an attempt to delimit phenotypically distinct and stable entities to serve as a starting point for sexual incompatibility studies which he stated were much needed in this group.

An examination of these type specimens, however, has shown that the distinctions between the two species become blurred and in some cases the varieties of one species intergrades with the varieties of the other species (Appendices B, C). Additionally, initial attempts to fit my collections into these varieties were soon abandoned due to the very narrow morphological range of the varieties.

As stated above, I consider L. laccata and L. ohienis (= L. tetraspora) as contaxic. This decision was based on the following data. (1) Not only did an examination of type specimens show that several of the varieties intergrade between the two species, but my basidiospore ornamentation measurement data for several L. laccata varieties were larger than those presented by Singer. Additionally, Lahaie (1981) presented basidiospore ornamentation data for two L. laccata varieties, and his measurements were even larger than mine. One of the major delimiting characters between the two taxa, therefore, appears to be highly variable within the group and thus, not a

good diagnostic character. (2) Data from the examination of material used in this study do not support any distinct hiatus in either basidiospore size, shape, or ornamentation height or width, except for a few extremes. These data all appear to form a continuum. Basidiocarp size also appears to form a continuum from very small to moderate. (3) Finally, culture mat morphology data do not support the separation of these taxa. Although differing in basidiocarp characters, all 11 of the isolates examined exhibited similarities in growth form and color. Therefore, at least for the present, it appears that Laccaria laccata is a highly variable species with most of its morphological characters describing continua of variation. Possibly, after a detailed examination of material from outside N.A. along with further culture mat analyses and sexual incompatibility studies, two or more natural groups will become apparent within this taxon. At present, however, any attempt to subdivide this group is likely to result in a highly artificial taxonomic scheme.

A major problem which has hindered the formation of a stable concept for L. laccata has been the lack of a type specimen. In hopes of rectifying this problem, Singer (1967) proposed a lectotype-topotype from Femsjö, Sweden. This typification has some major problems (refer to Chapter VII). There is still a great need, therefore, for a neotype to be designated, preferably one from the Tyrol Mountains and one which has successfully been tissue cultured.

As can be expected from a taxon that is as phenotypically plastic as L. laccata, this taxon can be found throughout the U.S.

and Canada. No apparent habitat preference could be determined from the material collected during this study.

For a list of specimens examined, refer to Appendix A.

Laccaria lateritia Malencon. 1966. Bull. Soc. Mycol. France 82:

= Naucoria goossensiae Beeli. 1928. Bull. Soc. Roy.

Bot. Belgique 61: 88. [!]

= Laccaria laccata f. bispora Beeli apud Heinemann. 1964.

Bull. Jard. Bot. Etat 34: 310-311.

Type specimen (HOLOTYPE): Herb. G. Malencon - Malencon 5102; Morocco: I.S.C. [not seen].

Specimen examined as representative material: MPU - Felippone 2800; Uruguay: Montevideo. 1927. [!]

SPECIES SYNOPSIS. Pileus 10-25 mm broad, strongly striate when fresh, dull brownish orange to brick red, fading ochraceous. Lamellae pinkish flesh color. Stipe up to 50 mm long, striate, concolorous with pileus; basal mycelium white. Basidia 2-sterigmate. Cheilocystidia lacking. Basidiospores mostly 8.3-11 x 7.5-10.5 μ m (excluding ornamentation), echinulate; spines mostly 1-2.3 μ m long. Range and habitat unknown, rare.

MACROMORPHOLOGY (Teste Heinemann, 1964: Malencon, 1966).

BASIDIOMA: Pileus 10-25 mm broad, hemispherical to convex, becoming plane, often depressed, plicate-striate when fresh, dry, finely fibrillose to subsquamulose, hygrophanous, dull brownish orange to brick red (3 F 10, 3 A 11: 58, 78, 82, Klincksieck), fading ochraceous (11 J 8); margin incurved to plane, entire to undulate,

occasionally becoming eroded in age. Lamellae up to 9 mm broad, moderately thick, adnate to arcuate, subdistant to distant, pinkish flesh color (2 D 9 to 4 I 8; 87 to 92, Klincksieck). Stipe 20-50 x 2-5 mm, equal or slightly subclavate, glabrous, to finely fibrillose, longitudinally striate, concolorous with pileus. Basal mycelium white. Spores white in mass.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 5-15 hyphae; terminal cells of fascicular hyphae ($n=30$) 30-60 x 5-13(-16) μm , undifferentiated to subclavate to clavate, light to moderate yellowish brown in mass; walls up to 0.5 μm thick, light to moderate yellowish brown; contents hyaline to moderate light yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae 2.5-16 μm diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia ($n=45$) 28-44 x 7.8-13.3 μm , mean $L/W = 3.62 \pm 0.11$, clavate, elongate, hyaline; sterigmata 2(-4), up to 13.8 μm long. Pleurocystidia lacking. Cheilocystidia lacking. Basidiospores (excluding ornamentation) [45/3] 8.3-11(-13.3) x 7.4-10.6(-13.3) μm (mean dimensions = $9.7 \pm 0.9 \times 9 \pm 1 \mu\text{m}$), $L/W = 1-1.18(-1.22)$ (mean $L/W = 1.08 \pm 0.06$), subglobose to broadly elliptical, occasionally globose, hyaline, echinulate; spines (0.5-)0.9-2.3 μm long (mean length = $1.3 \pm 0.4 \mu\text{m}$), crowded; hilar appendage 1.3-2.3 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae

mostly 2.7-12.5 μ m diam, hyaline, light to moderate yellowish brown in mass; cells long, undifferentiated to barrel-shaped.

HABITAT AND DISTRIBUTION: Unknown.

OBSERVATIONS: Laccaria lateritia can be distinguished from other, small orange brown laccaria taxa by its 2-sterigmata basidia which bear moderate-sized globose to broadly elliptical, moderately spined basidiospores.

There has been much confusion in the literature concerning the correct name for this taxon. Since 1946, Singer (1946, 1949, 1967, 1975, 1977) has used the name L. ohiensis for this taxon. An examination of the type of A. ohiensis has revealed, however, that it is 4-sterigmate and synonymous with L. laccata. Singer (1943) also incorrectly stated that C. laccata var. striatula has 2-sterigmate basidia. As in A. ohiensis, C. laccata var. striatula is tetrasporic and synonymous with L. laccata.

Laccaria lateritia is apparently very rare in the U.S. and Canada. Only one collection of this taxon was found in all of the material borrowed from U.S. and Canadian herbaria. Laccaria lateritia (as L. ohiensis sensu Singer) is reported to play an important floristic and ecological role in South America (e.g., Singer, 1977).

For a list of specimens examined, refer to Appendix A.

Laccaria lavendipes Mueller. sp. nov.

Pileo (6-)10-32 mm lato, brunneolo-incarnato. Lamellis carneoroselles. Stipite (19-)24-63 x 2-4 mm, striatus, concolor;

mycelio basali violaceus in statu humido, albo in statu sicco.
 Basidiis tetrasporis. Cheilocystidiis absens vel abundus. Sporis
 plerumque $6.4-8.7 \times 6-7.8 \mu\text{m}$ sine ornamentatione, plerumque sub-
 globosis vel late ellipticis vel ellipticis; spinae curta vel
 moderata.

Type specimen (HOLOTYPE): TENN - TENN 42521: Tennessee,
 Sevier Co., GSMNP, 5 km east of Clingman's Dome. 6.IX.1980. [!]

SPECIES SYNOPSIS: Pileus mostly 10-32 mm broad, not striate,
 brownish orange. Lamellae pinkish flesh color. Stipe mostly 24-63
 mm long, striate, concolorous with pileus; basal mycelium violet
 when fresh, becoming white. Basidia 4-sterigmate. Cheilocystidia
 $20-60 \times 1.8-6.5 \mu\text{m}$, filamentous, absent to abundant. Basidiospores
 mostly $6.4-8.5 \times 6-8 \mu\text{m}$ (excluding ornamentation), subglobose to
 broadly elliptical, echinulate; spines $0.5-1.8 \mu\text{m}$ long. Eastern
 North America.

MACROMORPHOLOGY: BASIDIOMA: Pileus (6-)10-32 mm broad,
 obtuse to convex, occasionally becoming plane, not striate, dry,
 strongly pruinose to fibrillose, occasionally becoming finely scaly,
 hygrophanous, brownish orange ("Sanford's-Brown" to "Orange Rufous"
 or "Cinnamon-Rufous" to "Apricot Buff"), eventually fading to buff
 color; margin decurved to plane, entire to undulate, occasionally
 becoming eroded with age; disc occasionally darker (near "Pecan
 Brown"); context thin, tapering quickly to margin, concolorous.
Lamellae moderately broad to broad, thick to very thick, sinuate to
 adnate, subdistant to distant, pinkish flesh-color ("Flesh Color" to

"Pale Salmon Color"). Stipe (19-)24-63 x 2-7 mm, equal to sub-clavate, often slightly bulbous, dry, fibrillose, often longitudinally striate, occasionally strongly striate, concolorous with pileus. Basal mycelium light violet when fresh (near "Pallid Violet"), strongly hygrophanous, soon white. Spores white in mass.

MICROMORPHOLOGY: PILEUS: Cuticle interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 5-15(-30) hyphae; terminal cells of fascicular hyphae ($n=80$) (17.5-) 29-73.5 x 5.5-13.3(-32) μm , undifferentiated to subclavate to clavate, rarely broadly clavate or ventricose-rostrate; walls up to 0.5 μm thick, light to moderate yellowish brown; contents hyaline to light yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae mostly 3.2-18.4 μm diam, thin-walled, hyaline to light yellowish brown; cells long, undifferentiated to barrel-shaped. Subhymenium undifferentiated. Basidia ($n=98$) 24.4-55 x (6.4-) 8.3-12.4(-19.5) μm , mean $L/W = 3.59 \pm 0.5$, clavate, elongate, hyaline; sterigmata 4, up to 7.8 μm long. Pleurocystidia lacking. Cheilocystidia ($n=70$) 17.5-60 x 1.8-6.4 μm , mean $L/W = 9.27 \pm 2.24$, undifferentiated, occasionally subclavate or subcapitate, some strangulate, absent to scattered to abundant, if present extending moderate distance to well beyond basidia and basidioles, thin-walled, hyaline. Basidiospores (excluding ornamentation) [120/8] 6.4-8.7 (-10.6) x 6-7.8(-8.7) μm (mean dimensions = $7.6 \pm 0.7 \times 7 \pm 0.5 \mu\text{m}$), $L/W = (0.88-)1-1.22(-1.36)$ (mean $L/W = 1.1 \pm 0.08$), subglobose to

broadly elliptical, occasionally globose or elliptical to amygdali-form, hyaline, echinulate; spines $<0.5-1.8\ \mu\text{m}$ long (mean length = $1.1 \pm 0.4\ \mu\text{m}$), crowded; hilar appendage $1.3-2\ \mu\text{m}$ long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly $2.8-12\ \mu\text{m}$ diam, tightly interwoven, hyaline; cells long, undifferentiated to barrel-shaped.

CULTURE MAT ANALYSIS: MACROMORPHOLOGY (n=5): PDA: Radius at week III 15-26 mm, week VI (23-)35-53 mm; mat felty, moderately thick to thick, tightly interwoven, submerged, in time forming pruinose aerial layer away from plug, not translucent, at first dark violet, often fading to light orange brown away from plug, week III dark violet broad band near margin, light orange brown from plug to mid-radius; often by week VI moderate violet restricted to band near margin, most of mat light orange brown; aerial hyphae light grayish violet, often covering most of mat by week VI masking mat color; margin 1-2 mm broad, subfelty to felty, thin becoming moderately thick, entire to sulcate, light violet to white; plug concolorous with mat. MNM: Radius at week III 24-38 mm, week VI (43-)50-72 mm; mat felty, moderately thick, rarely thin, loosely interwoven to moderately interwoven, occasionally with scattered small sectors of longer loosely interwoven hyphae, submerged, translucent becoming only slightly translucent, very light violet becoming white; margin narrow, subfelty, not well differentiated, uneven, concolorous with mat; plug concolorous. ME: Radius at week III (16-)21-36 mm, week VI 38-48 mm or 54-68 mm; mat silky to subfelty, thin, becoming

slightly thicker with time, subparallel to loosely interwoven, some becoming moderately interwoven near plug, submerged, translucent to slightly translucent, white; margin narrow, silky to subfelty, not well differentiated, entire, white; plug white. EXTRACELLULAR OXIDASE: Reaction negative.

CULTURE MAT ANALYSIS: MICROMORPHOLOGY: PDA: Hyphae mostly undifferentiated, rarely with a few scattered irregularly swollen hyphae; chlamydospores usually scarce, widely scattered, in one isolate TENN 42755 abundant. MNM: Hyphae same as PDA: chlamydospores same as PDA. ME: Hyphae undifferentiated; chlamydospores scarce to abundant.

HABITAT AND DISTRIBUTION: Solitary to scattered; usually under conifers; eastern North American; uncommon.

OBSERVATIONS: Laccaria lavendipes differs from L. laccata by exhibiting violet basal mycelium and smaller, usually more elongate basidiospores. Its culture mat morphology differs by having a faster growth rate and violet coloration on PDA and MNM (Appendix E). Because of the ephemeral nature of the pigment of the violet basal mycelium and the slight overlap of basidiospore size and shape with those of L. laccata, it is very difficult to differentiate between dried herbarium specimens of the two taxa.

Laccaria lavendipes can be distinguished from L. bicolor by its distribution--eastern North America--versus western North America for L. bicolor, brownish orange pileus and stipe color, flesh-colored gills, and scant basal mycelium. Additionally, the two taxa have

distinct culture mat morphologies (Appendix E). As can be seen on the phenogram (Fig. 20) the two taxa are closely related. It is possible that with data from genetic incompatibility studies and additional cultural studies, the decision may be made to combine the two taxa in the future. For the present, however, the macromorphological, cultural and distributional data are sufficient to separate the two.

Singer (1965, 1973, 1977) used the name L. farinacea for this taxon. However, no type exists for A. farinaceus and Hudson (1778) listed A. laccatus under A. farinaceus implying that A. farinaceus was only a new name for A. laccatus. Additionally, Fries (1821) placed A. farinaceus in synonymy under A. laccatus var. "a." Finally, neither Hudson nor Persoon (1801) mentioned the color of the basal mycelium in their description. It was necessary, therefore, to propose a new name for this taxon.

All of the collections of L. lavendipes observed were from eastern North America except TENN 42755, which was collected in Washington (refer to Chapter IV).

For a list of specimens examined, refer to Appendix A.

Laccaria microspora Mueller. sp. nov.

Pileo 15-28 mm lato, haud striato, vinaceo-brunneo, siccando pallidore. Lamelis carneorosellis. Stipe 28-45 x 2-3 mm, striatus, concolor; mycelio basali albo. Cuticula trichodermis. Basidiis tetrasporis. Cheilocystidiis filamentosis vel subclavatis, abundis. Sporis 6-7.8 x 6-7.8 μ m sine ornamentatione, globosis, echinatis.

Type specimen (HOLOTYPE): Tenn - TENN no. 42528; USA: TN, Blount Co., GSMNP, Cades Cove. 13.IX.1979. [!]

SPECIES SYNOPSIS: Pileus 15-28 mm broad, not striate, vinaceous-brown, fading to buff. Lamellae pinkish. Stipe up to 45 mm long, longitudinal-striate, concolorous with pileus; basal mycelium white. Pileipellis consists of a trichodermium when young. Basidia 4-sterigmate. Cheilocystidia 26-46 x 4-6.5 μ m, undifferentiated to subclavate, abundant. Basidiospores mostly 6.4-7.8 x 6.4-7.8 μ m (excluding ornamentation), globose, echinulate; spines mostly 1.4-2.3 μ m long. Southeastern Tennessee.

MACROMORPHOLOGY: BASIDIOMA: Pileus 15-28 mm broad (mean = 21.5 mm), obtuse to convex, not depressed, not striate, finely fibrillous, hygrophanous, when fresh vinaceous-brown ("Cacao Brown"), fading lighter ("Flesh-Ocher" to "Apricot Buff"); margin incurved to decurved, entire to undulate; context 1-2 mm thick, tapering quickly to margin, concolorous. Lamellae narrow to moderately broad, thick, adnate to arcuate, moderately distant, pinkish color ("Flesh-Pink"). Stipe 28-45 x 2-3 mm caespitose, dry, fibrillose, longitudinal-striate, light flesh color ("Pale Salmon Color"); striations vinaceous brown ("Vinaceous-Russet"). Basal mycelium white. Spores white in mass.

MICROMORPHOLOGY: PILEUS: Cuticle composed of very numerous large fascicles of $\pm$ perpendicular hyphae, forming a trichodermium in young specimens and at the disc when mature; fascicles usually composed of >30 hyphae; terminal hyphae cells (n=10) (28.5-)40-48 x

8-16 μm , subclavate to clavate, occasionally capitate; walls up to 0.5 μm thick, light to moderate yellowish brown; contents hyaline to light yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae mostly 2.8-14.3 μm diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 29-46 x 7-11 μm , mean L/W = 3.84 ± 0.58 , clavate, elongate, hyaline; sterigmata 4, up to 7.8 μm long. Pleurocystidia lacking. Cheilocystidia (n=10) 26-46 x 4-6.5 μm , mean L/W = 7.41 ± 1.9 , undifferentiated to subclavate, abundant, extending well beyond basidia and basidioles, hyaline. Basidiospores (excluding ornamentation) [30/1] (6-)6.4-7.8(-8.3) x (6-)6.4-7.8(-8.3) μm (mean dimensions = $7 \pm 0.6 \times 7 \pm 0.6 \mu\text{m}$), L/W = 1(-1.08) (mean L/W = 1.01 ± 0.02), globose, rarely subglobose, hyaline, echinulate; spines 1.4-2.3 μm long (mean length = $1.6 \pm 0.3 \mu\text{m}$), crowded; hilar appendage 1.3-1.9 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 2.3-4.6 μm diam, tightly interwoven, undifferentiated, long-celled, hyaline.

HABITAT AND DISTRIBUTION: Caespitose; under Canadian hemlock; rare.

OBSERVATIONS: Although it is generally unwise to designate a new species based on a single collection, the distinctive characteristics exhibited by this collection warrant it in this case. Laccaria microspora can be distinguished from other taxa in the "laccata-complex" by the vinaceous coloration of the pileus and stipe, cuticle

composed of a trichodermium, and small globose basidiospores. To date, it has been reported only from Tennessee (Appendix A).

Laccaria moelleri (Singer) Mueller. comb. nov.

Basionym: Laccaria laccata var. moelleri. Singer, 1973.

Sydowia 7: 9-10. [!]

Type specimen (HOLOTYPE): F - Singer C5227; CSSR: Trebon. 30.IX.1970. [!]

SPECIES SYNOPSIS: Pileus 10-69(-83) mm broad, not striate, fibrillose to fibrillose-scaly, often becoming scaly to squarrose, reddish brown to orange brown. Lamellae pinkish flesh color. Stipe 18-155 mm long, coarsely fibrillose, prominent longitudinal-striate; basal mycelium white. Basidia 4-sterigmate. Cheilocystidia up to $69 \times 6.5 \mu\text{m}$, undifferentiated to subclavate, usually abundant. Basidiospores mostly $8-11 \times 6.5-8 \mu\text{m}$ (excluding ornamentation), mostly elliptical, echinulate; spines mostly $<0.5-1 \mu\text{m}$ long. Eastern North America.

MACROMORPHOLOGY: BASIDIOMA: Pileus 10-69(-83) mm broad, obtuse to convex, becoming plane to uplifted, when young occasionally umbonate, occasionally translucent-striate when young and fresh, not striate when mature or faded, fibrillose soon becoming fibrillose-scaly, eventually scaly to squarrose, hygrophanous, reddish brown to orange brown ("dark red" to "dark grayish red" to "strong brown," ISSC-NBS; Kelley, 1965) fading lighter ("brownish orange" to "medium orange" to "light orange," ISSC-NBS); disc often darker red brown ("dark reddish brown" to "dark reddish orange" to "medium

reddish brown," ISSC-NBS); margin incurved to decurved, becoming plane, entire to undulate, becoming eroded to rimose; context tapering toward margin, pinkish flesh color ("light reddish brown" to "grayish pink" to "light yellowish pink," ISSC-NBS). Lamellae up to 1.1 mm broad, thick, sinuate to arcuate, close to subdistant, pinkish flesh color ("grayish pink" to "light grayish red" to "medium yellowish pink" to "light yellowish pink," ISSC-NBS). Stipe 18-155 x 2-11 mm, equal or subclavate, dry, coarsely fibrillose, prominent longitudinal striations sheathing most of the stipe; surface ground color ("medium orange" to "light orange" to "light brown" to "light brown" to "light yellowish pink," ISSC-NBS); striations reddish brown ("dark reddish brown" to "medium reddish brown" to "grayish reddish orange" to "dark brown" to "medium orange," ISSC-NBS). Basal mycelium usually copious, white. Spores white in mass.

MICROMORPHOLOGY: PILEUS: Cuticle interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 10-25 hyphae; terminal cells of fascicular hyphae (n=50) 29.5-64.5 (-76) x 5.5-16 μ m, subclavate to clavate, rarely ventricose-rostrate; walls up to 0.5 μ m thick, light to dark yellowish brown; contents hyaline to moderate yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae mostly 3.3-19.5 μ m diam, thin-walled, hyaline to light yellowish brown; cells long, undifferentiated to barrel-shaped. Subhymenium undifferentiated. Basidia (n=105) 29-48.5 x 7.8-13 μ m, mean L/W = 3.97 ± 0.23 , clavate, elongate, hyaline;

sterigmata 4, up to 7.8 μm long. Pleurocystidia lacking. Cheilocystidia (n=70) 23.5-69 x 2.8-6.4(-8.3), mean L/W = 11.58 ± 1.86 , thin, undifferentiated to subclavate, occasionally subcapitate, rarely ventricose-rostrate, even or strangulate, usually abundant, normally extending well beyond basidia and basidioles, thin-walled, hyaline. Basidiospores (excluding ornamentation) [100/7] 8.2-11 x (6.1-)6.6-8.2 μm (mean dimensions - $9.3 \pm 0.7 \times 7.2 \pm 0.5 \mu\text{m}$), L/W = (1.07-)1.13-1.43(-1.58) (mean L/W = 1.29 ± 0.1), elliptical to amygdaliform, occasionally oblong, rarely subglobose, hyaline, echinulate; spines <0.5-0.9(-2.3) μm (mean length = $0.6 \pm 0.2 \mu\text{m}$) long, crowded, often with one or two long spines at apex; hilar appendage 0.7-1.9 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 4-14.7 μm diam, tightly interwoven, hyaline; cells long, undifferentiated to barrel-shaped.

HABITAT AND DISTRIBUTION: Solitary, scattered, to gregarious, occasionally caespitose; in Sphagnum or other wet moss; eastern North America; not common.

OBSERVATIONS: Laccaria moelleri can be distinguished from L. proxima by its larger size and strongly longitudinally-striate stipe. Under the microscope, L. moelleri differs from L. proxima by having longer filamentous cheilocystidia and from L. oblongospora by having much less elongate basidiospores.

Mueller (1981) reported this taxon as L. proxima. In addition to the material from southern Illinois, only four more collections were found during this study.

For a list of specimens examined, refer to Appendix A.

Laccaria montana Singer. 1973. Sydowia 7: 89.

= Laccaria laccata var. montana Moeller. 1945. Fungi of Faeroes. pp. 264-270. [!]

= Russuliopsis laccata var. rosella f. pusilla Larsen. 1932. Bot. Iceland, Vol. II, Part. IV 9: 525.

= Laccaria laccata var. pusilla (Larsen) Singer. 1967. Bull.

Soc. Mycol. France 83: 109. [non. R. laccata f. pusilla

Schoeter. 1889. Lie Pilze Schlesiens. p. 623; = L. laccata.]

Type specimen (HOLOTYPE): F - Singer M5464; Switzerland:

Valais, Borgne de Ferpecle. 11.VII.1971. [!]

SPECIES SYNOPSIS: Pileus 6-35 mm broad, strongly striate, brownish orange. Lamellae pinkish flesh color. Stipe mostly 13-54 mm long, concolorous with pileus; basal mycelium white. Basidia 4-sterigmate. Cheilocystidia very scarce, undifferentiated. Basidiospores mostly 8.5-14 x 8-12 μ m (excluding ornamentation), mostly subglobose to broadly elliptical, echinulate; spines 1-1.8 μ m long. Restricted to alpine, arctic, or boreal habitats.

MACROMORPHOLOGY: BASIDIOMA: Pileus 6-35 mm broad, convex to plane, becoming uplifted, often depressed, occasionally umbonate when young, usually plicate-striate when fresh, fibrillose to finely fibrillose-scaly, hygrophanous, brownish orange ("Hazel" to

"Cinnamon-Rufous"), fading to buff color; margin decurved to plane, entire to undulate, occasionally becoming eroded; context very thin to thin, flesh color ("Buff-Pink"). Lamellae narrow to very broad, moderately thick to very thick, sinuate to decurrent, close to very distant, pinkish flesh color to light vinaceous ("Vinaceous-Pink"). Stipe 13-54(-101) x 2-4(-7) mm, equal or tapering slightly toward base or apex, occasionally swollen at base, occasionally caespitose, dry, fibrillose, not striate to moderately longitudinally striate, concolorous with pileus. Basal mycelium white. Spores white in mass.

MICROMORPHOLOGY: PILEUS: Cuticle: Interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 10-30 hyphae; terminal cells of fascicular hyphae (n=10) 39-51 x 5.5-10 μ m, undifferentiated to subclavate, light yellowish brown in mass; walls up to 0.5 μ m thick, light yellowish brown; contents hyaline to light yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel to subparallel, hyphae mostly 2.7-14(-20) μ m diam, thin-walled, hyaline to light yellowish brown; cells long, undifferentiated to barrel-shaped. Subhymenium undifferentiated. Basidia (n=50) 34.5-55.2 x 10-15.5 μ m, mean L/W = 3.88 ± 0.56 , clavate, elongate, hyaline; sterigmata 4, up to 10.6 μ m long. Pleurocystidia lacking. Cheilocystidia (n=10) 32-55.5 x 3.2-4.6(-7.4) μ m, mean L/W = 9.95 ± 2.91 , undifferentiated to subclavate, rarely clavate, scarce (only found in one collection), extending a moderate distance beyond basidia and basidioles, thin-walled, hyaline.

Basidiospores (excluding ornamentation) [60/4] (7.8-)8.7-13.8(-14.7) x (6.9-)7.8-12 μm (mean dimensions - $10.8 \pm 1.5 \times 9.5 \pm 1.1 \mu\text{m}$), L/W = 1-1.26(-1.33) (mean L/W = 1.14 ± 0.09), globose to broadly elliptical, occasionally elliptical to amygdaliform, hyaline, echinulate; spines (0.5-)0.9-1.8 μm long (mean length = $1.2 \pm 0.3 \mu\text{m}$), not crowded to crowded; hilar appendage 1.3-2 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly (2.8-)11-16(-20.7) μm diam, tightly interwoven, hyaline; cells short to long, undifferentiated to barrel-shaped.

HABITAT AND DISTRIBUTION: Scattered to gregarious, occasionally caespitose; restricted to arctic, boreal, or montane regions, common.

OBSERVATIONS: As discussed under L. altaica, the major delimiting factor between L. montana and L. altaica is that L. montana is 4-sterigmate and L. altaica is 2-sterigmate. Additionally, L. montana spores are generally somewhat smaller than those of L. altaica. L. montana can be distinguished from L. laccata by its larger basidiospores and arctic to boreal distribution.

Singer's L. montana and Moeller's L. laccata var. montana are based on different type specimens (refer to Chapter VII).

Laccaria montana is among the most common Laccaria taxa found at high elevations and latitudes. At least some of the reports of L. tetraspora from the arctic are, according to their descriptions

and illustrations, in reality L. montana (e.g., Koboyasi et al., 1967; Miller et al., 1982).

For a list of specimens examined, refer to Appendix A.

Laccaria nobilis Smith apud Mueller. sp. nov.

[Laccaria nobilis Smith, in herb.]

Pileo (16-)24-77 mm lato, haud striato, transeuns squamosus, aurantio-brunneo. Lamellis carneorosellis. Stipite (21-)26-110 x 4-10(-16) mm, fortiter striatus, interdum reticulatus, frequenter squamosus, concolor; mycelio basali albo. Basidiis tetrasporis. Cheilocystidis nullis. Sporis 7.4-9.7 x 6.4-8.7 sine ornamentatione, plerumque subglobosis vel late ellipticis; spinae breviae.

Type specimen (HOLOTYPE): TENN - TENN 42527; USA: Colorado, Larimer Co., Roosevelt National Forest, Rayah Wilderness, Blue Lake Trail. 13.IX.1981. [!]

SPECIES SYNOPSIS: Pileus 24-77 mm broad, not striate, fibrillose-scaly, becoming scaly to squarrose, brownish orange. Lamellae pinkish flesh color. Stipe up to 1.10 x 10 mm, strongly fibrillose, longitudinal-striate, occasionally reticulate, concolorous with pileus; basal mycelium white. Basidia 4-sterigmate. Cheilocystidia lacking. Basidiospores mostly 7.5-10 x 6.5-9 μ m (excluding ornamentation), most subglobose to broadly elliptical, echinulate; spines <0.5-1.4 μ m long. Western North America in montane habitats.

MACROMORPHOLOGY: BASIDIOMA: Pileus (16-)24-77 mm broad, convex to plane, occasionally becoming uplifted, depressed to

deeply depressed, not striate, fibrillose-scaly becoming scaly to squarrose, brownish orange ("Sanford's Brown" to "Cinnamon-Rufous"), occasionally darker at disc ("Hazel"); margin decurved to plane, occasionally becoming upturned, entire to eroded; context thin, concolorous. Lamellae moderately broad to very broad, moderately thick to thick, sinuate to adnate, close to distant, pinkish flesh color ("Flesh Color" to "Pale Flesh Color" to "Orange-Pink"). Stipe (21-)26-110 x 4-10(-16) mm, equal to slightly bulbous, dry, fibrillose, fibers forming prominent longitudinal striations, occasionally almost forming reticulate ridges, often with recurved scales near apex when mature, concolorous with pileus. Basal mycelium white. Spores white in mass.

MICROMORPHOLOGY: PILEUS: Cuticle interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 15-30 or more hyphae; terminal cells of fascicular hyphae (n=52) 34.5-59.8(-73.6) x (4-)7-13.8(-19.3) μ m, subclavate to clavate, occasionally broadly clavate or capitate; walls up to 0.5 μ m thick, light to moderate yellowish brown; contents hyaline to light yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: parallel; hyphae mostly 2.8-10 μ m diam, thin-walled, hyaline to light yellowish brown; cells long; barrel-shaped. Subhymenium undifferentiated. Basidia (n=75) 32.2-55 x 7.8-13.8 μ m, mean L/W = 4.16, clavate, elongate, hyaline; sterigmata 4, up to 8.7 μ m long. Pleurocystidia lacking. Cheilocystidia lacking. Basidiospores (excluding ornamentation)

[60/4] 7.4-9.7(-10.6) x 6.4-8.7 μm (mean dimensions = $8.50 \pm 0.7 \times 7.5 \pm 0.6 \mu\text{m}$), L/W = 1-1.26(-1.33) (mean L/W = 1.15 ± 0.09), sub-globose to broadly elliptical, occasionally globose or elliptical to amygdaliform, hyaline, echinulate; spines 0.5-1.4 μm long (mean length = $0.9 \pm 0.2 \mu\text{m}$), crowded; hilar appendage 1.3-2 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 1.8-12 μm diam, tightly interwoven, hyaline; cells long, undifferentiated to barrel-shaped.

CULTURE MAT ANALYSIS: MACROMORPHOLOGY (n=2): PDA: Radius at week III 23-31 mm, week VI 35-43 mm; mat felty, moderately thick to thick, tightly interwoven, almost crustose, submerged, with time forming pruinose aerial layer away from plug, not translucent, at first dark, bright violet, soon fading, by week VI dark purple color restricted to a 7-9 mm band near margin, rest of mat light orange brown; pruinose aerial hyphae light grayish purple becoming light orange brown; margin 3-4 mm broad, subfelty, thin, very uneven, light violet to white, plug concolorous with mat. MNM: Radius at week III 40-47 mm, week VI 67-78 mm; mat subfelty, thin, becoming slightly thicker with age, loosely to tightly interwoven, submerged, translucent to slightly translucent, light violet, with time color often restricted to 3-4 mm band at midpoint, remainder of mat white; margin 3-6 mm broad, silky to subfelty, thin, parallel to loosely interwoven, entire, very light violet to white; plug concolorous with mat. ME: Radius at week III 33-47 mm, week VI 47-77 mm; mat subfelty, thin to slightly thicker near plug, loosely interwoven, submerged,

translucent, white; margin 1-2 mm broad, subfelty, thinner than mat, undulate, white; plug white. EXTRACELLULAR OXIDASE: Reaction moderate blue color immediately.

CULTURE MAT ANALYSIS: MICROMORPHOLOGY: PDA: Hyphae mostly undifferentiated with occasional irregular swollen hyphae, purplish brown in mass; chlamydospores moderately to very abundant, often in chains of 2-4. MNM: Hyphae mostly undifferentiated with rare, widely scattered irregular swollen hyphae near margin; chlamydospores scarce, widely scattered, restricted to margin. ME: Hyphae undifferentiated; chlamydospores common.

HABITAT AND DISTRIBUTION: Solitary to scattered; usually at high elevation (below tree line); Cascade and Rocky Mts.

OBSERVATIONS: Laccaria nobilis can easily be distinguished from other members of the "laccata-complex" by its large size, scaly to squarrose pileus, scaly stipe, and lack of cheilocystidia. Its culture mat morphology, although showing similarities to that of L. bicolor and L. proxima, is distinct (Appendix E). A. H. Smith proposed the name in an unpublished manuscript along with several other proposed taxa including L. pisciodorus (Smith no. 18812) and L. sphagnicola (Smith no. 4573). These latter two taxa were not judged sufficiently distinct (based on available material) to justify validly publishing these names.

Laccaria nobilis can commonly be found at relatively high elevations (below tree line) in the mountains of western U.S. and probably also in Canada.

For a list of specimens examined, refer to Appendix A.

Laccaria oblongospora Mueller. sp. nov.

Pileo (5-)12-59 mm lato, haud striato, aurantio-brunneo, interdum vinacea. Lamellis plerumque carneorosellis, interdum vinacea. Stipite (11-)20-65 x 2-12 mm, interdum striatus, concolor; mycelio basali plerumque albo, interdum violacea. Basidiis tetrasporis. Cheilocystidis nullis vel dispersis. Sporis 7.4-10 x 5-7 μ m sine ornamentatione, ellipticis vel oblongis, brevispinosis.

Type specimen (HOLOTYPE): TENN - TENN 42522; USA: Mississippi, Harrison Co.; DeSoto Nat'l Forest, Harrison Experimental Forest, Road H-8. 7.X11.1980. [!]

SPECIES SYNOPSIS: Pileus 12-60 mm broad, not striate, often fibrillose-scaly, brownish orange. Lamellae pinkish flesh color. Stipe mostly 20-60 x 2-12 mm, concolorous with pileus; basal mycelium white, rarely violet. Basidia 4-sterigmate. Cheilocystidia absent or scattered, undifferentiated. Basidiospores 7.4-10 x 5-7 μ m (excluding ornamentation), elliptical to oblong, echinulate; spines mostly < 0.5 μ m. Southern Mississippi under long leaf pine.

MACROMORPHOLOGY: BASIDIOMA: Pileus (5-)12-59 mm broad, obtuse to convex, becoming plane to uplifted, often depressed, not striate, finely fibrillose, becoming fibrillose-scaly, hygrophanous, brownish orange ("Vinaceous-Rufous" to "Kaiser Brown" to "Apricot Buff" or "Burnt Sienna" to "Sanford's Brown"), occasionally vinaceous color ("Vinaceous-Brown" or "Vinaceous-Russet" to "Japan Rose"); disc often darker, red brown to dark orange brown or occasionally vinaceous ("Dark Livid Brown" to "Deep Brownish Vinaceous" to "Hay's Russet" or "Chocolate" to "Vinaceous-Russet" or "Mahogany Red"); margin incurved

to decurved, becoming plane to uplifted, entire to undulate, occasionally becoming eroded; context 1-2 mm thick, tapering quickly to margin, flesh color ("Pale Vinaceous-Pink"). Lamellae broad to very broad, thick to very thick, sinuate to adnate, occasionally arcuate, subdistant to distant, pinkish flesh color ("Vinaceous-Pink" to "Buff-Pink" or "Light Congo Pink" to "Shell Pink"), occasionally vinaceous or violaceous ("Light Brownish Vinaceous" to "Pale Brownish Vinaceous" or "Light Pinkish Lilac"). Stipe (11-)20-60(-65) x 2-12 mm, equal to subclavate, often slightly bulbous, dry, fibrillose, occasionally finely longitudinal-striate, concolorous with pileus; striations occasionally darker ("Pecan Brown"). Basal mycelium usually white, occasionally violet. Spores white in mass.

MICROMORPHOLOGY: PILEUS: Cuticle loosely interwoven with scattered large fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of (5-)10-30 or more hyphae, long; terminal cells (n=50) 32.5-71 x 7-24.5 μ m, undifferentiated to subclavate to clavate, occasionally broadly clavate or capitate; walls up to 0.5 μ m thick, light vinaceous; contents hyaline to light yellowish brown or light vinaceous. Trama lightly interwoven, undifferentiated, hyaline, moderate yellowish brown to light vinaceous toward cuticle. LAMELLA: Trama parallel; hyphae 3.2-10 μ m diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=53) 24-35 x 6.4-10 μ m; mean L/W = 3.55 ± 0.45 , clavate, elongate, hyaline; sterigmata 4, up to 5.5 μ m long. Pleurocystidia lacking. Cheilocystidia (n=20) 31.5-53 x 2.8-7 μ m,

mean $L/W = 10.27 \pm 3.29$, undifferentiated to subclavate, found only in some collections, scattered, extending beyond basidia and basidioles, thin-walled, hyaline. Basidiospores (excluding ornamentation) [75/5] $7.4-10 \times 5-7 \mu\text{m}$ (mean dimensions = $8.7 \pm 0.7 \times 5.8 \pm 0.5 \mu\text{m}$), $L/W = 1.3-1.76$ (mean $L/W = 1.51 \pm 0.12$), elliptical to oblong, occasionally subreniform, hyaline, echinulate; spines $< 0.5-$ (1.4) μm long (mean length = $0.6 \mu\text{m}$), spines over $0.5 \mu\text{m}$ long restricted to spore apex, crowded; hilar appendage $1.3-2 \mu\text{m}$ long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly $2.8-11 \mu\text{m}$ diam, tightly interwoven, hyaline; cells long, undifferentiated to barrel-shaped.

CULTURE MAT ANALYSIS: MACROMORPHOLOGY (n=5): PDA: Radius at week III 28-39 mm, week VI 45-78 mm; mat felty, moderately thick to thick, tightly interwoven, with scattered small sectors of longer, loosely interwoven hyphae, submerged, with time forming pruinose aerial layer away from plug, not translucent, at first dark violet, soon fading, week III light to moderate violet restricted either to 2-3 mm band near margin or 4-5 mm zone near plug, most of mat light orange brown, week VI all light orange brown, no violet coloration present; margin up to 5 mm broad, silky to subfelty, thin, uneven to very uneven, very light violet, becoming white; plug concolorous with mat. MNM: Radius at week III most 48-56 mm, one isolate 30-36 mm, week VI most covering agar surface, one isolate 58-78 mm, mat subfelty to subwooly, very thin to thin, becoming thicker, loosely interwoven, some with subwooly to wooly or cottony narrow strands

radiating out from the plug to margin, between strands very thin, submerged, translucent, becoming somewhat translucent, at first light violet, soon fading to very light violet to white, margin not well differentiated, thin, uneven to very uneven, concolorous; plug concolorous. ME: Radius at week III 26-40 mm, week VI 51-78 mm; mat subfelty, very thin to thin, loosely interwoven, some with 1-3 narrow, slightly thicker concentric bands, submerged, translucent, white; margin 1-2 mm broad, not well differentiated, even to uneven, white; plug white. EXTRACELLULAR OXIDASE: Reaction in one isolate moderate blue color after 1 hr; all others negative.

CULTURE MAT ANALYSIS: MICROMORPHOLOGY: PDA: Hyphae mostly undifferentiated with scattered irregular swollen hyphae and subcoralloid hyphae, occasionally coralloid hyphae present; chlamydospores common to very common, occasionally in chains of 2-4. MNM: Hyphae mostly undifferentiated with any combination of scattered to rare to moderately common irregular swollen hyphae, subcoralloid hyphae or coralloid hyphae; chlamydospores absent to common. ME: Hyphae mostly undifferentiated with scattered irregular swollen hyphae and subcoralloid hyphae; chlamydospores common to abundant, occasionally in chains.

HABITAT AND DISTRIBUTION: Gregarious; in very sandy soil under Pinus palustris; Gulf Coast.

OBSERVATIONS: Laccaria oblongospora often appears similar to L. laccata, L. lavendipes, L. proxima or L. trichodermophora in the field. It can be distinguished from these, however by its elliptical

to oblong, short-spined basidiospores. Additionally, it has a unique culture mat morphology (Appendix E).

Much variation in basidiocarp color was observed in this taxon. Most specimens exhibited the typical orange brown coloration of L. laccata sensu lato. Scattered amongst these were a few individual fruitbodies which were vinaceous to violaceous in color (e.g., TENN 42524). Initially, these vinaceous collections were thought to represent a separate variety. However, due to the occurrence of intermediate color forms (orange brown pilei and stipes with violaceous basal mycelium and/or lamellae) and the fact that both color forms showed identical culture mat morphologies, they have been treated as contaxic. The cause of the color variation, whether age, moisture or other microclimatic differences, has not been determined.

Only two populations of this species have been located. Both populations were very large and consisted of numerous fruitbodies. Additionally, both occurred under Pinus palustris Miller and were within several kilometers of each other.

For a list of specimens examined, refer to Appendix A.

Laccaria ochropurpurea (Berkeley) Peck. 1907. Rept. N. Y. State Bot. 116:

≡ Agaricus ochro-purpureus Berkeley. 1845. London J. Bot. 4: 299-300. [!]

≡ Agaricus ochro-purpurea (Berkeley) Saccardo. 1887. Sylloge Fung. 5: 148.

= Laccaria laccata f. major Bresadola. 1920. Ann. Mycol. 18: 65.

Type specimen (HOLOTYPE): K - Lea 261; USA: Cincinnati. No date. (!)

SPECIES SYNOPSIS: Pileus up to 125 mm broad, not striate, finely fibrillose, very light violaceous brown to buff. Lamellae thick, waxy appearing, dark purple. Stipe most 45-190 x 6-22 mm, coarsely fibrillose, striate, occasionally reticulate near apex, concolorous with pileus; basal mycelium violet. Basidia 4-sterigmate. Cheilocystidia 23-63.5 x 2.3-8.9 μ m, undifferentiated to subclavate, abundant. Basidiospores mostly 7-9.5 x 7-9 μ m (excluding ornamentation), globose to subglobose, echinulate; spines mostly 1-1.4 μ m long. Eastern North America.

MACROMORPHOLOGY: BASIDIOMA: Pileus (3.2-)35-100(-125) mm broad, obtuse to convex, becoming plane to uplifted, some depressed, not striate, dry, subglabrous to finely fibrillose, occasionally fibrillose-scaly, light violaceous brown to buff color, often with violaceous tint in young fresh specimens ("Vinaceous-Buff" to "Pale Vinaceous-Fawn" to "Pinkish Buff"); margin inrolled to decurved, becoming plane to uplifted, entire to slightly undulate, often becoming eroded to rimose with age; context up to 9 mm thick at disc, tapering quickly to margin, violaceous buff color. Lamellae narrow to broad, thick to very thick, waxy, sinuate to arcuate, occasionally subdecurrent, close to moderately distant, dark purple ("Dark Heliotrope Gray" to "Deep Vinaceous-Gray"). Stipe (14.7-)45-190 x (2-)6-22(-36) mm, equal to subclavate to clavate, occasionally

slightly bulbous, dry, coarsely fibrillose; fibers forming longitudinal striations or recurved scales or both, some forming reticulations in age; surface ground color concolorous with pileus; striations brownish to slightly reddish brown. Basal mycelium often copious, violet. Spores light violaceous to white in mass.

MICROMORPHOLOGY: PILEUS: Cuticle tightly interwoven with occasional widely scattered $\pm$ perpendicular individual hyphae, not fasciculate; terminal cells (n=30) 24.4-66.5 x 3.7-10 μm , undifferentiated to barrel-shaped, olive brown in mass; walls up to 0.5 μm thick, olive brown; contents hyaline to light olive brown or slightly light yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown to olive brown toward cuticle.

LAMELLA: Trama parallel; hyphae mostly 2.8-11.5 μm diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped.

Subhymenium undifferentiated. Basidia (n=85) 33-50(-61.5) x (5.6-) 8.3-11.5 μm , mean L/W = 4.1 ± 4.94 , clavate, elongate, hyaline; sterigmata (2-)4, up to 7.4 μm long. Pleurocystidia lacking.

Cheilocystidia (n=80) 23-63.5 x 2.3-8.9 μm , mean L/W = 11.28, undifferentiated to subclavate, infrequently subcapitate, abundant, extending well beyond basidia and basidioles, thin-walled, hyaline.

Basidiospores (excluding ornamentation) [60/4] (6.4-)6.9-9.2(-11) x (6.4-)6.9-8.7(-9.7) μm (mean dimensions = 8 ± 0.75 x 7.8 ± 0.69 μm). L/W = (0.93-)1-1.13(-1.16) (mean L/W = 1.04 ± 0.05), globose to subglobose, rarely broadly elliptical, hyaline, echinulate; spines 0.9-1.4(-1.8) μm long (mean length = 1.1 ± 0.2 μm), crowded; hilar

appendage 1.3-2 μ m long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 3.7-10.5 μ m diam, tightly interwoven, undifferentiated, long-celled, hyaline.

CULTURE MAT ANALYSIS: MACROMORPHOLOGY (n=5): PDA: Radius at week III 5-11 mm, week VI 7-23 mm; mat felty moderately thick to thick, tightly interwoven, submerged, with time forming pruinose aerial layer away from plug, not translucent, at first uniform, dark, bright violet, by week VI violet restricted to 2-3 mm band near margin, short aerial hyphae light grayish violet; margin 1-3 mm broad, very thin to thin, silky, becoming subfelty, even to uneven, light violet to white; plug often covered with white cottony hyphae, concolorous. MNM: Radius at week III 11-19 mm, week VI 23-39 mm; mat silky to subfelty, occasionally becoming felty, thin to moderately thick, loosely to moderately interwoven, submerged, translucent becoming only slightly translucent, very light to light violet, often with 1-3 concentric darker narrow bands; margin narrow, subfelty to silky, thin, entire to sulcate, very light violet; plug concolorous. ME: Radius at week III 6-17 mm, week VI 10-33 mm; mat subfelty to felty, rarely silky, relatively thin to moderately thick, moderately interwoven, rarely very loosely interwoven, submerged, only slightly translucent, white; margin not well differentiated, narrow, silky to subfelty, thin, even to undulate, white; plug white. EXTRACELLULAR OXIDASE: Reaction moderate to strong blue immediately or delayed.

CULTURE MAT ANALYSIS: MICROMORPHOLOGY: PDA: Hyphae undifferentiated, olivaceous brown in mass; chlamydospores infrequent,

widely scattered. ME: Hyphae undifferentiated; chlamydospores infrequent, widely scattered.

HABITAT AND DISTRIBUTION: Solitary to scattered, rarely caespitose, under conifers or mixed woods; eastern N.A.; common.

OBSERVATIONS: Laccaria ochropurpurea can easily be distinguished from all other Laccaria taxa by its large size, light violaceous brown to buff color pileus and stipe, dark purple, thick and waxy lamellae, and globose to subglobose basidiospores. The only two North American species which could be confused with it are faded L. amethysteo-occidentalis and L. trullisata. Both of these species have different basidiospore shape and size and L. amethysteo-occidentalis, even when faded, has more violaceous coloring and is not as robust. Laccaria trullisata is restricted to sand or very sandy soil and always has sand covering much of the stipe and adhering to the rest of the basidiocarp and has very elongate, finely roughened basidiospores.

The culture mat morphology of the five isolates utilized showed the least intraspecific variation of all the taxa examined. The slow growth rate and dark purple color on PDA was very distinctive. The isolate of L. amethysteo-occidentalis is the most similar in this regard, but it is unique (Appendix E).

Laccaria ochropurpurea appears to be restricted to the deciduous-coniferous forest of eastern North America. Lahaie (1981) reported that it does not occur in the coniferous boreal forest of eastern Colorado. Several reports of L. ochropurpurea

occurring in western North America have been noted (personal communications and herbarium specimens) but all of the specimens investigated during this study appeared to be either L. amethysteo-occidentalis or large L. bicolor.

For list of specimens examined, refer to Appendix A.

Laccaria proxima (Boudier) Patouillard. 1887. Hymeno. Eur. p. 97.

≡ Clitocybe proxima Boudier. 1881. Bull. Soc. Bot. France 28: 91-92. [!]

≡ Laccaria laccata var. proxima (Boudier) Maire. 1908. Bull. Soc. Mycol. France 24: 16.

≡ Clitocybe laccata var. proxima (Boudier) Bresadola. 1927. Icon. Mycologia. p. 43.

= Laccaria proximella Singer in Singer and Moser. 1965. Mycopath. Mycol. 26: 146. [!]

Type specimen (NEOTYPE, des. mihi): PC - Boudier; France: Montemorency. XI.1904. [!]

Stipe mostly 24-72 x 3-10 mm, often finely longitudinal-striate, concolorous with pileus; basal mycelium white, rarely light violaceous. Basidia 4-sterigmate. Cheilocystidia 19-66.5 x 2.5-8.5 μ m, undifferentiated to subclavate, often abundant. Basidiospores 7-11 x 6-9 μ m (excluding ornamentation), mostly broadly elliptical to elliptical, echinulate; spines mostly 0.5-1 μ m long. Cosmopolitan.

MACROMORPHOLOGY: BASIDIOMA: Pileus (7-)15-43(-60) mm broad, campanulate to convex, often becoming plane, some depressed; not striate, occasionally translucent-striate; finely fibrillose to

fibrillose, some becoming finely fibrillose-scaly in age, hygrophanous, reddish brown to orange brown ("Auburn" or "Sanford's Brown" to "Orange Rufous" or "Hazel" to "Cinnamon-Rufous"), fading lighter ("Apricot Buff"); margin incurved to decurved, sometimes becoming plane, entire to undulate, occasionally becoming eroded with age; context thin, tapering quickly to margin, pinkish flesh color ("Japan Rose" to "Shell Pink"). Lamellae up to 9 mm broad, moderately thick to very thick, sinuate to adnate, occasionally arcuate, subdistant to distant, pinkish flesh color ("Flesh Color" to "Pale Salmon Color"). Stipe (12-)24-72(-100) x (2-)3-10 mm, equal to subclavate, often slightly bulbous, dry, fibrillose, often longitudinally striate, striations not pronounced, most of stipe concolorous with pileus; base occasionally darker ("Rood's Brown"), striations concolorous with pileus or redder ("Hay's Russet" or "Pecan Brown" to "Onion-skin Pink"). Basal mycelium white, very rarely with light violaceous tinge. Spores white in mass.

MICROMORPHOLOGY: PILEUS: Cuticle interwoven with scattered to numerous large fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 15-30 or more hyphae; terminal cells of fascicular hyphae (n=146) 27.6-73.5(-92) x 4.6-16(-30) μ m, undifferentiated to subclavate to clavate, occasionally broadly clavate or capitate or ventricose-rostrate; walls up to 0.5 μ m thick, light to moderate yellowish brown; contents hyaline to light yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae mostly 2.8-19 μ m diam, thin-walled, hyaline to light yellowish brown; cells long,

undifferentiated to barrel-shaped. Subhymenium undifferentiated. Basidia (n=240) (23-)33-50.5(-62) $\times$ 7.8-14.7 μm , mean L/W = 3.74 ± 0.62 , clavate, elongate, hyaline; sterigmata 4, up to 7 μm long. Pleurocystidia lacking. Cheilocystidia (n=130) 19.3-66.5(-92) $\times$ 2.3-8.3(-16.5) μm , mean L/W = 9.81 ± 3.02 , undifferentiated to subclavate, occasionally subcapitate, often abundant, extending well beyond basidia and basidioles, thin-walled, hyaline. Basidiospores (excluding ornamentation) [225/17]6.9-11(-12.5) $\times$ 6-8.7(-9.2) μm (mean dimensions = $9.3 \pm 1.25 \times 7.3 \pm 0.74 \mu\text{m}$), L/W = (1-)1.12-1.49 (-1.55) (mean L/W = 1.27 ± 0.7), broadly elliptical to elliptical or amygdaliform, occasionally oblong, rarely globose to subglobose, hyaline, echinulate; spines 0.5-1.4(-23) μm long (mean length = 0.8 μm), often with one or two long spines at apex, crowded; hilar appendage 1.3-2 μm long, prominent, truncate, plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 2.8-17.5 μm diam, tightly interwoven, hyaline; cells long, undifferentiated to barrel-shaped.

CULTURE MAT ANALYSIS: MACROMORPHOLOGY (n=7): PDA: Radius at week III 13-27, week VI 22-39(-50) mm; mat felty, moderately thick to thick, tightly interwoven, submerged, with time forming pruinose aerial layer away from plug, occasionally becoming furrowed due to irregular infolding near plug, not translucent, dark bright violet, in some becoming light orange brown from plug to mid-radius, most of mat remaining violet; aerial hyphae light grayish violet, often covering most of mat by week VI, masking dark violet color; margin

1-3(-6) mm broad, subfelty, thin, uneven to very uneven, light violet becoming white; plug dark violet, soon becoming light orange brown. MNM: Radius at week III 25-40 mm, week VI 36-61 mm; mat subfelty, occasionally becoming felty, moderately thick, becoming thicker near plug, moderately interwoven, occasionally with either 3-4 thicker concentric bands or scattered radially arranged irregularly thickened bands, submerged, slightly translucent, light violet, soon becoming white; margin 1-2(-5) mm broad, not well differentiated, uneven, very light violet to white; plug concolorous with mat. ME: Radius at week III (19-)29-43 mm, week VI (26-)41-67 mm; mat felty, occasionally subfelty, moderately thick to thick, loosely interwoven to tightly interwoven, occasionally with 3 broad bands of different thickness and degree of interweaving with thickest tightest band near plug and thin loosely interwoven band near margin, submerged, translucent to not translucent, white; margin narrow, not well differentiated, often undifferentiated, white; plug white. EXTRACELLULAR OXIDASE: Reaction usually moderate blue color immediately, one isolate reacted after 1 hr.

CULTURE MAT ANALYSIS: MICROMORPHOLOGY: PDA: Hyphae mostly undifferentiated with scattered irregular swollen hyphae, often purple brown in mass; chlamydospores very abundant, often in long chains. MNM: Hyphae mostly undifferentiated with a few scattered irregular swollen hyphae or subcoralloid hyphae; chlamydospores scattered, scarce to moderately common. ME: Hyphae mostly undifferentiated with few scattered irregular swollen hyphae;

chlamydospores common to abundant, often in chains, occasionally associated with septa.

HABITAT AND DISTRIBUTION: Solitary to caespitose; often in very disturbed habitat; cosmopolitan, common.

OBSERVATIONS: Laccaria proxima can be distinguished from the two other Laccaria taxa that have elliptical to oblong spores by a combination of characters. It differs from L. moelleri by its smaller size, non-scaly or non-squarrose pileus, and non-prominently striate stipe. If, after L. moelleri has been successfully cultured, the two species' culture mat morphology are the same, the status of L. moelleri may need to be re-evaluated. Laccaria proxima can be distinguished from L. oblongospora by its less elongate basidiospores and unique culture mat morphology (Appendix E).

There has been much controversy in the literature as to the correct name of this taxon (Mueller, 1978; Mueller and Sundberg, 1981; Lahaie, 1981). Typification of the name L. proxima should stabilize application of the name and the taxonomy of the taxon.

Laccaria proxima can probably be found throughout the U.S. and Canada.

For a list of specimens examined, refer to Appendix A.

Laccaria tortilis (Bolton) Cooke. 1884. Grevillea 12: 70.

= Agaricus tortilis Bolton. 1789. Hist. Fung. Halifax.
p. 41, TAB XLI, Fig. A.

= Omphalia tortilis (Bolton) S. F. Gray. 1821. Nat. arr.
Brit. pl. p. 613.

- ≡ Clitocybe tortilis (Bolton) Saccardo. 1887. Sylloge Hym.
V. p. 198.
- ≡ Collybia tortilis (Bolton) Quelet. 1888. Flore Mycologique.
p. 237.
- ≡ Clitocybe laccata var. tortilis (Bolton) Barla. 1888.
Fl. Mycol. Ill. p. 64.
- = Agaricus echinosporus Spegazzini. 1880. An. Soc. Cien. Argentina
10: 123. [!]
- ≡ Clitocybe echinospora (Spegazzini) Saccardo. 1887.
Sylloge Fung. 5: 198.
- ≡ Laccaria echinospora (Spegazzini) Singer. 1943. Ann. Mycol.
41: 17.
- = Clitocybe revoluta Barla. 1888. Fl. Mycol. Ill. p. 64.
[non Clitocybe revoluta Peck. 1892. Annual Rep. New York
State Bot. 46: 23. [!]]
- = Laccaria pumila Fayod. 1893. Ann. R. Acc.
d'Agr. Torino. 35: 91.
- ≡ Clitocybe pumila (Fayod) Saccardo. 1905. Sylloge Fung.
17: 13.
- ≡ Laccaria laccata var. pumila (Fayod) Favre. 1955. Resultants
recherches scien. ent. Parc. Nat. Suisse. 5: 51-52.
[ut forma sub pl. 29].

SPECIES SYNOPSIS: Pileus 5-23 mm broad, strongly striate,
vinaceous brown to orange brown. Lamellae pinkish flesh color to
slightly vinaceous. Stipe 4-15 x 1-3.5 mm, not striate, concolorous

with pileus; basal mycelium white. Basidia 2-sterigmate. Cheilocystidia lacking or very scarce, undifferentiated. Basidiospores mostly 10-15 x 10-15 μm (excluding ornamentation), globose, strongly echinulate; spines up to 4 μm long. Cosmopolitan.

MACROMORPHOLOGY: BASIDIOMA: Pileus 5-23 mm broad, convex, becoming plane to uplifted, strongly plicate-striate, subglabrous to finely fibrillose, hygrophanous, vinaceous brown to brownish orange ("Vinaceous-Brown" to "Sorghum Brown" to "Orange Rufous") fading lighter ("Rood's Brown" to "Vinaceous-Russet"), eventually becoming buff color; margin plane, undulate to eroded to rimose; context very thin, concolorous. Lamellae broad, very thick, sinuate to adnate, distant, pinkish flesh color to slightly vinaceous ("Flesh Color" to "Light Russet-Vinaceous"). Stipe 4-15 x 1-3.5 mm, equal or subbulbose, often caespitose, dry, finely fibrillose, not striate, concolorous with pileus. Basal mycelium white. Spores white in mass.

MICROMORPHOLOGY: PILEUS: Cuticle interwoven with widely scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 5-15 hyphae; terminal cells of fascicular hyphae ($n=45$) (26.5-)34.5-69 x 6.5-15.2 μm , undifferentiated to clavate; walls up to 0.5 μm thick, light to moderate yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae mostly 6-14.5 μm diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia ($n=95$) 33-64 x (6.9-)9.2-16 μm , mean L/W = 3.8 ± 0.18 , clavate, elongate, hyaline; sterigmata 2(-3), up to 11.5 μm long. Pleurocystidia lacking.

Cheilocystidia lacking or very scarce, undifferentiated. Basidiospores (excluding ornamentation) [90/6] (9.2-)10-14.7(-16) x (8.3-)10-14.7(-16) μm (mean dimensions = $12 \pm 1.3 \times 11.8 \pm 1.4 \mu\text{m}$), L/W = 1-1.09(-1.17) (mean L/W = 1.02 ± 0.04), globose to subglobose, rarely broadly elliptical, hyaline, strongly echinulate; spines 1.4-3.2(-3.7) μm long (mean length = 2.2 μm), up to 2.3 μm wide at base, crowded; hilar appendage 1.3-2.3 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae 3.2-12(-14.3) μm diam, tightly interwoven, hyaline; cells long, undifferentiated to barrel-shaped.

HABITAT AND DISTRIBUTION: Scattered to gregarious, occasionally caespitose; cosmopolitan; not common.

OBSERVATIONS: Laccaria tortilis can be distinguished from the rest of the small, plicate-striate Laccaria taxa by its 2-sterigmate basidia which bear very large, long-spined, globose to subglobose basidiospores.

There has been some confusion in the literature concerning the correct name for this taxon. Agaricus tortilis is the earliest name used for this macromorphological form (Bolton, 1788). Although no holotype exists and Bolton's description did not give any micro-morphological data, his color plate clearly illustrated the macromorphological traits of this taxon. I agree with the majority of modern workers (e.g., Dennis et al., 1960; Orton, 1960; Lahaie, 1981) who use L. tortilis for this taxon based on common usage (Korf, 1982a; 1982b). Additionally, an examination of representative

material from the environs of the type locality shows that Bolton probably had access to specimens that fit into this micromorphological form. Rea (1922), Singer (1950, 1952), and a few others consider A. tortilis to be a smaller spored species and Singer (1943, 1950, 1952, 1967, 1975, 1977) used L. echinospora (Spegazzini) Singer for this taxon.

In an attempt to stabilize the application of the name and the taxonomy of the taxon, I wrote to Dr. Roy Watling and requested the loan of representative material of the taxon from the Halifax area. Although no specimens have been found in Halifax, due to disruption of the original habitat, one specimen, Orton No. 3642, was collected in an area similar to Bolton's original sites (Watling, personal communication). An examination of this collection showed it to have micromorphological characteristics which fit this taxon. Although the collection lacks macromorphological notes, because of its obvious resemblance to Bolton's plate, I have designated it a neotype.

In North American literature, Peck (1912) and Murrill (1914) used the name in the current sense, while Coker and Beardslee (1922) used L. tortilis for specimens with 4-sterigmate basidia and moderate-sized basidiospores.

Laccaria tortilis can be collected throughout much of the U.S. and Canada outside of arctic habitats. Most reports under this name from the arctic are L. altaica (see observations under L. altaica). Only two collections of L. tortilis were found during this study, and Lahaie (1981) reported only eight collections from

boreal Ontario, indicating that it is probably not common. (I have not seen his material.)

For a list of specimens examined, refer to Appendix A.

Laccaria trichodermophora Mueller. sp. nov.

Pileo 9-66 mm lato, haud striato, aurantio-brunneo. Lamellis carneorosellis. Stipite 22-125 x 2-11 mm, striatus, concolor; mycelio plerumque albo, interdum violacea. Cuticula trichodermus vel abundus perpendicularis fasciae. Basidiis tetrasporis. Cheilocystidis nullis. Sporis plerumque 7.4-9.2 x 6.4-8.3 μ m sine ornamentatione, plerumque subglobosis vel late ellipticus; spinae moderatae.

Type specimen (HOLOTYPE): TENN - TENN 42523; USA: Mississippi, Harrison Co., DeSoto Nat'l Forest, Harrison Experimental Forest, Road H-6. 5.XII.1980. [!]

SPECIES SYNOPSIS: Pileus 9-66 mm broad, not striate, often becoming fibrillose-scaly, brownish orange. Lamellae pinkish flesh color. Stipe 22-125 x 2-11 mm, longitudinal-striate, concolorous with pileus; basal mycelium usually white, occasionally violet. Pileipellis a trichodermium in young specimens, breaking up with maturity. Basidia 4-sterigmate. Cheilocystidia lacking. Basidiospores mostly 7.4-9.2 x 6.4-8.3 μ m (excluding ornamentation), subglobose to broadly elliptical, echinulate; spines mostly 1-1.8 μ m long. Gulf Coast States.

MACROMORPHOLOGY: BASIDIOMA: Pileus 9-66 mm broad, convex to plane, occasionally becoming uplifted, often depressed, not striate,

finely fibrillose, becoming fibrillose-scaly to scaly due to cuticular diffraction, hygrophanous, brownish orange, occasionally reddish brown ("Hazel" to "Vinaceous-Rufous" or "Auburn" to "Orange Rufous" or "Cacao Brown"), fading lighter ("Flesh-Ocher" to "Apricot Buff"), occasionally darker at disc ("Hay's Russet" to "Kaiser Brown"); margin incurved to decurved, often becoming plane, entire to undulate, occasionally becoming eroded; context 1-2 mm thick, tapering quickly to margin, pinkish flesh color ("Light Congo Pink" to "Pale Vinaceous-Pink"). Lamellae moderately broad to broad, relatively thin to thick, sinuate to adnate, close to subdistant to distant, flesh color ("Vinaceous-Pink" to "Shell Pink" or "Flesh Color" to "Pale Salmon Color"), sometimes becoming vinaceous in age (near "Vinaceous"). Stipe 22-125 x 2-11 mm, equal to subclavate, occasionally slightly bulbous, dry, fibrillose, inconspicuously to moderately longitudinally striate, brownish orange to reddish brown ("Rood's Brown" to "Onion-skin Pink" or "Kaiser Brown" to "Cinnamon-Rufous" to "Salmon Color"); context stuffed, becoming hollow, concolorous with pileus context. Basal mycelium usually white, occasionally violet (near "Lavender").

MICROMORPHOLOGY: PILEUS: Cuticle composed of very numerous large fascicles of $\pm$ perpendicular hyphae, forming a trichodermium in young specimens and at the disc; fascicles usually composed of > 30 hyphae, long; terminal cells (n=60) 25.3-73.6 x 6-28 μ m, undifferentiated to clavate, occasionally capitate; walls up to 0.5 μ m thick, light to moderate yellowish brown; contents hyaline to light yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae

mostly 3.2-15 μm diam, thin-walled, hyaline to light yellowish brown; cells long, undifferentiated to barrel-shaped. Subhymenium undifferentiated. Basidia (n=70) 25.8-46 x 7.4-12.4 μm , mean L/W = 3.54 $\pm$ 0.52, clavate, elongate, hyaline; sterigmata 4, up to 8.7 μm long. Pleurocystidia lacking. Cheilocystidia lacking. Basidiospores (excluding ornamentation) [190/6] (6.9-)7.4-9.2(-10.6) x 6.4-8.3(-9.2) μm (mean dimensions = 8.3 $\pm$ 0.6 x 7.6 $\pm$ 0.5 μm), L/W = 1-1.24(-1.33) (mean L/W = 1.09 $\pm$ 0.07), subglobose to broadly elliptical, occasionally globose or elliptical to amygdaliform, hyaline, echinulate; spines (0.5-)0.9-1.8 μm long (mean length = 1.3 $\pm$ 0.3 μm), irregularly spaced to crowded; hilar appendage 1.3-1.8 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 3.2-12 μm diam, tightly interwoven, hyaline; cells long, undifferentiated to barrel-shaped.

CULTURE MAT ANALYSIS: MACROMORPHOLOGY (n=5): PDA: Radius at week III 16-38 mm or 42-45 mm, week VI 29-48(-59) mm or covering agar surface; mat felty, moderately thick to thick, tightly interwoven, uniformly thick or with narrow thicker dendritic strands radiating out from plug, submerged, normally forming pruinose aerial layer away from plug with time, or not forming layer, not translucent, very dark, bright violet, fading to moderate violet, finally to light orange brown near plug; aerial hyphae light grayish violet; margin 5-6 mm broad, subfelty to felty or silky, thin to almost moderately thick, entire to very uneven, very light violet to white; plug very dark violet, soon becoming light orange brown. MNM: Radius at week III

26-44 mm or 52-64 mm, week VI 54-78 mm or agar surface covered; mat subfelty becoming felty or silky, moderate to moderately thick or very thin, with 2-3 narrow (2-3 mm) slightly thicker concentric zones or with slightly thicker radially arranged dendritic strands from midpoint to margin or uniformly thin, submerged, translucent to slightly translucent, very light violet, thicker zones somewhat darker; margin not well differentiated from mat, silky to subfelty, sinuate, very light violet to white; plug concolorous with mat. ME: Radius at week III 20-26 mm or 35-42 mm, week VI 38 mm to agar surface covered; mat subfelty, very thin or moderate, occasionally thicker near plug, loosely interwoven or moderately interwoven, submerged, translucent or somewhat translucent, white; margin not well differentiated from mat, silky to subfelty, entire to sulcate, white; plug white. EXTRACELLULAR OXIDASE: Reaction normally moderate blue color immediately, negative in TENN 42523.

CULTURE MAT ANALYSIS: MICROMORPHOLOGY: PDA: Hyphae mostly undifferentiated with occasional subcoralloid hyphae and irregular swollen hyphae; chlamydospores common to abundant. MNM: Hyphae same as in PDA; chlamydospores few to common. ME: Hyphae mostly undifferentiated, occasionally with scattered irregular swollen hyphae; chlamydospores few to abundant.

HABITAT AND DISTRIBUTION: Scattered to gregarious; in very sandy soil, under Pinus palustris; Gulf Coast.

OBSERVATIONS: Laccaria trichodermophora can be distinguished from other members of the "laccata-complex" by its relatively large

and robust basidiocarps, relatively small, subglobose to broadly elliptical, moderately spined basidiospores, and cuticle composed of a trichoderm or numerous large hyphal fascicles. Additionally, its culture mat is unique (Appendix E).

Although similar in overall culture mat morphology, isolate TENN 42705 grew at a much faster rate than the other four isolates used. Since there is no apparent basidiocarp morphology differences between TENN 42705 and most of the other collections of the species, it is considered contaxic. Similarly, even though the basidiocarp of TENN 42706 had violet basal mycelium, no significant differences in its culture mat could be discerned.

Except for TENN 42707, which was collected in Washington, all other material of this taxon was found in southern Louisiana and Mississippi (refer to Chapter IV).

For a list of specimens examined, refer to Appendix A.

Laccaria trullisata (Ellis) Peck. 1912. Rept. N. Y. State Bot. 157: 90-91.

= Agaricus trullisatus Ellis. 1874. Bull. Torrey Bot. Soc. 5: 45. [!]

= Clitocybe trullisata (Ellis) Saccardo. 1887. Sylloge Fung. 5: 195.

Type specimen (LECTOTYPE des. mihi): NYS - Ellis; USA: New Jersey, Newfield. [!]

SPECIES SYNOPSIS: Pileus 17-72 mm broad, not striate, becoming fibrillose scaly, brown to buff color. Lamellae thick, waxy-appearing,

dark purple. Stipe 40-93 x 6-23 mm, covered with sand, concolorous; basal mycelium violet. Basidia 4-sterigmate. Cheilocystidia lacking or very scarce, undifferentiated. Basidiospores mostly 14-20 x 5.5-8.3 μm , subfusiform to fusiform-elliptical, not echinulate, very finely roughened. Eastern North America.

MACROMORPHOLOGY: BASIDIOMA: Pileus 17-72 mm broad, convex to plane, occasionally depressed, not striate, fibrillose to fibrillose-scaly, brown to buff color ("Fawn Color" to "Avellaneous" to "Vinaceous-Buff" to "Pale Vinaceous-Fawn" to "Pinkish Buff"); margin incurved to decurved, entire to eroded; context tapering to margin, pale purple (near "Light Vinaceous-Gray"). Lamellae narrow to moderately broad, thick to very thick, waxy, adnate to arcuate, close to subdistant, dark violaceous ("Dark Heliotrope Gray" to "Deep Vinaceous-Gray"). Stipe 40-93 x 6-23 mm, subclavate to clavate, dry, fibrillose, longitudinally striate, covered with sand, occasionally with outer "cortical" layer splitting near apex, concolorous with pileus; context solid, concolorous with pileus context. Basal mycelium violaceous. Spores white in mass.

MICROMORPHOLOGY: PILEUS: Cuticle interwoven, often with widely scattered fascicles of $\pm$ perpendicular hyphae, fascicles usually composed of 10-25 hyphae; terminal cells (n=40) 33.5-64.5(-85) x 7-13.8(-16) μm , subclavate to clavate, occasionally broadly clavate or capitate, walls up to 0.5 μm thick, light to moderate yellowish brown; contents hyaline to light yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward

cuticle. LAMELLAE: Trama parallel; hyphae mostly 3.5-16.5 μm diam, hyaline to light yellowish brown or light vinaceous color; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=75) 30-64.5 x 9.2-16 μm , mean L/W = 4.19 ± 0.49 , clavate, elongate, hyaline; sterigmata 4, up to 9.7 μm long. Pleurocystidia lacking. Cheilocystidia lacking or very scarce, undifferentiated. Basidiospores [75/5] (13.3-)13.8-20.2(-21.6) x 5.5-8.3 μm (mean dimensions = $16.4 \pm 1.8 \times 6.8 \pm 0.7 \mu\text{m}$), L/W = 1.83-3.31 (mean L/W = 2.43 ± 0.25), subfusiform to fusiform-elliptical, hyaline, very finely roughened; hilar appendage 1.3-2 μm long, prominent, truncate; contents occasionally uniguttulate, rarely biguttulate. BASAL MYCELIUM: Hyphae (2.8-)4-15.5 μm diam, tightly interwoven, hyaline; cells long, undifferentiated to barrel-shaped.

HABITAT AND DISTRIBUTIONS: Solitary to scattered; sand dunes or very sandy soil; eastern and mid-central N.A.

OBSERVATIONS: Laccaria trullisata can easily be distinguished from all other North American Laccaria taxa by its unique habitat preference, macromorphology, and spore shape, size, and near lack of ornamentation.

There is a sister species of L. trullisata which occurs in northern Europe and Greenland. This taxon differs by having somewhat shorter and less elongate basidiospores which have very fine but visible (under a light microscope) ornamentation. The name most commonly used for this European taxon is L. maritima (Teodorowicz) Singer (Singer, 1961, 1962). I have not seen the type of Hygrophorous maritimus Teodorowicz (Teodorowicz, 1936) and, therefore, am

not in a position to comment on its characteristics. Singer (1961, 1962) and Holland (1976) stated that L. maritimus is the same as L. trullisata f. rugulospora Lange (1955). The type of Lange's taxon supports the separation of the North American and European species. For further details including SEMs of the basidiospores of both taxa, refer to Holland (1976).

Laccaria trullisata occurs in sandy areas of far eastern N.A. from the Maritime Provinces of Canada to North and South Carolina and in north central U.S. and south central Canada (Bigelow and Barr, 1962; Lahaie, 1981; this study).

For a list of specimens examined, refer to Appendix A.

Laccaria vinaceo-brunnea Mueller. sp. nov.

Pileo 7-25(-42) mm lato, violaceo in stato juvenilis, transeuns vinaceo dein rufrobrunneo, siccando pallidore. Lamellis purpureo-violaceo. Stipite 7-56(-98) x 2-7 mm, haud fortiter striatus, concolor. Cuticula intertexta cum abundum grandis perpendicularis hyphae. Basidiis tetrasporis. Cheilocystidis grandis, abundus. Sporis plerumque 7.4-10 x 6.4-9.2 μ m sine ornamentatione, plerumque subglobosis vel late ellipticis; spinae curtae vel moderatae.

Type specimen (HOLOTYPE): TENN - TENN 42525; USA: Louisiana, Tammany Parish, Fountainebleau State Park, under Quercus virginiana. 9.XII.1980. [!]

SPECIES SYNOPSIS: Pileus mostly 7-25 mm broad, not striate, fibrillose, hygrophanous, bright purple when young and fresh, soon becoming vinaceous to reddish brown, eventually fading to buff.

Lamellae purple. Stipe 7-56 x 2-7 mm, fibrillose, concolorous with pileus; basal mycelium violet. Pileipellis interwoven with very numerous $\pm$ perpendicular individual large hyphae, almost a palisadoderm. Basidia 4-sterigmate. Cheilocystidia 31-92 x 5.5-11 μ m, undifferentiated to clavate, very abundant. Basidiospores mostly 7.4-10 x 6.4-9.2 μ m (excluding ornamentation), subglobose to broadly elliptical, echinulate; spines 0.5-1.8 μ m long. Gulf Coast states.

MACROMORPHOLOGY: BASIDIOMA: Pileus 7-25(-42) mm broad, obtuse to convex, becoming plane to uplifted, often depressed, not striate or occasionally finely striate when wet, finely fibrillose, occasionally becoming finely fibrillose-scaly, hygrophanous, when very young violaceous (near "Purplish Lilac"), soon becoming vinaceous ("Dark Vinaceous-Brown" to "Hay's Brown" to "Vinaceous-Brown"), becoming reddish brown ("Cameo Brown" to "Walnut Brown") fading to near orange brown to buff ("Cinnamon-Rufous" to "Light Ochraceous-Buff"); margin decurved to plane, entire to eroded; context thin, tapering to margin, light vinaceous ("Light Brownish Vinaceous" to near "Vinaceous-Fawn"). Lamellae moderately broad to very broad, thick to very thick, waxy, adnate to arcuate, subdistant to distant, purple ("Purplish Lilac" to "Purplish Vinaceous"). Stipe 7-56(-98) x 2-7 mm, equal or occasionally subclavate, often slightly bulbous, dry, fibrillose, occasionally with recurved fibers or finely striate, concolorous with pileus; fibers ("Hazel" to "Vinaceous-Brown"). Basal mycelium violet. Spores white in mass.

MICROMORPHOLOGY: PILEUS: Cuticle interwoven with very numerous $\pm$ perpendicular individual large hyphae, almost forming

palisadoderm but hyphae not dense enough; terminal cells ($n=30$) $32-78 \times 7-14.5 \mu\text{m}$, undifferentiated to clavate, hyaline to light vinaceous; walls up to $0.5 \mu\text{m}$ thick; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline to light olive brown in mass. LAMELLA: Trama parallel; hyphae thin-walled, hyaline; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia ($n=30$) $33-60 \times 8.5-9.2 \mu\text{m}$, mean $L/W = 4.53 \pm 0.65$, clavate, elongate, hyaline; sterigmata 4, up to $9.2 \mu\text{m}$ long. Pleurocystidia lacking. Cheilocystidia ($n=32$) $31.5-92 \times 5.5-11 \mu\text{m}$, mean $L/W = 6.84 \pm 0.89$, undifferentiated to clavate, very abundant, extending well beyond basidia and basidioles, hyaline. Basidiospores (excluding ornamentation) $[60/4] (6.9-7.4-10(-10.6) \times 6.4-9.2(-9.7)$ (mean dimensions = $8.7 \pm 0.8 \times 7.8 \pm 0.7 \mu\text{m}$), $L/W = 1-1.26$ (mean $L/W = 1.11 \pm 0.06$), subglobose to broadly elliptical, occasionally globose, hyaline, echinulate, spines $0.5-1.8 \mu\text{m}$ (mean length = 1 ± 0.26), long, crowded; hilar appendage $1.3-1.8 \mu\text{m}$ long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly $2.8-8.2 \mu\text{m}$ diam, tightly interwoven, long-celled, hyaline.

HABITAT AND DISTRIBUTION: Scattered to gregarious; often caespitose; in sandy soil under Quercus virginiana; Gulf Coast.

OBSERVATIONS: Laccaria vinaceo-brunnea can readily be distinguished from L. amethystina and L. amethysteo-occidentalis by its habitat, almost exclusively under Quercus virginiana Miller, its color (quickly becoming vinaceous), its unique cuticular arrangement, and its relatively short-spined, subglobose to broadly

elliptical basidiospores. As in the latter two species, the abundant large cheilocystidia makes a reliable character to use in identifying dry collections which lack notes on macromorphology.

For a list of specimens examined, refer to Appendix A.

CHAPTER VI

TENTATIVE KEY TO LACCARIA FOR THE WORLD

The concepts of non-North American taxa included in the following key are based solely on an examination of type specimens or, in instances where no representative material was available, on a review of the literature. It is presented for two reasons: (1) to summarize the delimiting characters of the taxa involved, and (2) to provide a framework which hopefully will facilitate further taxonomic work on the genus. It is not presented as a definitive statement on the genus for the world. In instances where it was not feasible to discriminate between two or more taxa, the names are listed at the same place.

1. Lamellae ochraceous-isabelline; South America.
 L. galerinoides Singer
1. Lamellae grayish, violaceous to purple, or flesh color to pinkish when fresh 2
2. Lamellae gray; Japan 3
2. Lamellae violaceous to purple or flesh color to purple or flesh color to pinkish when fresh 4
3. Basidia bisporic; basidiospores 8-11 μ m diam, globose, spines up to 3 μ m long; pileus grayish, almost black. . L. nigra Hongo
3. Basidia tetrasporic; basidiospores 7.5-10 μ m diam, globose, verruculose; becoming mouse gray or subavellaneous L. murina Imai
4. Lamellae violaceous to purple when young and fresh 5
4. Lamellae flesh color to pinkish when fresh 17

5. Basidiospores large, up to 22 μm long, strongly elongate,
(mean L/W > 1.5 μm), smooth to finely echinulate; lamellae
dark purple. 6
5. Basidiospores smaller (< 10.5 μm long), less elongate
(mean L/W $\leq$ 1.51). 7
6. North America; basidiospores subfusiform to fusiform,
elliptical (mean L/W = 2.43); smooth to finely
roughened. L. trullisata (Ellis) Peck
6. North Europe; basidiospores oblong to subfusiform
(mean L/W = 1.67), finely echinulate
. L. trullisata var. rugulospora Lange
= L. maritima (Theod.) Singer
7. Lamellae bright violaceous or purple, color constant 8
7. Lamellae pallid violaceous to vinaceous when young, often
disappearing when mature 13
8. Pilei bright violaceous, purple or grayish black when
young and fresh. 9
8. Pilei fawn or buff color, often with violaceous tints. . . 12
9. Pilei, lamellae, and stipes bright violaceous or purple when
young and fresh. 10
9. Pilei purple to grayish lavender; stipes apex purple, bases
vinaceous-brown; New Zealand L. violaceo-niger Stevenson
10. Basidiocarps large (pilei up to 9 cm broad), fading in age
to vinaceous color; western N.A.
. L. amethysteo-occidentalis sp. nov.

10. Basidiocarps smaller (pilei rarely up to 5 cm broad), fading in age to buff color or reddish brown.11
11. Basidiospores globose, rarely subglobose (mean L/W = 1.0), ornamentation mean length = 1.9 μ m; basidiocarps fading in age to buff color; eastern N.A., western Europe.
 L. amethystina (Hudson) Cooke
11. Basidiospores subglobose to broadly elliptical (mean L/W = 1.11); spore ornamentation mean length = 1.0 μ m; basidiocarps becoming reddish brown when mature; southern U.S.A..
 L. vinaceo-brunnea sp. nov.
12. Pilei fawn-colored with fulvous fibrils; lamellae lilac; New Zealand. L. lilacina Stevenson
12. Pilei buff colored, lacking distinct fibrils; lamellae dark purple. L. ochropurpurea (Berk.) Peck
13. Pilei dark purple brown, fading to light purple-brown; stipes purplish brown at base; eastern N.A., western Europe
 L. purpureo-badia Reid
13. Pilei orange brown to pinkish flesh color, light violaceous, or buff color; stipes subconcolorous14
14. Pilei strongly radially fibrillose; fibers dark brown to black; margin often dentate to lacerate; New Zealand
 L. fibrillosa McNabb
14. Pilei not strongly radially striate; margin entire to undulate15

15. Basidiocarps orange brown to pinkish flesh color; basidiospores subglobose to broadly elliptical (mean L/W = 1.11); mean spine length = 1.3 μm ; western N.A., western Europe
 L. bicolor (Maire) Orton
15. Basidiocarps violet when young, soon fading buff color with only traces of violet remaining; basidiospores globose; spines up to 6.4 μm long.16
16. Basidiospore ornamentation mostly <2 μm long; New Zealand.
 L. masonii var. brevispinosa McNabb
16. Basidiospore ornamentation >2 μm long, normally up to 5 μm long; New Zealand. L. masonii var. masonii Stevenson
17. Basidia normally tetrasporic, basidiocarps small to large. . .18
17. Basidia normally bisporic, basidiocarps very small to small. .29
18. Basidiospores mean L/W $\leq$ 1.15; spore mean ornamentation length $\geq$ 0.9 μm19
18. Basidiospores mean L/W > 1.27; spore mean ornamentation length $\leq$ 0.8 μm27
19. Pilei cuticle composed of a trichodermium, at margin becoming interwoven with numerous large, perpendicular fascicles of hyphae20
19. Pilei cuticle interwoven with scattered small to moderate-sized, perpendicular fascicles of hyphae21
20. Basidiospores (excluding ornamentation) 6-7.8 x 6-7.8 μm , globose rarely subglobose (mean L/W = 1.01); basidiocarps vinaceous-brown; basal mycelium white; southern U.S.A.
 L. microspora sp. nov.

20. Basidiospores (excluding ornamentation) 7-10 x 6.4-9 μm , subglobose to broadly elliptical (mean L/W = 1.09); basidiocarps orange brown; basal mycelium usually white, occasionally violet; southern U.S.A.
 L. trichodermophora sp. nov.
21. Basal mycelium violaceous when fresh 22
21. Basal mycelium white when fresh. 23
22. Cheilocystidia vesiculose to subglobose (up to 9.3 μm broad); basidiospores 7-9 x 6.3-7.7 μm , spines up to 0.9 μm long; Mexico. L. bullulifera Singer
23. Pilei ochraceous dark brown, tinted with a light blue pruina; U.S.S.R. L. chibinensis Michal.
23. Pilei orange brown to pinkish flesh color or vinaceous brown. 24
24. Basidiospores (excluding ornamentation) 9-13.5 x 8.3-11.5 μm (mean dimensions = 10.8 x 9.5 μm); pilei up to 35 mm broad, striate to often strongly striate; restricted to arctic, boreal or alpine habitats; circumboreal. . L. montana Singer
24. Basidiospores smaller (mean dimensions 8.6 x 8.6 μm); pilei either up to 40 mm or up to 77 mm, not striate or occasionally finely striate, some translucent-striate. 25
25. Pilei up to 77 mm broad, scaly; stipe robust, strongly striate to reticulate, occasionally scaly; basidiospores (excluding ornamentation) 7.4-10 x 6.4-8.7 μm , subglobose to broadly elliptical, occasionally elliptical (mean L/W = 1.15); western N.A. L. nobilis Smith apud Mueller sp. nov.

25. Pilei up to 40 mm broad, not scaly; stipe not robust, not striate or finely striate, not scaly; basidiospores globose to subglobose (mean L/W = 1.04)26
26. Stipes gracile, 1-4 mm broad at apex, glabrous, darker than the pileus; pilei strongly translucent-striate; basidiospore ornamentation mean length = 2 μ m; New Zealand; eastern N.A., Mexico. L. glabripes McNabb
26. Stipe up to 8 mm broad, fibrillose, not striate to finely striate, concolorous with pileus; pileus not striate to striate, rarely slightly translucent-striate; basidiospore ornamentation mean length = 1.4 μ m; cosmopolitan or Japan endemic. L. laccata (Scop.:Fr.) Berk. and Br.
L. vinaceo-avellanea Hongo
27. Basidiospores elliptical to oblong (mean L/W = 1.51), 7.8-10 x 5-6.5 μ m (excluding ornamentation); basal mycelium normally white occasionally violet; southern U.S.A.
. L. oblongospora sp. nov.
27. Basidiospore mean L/W $\leq$ 1.29; basal mycelium white28
28. Pilei up to 85 mm broad; stipes with prominent dark striations; cheilocystidia numerous, long, filamentous; eastern N.A., Europe
. L. moelleri (Singer) Mueller comb. nov.
28. Pilei rarely up to 50 mm broad; stipes lacking prominent striations; cheilocystidia absent or not filamentous; cosmopolitan L. proxima (Boud.) Pat.

29. Basidiospores (excluding ornamentation) 7.4-11 x 7.4-10.5 μm .30
29. Basidiospores large, most > 11 μm31
30. Pleurocystidia absent; cosmopolitan or Australian.
-L. lateritia var. lateritia Malencon
-L. canaliculata (Cooke & Masee) Pegler
-L. fraternus (Cooke & Masee) Pegler
30. Pleurocystidia present; New Zealand.
-L. lateritia var. paraphysata McNabb
31. Basidiospores (excluding ornamentation) 11-17 x 10-14.5 μm ,
subglobose to broadly elliptical (mean L/W = 1.14); spore
ornamentation mean length = 1.0 μm ; circumboreal
-L. altaica Singer
31. Basidiospores 10-15 x 10-15 μm , globose, occasionally sub-
globose (mean L/W = 1.02); spore ornamentation mean length =
2.2 μm 32
32. Pilei strongly striate; orange brown; basidiospore orna-
mentation crowded; cosmopolitan. . L. tortilis (Bolt.) Cooke
32. Pilei not striate, reddish brown; basidiospore ornamentation
very crowded; Kew Gardens.L. nana Masee

CHAPTER VII

TYPE STUDIES

Although this study dealt primarily with North American taxa of Laccaria, it was considered necessary that an examination of all extant Laccaria type collections be undertaken. In addition, when no holotype existed or none was available for a North American taxon, either a lectotype, neotype, or representative collection has been designated and described.

The importance of type studies was discussed by Ammirati and Ovrebo (1979). Some of the reasons given were ". . . to establish species concepts and relationships, to determine synonymy, and . . . for the development of a world-wide system of taxonomy for fleshy fungi" (Ammirati and Ovrebo, 1979). Additionally, they mentioned the importance of making detailed macro- and micromorphological information on each type collection available for workers involved in general studies.

The following type descriptions are arranged alphabetically by the final epithet, specific or infraspecific. Color names outside of parentheses are author generated while color names inside parentheses are derived from standard color manuals. Unless otherwise noted, color names within parentheses and quotation marks are from Ridgway (1912) while colors from Maerz and Paul (1930) are noted by (page number/column letter/row number). For further details of techniques refer to Chapter II. Unless noted in Observations, the

type collection consists of more than one basidiocarp and is in an adequate state of preservation. Excluded taxa are discussed in Chapter VIII.

Illustrations of basidiospores from each Laccaria type collection or representative specimen are presented in Appendix B. "Boxplots" of basidiospore data for each of these collections are presented in Appendix C.

Laccaria tetraspora var. aberrans Singer. 1967. Bull. Soc. Mycol. France 83: 116.

Type specimen (HOLOTYPE): BAFC - Singer M1774; Argentina: Neuguen, Parque Nacional de Nahuel Huapi, Camino a los Cantaros. 14.III.1959. [!]

MACROMORPHOLOGY (Teste Singer, Ibid.): BASIDIOMA: As in var. scotica.

MICROMORPHOLOGY (Mihi): LAMELLA: Trama parallel; hyphae mostly 3.7-10 μm diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 33-44 x 10-13 μm , L/W = 2.97-4.12, clavate, elongate, hyaline; sterigmata 4, up to 8.3 μm long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) 6.9-8.7(-9) x 6.9-8.7(-9.2) μm (mean dimensions = 7.9 ± 0.6 x 7.8 ± 0.6 μm , L/W = 1-1.05(-1.12) (mean L/W = 1.01 ± 0.03), globose, occasionally subglobose, hyaline, echinulate; spines (0.9-)1.4-1.8 μm long, crowded; hilar appendage 1.3-1.8 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM:

Hyphae mostly 3.6-7.8 μ m diam, long-celled, undifferentiated, tightly interwoven, hyaline.

OBSERVATIONS: The type collection is infested with an "Aspergillus-like" fungus, with numerous conidia and conidiophores present. Because of this, no observations on cuticle arrangement or cheilocystidia could be made. Singer (1967) separated this variety from var. scotica on the smaller spores of var. aberrans, shorter spore ornamentation, and difference in habitat. Variety aberrans was found on humus while var. scotica fruited in Sphagnum.

Laccaria laccata var. affinis Singer. 1967. Bull. Soc. Mycol. France 83: 111-112.

Type specimen (HOLOTYPE): BAFC - Singer C 3118; England: Bedgebury, Kent, Nat'l Pine Arboretum. 30.X.1960. [!]

MACROMORPHOLOGY (Teste Singer, 1967): BASIDIOMA: Pileus 30-48 mm broad, convex, centrally depressed, glabrous, distinctly fibrillose-asperulate under hand lens as in Hygrocybe miniata, slightly striate when moist, hygrophanous, uniform brownish rose color, fading to very pale leather-rose-colored when dehydrated; margin often crenulate-furrowed. Lamellae 5-6 mm broad, sinuate to decurrent, slightly serrate, often anastomosing and wrinkled, dull rose-colored, not as dull brownish-color as in var. anglica; lamellulae wrinkled. Stipe 80-110 x 5-6.5 mm, equal or nearly so, fibrillose, longitudinally striate, brownish rose-colored ("brun fauve roussatre," Singer); striations very pale. Basal mycelium white. Spores in mass pure white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with widely scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 5-15 hyphae; terminal cells of fascicular hyphae (n=10) 37-55 x 6.5-13.5 μ m, subclavate to clavate; walls up to 0.5 μ m thick, light yellowish brown; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown towards cuticle. LAMELLA: Trama parallel; hyphae mostly 3.2-8.3 μ m diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 29-47 x 9-12.5 μ m, L/W = 2.67-3.78(-4.5), clavate, elongate, hyaline; sterigmata 4, up to 9.2 μ m long. Pleurocystidia lacking. Cheilocystidia (n=10) 24.5-46 x (2-)3-5.5 μ m, L/W = 4.44-12.94(-18.39), undifferentiated to subcapitate, occasionally strangulated, scattered, extending well beyond basidia and basidioles, thin-walled, hyaline. Basidiospores (excluding ornamentation) (n=30) (6.9-)7.8-10 x (6.9-)7.8-10 μ m (mean dimensions = $8.6 \pm 0.8 \times 8.6 \pm 0.8 \mu$ m), L/W = 1(-1.06) (mean L/W = 1 ± 0.1), globose, rarely subglobose, hyaline, echinulate; spines 0.9-1.4 μ m long, crowded; hilar appendage 1.3-1.8 μ m long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 2.8-7 μ m diam, long-celled, undifferentiated, tightly interwoven, hyaline.

Agaricus alpestris Britzelmayr. 1894. Hym. Sudb. VIII: 4.

f. 442.

Type specimen (lacking).

MACROMORPHOLOGY (Teste Britzelmayr, Ibid.): BASIDIOMA:
Pileus fleshy; margin crenulate. Lamellae whitish or yellowish-
 redbrown. Stipe bent.

MICROMORPHOLOGY: (Teste Britzelmayr, Ibid.): LAMELLA:
Basidiospores 3-4 μm diam, rough, yellowish.

OBSERVATIONS: The protologue stated that this taxon was
 similar to A. laccatus. The basidiospore dimensions, however,
 appear to be too small. Without additional micromorphological data,
 it is impossible to clarify the concepts of this taxon. Thus, the
 name is treated as a nom. dubium.

Laccaria altaica Singer. 1967. Bull. Soc. Mycol. France 83: 122.

Type specimen (HOLOTYPE): LF - Singer A439; USSR: Kuraika.
 31.VII.1937. [!]

MACROMORPHOLOGY (Teste Singer, Ibid.): BASIDIOMA: Similar to
Laccaria echinospora (Speg.) Singer.

MICROMORPHOLOGY (Mihi): LAMELLA: Trama parallel; hyphae
 thin-walled, hyaline to light yellowish brown; cells long, barrel-
 shaped. Subhymenium undifferentiated. Basidia (n=15) 38-62 x 11.5-
 16 μm , L/W = 3.14-4.46, clavate, elongate, hyaline; sterigmata 2(-4),
 up to 11.5 μm long. Pleurocystidia lacking. Cheilocystidia not
 observed. Basidiospores (excluding ornamentation) (n=30) (8.3-)11.5-
 14.7(-15.6) x (8.3-)10.1-13.8 μm (mean dimensions = $12.8 \pm 1.5 \times$
 $11.5 \pm \mu\text{m}$), L/W = 1-1.2(-1.28) (mean L/W = 1.12 ± 0.07), globose to
 subglobose to broadly elliptical, occasionally elliptical, hyaline,
 echinulate; spines < 0.5(-0.9) μm long, crowded; hilar appendage

1.3-2 m long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae not present.

OBSERVATIONS: The name, without a description, was originally published by Singer (1951). Due to the extremely poor condition of the type collection, with only a few gill fragments extant, no comments can be made concerning macromorphological and some micro-morphological characters.

Laccaria amethysteo-occidentalis Mueller. 1982. This paper p. 78.

Type specimen (HOLOTYPE): TENN - TENN No. 42526; Canada: B.C., near Squamish, Alice Lake Prov. Park campground. 3.X.1981. [!]

MACROMORPHOLOGY (Mihi): BASIDIOMA: Pileus 10-33 mm broad (mean 20 mm), convex becoming plane, occasionally depressed, not striate, finely fibrillose to fibrillose, deep purple ("Taupe Brown" to "Dull Indian Purple"); margin decurved, entire; context purple ("Dark Slate-Violet") with lighter gray-purple to white areas intermixed ("Pale Bluish Lavender"). Lamellae moderately deep (≤ 5 mm), thick, adnate to arcuate, distant, violaceous ("Deep Slate Violet" to "Slate-Violet"). Stipe 18-87 x 4-12 mm (mean = 50 x 7.3 mm), equal or tapering slowly toward apex, occasionally bulbous, dry, fibrillose, longitudinal-striate, purple ("Dark Slate-Purple" to "Dark Vinaceous Brown" to "Hay's Brown"), often with lighter violet to white streaks ("Pale Bluish Lavender"); context solid, concolorous with pileus context. Basal mycelium violet ("Dark Slate-Purple" to "Deep Slate-Violet"). Spores in mass white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle tightly interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 15-30 hyphae, long; terminal cells of fascicular hyphae (n=10) $30-73.5 \times 7.8-15.2 \mu\text{m}$, undifferentiated to clavate, occasionally broadly clavate; walls up to $0.5 \mu\text{m}$ thick, vinaceous brown; contents hyaline to light vinaceous brown. Trama tightly interwoven, undifferentiated, hyaline, light vinaceous brown toward cuticle. LAMELLA: Trama parallel; hyphae mostly $3-11.5 \mu\text{m}$ diam, thin-walled, hyaline to light vinaceous brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) $36.5-50.5 \times 9.7-14.7 \mu\text{m}$, L/W = $2.66-4.56$, clavate, elongate, hyaline, vinaceous brown in mass; sterigmata 4, up to $7.8 \mu\text{m}$ long. Pleurocystidia lacking. Cheilocystidia lacking. Basidiospores (excluding ornamentation) (n=30) $7.8-9.7 \times 6-8.3 \mu\text{m}$ (mean dimensions - $8.7 \pm 0.6 \times 7.3 \pm 0.7 \mu\text{m}$), L/W = $(1.05-1.11-1.33(-1.36))$ (mean L/W = 1.19 ± 0.08), subglobose to broadly elliptical, occasionally elliptical to amygdaliform, echinulate; spines $0.9-1.4 \mu\text{m}$ long, crowded; hilar appendage $1.3-1.9 \mu\text{m}$ long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly $2.7-6.4 \mu\text{m}$ diam, hyaline, undifferentiated, long-celled.

CULTURE MAT ANALYSIS: See p. 80.

Agaricus amethystinus Hudson. 1778. Flora Anglica. p. 612.

Type specimen lacking.

Specimen presented as material representative of this paper's concept: TENN No. 42544; USA: IL, Pope Co., Bell Smith Springs Rec. Area. 9.VI.1981.

MAXROMORPHOLOGY (Mihi): BASIDIOMA: Pileus 3-22 mm broad, convex to plane, becoming depressed, translucent-striate when fresh, not so when faded, finely fibrillose, hygrophanous, dark, bright purple ("Heliotrope-Slate" to "Dark Slate-Violet 1") fading to light violet ("Vinaceous-Gray") eventually becoming buff ("Pale Ochraceous-Buff"), margin incurved to decurved, entire to undulate; context concolorous with surface. Lamellae broad, thick, waxy-appearing, sinuate to adnate, subdistant to distant, dark violet to purple (near "Heliotrope-Slate"). Stipe 17-35 x 1-3 mm, equal, occasionally slightly bulbous, fibrillose, finely longitudinally striate, concolorous with pileus. Basal mycelium hygrophanous, violet becoming white. Spores in mass white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with widely scattered small fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 5-10 hyphae; terminal cells of fascicular hyphae ($n=10$) 31-55 x 7.4-17 μm , subclavate to clavate, occasionally broadly clavate; walls up to 0.5 μm thick, light to moderate yellowish brown; contents hyaline to light yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel: hyphae mostly 3.7-16 μm diam, thin-walled, hyaline to vinaceous brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia ($n=10$) 40-47 x 9-13.5 μm , L/W = 2.9-4.29, clavate, elongate, hyaline; sterigmata 4, up to 7 μm long. Pleurocystidia lacking. Cheilocystidia ($n=10$) 33-65 x 6-10 μm , L/W = 4-7.69, undifferentiated to clavate, occasionally broadly

clavate or ventricose-rostrate, very abundant, extending well beyond basidia and basidioles, thin-walled, hyaline. Basidiospores (excluding ornamentation) (n=30) 7.8-10 x 7.8-10(-10.5) μm (mean dimensions = $8.7 \pm 0.8 \times 8.6 \pm 0.8 \mu\text{m}$), L/W = 0.95-1.06 (mean L/W = 1.01 ± 0.03), globose, rarely subglobose, hyaline, echinulate; spines 1.4-1.8 μm long, crowded; hilar appendage 1.3-2 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 4-9.2 μm diam, tightly interwoven, hyaline; cells long, undifferentiated to barrel-shaped.

Laccaria laccata var. anglica Singer. 1967. Bull. Soc. Mycol. France 83: 110-111.

Type specimen (HOLOTYPE): BAFC - Singer C3119; England: Kent, Bedgebury, Nat'l Pine Arboretum. 20.X.1960. [!]

MACROMORPHOLOGY (Teste, Singer, Ibid.): BASIDIOMA: Pileus 25-37 mm, convex, plane or depressed at disc, often umbonate, pellucid-striate when fresh, occasionally radially sulcate at margin, finely tomentose to tomentose-fibrillose, strongly hygrophanous, reddish brown rose-colored, fading to very pale beige-red or very pale dull rose-colored, finally to pale-mouse-colored; disc rust-red. Lamellae moderately broad, subcrowded, sinuate to adnate, occasionally subventricose, rose-colored to dull rose-colored. Stipe 45-100 x 2-8 mm, equal or tapering toward apex, tomentose especially above, hollow, subhygrophanous, brown to reddish brown. Basal mycelium pure white. Spores in mass pure white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 10-20 hyphae; terminal cells of fascicular hyphae (n=10) 41.5-53 x 7.4-13.8, subclavate to clavate; walls up to 0.5 μ m thick, light yellowish brown; contents hyaline to light yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel to subparallel; hyphae mostly 3.7-9.2 μ m diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 30-44 x 8.7-13.8 μ m, L/W = 2.99-4.25, clavate, elongate, hyaline; sterigmata 4, up to 7 μ m long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) (7.4-)7.8-9.2(-9.7) x (7.4-)7.8-9.2(-9.7) μ m (mean dimensions = $8.4 \pm 0.6 \times 8.3 \pm 0.6 \mu$ m), L/W = 1-1.06 (mean L/W = 1.01 ± 0.02), globose, occasionally subglobose, hyaline, echinulate; spines (0.9-) 1.4-1.8 μ m long, crowded; hilar appendage 1.2-1.8 μ m long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 4-10.5 μ m diam, undifferentiated, tightly interwoven, hyaline; cells long, occasionally barrel-shaped.

OBSERVATIONS: The type collection is in good condition. Although the basidiospore size and shape presented here fit the original circumscription, the length of spore ornamentation observed in this study was larger than that reported by Singer (1967). Additionally, he reported numerous cheilocystidia ("cheilocystides et cystidioles nombreuses pres de l'arete, versiforme, le plus souvent filamenteuses-subclaviculees, simple ou fourchues-ramifiees, 17-29 x 3-4, 7 μ ").

Agaricus bellus Persoon. 1801. Synopsis methodica fungorum. p. 452.

Type specimen (not located).

MACROMORPHOLOGY (Teste Persoon, Ibid.): BASIDIOMA: Pileus fleshy, umbilicate, squamulose, yellow. Lamellae decurrent-toothed, distant. Stipe 25 mm long, thin, tough, lighter colored than pileus.

OBSERVATIONS: No authentic material of A. bellus could be found at L, LG, or GOET. Berkeley and Broome (1883) included this name in their new genus Laccaria and other workers, including Rea (1922), concurred. Without a representative specimen from which to obtain micromorphological data, however, I support the thesis of Dennis et al. (1960) that the name should be considered a nom. dubium.

Laccaria laccata var. bicolor Maire. 1937. Pub. Inst. Bot.

Barcelona 3: 84.

Type specimen (HOLOTYPE): MPU - Maire; Spain: Catalonia, Collado de Tosses. 7.X.1933. [!]

MACROMORPHOLOGY (Teste Maire, Ibid.): BASIDIOMA: Pileus reddish, squamulose. Lamellae distant, lilac. Stipe reddish. Basal mycelium wooly, violet.

OBSERVATIONS: The single basidiocarp of the type collection is severely infected by an "Aspergillus-like" fungus. Because of distortion caused by the parasite, no micromorphological data could be obtained. My concept of the taxon is based, therefore, on Maire's description and on the common usage of the name (Korf, 1982a; 1982b). The following description is presented to illustrate my concept of the taxon.

Specimen presented as representative material of this paper's concept: TENN No. 42529; USA: WA, King Co., near Pedmond, Watermain Woods. 24.X.1981.

MACROMORPHOLOGY (Mihi): BASIDIOMA: Pileus 12-43 mm broad (mean = 6.3 mm), convex, often depressed, not striate, fibrillose-scaly, occasionally becoming scaly, hygrophanous, pinkish flesh color ("Onion-skin Pink"), fading to ("Salmon-Buff"); margin decurved, entire to undulate, becoming eroded. Lamellae moderately deep, thick, adnate-arcuate, moderately distant, light vinaceous to light pinkish flesh color ("Pale Purplish Vinaceous" to "Pale Congo Pink" to "Light Congo Pink"). Stipe 48-120 x 3-10 mm (mean = 85 x 4 mm), equal with bulbous base, occasionally slightly clavate, dry, fibrillose, longitudinal-striate, light pinkish flesh color ("Flesh Pink"); striations darker ("Cacao Brown" to "Pecan Brown"). Basal mycelium copious, hygrophanous, when fresh violet ("Pale Vinaceous-Lilac"), becoming white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 15-30 hyphae; terminal cells of fascicular hyphae ($n=10$) 37-76 x (6-)10-17.5 μ m, subclavate to clavate; walls up to 0.5 μ m thick, light to moderate yellowish brown; contents hyaline to light yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae mostly 3.7-6 μ m diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated.

Basidia (n=15) 33-43.5 x 9.7-12 μ m, L/W = 2.88-4.33, clavate, elongate, hyaline; sterigmata 4, up to 6.4 μ m long. Pleurocystidia lacking. Cheilocystidia (n=10) 29-50 x 2.3-3.7 μ m, L/W = 9.7-15.11, undifferentiated to subclavate, abundant, extending well beyond basidia and basidioles, hyaline. Basidiospores (excluding ornamentation) (n=30) 7-8.3 x (6-)6.4-7.8 μ m (mean dimensions = $7.6 \pm 0.4 \times 7.1 \pm 0.5 \mu$ m), L/W = 1-1.16 (mean L/W = 1.07 ± 0.05), subglobose to broadly elliptical, rarely globose, hyaline, echinulate; spines 0.9-1.8 μ m long, crowded; hilar appendage 1.3-1.9 μ m long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 5-9.8 μ m diam, tightly interwoven, undifferentiated, long-celled, hyaline.

CULTURE MAT ANALYSIS: MACROMORPHOLOGY: PDA: Radius at week III 14-19 mm, week VI 23-30 mm; mat felty, moderately thick to thick, tightly interwoven, submerged, with time forming pruinose aerial layer out from plug, becoming furrowed due to irregular infolding near plug, not translucent, dark, bright violet, fading to light orange brown, week VI violet only at 3-4 mm band near margin, most of mat light orange brown; aerial hyphae light grayish violet; margin 1-2 mm broad, subfelty, thin, light violet; plug soon becoming light orange brown. MNM: Radius at week III 37-45 mm, week VI 58-64 mm; mat subfelty to silky, thin, loosely interwoven, submerged, translucent, very light to light violet, becoming buff-colored; margin 1-2 mm broad, subfelty to silky, thin, even to serrate, light violet; plug concolorous. ME: Radius at week III 32-43 mm, week IV 68-76 mm;

mat subfelty, almost felty near plug, moderately thick, becoming thick, tightly interwoven, submerged, only slightly translucent, white; margin subfelty, thin, loosely interwoven, very uneven, white; plug white. EXTRACELLULAR OXIDASE: Reaction moderate blue color immediately.

CULTURE MAT ANALYSIS: MICROMORPHOLOGY: PDA: Hyphae mostly undifferentiated with scattered irregular swollen hyphae, purplish brown in mass; chlamydospores very abundant, often in long chains. MNM: Hyphae undifferentiated; chlamydospores common at plug. ME: Hyphae undifferentiated; chlamydospores abundant.

Laccaria masonii var. brevispinosa McNabb. 1972. New Zealand J. Bot. 10: 466-467.

Type specimen (HOLOTYPE): PDD - McNabb PDD 29641; New Zealand: Nelson, Lake Daniels track. 16.V.1969. [!]

MACROMORPHOLOGY (Teste McNabb, Ibid.): BASIDIOMA: Pileus 5-35 mm broad, convex to plano-convex, occasionally plane at maturity, glabrous or minutely furfuraceous at disc, translucent striate at margin, hygrophanous, violaceous with buff tints when young, fading until entirely buff at maturity. Lamellae up to 4 mm deep, adnexed to adnate, distant, thick, pallid violaceous when young, becoming pallid brownish pink, occasionally with faint violaceous tints, glaucous. Stipe up to 100 x 1-2.5 mm, 3-6 mm diam at base, tough, dry, longitudinally fibrillose-sulcate, violaceous when young, becoming buff at base, finally entirely buff except for violaceous tints at

apex. Basal mycelium pallid violaceous. Spores in mass white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered small fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 5-10(-15) hyphae; terminal cells of fascicular hyphae (n=10) 33-62 x 5.5-13 μ m, undifferentiated to swollen, subclavate to clavate, light to moderate yellowish brown in mass; walls up to 0.5 μ m thick, light yellowish brown; contents hyaline to moderate yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae 2.5-7 μ m diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 29-39 x 7.8-11.5 μ m, L/W = 2.88-4.6, clavate, elongate, hyaline; sterigmata 4, up to 6.5 μ m long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) 6-8.3(-9.2) x 6-8.3(-8.7) μ m (mean dimensions = 7.5 ± 0.8 x 7.2 ± 0.7 μ m), L/W = 1-1.13(-1.16) (mean L/W = 1.04 ± 0.05), globose to subglobose, occasionally broadly elliptical, hyaline, echinulate; spines 1.4-1.8 (-2.3) μ m long, crowded; hilar appendage 1.3-1.8 μ m long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 2.5-7.4(-15) μ m diam, long-celled, undifferentiated, tightly interwoven, hyaline.

OBSERVATIONS: Although the basidiospore shape and size fit the original circumscription, I measure the size of the ornamentation as slightly longer than McNabb ("spines 1.2-1.5 μ m long"). Additionally, McNabb reported the presence of cystidia ("paraphyses

numerous, simple or sparingly branched, filamentous, to 3 μ m diam, projecting beyond basidia"). This discrepancy is probably due to the poor preservation of the collection. The specimens appear to have been over-dried, and consequently the material did not rehydrate well. Due to PDD policy, only half of the type collection was sent on loan. Thus, the possibility exists that more variation is present in the complete type collection than described above.

Laccaria bullulifera Singer in Singer and Moser. 1965. Mycopath. Mycol. 26: 149.

Type specimen (HOLOTYPE): MICH - Singer M1581; Mexico: Popocatepetl. 21.VIII.1957. [not seen]

MACROMORPHOLOGY (Teste Singer, Ibid.): BASIDIOMA: Pileus 10 mm broad, convex, depressed, fibrillose, fulvous to reddish brown. Lamellae not broad, thick, subdecurrent to decurrent, distant, flesh color. Stipe 40 x 2 mm, tapering above; fibrillose, subconcolorous with pileus. Basal mycelium amethyst lilac.

MICROMORPHOLOGY (Teste Singer, Ibid.): LAMELLAE: Trama parallel. Basidia 30-31 x 8.5-10 μ m, 4-sterigmate. Cheilocystidia 14 x 9.3 μ m, balloon-shaped to subglobose, hyaline. Basidiospores 7-9 x 6.3-7.7 μ m (including ornamentation), globose to broadly elliptical, hyaline, echinulate; spines 0.3-0.9 μ m long.

OBSERVATIONS: No material of this taxon could be located at MICH. Although validly published in Singer and Moser (1965), the full description is found in Singer, 1957.

Laccaria calospora Singer. 1973. Sydowia 7: 7-8.

Type specimen (HOLOTYPE): FH - Southwick; USA: MA, Waban.
21.VI.1945. [!]

MACROMORPHOLOGY (Teste Singer, Ibid.): BASIDIOMA: Pileus 15-26 mm broad, convex, becoming depressed, occasionally becoming concave, finely fibrillose-asperate, hygrophanous, dingy purple-violet ("Vinaceous Purple") fading to dingy violaceous brown to buff color ("Fawn Color" to "Army Brown"); margin frequently sulcate. Lamellae 2-3 mm broad, distant, sinuate to arcuate, many-ranked, purplish ("Amaranth" or "Wild Aster"). Stipe 38-50 x 3-9 mm, tapering toward apex, fibrillose, striate above, concolorous with pileus. Basal mycelium tomentose, subconcolorous. Spores in mass violaceous ("Pale Verbena Violet").

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with numerous fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 10-20 hyphae; terminal cells of fascicular hyphae ($n=10$) 32-69 x 8-11 μm , undifferentiated to clavate, occasionally capitate or broadly clavate; walls up to 0.5 μm thick, light yellowish brown; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae mostly 3.7-10.6 μm diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia ($n=15$) 32-46 x 8.5-13.3 μm , L/W = 2.57-4.33, clavate, elongate, hyaline; sterigmata 4, up to 8.3 μm long. Pleurocystidia lacking. Cheilocystidia ($n=10$) 36.5-64.5 x 5.5-7.8 μm , L/W = 4.95-10.06,

undifferentiated to subclavate, scattered, extending well beyond basidia and basidioles, hyaline. Basidiospores (excluding ornamentation) ($n=30$) $7.4-8.7 \times 6.9-8.3 \mu\text{m}$ (mean dimensions = $8 \pm 0.4 \times 7.7 \pm 0.5 \mu\text{m}$), $L/W = 1-1.12$ (mean $L/W = 1.03 \pm 0.04$), globose to subglobose, rarely broadly elliptical, hyaline, echinulate; spines $1.4-2.3 \mu\text{m}$ long, crowded; hilar appendage $1.2-1.8 \mu\text{m}$ long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly $3.2-12 \mu\text{m}$ diam, tightly interwoven, hyaline; cells long, undifferentiated to barrel-shaped.

Agaricus (Laccaria) canaliculata Cooke & Massee. 1889. Grevillea 18: 2.

Type specimen (HOLOTYPE): K - Baily 710; Australia: Brisbane. Before 1889. [!]

MACROMORPHOLOGY (Teste Cooke & Massee, Ibid.): BASIDIOMA: Pileus submembranous, small, becoming umbilicate, velvety, radially sulcate, light brown; margin slightly crenulate. Lamellae broad, subdistant, adnate, flesh-colored, with a white dust. Stipe thin, equal, longitudinally fibrillose, becoming hollow, pallid.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven; hyphae up to $10.6 \mu\text{m}$ diam; cells undifferentiated to barrel-shaped; walls up to $0.5 \mu\text{m}$ thick, light yellowish brown; contents hyaline to light yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae $3.6-9.2 \mu\text{m}$ diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia

(n=15) 30.5-50.5 x 7.8-12.4 μ m, L/W = 3.01-4.83, clavate, elongate, hyaline; sterigmata 2(-4), up to 7.8 μ m long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) 7.4-9.7 x (6.9-)7.4-9.2(-9.7) μ m (mean dimensions = 8.6 ± 0.7 x 8.3 ± 0.7 μ m), L/W = 1-1.05(-1.17) (mean L/W = 1.03 ± 0.05), globose to subglobose, rarely broadly elliptical, hyaline, echinulate; spines < 0.5-1.4(-1.8) μ m long, crowded; hilar appendage 1.3-2 μ m long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 8.3-20.2 μ m diam, tightly interwoven, hyaline; cells barrel-shaped.

OBSERVATIONS: The type collection consists only of part of one basidiocarp.

Laccaria laccata var. carbonicola Singer. 1967. Bull. Soc. Mycol. France 83: 110.

Type specimen (HOLOTYPE): FH - Singer; USA: MA, Blue Hills. 11.XI.1943. [not seen]

MACROMORPHOLOGY (Teste Singer, Ibid.): BASIDIOMA: Pileus 10-30 mm broad, convex, becoming depressed, glabrous, translucent-striate when fresh, strongly hygrophanous, reddish fawn color when fresh. Lamellae moderately broad, adnexed or adnate, subdistant, dull rose color. Stipe 40-60 x 3-7 mm, equal or tapering toward the apex, finely fibrillose, farinaceous at apex, concolorous with pileus; apex often paler. Basal mycelium white. Spores in mass white.

MICROMORPHOLOGY (Teste Singer, Ibid.); LAMELLA: Basidia 40-47 x 9 μ m, 4-sterigmate. Cheilocystidia not observed.

Basidiospores 7.7-8.2 x 6.5-7.2 μm (including ornamentation); spines mostly 0.7 μm long.

OBSERVATIONS: This collection could not be found at FH.

Laccaria chibinensis Michailovski. 1974. Mikologia Fitopatologia 8: 523-524.

Type specimen (HOLOTYPE): LE - Michailovski; USSR: Murmansk. 5.VII.1973. [!]

MACROMORPHOLOGY (Teste Mikhailovski, Ibid.): BASIDIOMA: Pileus 20-40 mm broad, convex, then cushion-shaped, glabrous, not hygrophanous, ochraceous-dark brown ("ochraceo-fuscidulus," Michail.), tinted with a light blue pruina ("vix coerulescenti-pruinosis," Michail.); margin entire. Lamellae distant, decurrent, moderately thick, sublilac-ochraceous ("sublilacino-ochraceae," Michail.). Stipe 30-45 x 8-15 mm, subclavate, rarely entire, fleshy, subfibrose, hollow, concolorous with pileus, lacking pruina.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with numerous scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 10-30 hyphae; terminal cells of fascicular hyphae ($n=10$) 23-53 x 5.5-10.6 μm , undifferentiated to swollen, subclavate, clavate to capitate, light yellowish brown in mass; walls up to 0.5 μm thick, light yellowish brown; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae 2.8-7 μm diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia ($n=10$) 33-46 x 8.7-11 μm , L/W = 3.39-4.36,

clavate, elongate, hyaline; sterigmata (2-)4, up to 6 μm long.

Pleurocystidia lacking. Cheilocystidia (n=10) 27-50.5 x 2.3-4.1 μm , L/W = 8.62-11.22, undifferentiated to subcapitate, abundant, extending a moderate distance beyond basidia and basidioles, hyaline.

Basidiospores (excluding ornamentation) (n=30) 6.9-9.2 x 6.4-8.3 μm (mean dimensions - $8.1 \pm 0.6 \times 7.4 \pm 0.5 \mu\text{m}$), L/W = 1-1.2 (mean L/W = 1.09 ± 0.06), globose to subglobose, rarely broadly elliptical, hyaline, echinulate; spines (0.9-)1.4-1.8 μm long, wide at base, relatively crowded; hilar appendage 1.3-1.8 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 4-11.5 μm diam, tightly interwoven, hyaline; cells long, barrel-shaped.

Laccaria laccata var. chilensis Singer. 1967. Bull. Soc. Mycol. France 83: 109.

Type specimen (HOLOTYPE): BAFC - Singer M5514; Chili: Valdivia, Cordillera Pelada, El Mirador. 5.V.1965. [!]

MACROMORPHOLOGY (Teste Singer, Ibid.): BASIDIOMA: Pileus 12-24 mm broad, convex, slightly applanate to depressed at center, glabrous, innately fibrillose under hand lens, occasionally rivulose in age, hygrophanous, rose-brown-colored, fading to ochre when dehydrated. Lamellae moderately broad, subdistant, adnate, dull rose-colored. Stipe at least 2.5-3 times longer than diam of pileus, tapering slightly toward apex, slightly fibrillose with longitudinal innate fibrils, stuffed, concolorous with pileus or browner. Basal mycelium pure white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with widely scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 5-15 hyphae; terminal cells of fascicular hyphae (n=10) 33-60 x 4.6-10 μ m, undifferentiated to subclavate; walls up to 0.5 μ m thick, light yellowish brown; contents hyaline to light or moderate yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae mostly 4.6-13.8 μ m diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 31-42 x 7.8-11 μ m, L/W = 3.21-4.65, clavate, elongate, hyaline; sterigmata 4, up to 7 μ m long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) 6.4-7.8 x 6-7.4(-7.8) μ m (mean dimensions = 7.3 ± 0.4 x 6.7 ± 0.5 μ m), L/W = 1-1.16 (mean L/W = 1.08 ± 0.06), globose to subglobose, rarely broadly elliptical, hyaline, echinulate; spines (< 0.5-)1.4-1.8 μ m long, crowded; hilar appendage 1.5-2.2 μ m long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 4.6-13.8 μ m diam, tightly interwoven, hyaline; cells long, undifferentiated to barrel-shaped.

OBSERVATIONS: The type collection consists only of one sporocarp. Singer (1967) reports very infrequent cheilocystidia ("Cheilocystides et cystidioles tres esparses, filamenteuses ou versiformes").

Clitocybe laccata var. decurrans Peck. 1912. Ann. Rept. N.Y. State Bot. 157: 92.

Type specimen (HOLOTYPE): NYS - Peck; USA: N.Y., Warren Co., Bolton Landing. August. [!]

MACROMORPHOLOGY (Teste Peck, Ibid.): Differing from the type by its distinctly decurrent to arcuate-decurrent lamellae.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with very numerous fascicles of $\pm$ perpendicular loosely interwoven hyphae; fascicles usually composed of 5-10 hyphae, occasional perpendicular single hyphae; terminal cells of fascicular hyphae ($n=10$) $30-55 \times 4.6-9.2 \mu\text{m}$, undifferentiated to subclavate, rarely clavate; walls up to $0.5 \mu\text{m}$ thick, light yellowish brown; contents of hyphae light yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae usually $3.7-10 \mu\text{m}$ diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia ($n=15$) $30-46 \times 11-14.7 \mu\text{m}$, $L/W = 2.29-4.1$, clavate, elongate, hyaline; sterigmata 4, up to $9.2 \mu\text{m}$ long. Pleurocystidia lacking. Cheilocystidia ($n=10$) $27-41 \times 2.8-4.6 \mu\text{m}$, $L/W = 6.8-14.61$, undifferentiated to subcapitate, rarely branched, abundant, extending well beyond basidia and basidioles, thin-walled, hyaline. Basidiospores (excluding ornamentation) ($n=30$) $7.4-9.2(-11.5) \times 6.9-9.2(-10) \mu\text{m}$ (mean dimensions = $8.6 \pm 0.9 \times 8 \pm 0.8 \mu\text{m}$), $L/W = 1-1.14(-1.24)$ (mean $L/W = 1.08 \pm 0.07$), globose to subglobose, occasionally broadly elliptical, hyaline, echinulate; spines ($< 0.5-$) $0.9(-1.4) \mu\text{m}$ long, crowded; hilar appendage $1.3-1.8 \mu\text{m}$ long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM:

Hyphae mostly 2.3-4(-8.2) μm diam, long-celled, undifferentiated, tightly interwoven, hyaline.

Agaricus demissus Fries. 1821. Sys. Mycol. I: 157.

Type specimen (lacking).

MACROMORPHOLOGY (Teste Fries, Ibid.): BASIDIOMA: Pileus 4-5 lines broad, convex, striate, reddish brown. Lamellae distant, subdecurrent, purple. Stipe short, glabrous, dark reddish brown.

OBSERVATIONS: Without micromorphological data it is impossible to clarify the concept of this taxon. Thus, the name is treated as a nom. dubium.

Agaricus echinospermus Britzelmayer. 1893. Hym. Sudb., Bot. Centralbl. 54: 5-6. f. 512 & f. 518.

Type specimen (lacking).

MACROMORPHOLOGY (Teste Britzelmayer, Ibid.): BASIDIOMA: Pileus glabrous to slightly fibrillose, somewhat translucent, yellowish brown to brown. Lamellae adnate, rather crenate, whitish to brownish. Stipe solid yellowish brown to brown, lighter underneath.

MICROMORPHOLOGY (Teste Britzelmayer, Ibid.): LAMELLA: Basidiospores 6-8 μm diam, angular spined.

OBSERVATIONS: The protologue stated that this taxon was similar to A. echinosporous. Without additional micromorphological data, however, it is impossible to clarify the concept of this taxon. Thus, the name is treated as a nom. dubium.

Agaricus (Clitocybe) echinosporus Spegazzini. 1880. *Anales de la Soc. Cient. Argentina* 10: 123.

Type specimen (HOLOTYPE): LPS - Spegazzini 2891; Argentina: La Baea. V.1880. [!]

MACROMORPHOLOGY (Teste Spegazzini, Ibid.): BASIDIOMA: Pileus 5-10 mm broad, hemispherical to subglobose, becoming plano-convex, centrally depressed, radially sulcate, pellucid, subhygrophanous, rose-colored; disc darker; margin straight, wavy to subcrenulate. Lamellae up to 2.5 mm broad, distant, thick, fleshy, acute at apex, long decurrent, entire, more pallid than pileus. Stipe 10-15 x 1.5-3.5 mm, terete, fragile, fibrous-fleshy, rose-colored; base subclavate.

MICROMORPHOLOGY (Mihi): LAMELLA: Trama parallel; hyphae mostly 2.7-12 μ m diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=9) 39-64 x 10-13.8 μ m, L/W = 3.6-4.67, clavate, elongate, hyaline, not rehydrating well; sterigmata 2, up to 10.7 μ m long, stout. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) 11-13.8(-15.6) x 11-14.7 μ m (mean dimensions = 12.5 ± 1.1 x 12.4 ± 1.02 μ m), L/W = 1-1.06 (mean L/W = 1.01 ± 0.02), globose, occasionally subglobose, hyaline, echinulate; spines 2.3-3.2(-3.7) μ m long, 1.3-1.8 μ m wide at base, very crowded; hilar appendage 1.5-2.3 μ m long, prominent, truncate; plage present; contents often uniguttulate.

OBSERVATIONS: The type collection consists only of a fragment of one small pileus. No observations could be made on cuticular

arrangement or on stipe characteristics. No cystidia were observed although the original description reported them ("basidia . . . (55-60 x 10), cystidiis major, . . ."). The discrepancy between Spegazzini's and my description may be due to poor rehydration or to the absence of cystidia in the preparations I examined.

Agaricus (Clitocybe?) fallacious Spegazzini. 1880. Acad. Nac. Cien. Cordoba. XI:139.

Type specimen (not located).

MACROMORPHOLOGY (Teste Spegazzini, Ibid.): BASIDIOMA: Pileus 25-75 mm broad, hemispherical to convex, becoming plane to concave, glabrous, flesh color or honey color to tawny; margin plane to revolute. Lamellae broad, sinuate to adnate, subdistant, very light rose color. Stipe 125-200 x 7-10 mm, equal or tapering slightly above base often thickened, glabrous, dark red or tawny.

MICROMORPHOLOGY (Teste Spegazzini, Ibid.): LAMELLA: Basidiospores 10 x 6 μ m, ovoid, smooth, hyaline.

OBSERVATIONS: No collections of this taxon were included with the other material received from LPS. Based on the original description, I doubt that it is a Laccaria, however, it is impossible to clarify the concept of this taxon without an examination of representative material. Thus, the name is considered a nom. dubium.

Laccaria flavo-brunnea Lebedeva. 1949. Opredelitel' Shlyapochykh Gribov. p. 350.

Type specimen (not located).

OBSERVATIONS: No authentic material of this name was included with the material on loan from LE. Additionally, I have not located a copy of the original description. At this time, therefore, the name is considered a nom. dubium.

Agaricus flavo-fuscus Britzelmayr. 1894. Hym. Sudb. VIII:4. f. 441.

Type specimen (lacking).

MACROMORPHOLOGY (Teste Britzelmayr, Ibid.): BASIDIOMA:

Lamellae white or brownish.

MICROMORPHOLOGY (Teste Britzelmayr, Ibid.): LAMELLA:

Basidiospores smooth.

OBSERVATIONS: The protologue stated that this taxon was very similar to A. alpestris and that it was hard to tell the two apart. Based on the report that the basidiospores are smooth, I doubt that this taxon is a Laccaria. Without additional micromorphological data, however, it is impossible to clarify the concept of this taxon. Thus, the name is treated as a nom. dubium.

Laccaria fibrillosa McNabb. 1972. New Zealand J. Bot. 10: 468-469.

Type specimen (HOLOTYPE): PDD - McNabb PDD 29639; New Zealand: Nelson, Lake Daniels track. 15.V.1969. [!]

MACROMORPHOLOGY (Teste McNabb, Ibid.): BASIDIOMA: Pileus 5-35 mm broad, strongly convex, becoming convex to plano-convex, umbonate, radially fibrillose, disc scurfy, fibers aggregated toward margin, hygrophanous, buff with faint violaceous tints, fibrils dark brown to brownish black at disc, paler toward margin; margin often dentate to lacerate with age. Lamellae $\geq$ 5 mm broad, adnexed to adnate, distant, pallid violaceous, often becoming buff with age,

glaucous. Stipe 20-70 x 1.5-3 mm, equal or slightly expanded at base, tough, dry, hollow, longitudinally fibrillose-striate, pallid, violaceous when young, fading to buff from base upward, at maturity buff with violaceous tints at extreme apex. Basal mycelium pallid violaceous. Spores in mass white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle composed of $\pm$ parallel, radially arranged hyphae covering disc, separating toward margin yielding an appearance similar to spokes of a wheel; hyphal elements (n=10) 33-60 x 6-10 μ m; cells barrel-shaped; walls up to 0.5 μ m thick, light to moderate yellowish brown; contents moderate to dark brown in mass. Trama tightly interwoven, undifferentiated, hyaline to light yellowish brown. LAMELLA: Trama parallel to sub-parallel; hyphae 2.5-9.2 μ m diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 38.5-60 x 9.2-14.3 μ m, L/W = 3.38-5.44, clavate, elongate, hyaline; sterigmata 4, up to 7.5 μ m long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) 6.9-8.7 x 6.9-8.7 μ m (mean dimensions = $8.9 \pm 0.6 \times 8.8 \pm 0.6 \mu$ m), L/W = 1-1.12 (mean L/W = 1.02 ± 0.04), globose to subglobose, hyaline, strongly echinate; spines (1.4-)1.8-2.3(-2.8) μ m long, not crowded; hilar appendage 1.4-2 μ m long, prominent, truncate; plage present; contents usually uniguttulate. BASAL MYCELIUM: Hyphae mostly 2.5-9.2 μ m diam, undifferentiated, tightly interwoven, hyaline.

OBSERVATIONS: McNabb (1972) reported that the cuticle was "composed of unspecialized, repent, interwoven, thin-walled, clamped

hyphae. . . ." This discrepancy may be due to poor rehydration in the material I examined. In longitudinal section, the cuticular arrangement was not discernible, and my data were based on a whole mount of a scalp section. Due to PDD policy, only half of the type collection was sent on loan. Thus, the possibility exists that more variation is present in the complete type collection than described above.

Agaricus fraternus Cooke & Massee. 1887. *Grevillea* 16: 31.

Type specimen (HOLOTYPE): K - French No. 1; Australia: vic. Port Phillip. [!]

MACROMORPHOLOGY (Teste Cooke & Massee, Ibid.): BASIDIOMA: Pileus convex, depressed, umbilicate, smooth, glabrous, dark-rusty-red color. Lamellae broad, subdistant, adnate, rusty-red color. Stipe elongate, thin, tapering toward apex, glabrous, hollow, concolorous with pileus.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 10-20 hyphae; individual hyphae not discernible, moderate to dark yellowish brown in mass. Trama tightly interwoven, undifferentiated, hyaline, light to moderate yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae 2.8-10 μ m diam, thin-walled, hyaline to light yellowish brown. Subhymenium undifferentiated. Basidia (n=15) 29-44 x 8.3-12 μ m, L/W = 2.87-4.6, clavate, elongate, hyaline; sterigmata 2, up to 11 μ m long, stout. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation)

(n=30) (8.3-)9.2-11(-11.5) x 8.7-10.6(-11.5) μ m (mean dimensions = $9.9 \pm 0.7 \times 9.9 \pm 0.7 \mu$ m), L/W = (0.95-)1-1.06(-1.09) (mean L/W = 1.01 ± 0.03), globose, occasionally subglobose, hyaline, echinulate; spines (0.9-)1.4-1.8 μ m long, crowded; hilar appendage 1.3-2.8 μ m long, prominent, truncate; plage present; contents often uniguttulate.

OBSERVATIONS: The type collection consists only of a fragment of one small pileus and a short segment of stipe. Additionally, individual hyphae of the cuticle were not discernible due to poor rehydration.

Laccaria galerinoides Singer in Singer & Moser. 1965. Mycopath. Mycol. 26: 147-148.

Type specimen (HOLOTYPE): BAFC - Singer M3212; Chile: Valdivia, Cordillera Pelada, 930-1000 m. alt. 28.III.1963. [!]

MACROMORPHOLOGY (Teste Singer & Moser, Ibid.): BASIDIOMA: Pileus 16-17 mm broad, convex, centrally depressed, glabrous, pellucid striate, occasionally sulcate, light ochraceous-brown (13 L 11), golden-ochraceous (11 J 7) at margin, becoming sordid (tc 14 A 10). Lamellae subcrowded to subdistant, adnate, moderately thick, entire, pallid ochraceous-isabelline (11 B 5), becoming avellaneous-argillaceous, 2-ranked; lamellulae narrow. Stipe 95-115 x 2-5 mm, glabrous, tubular, with distinct superficial innate striations, radicating, ochraceous-brown (13 J 12) to red-brown (7 J 12) to almost black, much lighter color toward apex. Basal mycelium white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 10-20 hyphae; terminal cells of fascicular hyphae (n=10) 37-57.5 x 6.4-12 μ m, undifferentiated to subclavate, rarely clavate; walls up to 0.5 μ m thick, light yellowish brown; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel to subparallel; hyphae mostly 3.7-19 μ m diam, thin-walled, hyaline to light yellowish brown. Subhymenium undifferentiated. Basidia (n=15) 29-40 x 9.2-11 μ m, L/W = 2.87-4.25, clavate, elongate, hyaline; sterigmata 4, up to 6.4 μ m long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) 7.4-9.7(-10) x 5.5-7.8 μ m (mean dimensions = 8.5 ± 0.7 x 6.3 ± 0.6 μ m), L/W = 1.16-1.52 (mean L/W = 1.34 ± 0.08), elliptical to amygdaliform, rarely subglobose, hyaline, echinate; spines 0.9-1.4(-1.8) μ m long, not crowded; hilar appendage 1.5-2.3 μ m long, very prominent, truncate; plage present; contents occasionally uniguttulate.

OBSERVATIONS: The type collection consists only of one sporocarp lacking the stipe base. The spores observed in this study were larger than those reported by Singer (Singer & Moser, 1968) ("sporis 7-8 x 5.7-6, 8 μ "). Although not stated, Singer's spore measurements usually include ornamentation. Additionally, Singer (Singer & Moser, 1965) reports sparse cheilocystidia ("cheilocystiis sparsis, ad nec non prope aciem visis, hyalinis, $\pm$ 2, 5 μ latis").

Laccaria laccata var. gibba Singer. 1969. Beih. Nova Hed. 29: 27.

Type specimen (HOLOTYPE): SGC - Singer M6738; Chile:

Valdivia, Cordillera Pelada. 6.V.1967. [!]

MACROMORPHOLOGY (Teste Singer, Ibid.): BASIDIOMA: Pileus 10-16 mm broad, convex, becoming plane, umbonate, glabrous, when dry with innately appressed subtile fibers, radially pellucid striate, sulcate, hygrophanous, reddish-brown (between 14 A 11 and 5 C 11); margin light flesh color (between 11 C 7 and 12 E 8). Lamellae broad, distant, adnate or adnate-decurrent or decurrent, rose-colored (between 3 A 10 and 9 A 6). Stipe 45-50 x 2-2.5 mm, equal or narrowed at apex, glabrous when moist, hygrophanous, dark red (6 J 12); apex lighter color. Basal mycelium white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven, no fascicles of hyphae observed; terminal hyphal cells (n=10) 38-67 x 7-18 μ m, subclavate to clavate, light yellowish brown in mass; walls up to 0.5 μ m thick, light yellowish brown; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae thin-walled, hyaline to light yellowish brown. Subhymenium undifferentiated. Basidia (n=15) 29-48 x 7.4-11 μ m, L/W = 2.99-6.53, clavate, elongate, hyaline; sterigmata (2-)4, up to 7 μ m long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) 7-8.7 x (5-)6-7.4 μ m (mean dimensions = $7.8 \pm 0.5 \times 6.3 \pm 0.5 \mu$ m), L/W = 1.08-1.35(-1.38)

(mean L/W = 1.25 ± 0.07), occasionally subglobose, usually broadly elliptical to elliptical, hyaline, echinulate; spines 0.9-1.8(-2.3) μm long, not crowded; hilar appendage 1.3-1.8 μm long, prominent, truncate; plage present; contents occasionally uniguttulate.

OBSERVATIONS: The type collection consists only of one pileus and one stipe segment without base. Singer (1969) reported shorter spore ornamentation ("spinulis 0, 3-0, 9 μ projicientibus") than that presented here. The specimen examined lacked lamellar margins, so no observation of cheilocystidia was possible. Singer (1969) reported "inconspicuis subfilamentosis consistente" cystidia.

Laccaria glabripes McNabb. 1972. New Zealand J. Bot. 10: 477-478.

Type specimen (HOLOTYPE): PDD - McNabb PDD 29640; New Zealand: Nelson, Lake Daniels track. 25.IV.1969. [!]

MACROMORPHOLOGY (Teste McNabb, Ibid.): BASIDIOMA: Pileus 5-25(-35) mm broad, convex, becoming plano-convex, applanate, occasionally depressed, conspicuously pellucid-striate when wet, slightly sulcate, almost glabrous when wet, minutely furfuraceous when dry, hygrophanous, flesh pink to reddish brown, drying buff, disc darker; margin reflexed in age. Lamellae up to 6 mm deep, thick, adnate to subdecurrent, distant, intermixed, flesh pink, glaucous. Stipe 25-60 x 1.5-3.5 mm, equal, dry, glabrous, appearing cartilaginous when wet, not longitudinally fibrillose, reddish brown, concolorous with disc. Basal mycelium white. Spores in mass white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered small fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 5-10 hyphae; terminal cells of fascicular hyphae (n=10) 33-60 x 6-10 μ m, undifferentiated to slightly swollen, subclavate to subcapitate, occasionally strangulate, light yellowish brown in mass; walls up to 0.5 μ m thick, light yellowish brown; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae 2.5-10 μ m diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 38.5-60 x 9.2-14.3 μ m, L/W = 3.38-5.44, clavate, elongate, hyaline; sterigmata 4, up to 9.2 μ m long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) 6.9-8.7 x 6.9-8.7 μ m (mean dimensions = $7.9 \pm 0.5 \times 7.8 \pm 0.5 \mu$ m), L/W = 1-1.12 (mean L/W = 1.02 ± 0.04), globose to subglobose, rarely broadly elliptical, hyaline, echinulate; spines (1.4-)1.8-2.3(-2.8) μ m long, wide at base, relatively crowded; hilar appendage 1.3-1.9 μ m long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 2.3-12.4 μ m diam, tightly interwoven, hyaline; cells long, barrel-shaped.

OBSERVATIONS: Due to PDD policy, only half of the type collection was sent on loan. Thus, the possibility exists that more variation is present in the complete type collection than described above.

Agaricus (Clitocybe) glaucipes Berkeley & Curtis. 1859. Ann. Mag. Hist., III. 4: 284.

Type specimen (HOLOTYPE): K - Curtis No. 5546; USA: CT, coll. C. Wright. No date. [!]

MACROMORPHOLOGY (Teste Berkeley & Curtis, Ibid.): BASIDIOMA: Pileus 25 mm broad, convex, thin, pubescent, pale rufous; margin incurved. Lamellae moderately distant, adnate, white. Stipe 50 x 6 mm, solid, concolorous with pileus.

OBSERVATIONS: The type collection consists of one very moldy basidiocarp. No micromorphological observations, therefore, could be obtained. Additionally, the original description does not include micromorphological data. Although the original description stated that it was allied to A. laccata, it is impossible to clarify the concept of this taxon and its identity remains uncertain. Thus, the name is considered a nom dubium.

Naucoria goossensiae Beeli. 1928. Bull. Soc. Roy. Bot. Belg. 61: 88.

= Laccaria laccata f. bispora Heinemann. 1964. Bull. Jard. Bot. Bruxelles 34: 310-311.

Type specimen (HOLOTYPE): BR - Goossens 558; Zaire: Ori, Nioka. V.1926. [!]

MACROMORPHOLOGY (Teste Beeli, Ibid.): BASIDIOMA: Pileus 25-35 mm broad, convex to umbilicate, glabrous, brownish rust color; margin incurved. Lamellae up to 7 mm broad, adnate or free, brownish

red color. Stipe 45 x 4-5 mm, cylindrical, thickened at base, glabrous, hollow, concolorous with pileus.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 10-15 hyphae; terminal cells of fascicular hyphae (n=5) 37-57.5 x 5-10.6 μ m, undifferentiated to subclavate to clavate, light to moderate yellowish brown in mass; walls up to 0.5 μ m thick, light yellowish brown; contents hyaline to light yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae 2.5-10(-15.6) μ m diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 28-44 x 9.2-12.4 μ m, L/W = 2.51-4.33, clavate, elongate, hyaline; sterigmata 2(-4), up to 13.8 μ m long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) (7.8-) 8.7-11(-11.5) x (7.4-)7.8-10.1 μ m (mean dimensions = 9.9 ± 0.9 x 8.9 ± 0.7 μ m), L/W = 1.04-1.2(-1.22) (mean L/W = 1.11 ± 0.06), subglobose to broadly elliptical or broadly amygdaliform, echinulate; spines < 0.5-1.4 μ m long, crowded; hilar appendage 1.3-2.3 μ m long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 4.6-12.5 μ m diam, hyaline, light to moderate yellowish brown in mass; cells long, barrel-shaped.

Clitocybe tortilis var. gracilis Peck. 1902. Ann. Rep. N.Y. State Museum 67: 36.

Type specimen (HOLOTYPE): NYS - Earle; USA: N.Y., Bronx,
N.Y. Bot. Garden. 13.VII.1902. [!]

MACROMORPHOLOGY (Teste Peck, Ibid.): BASIDIOMA: Pileus
3-6 lines broad, thin, convex, slightly umbilicate, becoming
depressed or infundibuliform in age, irregular, striate, hygrophanous,
when fresh reddish flesh color, paler when dry. Lamellae broad,
distant, adnate to decurrent, pruinose when old and dry. Stipe 6-10
x 0.5 lines, glabrous, hollow.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with a
few widely scattered small fascicles of $\pm$ perpendicular hyphae;
terminal cells of fascicular hyphae (n=5) 39-67 x 10-13 μ m, undif-
ferentiated to subclavate, not rehydrating well; walls up to 0.5 μ m
thick, light to moderate yellowish brown; contents hyaline to light
yellowish brown. Trama tightly interwoven, undifferentiated, very
thin, hyaline to light yellowish brown. LAMELLA: Trama parallel;
hyphae usually 2.3-8.3 μ m diam, thin-walled, hyaline to light yellow-
ish brown; cells long, barrel-shaped. Subhymenium undifferentiated.
Basidia (n=15) 37-60 x 8.3-13.8 μ m, L/W = 3.14-5.44, clavate, elongate,
hyaline; sterigmata 4, up to 7 μ m long. Pleurocystidia lacking.
Cheilocystidia (n=10) 33-55 x 2.8-4 μ m, L/W = 9.54-14.92, undif-
ferentiated, occasionally subcapitate, relatively abundant, extending
well beyond basidia and basidioles, thin-walled, hyaline.
Basidiospores (excluding ornamentation) (n=30) (7.8-)8.3-10.6 x
7.8-10(-10.6) μ m (mean dimensions = $9.3 \pm 0.7 \times 9.1 \pm 0.7 \mu$ m),
L/W = 1-1.06(-1.11) (mean L/W = 1.02 ± 0.03) globose, occasionally
subglobose, hyaline, echinulate; spines 1.4-2.3(-2.8) μ m long,

crowded; hilar appendage 1.3-1.8 μ m long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 3.7-8.3 μ m diam, tightly interwoven, hyaline; cells long, undifferentiated to barrel-shaped.

OBSERVATIONS: Because the type variety has much larger spores and 2-sterigmate basidia, I judge this taxon as not a variety of L. tortilis.

Agaricus grumatus Scopoli. 1772. Flora Carniolica. p. 433.

Type specimen (lacking).

MACROMORPHOLOGY (Teste Scopoli, Ibid.): BASIDIOMA: Pileus convex, dry, filamentous. Lamellae free, abundant. Stipe long, glabrous, hollow.

OBSERVATIONS: Fries (1836-1838) stated that this taxon showed affinities to A. pachyphyllus Fries which showed affinities to A. laccatus. However, without micromorphological data, it is impossible to clarify the concept of this taxon. Thus, the name is treated as a nom. dubium.

Agaricus (Clitocybe) incongruus Berkeley. 1850. J. Bot. (Hooker) 2: 48.

Type specimen (HOLOTYPE): K - Berkeley; Jillapahar, Darjeeling. Aug.-Sept. [!]

MACROMORPHOLOGY (Teste Berkeley, Ibid.): BASIDIOMA: Pileus 31 mm broad, umbilicate, smooth, dry, cinereous-blue; margin undulate; context white. Lamellae 150 x 12 mm, subclavate, slightly fibrillose, hollow, concolorous with pileus.

OBSERVATIONS: The type collection consists of only one stipe with an attached pileus fragment. Almost no hymenial material was available for micromorphological analysis. Additionally, the original description does not include micromorphological data. Although the only basidiospores seen were nodulose and not echinulate, so few were observed that it was thought unwise to base any conclusions on these micromorphological data. Berkeley (1850) considered it "A very curious species, resembling somewhat the amethyst form of A. laccatus, and perhaps as nearly allied to that species as to any described." Without micromorphological data, however, it is impossible to clarify the concept of this taxon and its identity remains uncertain. Thus the name is considered as a nom. dubium.

Laccaria laccata var. intermedia Singer. 1977. Plant Syst. Evol. 126: 368-369.

Type specimen (HOLOTYPE): F - Singer C5664; CSSB: Moravia, Jeseniky, Reiviz pr. Jesenik. 24.VII.1974. [!]

MACROMORPHOLOGY (Teste Singer, Ibid.): BASIDIOMA: Pileus 10-24 mm broad, convex, soon becoming plane to centrally depressed, when fresh glabrous and bare, or near glabrous, when dried fibrous to filamentous, strongly hygrophanous, red-brown to flesh-colored to pallid (e.g., 11 B 6 to 11 C 6); disc subtomentose to tomentose, darker red-brown or more sordid-rose than pileus; margin translucent striate or sulcate. Lamellae moderately broad, subcrowded to subdistant, adnate to decurrent, at least partially curved, flesh-rose to dull flesh-colored. Stipe 30-62 x 1.8-5.8 mm, equal or

thickened at base, glabrous, becoming coarse-fibred and rough, hygrophanous, concolorous with pileus or darker brown along basal half. Basal mycelium white. Spores in mass white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 15-30 hyphae; terminal cells of fascicular hyphae (n=10) 33.5-50.5 x 6-9.2 μ m, undifferentiated to slightly swollen, some subclavate, light yellowish brown in mass; walls up to 0.5 μ m thick, light yellowish brown; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle.

LAMELLA: Trama parallel, hyphae 3-11.5 μ m diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 35-48.5 x 8.7-12.9 μ m, L/W = 3.04-4.65, clavate, elongate, hyaline; sterigmata 4, occasionally 2 or 3, up to 8.3 μ m long. Pleurocystidia lacking. Cheilocystidia (n=10) 31-47 x 2.8-7.4 μ m, L/W = 5.97-11, undifferentiated to strangulate, common, extending well beyond basidia and basidioles, hyaline.

Basidiospores (excluding ornamentation) (n=30) (6.4-)7.4-10(-12.9) x (6.4-)6.9-10(-12.4) μ m (mean dimensions - 8.9 ± 1.4 x 8.6 ± 1.3 μ m), L/W = 0.95-1.18(-1.28) (mean L/W = 1.04 ± 0.08), globose to subglobose, occasionally broadly elliptical, hyaline, echinulate; spines 1.4-1.8(-2.3) μ m long, not crowded; hilar appendage 1.3-1.8 μ m long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 3.5-14 μ m diam, tightly interwoven, hyaline; cells long, barrel-shaped.

OBSERVATIONS: I measure the spore spines as longer than reported by Singer (1977) ("0,7-1,3 μm hoch ist, selton 1,5 μm erreicht").

Agaricus laccatus Scopoli. 1772. Flora Carniolica. 444 pp.

Type specimen lacking.

Specimen presented as material representative of this paper's concept: TENN No. 42546; USA: IL; Jackson Co., Devil's Kitchen Rec. Area. 9.VI.1981.

MACROMORPHOLOGY (Mihi): BASIDIOMA: Pileus 8-28 mm broad, convex to plane, some depressed in age, not striate, finely fibrillose, hygrophanous, orange brown when fresh ("Sanford's Brown" to "Orange Rufous" or Cinnamon-Rufous") fading lighter ("Apricot Buff" to "Salmon Color"), finally to buff ("Pale Ochraceous Buff"); margin incurved to decurved, entire to undulate, some becoming eroded; context concolorous with surface. Lamellae very broad, thick, sinuate to adnate, subdistant, pinkish flesh color ("Flesh Color" to "Salmon-Buffer" or "Flesh-Pink"). Stipe 18-64 x 2-5 mm, equal, occasionally slightly bulbous, fibrillose, longitudinally striate, concolorous with pileus. Basal mycelium white. Spores in mass white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered fascicles of $\perp$ perpendicular hyphae; fascicles usually composed of 10-25 hyphae; terminal cells of fascicular hyphae ($n=10$) (16-)33.5-60 x 6.5-11 μm , undifferentiated to subclavate; walls up to 0.5 μm thick, light to moderate yellowish brown; contents hyaline

to light yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae mostly 3.5-8.5 μm diam, thin-walled, hyaline to light yellowish brown; cells long, undifferentiated to barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 36-50.5 x 10.5-15 μm , L/W = 3.23-4.58, clavate, elongate, hyaline; sterigmata 4, up to 9.5 μm long. Pleurocystidia lacking. Cheilocystidia (n=10) 33-55.5 x 3-4.6 μm , L/W = 10.28-17.14, undifferentiated to subclavate, abundant, extending well beyond basidia and basidioles, hyaline. Basidiospores (excluding ornamentation) (n=30) 8.3-10 x 7.8-9.2(-9.7) μm (mean dimensions - $9.2 \pm 0.5 \times 8.7 \pm 0.5 \mu\text{m}$), L/W = 1-1.17 (mean L/W = 1.06 ± 0.050 , globose to subglobose, rarely broadly elliptical, hyaline, echinulate; spines 0.9-1.8 μm long, crowded; hilar appendage 1.3 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 3.2-4.6 μm diam, tightly interwoven, undifferentiated, long-celled, hyaline.

CULTURE MAT ANALYSIS: MACROMORPHOLOGY: PDA: Radius at week III 11-12 mm, week VI 23-24 mm; mat felty, thick, tightly interwoven submerged, forming cottony to felty aerial layer away from plug, not translucent, white, becoming light chocolate color away from plug; margin narrow, silky to subfelty, thin, white entire to slightly undulate; plug becoming covered with white aerial hyphae, chocolate brown. MNM: Radius at week III 27-34 mm, week VI 47-55 mm; mat relatively thin, silky to subfelty, somewhat interwoven, submerged, translucent, white; margin narrow, silky to subfelty, not well

differentiated, even to slightly undulate, white; plug white. ME: Radius at week III 31-33 mm, week VI 51-54 mm; mat silky, very thin, only slightly interwoven, submerged, translucent, white; margin silky, not differentiated, even, white; plug white.

CULTURE MAT ANALYSIS: MICROMORPHOLOGY: PDA: Hyphae undifferentiated; chlamydospores scarce and widely scattered. MNM: Hyphae undifferentiated; chlamydospores none observed. ME: Hyphae undifferentiated; chlamydospores scarce and widely scattered.

OBSERVATIONS: At present, no acceptable type specimen exists for this taxon. Singer (1967) proposed a lectotype-topotype from Femsjo, Sweden. This typification, however, has several problems. First, since the collection was not available to Scopoli when he proposed the name, it cannot be a lectotype. Second, the type locality is southern Austria and not southern Sweden. This is because the first binomial for the taxon, A. laccatus, was proposed by Scopoli (1772) from the Austrian Tyrol. Fries (1821) accepted the name, thus, according to the current ICBN, gave the name special priority. However, this constitutes only a nomenclatural act, and not a taxonomic act, thus, Scopoli's collecting area is the type locality. Finally, the specimen chosen by Singer has basidiospore characteristics which are near the extreme range for the taxon, even as circumscribed by Singer. Until a suitable collection from the Austrian Tyrol has been designated as a neotype, the above described collection (TENN 42546) can be used to determine the concept of the taxon used in this paper.

Russuliopsis laricina Velenovsky. 1939. Novitates Mycologicae.
p. 77.

Type specimen (lacking).

MACROMORPHOLOGY (Teste Velenovsky, Ibid.): Basidioma: Pileus
10 mm broad, plane, becoming depressed, glabrous, translucent-striate,
dirty ochre-yellow. Lamellae broad, narrowed at margin, broadly
adnate, not decurrent, crowded, white, becoming clay-colored. Stipe
2-3 times longer than pileus diameter, 1-1.5 mm broad, equal,
straight, glabrous, translucent, fragile.

MICROMORPHOLOGY (Teste Velenovsky, Ibid.): LAMELLA:
Basidiospores 3-5 μ m diam, globose, smooth.

OBSERVATIONS: Type material of this name was not found at
either PRM or PRC. Based on the original description, I doubt that
it is a Laccaria, however, it is impossible to clarify the concept of
this taxon without an examination of representative material. Thus,
the name is considered a nom. dubium.

Laccaria lateritia Malençon. 1966. Bull. Soc. Mycol. France 82:
189.

Type specimen (HOLOTYPE): Herb. G. Malençon - Malençon No.
5102; Morocco: I.S.C.

Specimen examined as representative material: Felippone No.
2800; Uruguay: Montevideo. 1927.

MACROMORPHOLOGY (Teste Malençon, Ibid.): BASIDIOMA: Pileus
10-25 mm broad, thin, almost hemispherical to convex, centrally
truncate or slightly depressed, becoming plane, when wet

pellucid-striate to disc, not striate when dry, hygrophanous, indistinctly reddish-brown to dark brick red (8, 78, 82, Klincksieck), becoming pallid. Lamellae broad, moderately thick, moderately crowded, mostly adnate to arcuate, pallid rose colored to purple-ochraceous (to 87 or 92, Klincksieck). Stipe 20-25 x 2-5 mm, thickened at base, striate, often compressed-sulcate and twisted, reddish-brown, base vinaceous when immature (39, 54, 58, Klincksieck; Seguy 102, 106; Saccardo badius), lacking purple color when mature, pallid when dry. Basal mycelium white. Spores in mass white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 10-20 hyphae; terminal cells of fascicular hyphae long, narrow, undifferentiated to subclavate, occasionally clavate, light to moderate yellowish brown in mass; walls up to 0.5 μ m thick, light yellowish brown; contents hyaline to light yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae mostly 3.7-10.5 μ m diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 29-46 x 7.8-11 μ m, L/W = 2.77-4.55, clavate, elongate, hyaline; sterigmata 2, up to 10 μ m long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) 8.3-11 (-13.3) x 8.3-10.6(-13.3) μ m (mean dimensions - $9.7 \pm 1.04 \times 9.5 \pm 1.1$ μ m), L/W = (0.95-)1-1.06(-1.11) (mean L/W = 1.02 ± 0.03), globose to subglobose, rarely broadly elliptical or broadly amygdaliform,

hyaline, echinulate; spines 0.9-1.4 μ m long, crowded; hilar appendage 1.4-2.3 μ m long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 2.7-6.5 μ m diam, narrow, undifferentiated, tightly interwoven, hyaline.

OBSERVATIONS: Because the holotype was not available for study, the micromorphological description above was based on an authentic collection on loan from Montpellier. Of the four authentic collections made available to me, the above was chosen because Malençon mentioned that it was the first collection he saw of the taxon (Malençon, 1966). Additionally, two of the other three were not suitable. One collection was badly parasitized, and the other packet stated that it was a robust form of the taxon and, therefore, was not typical. The collection used was also somewhat parasitized, and cuticular characters were difficult to ascertain and the presence of cheilocystidia impossible to determine.

Laccaria lavendipes Mueller. 1982. This paper p. 105.

Type specimen (HOLOTYPE): TENN - TENN No. 42521; USA: TN, Sevier Co., GSMNP, 5 km east of Clingmans Dome. 6.IX.1980. [!]

MACROMORPHOLOGY (Mihi): BASIDIOMA: Pileus 13-29 broad (mean = 20 mm), obtuse to convex, not striate, dry, strongly pruinose to fibrillose, occasionally becoming finely scaly, hygrophanous, brownish orange (6C6 = "carmel" to 6C7 = "reddish golden" to 6D7 = "raw sienna," Methuen), drying buff; margin decurved, entire.

Lamellae very deep, thick, sinuate to adnate, subdistant to distant,

pinkish flesh-color (7A3 = "pale red" to 7B3 = "greyish red," Methuen). Stipe 22-46 x 2-6 mm (mean = 35 x 3.3 mm), equal or occasionally with bulbous base, fibrillose, longitudinally striate, concolorous with pileus. Basal mycelium light violet when fresh, hygrophanous. Spores in mass white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered fascicles of $\perp$ perpendicular hyphae; fascicles usually composed of 5-15 hyphae; terminal cells of fascicular hyphae (n=10) 36-57.5 x 7-13(-16) μm , undifferentiated to clavate, rarely capitate; walls up to 0.5 μm thick, light to moderate yellowish brown; contents hyaline to light yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae mostly 3.7-9.5 μm diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=10) 30-40.5 x 8.7-11 μm , L/W = 2.96-4.44, clavate, elongate, hyaline; sterigmata 4, up to 7 μm long. Pleurocystidia lacking. Cheilocystidia lacking. Basidiospores (excluding ornamentation) (n=30) 6.4-8.7 x 6.4-7.4(-8.3 μm) (mean dimensions = 7.6 ± 0.6 x 6.9 ± 0.5 μm), L/W = 1-1.22 (mean L/W = 1.1 ± 0.06), subglobose to broadly elliptical, rarely globose, echinulate; spines 0.9-1.4(-1.8) μm long, crowded; hilar appendage 1.3-2 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 3.7-12 μm diam, tightly interwoven, hyaline; cells long, barrel-shaped.

CULTURE MAT ANALYSIS: MACROMORPHOLOGY: PDA: Radius at week III 23-26 mm, week VI 48-53 mm; mat felty, moderately thick, tightly interwoven, submerged, with time forming pruinose aerial layer out from plug, not translucent, at first dark violet, fading to light orange brown, week III dark bright violet broad band near margin, light orange brown from plug; week VI moderate violet at band near margin, most of mat light orange brown, short aerial hyphae light grayish violet; margin 1-2 mm broad, felty, moderately thick, entire to slightly sulcate, light violet to white; plug concolorous with mat. MNM: Radius at week III 36-37, week VI 63-70; mat subfelty to cottony, thin, becoming moderate, loosely interwoven, with scattered small sectors of longer loosely interwoven hyphae, submerged, translucent becoming only slightly translucent, very light violet becoming white; margin not well differentiated, uneven, concolorous with mat; plug concolorous. ME: Radius at week III 26-27 mm, week VI 54-57 mm; mat silky to subfelty, thin, subparallel to loosely interwoven, submerged, translucent, white; margin undifferentiated, entire, white; plug white. EXTRACELLULAR OXIDASE: Reaction negative.

CULTURE MAT ANALYSIS: MICROMORPHOLOGY: PDA: Hyphae mostly undifferentiated with a few scattered irregular swollen hyphae; chlamydospores scarce, widely scattered. MNM: Hyphae undifferentiated; chlamydospores absent. ME: Hyphae undifferentiated; chlamydospores scarce, widely scattered, most numerous at plug.

Laccaria lilacina Stevenson. 1964. Kew Bull. 19: 3.

Type specimen (HOLOTYPE): K - Stevenson 924; New Zealand: Woodside. 1.VII.1955. [!]

MACROMORPHOLOGY (Teste Stevenson, Ibid.): BASIDIOMA: Pileus 40-55 mm broad, convex to plane, fibrillose becoming finely scaly due to cuticular diffraction, fawn-colored with fulvous fibrils; margin upturned, often split. Lamellae adnate, distant, lilac, mealy. Stipe 100 x 30-40 mm, subfibrous, silky striate, dull fawn. Basal mycelium white. Spores in mass white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with numerous large fascicles of $\pm$ perpendicular hyphae; fascicles composed of up to 40 hyphae; terminal cells of fascicular hyphae ($n=10$) $39-60 \times 5.1-12.4 \mu\text{m}$, undifferentiated to somewhat swollen to subclavate, dark yellowish brown in mass; walls up to $0.5 \mu\text{m}$ thick, light yellowish brown; contents moderate to dark yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light to moderate yellowish brown toward cuticle. LAMELLA: Trama parallel to subparallel; hyphae $2.8-9.2 \mu\text{m}$ diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia ($n=15$) $37-50.5 \times 6.9-11 \mu\text{m}$, $L/W = 3.64-5.47$, clavate, elongate, hyaline; sterigmata 4, up to $10 \mu\text{m}$ long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) ($n=30$) $(6.9-7.4-9.7 \times 6.9-9.7 \mu\text{m})$ (mean dimensions - $8.4 \pm 0.7 \times 8.3 \pm 0.7 \mu\text{m}$), $L/W = 1-1.07$ (mean $L/W = 1.01 \pm 0.03$), globose, occasionally subglobose, hyaline, echinulate; spines $(0.9-1.4-1.8$

(-2.3), up to 1 μm wide at base, crowded; hilar appendage 1.3-2.5 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae 2.8-7.4 μm diam, undifferentiated, tightly interwoven, hyaline; wall up to 0.5 μm thick.

OBSERVATIONS: The spore size and ornamentation length reported here are somewhat larger than those presented in Stevenson's original description ("Sporae 7-8 μm diam., spinis 0.5-1 μm longis").

Clitocybe laccata f. lilipuntuana Rich. 1930. Broteria, Ser. Bot. 24: 100.

Type specimen (not located).

OBSERVATIONS: No authentic material of this name was located. Additionally, I did not locate a copy of the original description. At this time, therefore, the name is considered a nom. dubium.

Russuliopsis lineata Velenovsky. 1920. Ceske Houby. p. 279.

Type specimen (not seen).

MACROMORPHOLOGY: (Teste Pilat, 1948): BASIDIOMA: Pileus 10-20 mm diam, obtuse to convex, becoming plane, occasionally slightly umbonate, translucent-striate, hygrophanous, honey-colored to sombre brown when fresh, when dry almost white. Lamellae broad, thin, becoming rounded-free, farinaceous, white. Stipe 2-4 times longer than pileus diameter, 2-3 mm thick, equal, base not thickened, glabrous to finely fibrillose, longitudinal-striate, covered with white spores at apex, slight gray color. Spores in mass white.

MICROMORPHOLOGY (Teste Pilat, 1948): LAMELLA: Basidiospores 8-9 μm diam, globose, thick, tunicate, echinulate, hyaline.

OBSERVATIONS: A formalin preserved specimen of this taxon was supposed to be sent to me from PRC but I never received it. Without additional micromorphological data, it is impossible to clarify the concept of this taxon. Thus, the name is considered as a nom. dubium.

Agaricus (Clitocybe) laccata var. lutea Fries. 1836-1838. Epicr. Syst. Mycol. p. 79.

Type specimen (lacking).

MACROMORPHOLOGY (Teste Fries, Ibid.): BASIDIOMA: As in type variety, lamellae flesh color.

OBSERVATIONS: Without micromorphological data it is impossible to clarify the concept of this taxon. Thus, the name is treated as a nom. dubium.

Agaricus (Clitocybe) laccata var. [pileo] luteoviolaceo Fries. 1836-1838. Epicr. Syst. Mycol. p. 79.

Type specimen (lacking).

MACROMORPHOLOGY (Teste Fries, Ibid.): BASIDIOMA: Pileus drying ochraceous. Lamellae violaceous.

OBSERVATIONS: Without micromorphological data it is impossible to clarify the concept of this taxon. Thus, the name is treated as a nom. dubium.

Hygrophorus maritimus Teodorowicz. 1936. Grzby wyższe Poleskiego wybrzeża.

OBSERVATIONS: No response was received from Poland concerning my request of authentic material of this taxon. Additionally, I have

not located a copy of the original description. Singer (1960, 1961) transferred the name to Laccaria and considered it contaxic with L. trullisata var. rugulospora (Singer, 1960, 1961; Holland, 1976).

Laccaria masonii Stevenson. 1964. Kew Bull. 19: 4.

Type specimen (HOLOTYPE): K - Stevenson 733; New Zealand: Silverstream. 19.VII.1949. [!]

MACROMORPHOLOGY (Teste Stevenson, Ibid., McNabb, 1971):

BASIDIOMA: Pileus 0.5-3 cm broad, convex to plano-convex when young, plano-convex, occasionally applanate, glabrous or minutely furfuraceous at disc, pellucid-striate at margin, hygrophanous, violaceous when young, fading to buff at maturity. Lamellae up to 4 mm broad, distant, adnexed to adnate, pallid violaceous when young, becoming pallid brownish pink, occasionally faint violaceous tints remain. Stipe 30-100 x 1-3 mm, swollen at base, longitudinally fibrillose-sulcate, often twisted, violaceous when young, fading with maturity, becoming entirely buff; apex sometimes with violaceous tints. Basal mycelium pallid violaceous. Spores in mass white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with widely scattered small fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 5-10 hyphae; terminal cells (n=10) 46-67 x 8.3-12.9 μ m, undifferentiated to subclavate, light yellowish brown in mass; walls up to 0.5 μ m thick, light yellowish brown; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel to sub-parallel; hyphae 2.8-6.5 μ m diam, thin-walled, hyaline to light

yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 29.5-44 x 7.4-10.6 μm , L/W = 2.91-5.72, clavate, elongate, hyaline; sterigmata 4, up to 9.7 μm long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) 7.8-9.7(-10.6) x (7.4-)7.8-9.7(-10.6) μm (mean dimensions - $8.9 \pm 0.8 \times 8.7 \pm 0.8 \mu\text{m}$), L/W = 1-1.06(-1.11) (mean L/W = 1.02 ± 0.03), globose to subglobose, hyaline, strongly echinulate; spines (1.4-)2.3-4.6(-6.4) μm long, up to 1.8 μm wide at base, occasionally curved, not crowded; hilar appendage 1.3-2.3 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 2.8-5.5 μm diam, tightly interwoven, hyaline; cells long, undifferentiated to barrel-shaped.

OBSERVATIONS: Two taxa were included in Stevenson's original description and illustration of L. masonii. The type collection consists entirely of basidiocarps with glabrous pilei and, thus, the name is restricted to that circumscription. McNabb (1972) proposed L. fibrillosa to represent the other taxon included in the description.

Laccaria microspora Mueller. 1982. This paper, p. 110.

Type specimen (HOLOTYPE): TENN - TENN No. 42528; USA: TN, Blount Co., GSMNP, Cades Cove. 13.IX.1979. [!]

MORPHOLOGY: See p. 110.

Clitocybe (Laccaria) nana var. microspora Lange. 1935. Flora

Agaricina Danica 1: 90.

Type specimen (not located).

MACROMORPHOLOGY (Teste Lange, Ibid.): BASIDIOMA: Pileus 8 mm broad, convex-applanate, not striate, farinaceous, ashy gray; disc somewhat darker. Lamellae narrow, thin, attenuated behind, distant, white. Stipe short, thin, pale ash gray. Spores in mass white.

MICROMORPHOLOGY (Teste Lange, Ibid.): PILEUS: Cuticle with conidiform, lanceolate, ellipsoid cells; cells 12 x 5 μ m. LAMELLA: Basidia (2-)4 sterigmate. Cystidia 6-12 μ m broad, awl shaped-conical. Basidiospores 5 μ m diam, subglobose, warty spinulose.

OBSERVATIONS: No specimens of this taxon was acquired from C. Lange (1935) stated that this taxon is a "very strange little Agaric . . ." and that it required further study. Based on the original description, I doubt that it is a Laccaria, however, until its type specimen is examined, its identity remains uncertain. Thus, the name is considered as a nom. dubium.

Laccaria laccata f. minuta Imai. 1938. J. Fac. Sci. Hokkaido Imp. Univ., Ser. 5, Bot. 18: 90.

Type specimen (HOLOTYPE): SAP - Imai 314; Japan: Prov. Ishikari, Nopporo Forest. 17.VII.1932. [!]

MACROMORPHOLOGY (Teste Imai, Ibid.): BASIDIOMA: Pileus 5-10 mm broad, not striate or only slightly striate. Stipe 25-35 x 1-2 mm, subclavate. All other characters as in the type variety.

MICROMORPHOLOGY (Mihi): LAMELLA: Trama parallel; hyphae mostly 5-13.3 μm diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 30-43 x 9.2-11.5 μm , L/W = 3-4.24, clavate, elongate, hyaline; sterigmata 4, up to 7 μm long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) 6.9-8.7(-9.2) x 6.9-8.7 μm (mean dimensions = $8 \pm 0.6 \times 7.9 \pm 0.6 \mu\text{m}$), L/W = 1-1.06 (mean L/W = 1.01 ± 0.02), globose, rarely subglobose, hyaline, echinulate; spines 0.9-1.8 μm long, moderately crowded; hilar appendage 1.3-1.8 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 4-9.2 μm diam, long-celled, undifferentiated, tightly interwoven, hyaline.

Laccaria laccata var. moelleri Singer. 1973. Sydowia 7: 9-10.

Type specimen (HOLOTYPE): F - Singer C5227; CSSR: Trebon. 30 IX.1970. [!]

MACROMORPHOLOGY (Teste Singer, Ibid.): BASIDIOMA: Pileus 30-69 mm broad, convex, deeply depressed, minutely fibrillose-scabrous, rusty-orange-tawny ("ferrugineo-aurantiaco-fulvo," Singer) or tawny-reddish ("fulvido-rufo," Singer), drying paler at disc; depression frequently minutely papillate; margin sulcate, rarely plicate or lobate. Lamellae moderate to moderately broad (6 mm, occasionally to 8 mm), subcrowded to subdistant, arcuate or adnate, rose flesh-colored ("carneorosellis," Singer), becoming covered with a white powder (?spores). Stipe 100-155 x 5-6(-11) mm; equal or tapering towards

apex; apex finally fibrillose, becoming glabrescent, stuffed becoming hollow, dull yellowish-brown ("fulva-brunneo," Singer) or brownish ("brunneo," Singer). Basal mycelium white. Spores in mass white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 5-10 hyphae; terminal cells of fascicular hyphae ($n=10$) $40.5-60(-76) \times 6.4-16 \mu\text{m}$, undifferentiated to swollen, subclavate to clavate to ventricose-rostrate, light yellowish brown in mass; walls up to $0.5 \mu\text{m}$ thick, light yellowish brown; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia ($n=15$) $34-47 \times 9.7-13 \mu\text{m}$, $L/W = 3.02-4.55$, clavate, elongate, hyaline; sterigmata 4, up to $5.5 \mu\text{m}$ long. Pleurocystidia lacking. Cheilocystidia ($n=10$) $31-57.5 \times 2.8-4.1 (-8.3 \mu\text{m})$, $L/W = 3.77-18.07$, thin, undifferentiated, abundant, extending well beyond basidia and basidioles, hyaline. Basidiospores (excluding ornamentation) ($n=30$) $9.2-11 \times (6.4-)6.7-8.3 \mu\text{m}$ (mean dimensions - $10 \pm 0.6 \times 7.3 \pm 0.4 \mu\text{m}$), $L/W = 1.24-1.56(-1.58)$ (mean $L/W = 1.3 \pm 0.01$), elliptical to amygdaliform, hyaline, echinulate; spines $< 0.5-1.6(-2.3) \mu\text{m}$ long, relatively short, crowded, often with one or two long spines at apex; hilar appendage $1.4-1.8 \mu\text{m}$ long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly $4-5 \mu\text{m}$ diam, narrow, undifferentiated, tightly interwoven, hyaline.

OBSERVATIONS: Although the spore shape and spine length fit the original circumscription, the spores dimensions measured in this study were all larger than the range presented by Singer.

Laccaria laccata var. montana Möller. 1945. Fungi of the Faeröes. pp. 269-270.

Type specimen (HOLOTYPE): C - Möller, Faeröe IIs. Osterø, Slattaratinde. 17.VII.1938. [!]

MACROMORPHOLOGY (Teste Möller, Ibid.): BASIDIOMA: Pileus 7-17 mm broad, convex becoming expanded, depressed in age, occasionally with small papilla, often somewhat irregular, slightly squamulose, hygrophanous, greasy-shiny and deep flesh-colored to pallid brownish-purple when fresh, fading opaque, lighter; margin incurved at first. Lamellae up to 2 mm broad, subdistant, thick, tough, decurrent, emarginate, pale pinkish flesh-colored, becoming white-mealy. Stipe 10-30 x 1-3 mm, occasionally 30 x 1-2 mm, equal or thickened below, straight or strongly flexuose and twisted, strongly fibrillose striate, hollow, concolorous with lamellae. Basal mycelium white. Spores in mass white.

MICROMORPHOLOGY: (Mihi): LAMELLA: Trama parallel; hyphae thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=10) 34.5-45 x 10.6-15.2 μ m, L/W = 2.72-3.48, clavate, elongate, hyaline, not rehydrating well; sterigmata 4, up to 9.2 μ m long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding

ornamentation) (n=30) 8.3-11.5 x (7.8-)8.3-10.6 μm (mean dimensions = $10 \pm 0.9 \times 9.6 \pm 0.9 \mu\text{m}$), L/W = 1-1.11(-1.22) (mean L/W = 1.04 ± 0.06), globose to subglobose, rarely broadly elliptical, hyaline, echinulate; spines < 0.5-1.4 μm long, crowded; hilar appendage 1.3-1.8 μm long, prominent, truncate; plage present, contents occasionally uniguttulate.

OBSERVATIONS: The type collection consists only of lamella fragments. Additionally, the collection is moldy. No observations could be made on cuticular arrangement or on stipe characteristics.

Laccaria montana Singer. 1973. Sydowia 7: 8-9.

Type specimen (HOLOTYPE): F - Singer M5464; Switzerland: Valais, Borgne de Ferpecte. 11.VII.1971. [!]

MACROMORPHOLOGY (Teste Singer, Ibid.): BASIDIOMA: Pileus 7-35 mm broad, convex, occasionally papillate when young, becoming strongly umbilicate to infundibuliform; disc rimulose becoming finely fibrillose, becoming diffracted to squamulose, hygrophanous to subhygrophanous, orangish brown (6 E 12 to 4 B 10 continuing to 7 J 12 to 7 L 12) fading to ochraceous (11 F 7); margin radially sulcate.

Lamellae moderately broad to broad, subcrowded to distant, adnate to decurrent, occasionally anastomosing, rosey-flesh-colored (11 A 8), becoming cinnamon-flesh-colored (5 D 10 to 5 F 11), when dry margin purplish-brown and white pulverulent with spores. Stipe 15-55 x 2-5 mm, usually 16-20 x ± 4 mm, equal, glabrous or innately fibrillose, more pallid than pileus to subochraceous, becoming brownish and frequently variegated (6 B 12 and 14 A 11). Basal mycelium white. Spores in mass white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 15-30 hyphae; terminal cells of fascicular hyphae (n=10) 39-51 x 5.5-10 μ m, undifferentiated to slightly swollen, subclavate, light yellowish brown in mass; walls up to 0.5 μ m thick, light yellowish brown; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel to subparallel; hyphae 3.2-14 μ m diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 42-48 x 10-15.5 μ m, L/W = 3.01-4.78, clavate, elongate, hyaline; sterigmata 4, up to 10.6 μ m long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) (7.8-)8.7-10.6(-11.5) x (6.9-)7.8-10.6 μ m (mean L/W = 1.06 ± 0.06), globose to subglobose, hyaline, echinulate; spines 1.4-1.8 μ m long, not crowded; hilar appendage 1.3-1.8 μ m long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae (2.8-) 11-16(-20.7) μ m diam, tightly interwoven, hyaline; cells short, barrel-shaped.

OBSERVATIONS: Singer (1973) reported occasional cheilocystidia ("cheilocystidiis 17-47.5 x 5.5-9.5 μ m, versiformibus, clavatis, ventricose, cylindraceis vel flexuosis, frequenter pedicelliatibus, hyalinis vel rubenscentibus, sat numerous"). The discrepancy between Singer's and my descriptions may be due either to poor rehydration or to the absence of cheilocystidia in the preparations I examined.

Laccaria murina Imai. 1938. J. Fac. Sci. Hokkaido Imp. Univ., Ser. 5, Bot. 18: 91.

Type specimen (not located).

MACROMORPHOLOGY (Teste Imai, Ibid.): BASIDIOMA: Pileus 10-15 mm broad, hemispherical to convex, becoming plane, subvelutinous, striate, dark, dirty brown, almost black when young and fresh, mouse gray or subavellaceous when dry; margin involuted at first. Lamellae thick, distant, adnate, gray, becoming pruinose with white spores. Stipe 15-25 x 1.5-2.5 mm, equal or tapering slightly above, striate, subconcolorous or slightly more pallid. Spores in mass white.

MICROMORPHOLOGY (Teste Imai, Ibid.): LAMELLAE: Basidiospores 7.5-10 μ m, globose, verruculose.

OBSERVATIONS: No collection of this taxon was included with the other material received from SAP.

Laccaria nana Massee. 1913. Kew Bull. 6: 2.

Type specimen (HOLOTYPE): K - Massee; England: Grounds of Royal Botanic Gardens, Kew, Surrey. Before 1913. [!]

MACROMORPHOLOGY (Teste Massee, Ibid.): BASIDIOMA: Pileus 10 mm broad, plano-convex, glabrous, smooth, dark cinnamon-colored, becoming pallid; margin at first farinaceous. Lamellae subdistant, attenuate-adnate, pallid, becoming covered with a white powder. Stipe 10 mm long, fibrillose, hollow, white.

MICROMORPHOLOGY (Mihi): LAMELLA: Trama parallel; hyphae thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia not rehydrating,

?clavate, elongate, hyaline; sterigmata 2. Pleurocystidia ?lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) 10.6-12.9(-13.8) x 10.6-12.9(-13.8) μm (mean dimensions = $11.7 \pm 0.9 \times 11.5 \pm 0.9 \mu\text{m}$), L/W = 1-1.04(-1.09) (mean L/W = 1.01 ± 0.03), globose, rarely subglobose, hyaline, strongly echinulate; spines (2.3-)2.8-4.1 μm long, 1.8-2.3 μm wide at base, very crowded; hilar appendage 1.3-2 μm long, prominent, truncate; plage present; contents usually uniguttulate.

OBSERVATIONS: The type collection consists only of a few small lamella fragments. These fragments, however, contain numerous basidiospores.

Laccaria nigra Hongo. 1959. Mem. Shiga. Univ. 9: 58-59.

Type specimen (HOLOTYPE): Hongo - 1779; Japan: Omi-Jingu, Otsu, Shiga. 10.VI.1958. [!]

MACROMORPHOLOGY (Teste Hongo, Ibid.): BASIDIOMA: Pileus 8-22 mm broad, obtuse, conic to convex, becoming expanded, often with large umbo, glabrous, pellucid-striate, hygrophanous, grayish-subfuscus, disc almost black; flesh thin, membranous, concolorous, with an alkaline odor. Lamellae 1-3 mm broad, distant, moderately thick, adnexed to adnate, ventricose, ash grey color. Stipe 18-35 x 1.5-3 mm, equal, hollow, concolorous with pileus.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 10-20 hyphae; terminal cells of fascicular hyphae undifferentiated to subclavate to clavate, not rehydrating well;

walls up to 0.5 μm thick, light yellowish brown; contents hyaline. Trama tightly interwoven, undifferentiated, narrow, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae mostly 3.5-11 μm diam, thin-walled, hyaline; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 28.5-41 x 10-15.5 μm , L/W = 2.31-3.56, clavate, elongate, hyaline, not rehydrating well; sterigmata 2(-4), up to 9.7 μm long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) (7.8-)8.3-10.6(-12.4) x (7.8-)8.3-10.6(-12.4) μm (mean dimensions = $9.5 \pm 1.04 \times 9.5 \pm 1.05 \mu\text{m}$), L/W = 1(-1.06) (mean L/W = 1 ± 0.01), globose, rarely subglobose, hyaline, echinulate, spines 1.8-2.8(-3.2) μm long, 1.3-1.8 μm wide at base, moderately crowded; hilar appendage 1.6-2 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 2.7-11 μm diam, long-celled, undifferentiated, tightly interwoven, hyaline.

Russuliopsis nigricans Velenovsky. 1939. Novitates Mycologicae. p. 77.

Type specimen (lacking).

MACROMORPHOLOGY (Teste Velenovsky, Ibid.): BASIDIOMA: Pileus 10-15 mm, bell-shaped, translucent-striate, hygrophanous, dark brown (almost black), becoming pale yellow. Lamellae broad, thick, adnate becoming sinuate to free, moderately distant, pale, farinose. Stipe 3 times longer than pileus diameter, 2 mm broad, equal, straight, concolorous.

MICROMORPHOLOGY (Teste Velenovsky, Ibid.): LAMELLA:

Basidiospores 6-8 μ m diam, globose, echinulate.

OBSERVATIONS: Type material of this name was not found at either PRM or PRC. Without additional micromorphological data, it is impossible to clarify the concept of this taxon. Thus, the name is considered as a nom. dubium.

Laccaria nobilis Smith apud Mueller. 1982. This paper, p. 119.

Type specimen (HOLOTYPE): TENN - TENN No. 42527; USA: CO, Larimer Co., Roosevelt National Forest, Rayah Wilderness, Blue Lake Trail. 13.IX.1981. [!]

MACROMORPHOLOGY (Mihi): BASIDIOMA: Pileus 30-60 mm broad (mean = 43.3 mm), convex, deeply depressed, not striate, fibrillose-scaly becoming scaly, brownish orange ("Sanford's Brown" to "Cinnamon-Rufous"), occasionally darker at disc ("Hazel"); margin decurved to upturned, entire to eroded. Lamellae moderately deep, moderately thick, sinuate to adnate, close, pinkish flesh color ("Pale Flesh Color" to "Flesh Color"). Stipe 37-110 x 4-10 mm (mean 79.5 x 6.5 mm), equal or bulbous, dry, fibrillose, fibers forming prominent longitudinal striations, scaly from apex to midstipe, concolorous with pileus. Basal mycelium white. Spores in mass white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 20-30 hyphae; terminal cells of fascicular hyphae (n=10) 36-58.5 x 7.4-13 μ m, subclavate to clavate; walls up to 0.5 μ m thick, light to moderate yellowish brown; contents hyaline to light yellowish

brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae mostly 3.7-10 μm diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 37.5-55 x 7.8-11, L/W = 3.56-5.47, clavate, elongate, hyaline; sterigmata 4, up to 7.4 μm long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) 7.8-9.7(-10.6) x (5-)6.4-7.8(-8.3) μm (mean dimensions = $8.6 \pm 0.7 \times 7.0 \pm 0.6 \mu\text{m}$), L/W = (1.06-)1.13-1.26(-1.9) (mean L/W = 1.23 ± 0.14), broadly elliptical to elliptical or amygdaliform, rarely subglobose or oblong, hyaline, echinulate; spines 0.5-0.9 (-1.4) μm long, crowded; hilar appendage 1.3-2 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 1.8-5.5 μm diam, tightly interwoven, undifferentiated, long-celled, hyaline.

CULTURE MAT ANALYSIS: MACROMORPHOLOGY: PDA: Radius at week III 23-31 mm, week VI 35-42 mm; mat felty, moderately thick to thick, tightly interwoven, submerged, with time forming pruinose aerial layer out from plug, not translucent, at first dark, bright violet, soon fading, by week VI dark purple band (≤ 9 mm) near margin, rest of mat light orange brown; pruinose aerial hyphae light grayish purple becoming light orange brown; margin 3-4 mm broad, subfelty, thin, very uneven, light violet; plug concolorous with mat. MNM: Radius at week III 40-44 mm, week VI 69-78 mm; mat subfelty, thin becoming slightly thicker with age, moderately to tightly interwoven,

submerged, slightly translucent, light violet; margin 3-4 mm broad, silky to subfelty, thin, parallel to loosely interwoven, entire, concolorous; plug concolorous. ME: Radius at week III 33-35 mm, week VI 47-55 mm; mat subfelty, thin, loosely interwoven, submerged, translucent, white; margin 1-2 mm broad, subfelty, thinner than mat, undulate, white; plug white. EXTRACELLULAR OXIDASE: Reaction moderate blue color immediately.

CULTURE MAT ANALYSIS: MICROMORPHOLOGY: PDA: Hyphae mostly undifferentiated with occasional irregular swollen hyphae, purplish brown in mass; chlamydospores very abundant, often in chains of 2-4. MNM: Hyphae mostly undifferentiated with rare, widely scattered irregular swollen hyphae near margin; chlamydospores scarce, widely scattered, restricted to margin. ME: Hyphae undifferentiated; chlamydospores common.

Laccaria oblongospora Mueller. 1982. This paper, p. 123.

Type specimen (HOLOTYPE): TENN - TENN No. 42522; USA: MS, Harrison Co., DeSoto Nat'l Forest, Harrison Experimental Forest, Road H-8. 7.XII.1980. [!]

MACROMORPHOLOGY (Mihi): BASIDIOMA: Pileus 14-54 mm broad (mean = 29 mm), convex becoming plane, often depressed, not striate, finely fibrillose, becoming fibrillose-scaly, hygrophanous, brownish orange ("Cinnamon-Rufous" to "Hazel" to "Sanford's Brown"), occasionally darker at disc ("Chocolate"); margin decurved to upturned, entire to undulate, becoming eroded; context 1-2 mm thick, tapering quickly to margin, flesh-colored ("Pale Vinaceous-Pink"). Lamellae very deep,

thick to very thick, sinuate to adnate, subdistant to distant, pinkish flesh color ("Shell Pink" to "Vinaceous-Pink" to near "Buff-pink"). Stipe 23-60 x 3-10 mm (mean = 41 x 5 mm), equal or bulbous, dry, fibrillose, occasionally finely longitudinal-striate, brownish orange to reddish brown ("Pinkish Cinnamon" to "Cinnamon" to "Cacao Brown"), occasionally fibers darker ("Pecan Brown"). Basal mycelium white. Spores in mass white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle loosely interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 5-15 hyphae; terminal cells of fascicular hyphae (n=10) 28.5-69 x 13-24.5 μ m, subclavate to clavate to capitate; walls up to 0.5 μ m thick, light to moderate yellowish brown; contents hyaline to light yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel to subparallel; hyphae thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=10) 29-36 x 7.4-10 μ m, L/W = 3.2-4.73, clavate, elongate, hyaline; sterigmata 4, up to 5 μ m long. Pleurocystidia lacking. Cheilocystidia (n=10) 31.5-53 x 2.8-7 μ m, L/W = 4.54-12.14, undifferentiated to subclavate, scattered, extending beyond basidia and basidioles, hyaline. Basidiospores (excluding ornamentation) (n=30) (6.8-)7.4-9.2(-10) x (4-)5-6.4(-7) μ m (mean dimensions = $8.4 \pm 0.8 \times 5.8 \pm 0.5$), L/W = (1.25-)1.3-1.67(-1.8) (mean L/W = 1.46 ± 0.13), elliptical to oblong, occasionally subreniform, hyaline, echinulate; spines < 0.5 μ m long, often with 1 or 2 longer spines

(≤ 1.4) at apex, crowded; hilar appendage 1.3-1.8 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 4.6-11 μm diam, tightly interwoven, hyaline; cells long, barrel-shaped.

CULTURE MAT ANALYSIS: MACROMORPHOLOGY: PDA: Radius at week III 31-36 mm, week VI 70-75 mm; mat felty, moderately thick, tightly interwoven, submerged, with time forming pruinose aerial layer out from plug, not translucent, at first dark violet, soon fading; week III moderate violet 2-3 mm band near margin, most of mat light orange brown, week VI all light orange brown; margin up to 5 mm broad, silky to subfelty, thin, uneven, very light violet to white; plug concolorous with mat. MNM: Radius at week III 52-56 mm, week VI filled plate; mat subfelty to subwooly, very thin to thin, loosely interwoven, submerged, translucent, at first light violet, fading to very light violet to white; margin undifferentiated, uneven; plug concolorous with mat. ME: Radius at week III 26-31 mm, week VI 54-60 mm; mat subfelty, very thin, loosely interwoven, submerged, translucent, white; margin 1-2 mm broad, not well differentiated, even, white; plug white. EXTRACELLULAR OXIDASE: Reaction moderate blue color after 1 hr.

CULTURE MAT ANALYSIS: MICROMORPHOLOGY: PDA: Hyphae mostly undifferentiated with scattered irregular swollen hyphae and sub-coralloid hyphae; chlamydospores common. MNM: Hyphae mostly undifferentiated with scattered irregular swollen hyphae; chlamydospores common.

Agaricus (Clitocybe) ochro-purpureus Berkeley. 1845. London J. Bot. 4: 299-300.

Type specimen (HOLOTYPE): K - Lea 261; USA: Cincinnati. No date. [!]

MACROMORPHOLOGY (Teste Berkeley, Ibid.): BASIDIOMA: Pileus 50 mm broad, subhemispherical becoming depressed, fleshy pliant, pallid pale-brown to lightly purplish; cuticle easily separating; margin incurved; at first tomentose. Lamellae thick, not anastomising, decurrent, purple. Stipe 60 mm, swollen at middle, pallid purplish. Basal mycelium white. Spores in mass white.

MICROMORPHOLOGY (Mihi): LAMELLA: Trama parallel; hyphae usually 2.8-7 μm diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=3) 36-45 x 9.2-10.5 μm , L/W = 3.9-4.65, clavate, elongate, hyaline, not rehydrating well; sterigmata 4, up to 6 μm long. Pleurocystidia not observed. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) (6.9-)7.4-8.7 x (6.4-)6.9-8.3(-8.7) μm (mean dimensions = $8 \pm 0.5 \times 7.6 \pm 0.6 \mu\text{m}$), L/W = 1-1.13(-1.16) (mean L/W = 1.06 ± 0.05), globose to subglobose, hyaline, echinulate; spines (<0.5-)0.9-1.4 μm long, crowded; hilar appendage 1.3-1.9 μm long, prominent, truncate; plage present; contents occasionally uniguttulate.

OBSERVATIONS: Due to poor condition of this collection, no observations could be made on cuticular arrangement or the presence or absence of cheilocystidia.

Agarius ohiensis Montagne. 1856. Syll. Crypt. p. 100.

Type specimen (HOLOTYPE): NY - Sullivant; USA: OH: Columbus.

Before 1856. [!]

MACROMORPHOLOGY (Teste Montagne, Ibid.): BASIDIOMA: Pileus 30-50 mm broad, at first hemispherical, becoming convex, deeply depressed, glabrous, striate, cinnamon-colored; margin involuted, becoming expanded. Lamellae 3-5 mm broad, thick, subdistant, decurrent, rose-colored or more pallid than pileus; edge obtuse. Stipe 30-40 x 5-6 mm, thickened at base, striate, hollow, concolorous with pileus. Spores in mass white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven, possibly with scattered fascicles of $\pm$ perpendicular hyphae, not rehydrating well. Trama tightly interwoven, undifferentiated, hyaline, yellowish brown toward cuticle. LAMELLA: Trama parallel, hyphal cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 30-46(-53) x 8.7-14.3 μ m, L/W = 2.83-4.5, clavate, elongate, not rehydrating well, hyaline, sterigmata (2-)4, up to 8.3 μ m long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) 7.4-9.2(-10.1) x 7.4-9.2(-10.1) μ m (mean dimensions = 8.4 ± 0.6 x 8.4 ± 0.6 μ m), L/W = 0.95-1.06 (mean L/W = 1.01 ± 0.03), globose to subglobose, hyaline, echinate; spines 1.4-2.3 μ m long, moderately long, wide at base, hilar appendage 1.8-2.3 μ m long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae not observed (stipe lacking).

OBSERVATIONS: The first published report of the anatomy of the type specimen (Singer, 1942) stated that the basidia were

4-sterigmate. In subsequent papers, however, Singer (1946, 1949, 1967, 1975, 1977) reported that the basidia were 2-sterigmate. My observations of the type specimen along with the description by Lahaie (1981) have confirmed that A. ohiensis is tetrasporic. The type specimen consists only of a fragment of one pileus.

Agaricus orbisporus Britzelmayr. 1898. Revis Hymenomyc. I: 15.

Type specimen (lacking).

MACROMORPHOLOGY (Teste Saccardo, 1912): BASIDIOMA: Pileus 25 mm broad, conical to convex, umbonate, hygrophanous, brownish-gray, becoming pale. Lamellae 4 mm broad, moderately thick, distant, arcuate, gray. Stipe 70 x 5 mm, brownish-gray to white. Spores in mass white.

MICROMORPHOLOGY (Teste Saccardo, 1912): LAMELLA: Basidio-spores 8-10 μ m diam, globose.

OBSERVATIONS: Saccardo (1912) stated that this taxon was similar to A. echinosporus. Without additional micromorphological data, however, it is impossible to clarify the concept of this taxon. Thus, the name is treated as a nom. dubium.

Agaricus pachophyllus Fries. 1815. Obs. I: 76.

Type specimen (lacking).

MACROMORPHOLOGY (Teste Fries, Ibid.): BASIDIOMA: Pileus plano-convex, becoming depressed, somewhat fleshy, grayish-yellow; margin becoming rimose. Lamellae decurrent, light yellow. Stipe 1.5 unc., glabrous, solid becoming hollow, yellow.

OBSERVATIONS: Fries (1821) listed this name, as A. pachyphyllus, as one that needed more study. In 1836-1838, Fries stated that this taxon was similar to A. laccatus. Without micromorphological data, however, it is impossible to clarify the concept of this taxon. Thus, the name is treated as a nom. dubium.

Clitocybe laccata var. pallidifolia Peck. 1890.

Ann. Rep. N.Y. State Bot. 43: 38.

Type specimen (HOLOTYPE): NYS - Peck; USA: NY, Selkirk.

October. [!]

MACROMORPHOLOGY (Teste Peck, Ibid.): BASIDIOMA: Lamellae much paler than typical, with only a tinge of flesh color.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 10-25 hyphae; terminal cells of fascicular hyphae ($n=10$) $24-53 \times 6-10 \mu\text{m}$, undifferentiated to clavate, light yellowish brown in mass; walls up to $0.5 \mu\text{m}$ thick, light yellowish brown; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae $2.8-9.2 \mu\text{m}$ diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia ($n=15$) $39-57.5 \times 10.5-15.5 \mu\text{m}$, $L/W = 2.71-4.64$, clavate, elongate, hyaline; sterigmata 4, up to $9.2 \mu\text{m}$ long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) ($n=30$) $7.8-11(-11.5) \times 7.4-9.2(-10.6) \mu\text{m}$ (mean dimensions = $9.2 \pm 0.9 \times 8.5 \pm 0.8 \mu\text{m}$), $L/W = 1-1.12(-1.2)$ (mean $L/W = 1.08 \pm 0.06$), globose

to subglobose, occasionally broadly elliptical, hyaline, echinulate; spines $< 0.5-1.4(-1.8) \mu\text{m}$ long, crowded; hilar appendage $1.3-2 \mu\text{m}$ long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly $5.2-10.6 \mu\text{m}$ diam, long-celled, undifferentiated, tightly interwoven, hyaline.

OBSERVATIONS: The collection labelled TYPE on loan from NYS contained material from two localities, Selkirk and Lake Mohonk. Specimens from both locations were examined and found contaxic.

Laccaria ohiensis var. paraphysata McNabb. 1972. New Zealand J. Bot. 10: 474-475.

Type specimen (HOLOTYPE): PDD - McNabb PDD 25973; New Zealand: Auckland, Titirangi, Atkinson Park. 12.VII.1967. [!]

MACROMORPHOLOGY (Teste McNabb, Ibid.): BASIDIOMA: Pileus 10-35 mm broad, convex to plano-convex at maturity, occasionally depressed, inconspicuously translucent-striate at margin when wet, not so when dry, finely furfuraceous, hygrophanous, reddish brown to dark reddish brown, drying pallid fawn to buff. Lamellae up to 5 mm deep, thick, adnexed to adnate, distant, flesh pink, glaucous. Stipe 25-70 x 2-5 mm, equal or tapering slightly apically, dry, coarsely and sparingly longitudinally fibrillose, often twisted, reddish brown. Basal mycelium white. Spores in mass white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 5-10 hyphae; terminal cells of fascicular hyphae ($n=10$) $32-64 \times 6.5-10.5 \mu\text{m}$, undifferentiated to swollen, subclavate to

clavate, light yellowish brown in mass; walls up to $0.5\ \mu\text{m}$ thick, light yellowish brown; contents hyaline to light yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel to subparallel; hyphae $3.7\text{--}11\ \mu\text{m}$ diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia ($n=15$) $33\text{--}50.5 \times 8.3\text{--}12\ \mu\text{m}$, $L/W = 2.76\text{--}6.1$, clavate, elongate, hyaline; sterigmata 2(-3), up to $11\ \mu\text{m}$ long. Pleurocystidia ($n=10$) $27\text{--}42 \times 2.3\text{--}4.6\ \mu\text{m}$, undifferentiated to slightly swollen, subclavate to subcapitate to irregularly contorted, sometimes irregularly branched, extending a moderate distance beyond basidia and basidioles, thin-walled, hyaline. Cheilocystidia $20\text{--}41.5 \times 1.8\text{--}3.2\ \mu\text{m}$, $L/W = 6.19\text{--}20.94$, similar to pleurocystidia. Basidiospores (excluding ornamentation) $(7.4\text{--})7.8\text{--}9.7(-11.5) \times 7.4\text{--}9.7(-11.5)\ \mu\text{m}$ (mean dimensions = $9.1 \pm 0.8 \times 8.9 \pm 0.8\ \mu\text{m}$), $L/W = 1\text{--}1.05(-1.12)$ (mean $L/W = 1.02 \pm 0.03$), globose to subglobose, hyaline, echinulate; spines $0.9\text{--}1.4\ \mu\text{m}$ long, crowded; hilar appendage $1.3\text{--}2\ \mu\text{m}$ long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly $2.5\text{--}9.2\ \mu\text{m}$ diam, long-celled, undifferentiated, tightly interwoven, hyaline.

OBSERVATIONS: As discussed under its description, the type specimen of Agarius ohiensis is tetrasporic and not bisporic as had been reported. I judge that this bisporic taxon, therefore, cannot be a variety of L. ohiensis and must be renamed. Thus, the following new combination is proposed.

Laccaria lateritia var. paraphysata (McNabb) Mueller comb. nov.

Basionym: Laccaria ohiensis var. paraphysata McNabb. See above.

Laccaria tetraspora var. peladae Singer. 1967. Bull. Soc. Mycol. France 83: 117.

Type specimen (HOLOTYPE): BAFC - Singer M5515; Chile: Valdivia, Cordillera Pelada, Mirador. 5.V.1965. [!]

MACROMORPHOLOGY (Teste Singer, Ibid.): BASIDIOMA: As in var. tetraspora.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with widely scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 5-10 hyphae; terminal cells of fascicular hyphae ($n=10$) $37-60 \times 5-13.3 \mu\text{m}$, subclavate to clavate; walls up to $0.5 \mu\text{m}$ thick, light yellowish brown; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae mostly $4.6-10 \mu\text{m}$ diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia ($n=15$) $32-44 \times 9.2-12.5 \mu\text{m}$, $L/W = 2.8-3.9$, clavate, elongate, hyaline; sterigmata (2-)4, up to $9.8 \mu\text{m}$ long. Pleurocystidia lacking. Cheilocystidia ($n=10$) $20-34.5 \times 2.8-4 \mu\text{m}$, $L/W = 5.46-11.18$, undifferentiated, abundant, extending a moderate distance beyond basidia and basidioles, thin-walled, hyaline. Basidiospores (excluding ornamentation) ($n=30$) $(6.4-6.9-9.2 \times (6.4-6.9-9.2 \mu\text{m})$ (mean dimensions - $7.9 \pm 0.7 \times 7.8 \pm 0.7 \mu\text{m}$), $L/W = 1-1.06$ (mean $L/W = 1.01 \pm 0.02$), globose, occasionally subglobose, hyaline,

echinulate; spines 0.9-1.4(-1.8) μm , crowded; hilar appendage 1.3-1.8 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 6.4-18 μm diam, tightly interwoven, hyaline, walls up to 0.5 μm thick; cells long, undifferentiated to barrel-shaped.

OBSERVATIONS: The type collection is in good condition. Singer (1967) separated this variety from var. tetraspora solely by its smaller spores and shorter spore ornamentation.

Agaricus (Clitocybe) laccatus var. perpusillus Rabenhorst et al.

1862. Fungi Europaei exsiccati. Cent 5. n. 503.

Type specimen (not located).

Specimen examined as representative material: NY - Rabenhorst No. 503; Finland: Mustiala tradgard. IX.1866. [!]

MICROMORPHOLOGY (Mihi): LAMELLA: Basidia 2-sterigmate. Basidiospores (excluding ornamentation) 10.5-14 μm diam, globose to subglobose, hyaline, echinulate; spines up to 3.2 μm long.

OBSERVATIONS: This collection consisted of only fragments of 2 pilei. Because of the date on the collection (1866), it is doubtful that Rabenhorst had this particular collection available to him when he first designated the variety. Other specimens in the exsiccati, therefore, may be better candidates for typification.

Laccaria tetraspora var. peullensis Singer. 1967. Bull. Soc. Mycol. France 83: 113-114.

Type specimen (HOLOTYPE): BAFC - Singer M1991; Chile: Peulla, Logo, Todas los Santos. 22.III.1959. [!]

MACROMORPHOLOGY (Teste Singer, Ibid.): BASIDIOMA: Pileus 8-10 mm broad, campanulate or conic-obtuse, glabrous, pellucid-striate, hygrophanous, (13 A 8 and 14 A 9). Lamellae moderately broad, adnate (1 C 2 to 3 C 9). Stipe 50-55 x 2-3 mm, equal slender (13 A 9 and 14 A 10). Basal mycelium pale, whitish when dry.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven, no fascicles of hyphae observed, terminal cells (n=10) 28-55 x 6.4-13 μ m, undifferentiated to clavate, occasionally ventricose; walls up to 0.5 μ m thick, light yellowish brown; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae mostly 3.2-8.7 μ m diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 28.5-42 x 10-16.5 μ m, L/W = 2.35-2.37, clavate, elongate, hyaline; sterigmata 4, up to 8.7 μ m long. Pleurocystidia lacking. Cheilocystidia (n=10) 24-38 x 2.8-5.5 μ m, L/W = 6.11-13.14, undifferentiated to subcapitate to narrowly ventricose-rostrate, abundant, extending well beyond basidia and basidioles, thin-walled, hyaline. Basidiospores (excluding ornamentation) (n=30) 7.4-8.7(-9.7) x 7.4-8.7(-9.2) μ m (mean dimensions = $8.1 \pm 0.6 \times 8 \pm 0.5 \mu$ m), L/W = 1(-1.11) (mean L/W = 1.01 ± 0.02), globose, rarely subglobose, hyaline, echinulate; spines 0.9-1.8 μ m long, crowded; hilar appendage 1.3-1.8 μ m long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 1.8-5.5 μ m diam, long-celled, undifferentiated, tightly interwoven, hyaline.

OBSERVATIONS: Type collection consists only of part of one sporocarp.

Agaricus (Clitocybe) porphyrellus Berkeley & Curtis. 1859. Ann. Mag. Nat. Hist. III. 4: 284-285.

Type specimen (HOLOTYPE): K - Curtis No. 5520; USA: CT, coll. C. Wright. No date. [!]

MACROMORPHOLOGY (Teste Berkeley & Curtis, Ibid.): BASIDIOMA: Pileus 37 mm broad, convex, glabrous, pale dull purple. Lamellae pale purple. Stipe 25-37 x 2-3 mm, thickened upwards, glabrous, purplish white.

MICROMORPHOLOGY (Teste Berkeley & Curtis, Ibid.): LAMELLA: Spores elliptic 1/5750 inch long.

OBSERVATIONS: The type collections consists of one very moldy basidiocarp. No micromorphological observations, therefore, could be obtained. Additionally, the original description includes almost no micromorphological data. Berkeley and Curtis (1859) stated that this collection "Differs from A. laccatus in the numerous gills and very different spores." Murril (1916) also reported that the specimen was in poor condition rendering interpretation difficult. He speculated that it is "Prunulus purus or one of the species of Laccaria" (Murril, 1916). Without micromorphological data, therefore, it is impossible to clarify the concept of this taxon and its identity remains uncertain. Thus the name is considered as a nom. dubium.

Laccaria proxima Boudier. 1881. Bull. Soc. Bot. France 28: 91-92.

Type specimen (NEOTYPE, des. mihi): PC - Boudier; France: Montemorency. XI.1904. [!]

MACROMORPHOLOGY (Teste Boudier, Ibid.): BASIDIOMA: Pileus up to 30 mm broad, convex becoming plane, depressed, covered with appressed fibrils, hygrophanous, orange rust ("fauve orange," Boudier); disc becoming squamulose with age; margin striate when moist. Lamellae diam, distant, rather thick, pinkish flesh-colored ("rose carne," Singer), paler toward margin becoming subconcolorous with pileus, often covered with a white powder (?spores). Stipe up to 40 x 4 mm long, externally fibrillose, equal or slightly thickened at base.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 10-20 hyphae; terminal cells of fascicular hyphae (n=10) 38-64 x 4.6-9.2 μ m, undifferentiated to swollen, subclavate to clavate, occasionally subcapitate, light yellowish brown in mass; walls up to 0.5 μ m thick, pale yellowish brown; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae 3.7-12 μ m diam, mostly 5.5-9.5 μ m diam, thin-walled hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 30.5-43 x 8.7-11.5 μ m, L/W = 2.88-4.25, clavate, elongate, hyaline; sterigmata 4, up to 5.2 μ m long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding

ornamentation) (n=30) $7.8-11 \times (6.4)6.9-8.3(-8.7) \mu\text{m}$ (mean dimensions = $9.6 \pm 1 \times 7.6 \pm 0.6 \mu\text{m}$), $L/W = (1.05-)1.12-1.49$ (mean $L/W = 1.3 \pm 0.1$), usually elliptical to amygdaliform, occasionally subglobose, hyaline, echinulate; spines $0.5-0.9(-2.3) \mu\text{m}$ long, sometimes with one or two long spines at apex; hilar appendage, $1.4-1.8 \mu\text{m}$ long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly $2.5-4 \mu\text{m}$ diam, tightly interwoven, undifferentiated, hyaline.

OBSERVATIONS: Although collected 23 years after the original publication date, this is the only Boudier collection labelled C. proxima that could be found at PC, and thus it is the only authentic material from which to designate the type specimen. Spore data of this collection closely fit those in the original description ("spores ovales, finement echinulees"). Additionally, although difficult to discern with certainty due to possible preservation artifacts, the sporocarps appear to fit the morphological criteria as well.

Laccaria proximella Singer. 1965. Mycopathol. Mycol. Appl. 26: 146-147.

Type specimen (PARATYPE): BAFC - Singer M3247; Chili: Valdivia, Cordiellera Pelada. 30.III.1963. [!]

MACROMORPHOLOGY (Teste Singer, Ibid.): BASIDIOMA: Pileus 20-34 mm broad, convex, depressed, dry, radiately fibrillose, flesh-colored-brown ("incarnato-bruneo," Singer). Lamellae moderately

thick, subdistant, adnate, or subsinuate, moderately broad, flesh-color ("carneolis," Singer). Stipe up to 42 x 6.5 mm, almost equal or tapering toward apex, almost concolorous with pileus. Basal mycelium white. Spores in mass white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered fascicles of $\pm$ perpendicular hyphae, fascicles usually composed of 10-20 hyphae; terminal cells of fascicular hyphae (n=10) 42-64 x 6.4-13 μ m, undifferentiated to somewhat swollen, subclavate or subcapitate to capitate, light yellowish brown in mass; walls up to 0.5 μ m thick, pale yellowish brown; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae mostly 5.5-9.5 μ m diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 23-40 x 7.8-14.7 μ m, L/W = 1.92-3.47, clavate, elongate, hyaline; sterigmata (2)-4, up to 7.4 μ m long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) (8.3-) 8.7-11 x 6-8.3 μ m (mean dimensions = $9.6 \pm 0.7 \times 7.3 \pm 0.6 \mu$ m), L/W = 1.18-1.46 (mean L/W = 1.3 ± 0.1), elliptical to amygdaliform, hyaline, echinulate; spines 0.5-0.9(-2.3) μ m long, short, crowded, occasionally with one or two long spines at apex; hilar appendage 1.4-1.8 μ m long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae 5.5-25 μ m diam, tightly interwoven, undifferentiated, hyaline.

OBSERVATIONS: Singer (1965) reported sparse cheilocystidia ("cheilocystidiis admodum sparsis, filamentosis $\pm$ 3-3.7 μ latis, hyalinis"). The discrepancy between Singer's and my descriptions may be due either to poor rehydration or to the absence of cheilocystidia in the preparations I examined.

Clitocybe pruinosa Lovejoy. 1910. Bot. Gazette. 50: 383.

Type specimen (HOLOTYPE): RM - Lovejoy 83; USA: WY, Foxpark. 14.VIII.1909. [not located]

MACROMORPHOLOGY (Teste Lovejoy; Ibid.): BASIDIOMA: Pileus 30-50 mm broad, plano-convex, slightly depressed, dry, glabrous, shining, rich reddish brown over salmon; margin decurved, entire, paler than pileus. Lamellae thin, close, strongly decurrent, salmon yellow, becoming powdered with white spores. Stipe 50 x 10 mm, fleshy, glabrous, subconcolorous with pileus, hollow. Spores in mass white.

MICROMORPHOLOGY (Teste Lovejoy, Ibid.): LAMELLA: Basidio-spores 7-10.5 μ m, globose, spiny.

OBSERVATIONS: No authentic material of this name could be found at RM. Without additional micromorphological data, it is impossible to clarify the concept of this taxon. Thus, the name is considered as a nom. dubium.

Laccaria pumila Fayod. 1893. Ann. Della R. Acc. di Agric. di Torino 35: 91.

Type specimen (Illustration only): G. [!]

MACROMORPHOLOGY (Teste Fayod, Ibid.): BASIDIOMA: Pileus 5 mm broad at first, campanulate, then 10-15 mm broad, plane, centrally depressed, strongly striate, undulate, mahogany color when moist, when dry ochraceous, disc darker. Lamellae adnexed, submarginate, flesh color. Stipe 20 x 1.5 mm, slightly thickened upward, flexus, hollow, concolorous with pileus. Basal mycelium cottony, white.

MICROMORPHOLOGY (Teste Fayod, Ibid.): PILEUS: Cuticle typical. LAMELLA: Trama parallel. Basidia clavate, sterigmata 2. Paraphyses (=cystidia) short, clavate-globose. Basidiospores 12-18 μ m, globose, echinulate.

OBSERVATIONS: The illustration matches the protologue. Interpretation is difficult because micromorphological data could not be obtained first-hand.

Laccaria purpureo-badia Reid. 1966. Nova Hedwigia 11 (Supplement): 14-16.

Type specimen (HOLOTYPE): K - Reid; England: Bedfordshire, Flitwick, Follywood. 11.X.1959. [!]

MACROMORPHOLOGY (Teste Reid, Ibid.): BASIDIOMA: Pileus 20-55 mm broad, slightly convex, occasionally umbonate, soon becoming conspicuously, depressed or umbilicate, minutely scurfy-scaly, hygrophanous, when fresh uniform dark purple-brown ("Seal Brown"), fading to light purple-brown ("Sorghum Brown"); margin smooth becoming distinctly sulcate, usually with a scaly effervescence. Lamellae up to 8 mm broad, entire, subdistant, adnexed, pale pinkish-gray ("Pale Grayish Vinaceous") becoming pinkish-purplish-brown

("Livid Brown"). Stipe 30-60 x 3.5-8 mm, equal, slightly felty fibrillose, solid becoming hollow, purplish-pink ("Light Purplish Vinaceous") at apex, dark purplish-brown (between "Dark Livid Brown" and "Warm Blackish Brown") at base. Flesh purplish-pink ("Light Purplish Vinaceous").

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 10-25 hyphae; terminal cells of fascicular hyphae ($n=10$) 44-64(-92) x 6.4-11.5 μm , undifferentiated to subclavate, light yellowish brown in mass; walls up to 0.5 μm thick, light to moderate yellowish brown, often incrustated with light yellowish brown pigments; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline, light to moderate yellowish brown toward cuticle.

LAMELLA: Trama parallel, hyphae 2.8-12 μm diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia ($n=15$) 32-57.5 x 7.8-12.4 μm , L/W = 3.56-6.25, clavate, elongate, hyaline; sterigmata 4, up to 7.4 μm long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) ($n=30$) (7.4-)8.3-10.6 x 6-7.8 μm (mean dimensions = $9.1 \pm 0.8 \times 7.1 \pm 0.6 \mu\text{m}$), L/W = 1.12-1.41(-1.54) (mean L/W = 1.3 ± 0.1), oval or elliptical to amygdaliform, hyaline, echinulate; spines < 0.5-0.9 (-1.4) μm long, crowded; hilar appendage 1.3-1.8 μm long, prominent, truncate; plage present; contents usually uniguttulate. BASAL MYCELIUM: Hyphae mostly 4.6-14.7 μm diam, tightly interwoven, hyaline; cells long, undifferentiated to barrel-shaped.

Russuliopsis laccata var. rosella f. pusilla Larsen. 1932. Bot. of Ireland Vol. II, Part III. 9. Fungi of Iceland. p. 525.

Type specimen (not located).

MACROMORPHOLOGY (Teste Larsen, Ibid.): BASIDIOMA: Pileus 10-20 mm broad, depressed, thin, glabrous, pale or thick, distant, adnate-decurrent, concolorous. Stipe short, thin, concolorous.

Spores in mass white.

MICROMORPHOLOGY (Teste Larsen, Ibid.): LAMELLA: Basidiospores 8-9 μ m diam, globose, verrucose.

OBSERVATIONS: No authentic material of this name could be located at C.

Laccaria laccata f. retispora Rolland. 1904. Revue Mycol. 104: 139.

Type specimen (not seen).

MACROMORPHOLOGY (Teste Rolland, Ibid.): BASIDIOMA: Pileus flesh color. Stipe concolorous.

MICROMORPHOLOGY (Teste Rolland, Ibid.): LAMELLA: Basidiospores 10 μ m diam, strongly reticulate.

OBSERVATIONS: Based on the original description, I find this taxon to be a member of the Russulaceae and not a Laccaria.

Agaricus (Clitocybe) rubro-tinctus Berkeley & Curtis. 1868. J. Linn. Soc. X: 284.

Type specimen (HOLOTYPE): K - Write 89; Cuba. No date. [!]

MACROMORPHOLOGY (Teste Berkeley and Curtis, Ibid.): BASIDIOMA: Pileus 12-14 mm broad, umbilicate, glabrous, red. Lamellae broad,

decurrent, thin, pallid. Stipe 50 mm long, subequal, glabrous, concolorous with pileus, hollow.

OBSERVATIONS: The type collection consists of only one moldy basidiocarp. No micromorphological data, therefore, could be obtained. Additionally, no micromorphological data were presented in the original description. Without micromorphological data, it is impossible to clarify the concept of this taxon and its identity remains uncertain. Thus the name is considered as a nom. dubium.

Agaricus (Clitocybe) laccatus var. rufo-carnea Fries. 1836-1838. Epicr. Syst. Mycol. p. 79.

Type specimen (lacking).

MACROMORPHOLOGY (Teste Fries, Ibid.): BASIDIOMA: As in type variety, pileus becoming subochraceous when faded.

OBSERVATIONS: Without micromorphological data it is impossible to be certain of the concept of this taxon. Thus, the name is treated as a nom. dubium.

Laccaria trullisata f. rugulospora M. Lange. 1955. Medd. Gronl. 147: 30.

Type specimen (HOLOTYPE): C - Lange 384; Greenland: Sondre Stromfjord, Sandflugtsdalen. 24.VIII. 1946. [!]

MACROMORPHOLOGY (Teste Lange, Ibid.): Differs from the type variety only in its smaller size.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven, no distinct fascicles of hyphae seen; terminal cells (n=10) 33-64 x

5.5-9.2 μm , undifferentiated to subclavate, occasionally clavate, light yellowish brown in mass; walls up to 0.5 μm thick, light yellowish brown; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae mostly 5.5-11 μm diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 34-48 x 10.6-13.8(-16) μm , L/W = 2.92-4.39, clavate, elongate, hyaline; sterigmata 4, up to 7.4 μm long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) 11.5-14.7(-15.6) x (6.4-)7.4-8.7(-9.2) μm (mean dimensions = $13.3 \pm 1.1 \times 8.0 \pm 0.6 \mu\text{m}$), L/W = 1.43-1.83 (mean L/W = 1.67 ± 0.11), oblong to subfusiform, hyaline, echinulate; spines > 0.2(-0.5) μm long, distinct, crowded; hilar appendage 1.3-1.8 μm long, prominent, truncate; contents occasionally uniguttulate.

OBSERVATIONS: The type collection consists only of small pieces of pileus. This specimen is clearly distinct from the type of L. trullisata. Its basidiospores are shorter: its spore ornamentation is obvious and distinct under the light microscope. According to Singer (1961) and Holland (1976), L. trullisata f. rugulospora is synonymous with L. maritimus (Theod.) Singer. I have not seen the type of L. maritimus and, therefore, cannot comment on this.

Agaricus demissis var. sadicinus Fries. 1821. Sys. Mycol. I: 157.

Type specimen (lacking).

MACROMORPHOLOGY (Teste Fries, Ibid.): BASIDIOMA: Pileus purple-lilac. Lamellae adnate, concolorous. Stipe hollow, flaccid; base fibrillose.

OBSERVATIONS: Without micromorphological data, it is impossible to clarify the concept of this taxon. Thus, the name is treated as a nom. dubium.

Laccaria tetraspora var. scotica Singer. 1967. Bull. Soc. Mycol. France 83: 114.

Type specimen (HOLOTYPE): BAFC - Singer C4002; Scotland: Lake Katrin. 1.VII.1964. [!]

MACROMORPHOLOGY (Teste Singer, Ibid.): BASIDIOMA: Pileus 20-29 mm, convex, centrally depressed, umbilicate, smooth and glabrous, slightly tomentose at disc under a hand lens, hygrophanous, reddish fawn color (6 D 12), paler toward margin; margin slightly sulcate. Lamellae broad, subcrowded, adnate, dull rose color. Stipe usually 80 x 3.5-5.5 mm, equal or very slight narrowing toward the base, glabrous or slightly fibrillose, stuffed, concolorous with pileus, paler or whitish toward the base. Basal mycelium white. Spores in mass white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 15-30 hyphae; terminal cells of fascicular hyphae ($n=10$) 40-55 x 5.5-10.5 μ m, subclavate to clavate; walls up to 0.5 μ m thick, light yellowish brown; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward

cuticle. LAMELLA: Trama parallel; hyphae mostly 2.3-11 μm diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 30-40 x 7.8-12.5 μm , L/W = 2.72-4.31, clavate, elongate, hyaline; sterigmata 4, up to 12.4 μm . Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) 6.9-9.2 x 6.9-9.2 μm (mean dimensions = $8 \pm 0.6 \times 7.9 \pm 0.7 \mu\text{m}$), L/W = 1-1.07 (-1.13) (mean L/W = 1.01 ± 0.03), globose to subglobose, hyaline, echinulate; spines 0.9-1.8(-2.3) μm , crowded; hilar appendage 1.3-2.3 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 1.8-4.6 μm diam, long-celled, undifferentiated, tightly interwoven, hyaline.

OBSERVATIONS: The type collection is in good condition. Singer (1967) reported infrequent cheilocystidia ("cheilocystides et cystidioles eparses, 14-26 x 3 μ , filamenteuses"). Additionally, he reported the occurrence of rare 2-sterigmate basidia.

Agaricus sevocatus Britzelmayer. 1893. Hym. Sudb., Bot. Centralbl. 54: 5. f. 594.

Type specimen (lacking).

MACROMORPHOLOGY (Teste Britzelmayer, Ibid.): BASIDIOMA: Pileus hygrophaneous, gray or brownish gray. Lamellae rather decurrent. Stipe undulating.

MICROMORPHOLOGY (Teste Britzelmayer, Ibid.): LAMELLA: Basidiospores 5-7 μm diam, echinulate.

OBSERVATIONS: The original description stated that this taxon was similar to A. echinosporous. Without micromorphological data, however, it is impossible to clarify the concept of this taxon. Thus, the name is treated as a nom. dubium.

Agaricus (Clitocybe) spodophorus Berkeley & Broome. 1871. J. Linn. Soc. 11: 518.

Type specimen (HOLOTYPE--illustration only): K - Berk. 1215; Ceylon. IX.1869. [!]

MACROMORPHOLOGY (Teste Berkeley & Broome, Ibid.): BASIDIOMA: Pileus 13 mm broad, subhemispherical, slightly umbilicate, dull flesh color covered with black flocculent specks. Lamellae few, adnate with decurrent teeth; margin serrate, concolorous with black specks. Stipe subclavate, concolorous covered with fine black flocci, especially near apex, solid.

OBSERVATIONS: The illustration matches the protologue. Although Cooke (1884) included this name when he initially transferred taxa into the new genus Laccaria, without micromorphological data, it is impossible to clarify the concept of this taxon and its identity remains uncertain. Thus the name is considered as a nom. dubium.

Clitocybe laccata var. striatula Peck. 1894. Annual Rep. N.Y. State Mus. 48: 274.

Type specimen (HOLOTYPE): NYS - Peck; USA: NY, Catskill Mts. Sept. [!]

MACROMORPHOLOGY (Teste Peck, Ibid.; 1911): BASIDIOMA: Pileus 12-20 mm broad, convex to plane, translucent striate, thin glabrous, hygrophanous, buff red, fading to grayish or pale buff. Lamellae broad, adnate, distant, pale flesh color. Stipe 15-30 x 1-2 mm, equal, fibrous, concolorous with pileus.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle tightly interwoven with very widely scattered small fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 5-10 hyphae; terminal cells of fascicular hyphae ($n=10$) $37.5-69 \times 6-12 \mu\text{m}$, undifferentiated to subclavate, occasionally clavate; walls up to $0.5 \mu\text{m}$ thick, light yellowish brown; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae mostly $2.8-10 \mu\text{m}$ diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia ($n=15$) $35-46 \times 10-14 \mu\text{m}$, $L/W = 2.54-4.34$, clavate, elongate, hyaline; sterigmata 4, up to $10.6 \mu\text{m}$ long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) ($n=30$) $(6.9-)7.8-9.7(-12) \times (6.9-)7.8-9.7(-12) \mu\text{m}$ (mean dimensions - $8.8 \pm 0.9 \times 8.7 \pm 0.9 \mu\text{m}$), $L/W = 1(-1.06)$ (mean $L/W = 1.0 \pm 0.02$), globose, occasionally subglobose, hyaline, echinulate; spines $1.4-2.3(-2.8) \mu\text{m}$ long, up to $1.3 \mu\text{m}$ wide at base, crowded; hilar appendage $1.3-2 \mu\text{m}$ long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly $2.3-4 \mu\text{m}$ diam, tightly interwoven, undifferentiated, long-celled, hyaline.

OBSERVATIONS: The type collection appears mixed. Two distinct sets of basidiocarps can be segregated based on basidiospore size and length of spore ornamentation. Because Peck (1894, 1911) stated that the taxon had large spores, the above description is based on those basidiocarps which have large spores. Lahaie (1981) concurred with this segregation of the type collection.

Laccaria laccata var. subalpina Singer. 1977. Plant Syst. Evol. 126: 365.

Type specimen (HOLOTYPE): F - Singer C5870; CSSR: Slovakia, Hohe Tatra, Solisko. 4.IX.1974. [!]

MACROMORPHOLOGY (Teste Singer, Ibid.): BASIDIOMA: Pileus $\pm$ 26 mm broad, convex, glabrous, radially striate, slightly pellucid, hygrophanous, flesh brown, fading to pale flesh color; margin sinuous or almost sinuous. Lamellae moderately broad, subcrowded becoming distant, adnate, dirty pale lilac-pink to violet pink when young, soon becoming flesh-rose color. Stipe 40-45 x 3.5-4 mm, equal or nearly so, striate, tortulous, coarsely fibrous, not woolly or hoary, flesh-brown to brown. Basal mycelium white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered fascicles of $\pm$ perpendicular hyphae; terminal cells of fascicular hyphae (n=10) 39-57.5 x 7.8-13 μ m, undifferentiated to subclavate, light yellowish brown in mass; walls up to 0.5 μ m thick, light yellowish brown; contents hyaline. Trama tightly interwoven undifferentiated, hyaline, light yellowish brown toward cuticle.

LAMELLA: Trama parallel; hyphae thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 32-42 x 7.8-9.7(-11) μm , L/W = 3.05-5.13, clavate, elongate, hyaline; sterigmata 4, up to 6.5 μm long. Pleurocystidia lacking. Cheilocystidia (n=5) 30.5-35 x 3.7-4.6 μm , L/W = 7.3-9.46, undifferentiated to slightly swollen, relatively abundant, extending well beyond basidia and basidioles, hyaline. Basidiospores (excluding ornamentation) (n=30) (6.4-)6.9-7.8(-8.3) x (6.0-)6.4-7.4 μm (mean dimensions = $7.5 \pm 0.5 \times 6.8 \pm 0.3 \mu\text{m}$), L/W = 1-1.16(-1.22) (mean L/W = 1.1 ± 0.06), occasionally globose, usually subglobose, hyaline, echinulate; spines (0.9-)1.4-1.8 μm long, crowded; hilar appendage 1.3-1.8 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly (2.5-)5.5-11 μm diam, tightly interwoven, hyaline; cells long, barrel-shaped.

OBSERVATIONS: Although basidiospore shape and size fit the original circumscription, I measure the spore ornamentation as longer than that reported by Singer (1973).

Laccaria laccata var. tatrensis Singer. 1977. Plant Syst. Evol. 126: 367-368.

Type specimen (HOLOTYPE); F - Singer C6001; CSSR: Slovakia, Hohe Tatra, Mala Studena Dolina. 13.IX.1974. [!]

MACROMORPHOLOGY (Teste Singer, Ibid.): BASIDIOMA: Pileus 14-20 mm broad, convex, not umbilicate or umbonate, moderately depressed in age, glabrous, in age appearing subtomentose to fibrous

to subsquamulose under hand lens, translucent striate at margin, hygrophanous, reddish-cinnamon to moderately dark ocher reddish brown, fading to pallid flesh color. Lamellae moderately broad subdistant, adnate to subdecurrent, flesh-colored rose when fresh. Stipe 24-35(-50) x 2-3.5(-7) μm , equal or rarely thickened at base; at first glabrous, becoming sulcate and rough, flesh-colored-brown to almost reddish brown, drying paler. Basal mycelium white. Spores in mass white. Odor lacking or slightly raphinoid.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 15-25 hyphae; terminal cells of fascicular hyphae ($n=10$) 36-55 x 4-9.2 μm , undifferentiated to slightly swollen, subclavate or subcapitate, light yellowish brown in mass; walls up to 0.5 μm thick, light yellowish brown; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae 3.2-13.5 μm diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia ($n=15$) 27.5-40.5 x 10-12.5 μm , L/W = 2.4-3.77, clavate, elongate, hyaline; sterigmata 4, occasionally 2, up to 9.2 μm long. Pleurocystidia lacking. Cheilocystidia ($n=10$) 24.5-55 x 3.7-6 μm , L/W = 6.43-12.34, thin, undifferentiated to subclavate, moderately abundant, extending well beyond basidia and basidioles, hyaline. Basidiospores (excluding ornamentation) ($n=30$) 7.4-9.2 x 7.4-9.2 μm (mean dimensions = $8.4 \pm 0.6 \times 8.2 \pm 0.6$ μm), L/W = 1-1.11(-1.12) (mean L/W = 1.03 ± 0.04), globose rarely

subglobose, hyaline; echinulate; spines 0.9-1.8 μ m long, crowded; hilar appendage 1.3-1.8 μ m long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 3-7 μ m diam, long-celled, undifferentiated, tightly interwoven, hyaline.

Laccaria tetraspora Singer. 1946. Mycologia 38: 689-690.

Type specimen (HOLOTYPE): FH - Singer F16C; USA: FL, Highlands Hammock State Park, Sebring Co. 11.VII.1942. [!]

MACROMORPHOLOGY (Teste Singer, Ibid.): BASIDIOMA: Pileus 10-20 mm broad, convex, becoming plane and depressed, usually umbilicate, glabrous or fibrillose, pellucid, hygrophanous, when moist rose flesh-colored ("incarnato-rosea," Singer) or brownish flesh-colored ("brunneolo incarnato," Singer), when dry pale purple pink ("pallid-purpurascens-rosello," Singer); margin striate when fresh, sulcate when dry. Lamellae broad, distant, adnate to decurrent; rose flesh-colored ("incarnato-roseis," Singer), pulverulent from spores. Stipe 10-30 x 1.5-2.5 mm, equal or with expanded base, dry, subglabrous, solid, almost concolorous with pileus. Basal mycelium white, scant to copious.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle (n=10) 26-62 x 7.4-11.5 μ m, interwoven with scattered fascicles of $\pm$ perpendicular hyphae; terminal cells of fascicular hyphae undifferentiated to slightly swollen at apex, occasionally subclavate or subcapitate, light yellowish brown in mass; walls up to 0.5 μ m thick, pale yellowish

brown; contents hyaline, in mass. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae 3.2-15.2 μm diam, mostly 9.2-13.8 μm diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 42-55 x 10-13 μm , L/W = 3.64-5.21, clavate, elongate, hyaline; sterigmata 4, up to 8.7 μm long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) (7.8-)(8.7-11 x 8.3-10.1 (-10.6) μm (mean dimensions = $9.3 \pm 0.7 \times 9.1 \pm 0.5 \mu\text{m}$), L/W = 0.94-1.2 (mean L/W = 1.02 ± 0.1), globose to subglobose, hyaline, echinate; spines (0.9-)(1.4-2.3(-2.8) μm long, moderately long, relatively sparse; hilar appendage 1.8-2.3 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 2-5 μm diam, tightly interwoven, undifferentiated, hyaline.

OBSERVATIONS: Singer (1946) reported the presence of inconspicuous cheilocystidia ("cheilocystids praesentibus sed haud conspicuis"). The discrepancy between Singer's and my descriptions may be due to poor rehydration or to the absence of cheilocystidia in the preparations I examined.

Agaricus tortilis Bolton. 1788. Hist. Fung. Halifax. p. 41, Tab. XII, Fig. A.

Type specimen (NEOTYPE, des. mihi): E- Orton 3642; Great Britain: Scotland, Yorkshire, Tanfield Lodge. 6.IX.1969. [!]

MACROMORPHOLOGY (Teste Bolton, Ibid.): BASIDIOMA: Pileus very small to small, convex, becoming plane to uplifted, striate,

dark reddish brown; margin lobed, crumpled and distorted. Lamellae dusky flesh color. Stipe 6 mm long, dusky flesh color.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with widely scattered fascicles of $\pm$ perpendicular hyphae; terminal cells of fascicular hyphae ($n=5$) $32-55 \times 6.5-12.5 \mu\text{m}$, undifferentiated to subclavate, occasionally clavate; walls up to $0.5 \mu\text{m}$ thick, pale yellowish brown; contents hyaline to light yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae $3.2-13 \mu\text{m}$ diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia ($n=15$) $40-60 \times 9-13 \mu\text{m}$, $L/W = 3.35-5.64$, clavate, elongate, hyaline; sterigmata 2, up to $11 \mu\text{m}$ long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) ($n=30$) $11.5-14.7(-17) \times 11.5-14.7(-17) \mu\text{m}$ (mean dimensions = $13.4 \pm 1.3 \times 13.4 \pm 1.3 \mu\text{m}$), $L/W = 1(-1.04)$ (mean $L/W = 1 \pm 0.01$), globose, hyaline, strongly echinulate; spines $2.3-4 \mu\text{m}$ long, $1.3-1.8 \mu\text{m}$ wide at base, crowded to very crowded; hilar appendage $1.3-2.3 \mu\text{m}$ long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly $2.8-5.5 \mu\text{m}$ diam, tightly interwoven, undifferentiated, hyaline.

OBSERVATIONS: Although no specimen of A. tortilis is available from Halifax, due to disruption of the original habitat, this material was collected in an area similar to Bolton's original sites (R. Watling, personal communication). An examination of this

collection showed it to fit well within the circumscription of the common usage of the name. Although the collection lacks morphological notes, due to its obvious resemblance to Bolton's plate, I have proposed it as the neotype.

Russuliopsis thymiphila Velenovsky. 1939. Novitates Mycologicae. p. 77.

Type specimen (lacking).

MACROMORPHOLOGY (Teste Velenovsky, Ibid.): BASIDIOMA: Pileus 3-6 mm broad, convex, becoming plane, finely rimose, hygrophanous, cinnamon color when fresh, becoming ochraceous. Lamellae broad, thick, adnate to arcuate, crowded, flesh color to cinnamon color. Stipe 3 times longer than pileus diameter, flexuosus, glabrous, concolorous.

MICROMORPHOLOGY (Teste Velenovsky, Ibid.): LAMELLA: Basidiospores 5-7 μ m diam, globose, smooth, uniguttulate, hyaline.

OBSERVATIONS: Type material of this name was not found at either PRM or PRC. Based on the original description, I doubt that it is a Laccaria, however, it is impossible to clarify the concept of this taxon without an examination of representative material. Thus, the name is considered as a nom. dubium.

Laccaria trichodermophora Mueller. 1982. This paper, p. 141.

Type specimen (HOLOTYPE): TENN - TENN No. 42523; USA: MS, Harrison Co., DeSoto Nat'l Forest, Harrison Experimental Forest, Road H-6. 5.XII.1980. [!]

MACROMORPHOLOGY (Mihi): BASIDIOMA: Pileus 6-40 mm broad (mean = 20.7 mm), convex to plane, becoming uplifted, occasionally depressed, not striate, finely fibrillose when young, becoming finely scaly due to cuticular defraction, hygrophanous, brownish orange ("Auburn" to "Sanford's Brown" to "Burnt Sienna" to "Cinnamon-Rufous"), occasionally darker at disc ("Kaiser Brown"); margin decurved to plane, entire to eroded; context 1-2 mm thick, tapering quickly to margin, flesh-colored ("Pale Vinaceous-Pink"). Lamellae relatively thin, sinuate to adnate, close to subdistant, flesh-colored ("Pale Flesh Color" to "Salmon-Buff"). Stipe 25-85 x 2-7 mm (mean = 53 x 4.4 mm), equal, occasionally tapering toward base, dry, finely fibrillose, inconspicuously striate, brownish orange to reddish brown ("Hazel" to "Pecan Brown" or "Cacao Brown" to "Kaiser Brown"); context stuffed becoming hollow, flesh-colored ("Hydrangea-Pink" to "Pale Vinaceous-Pink"). Basal mycelium white. Spores in mass white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle composed of very numerous large fascicles of $\pm$ perpendicular hyphae, forming a trichodermium in young specimens and at the disc; fascicles usually composed of > 30 hyphae, long; terminal cells (n=10) 29-69 x 12-19.5 μ m, undifferentiated to clavate, occasionally capitate; walls up to 0.5 μ m thick, light to moderate yellowish brown; contents hyaline to light yellowish brown. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae mostly 5.5-11 μ m diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium

undifferentiated. Basidia (n=10) 31-43 x 7.4-10.6 μm , L/W = 2.99-5.35, clavate, elongate, hyaline; sterigmata 4, up to 6 μm long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) (6.8-)7.4-9.2 x 6.4-8.3 μm (mean dimensions - $7.9 \pm 0.5 \times 7.2 \pm 0.6 \mu\text{m}$), L/W - 1-1.22 (mean L/W = 1.1 ± 0.06), subglobose to broadly elliptical, infrequently globose, hyaline, echinulate; spines 0.9-1.8 μm long, irregularly spaced; hilar appendage 1.3-1.8 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 2.8-5.5 μm diam, hyaline, undifferentiated, long-celled.

CULTURE MAT ANALYSIS: MACROMORPHOLOGY: PDA: Radius at week III 15-19 mm, week VI 32-38 mm; mat felty, moderately thick, tightly interwoven, submerged, with time forming pruinose aerial layer out from plug, not translucent, very dark and bright violet, fading to moderate violet, finally to light orange brown near plug; margin up to 4 mm broad, silky to subfelty, very thin, entire to slightly uneven, very light violet to white; plug concolorous with mat. MNM: Radius at week III 26-44 mm, week VI 54-62 mm; mat subfelty, becoming felty, thin, becoming moderate, with 2-3 narrow (2-3 mm) slightly thicker concentric zones, moderately interwoven, submerged, slightly translucent, very light violet, thicker zones somewhat darker; margin not well differentiated from mat, silky to subfelty, sinuate, very light violet; plug concolorous with mat. ME: Radius at week III 20-22 mm, week VI 38-47; mat subfelty, very thin, loosely interwoven, submerged, translucent, white; margin 1-2 mm broad, very thin, silky

becoming subfelty, entire, white; plug white. EXTRACELLULAR OXIDASE: Reaction moderate blue color immediately.

CULTURE MAT ANALYSIS: MICROMORPHOLOGY: PDA: Hyphae mostly undifferentiated with occasional subcoralloid hyphae and irregular swollen hyphae; chlamydospores common. MNM: Hyphae mostly undifferentiated with a few scattered subcoralloid hyphae; chlamydospores few, scattered. ME: Hyphae mostly undifferentiated with some irregular swollen hyphae; chlamydospores abundant.

Agaricus (Clitocybe) trullisatus Ellis. 1874. Bull. Torrey Bot. Club. 5: 45.

Type specimen (LECTOTYPE des. mihi): NYS - Ellis; USA: NJ, Newfield. [!]

MACROMORPHOLOGY (Teste Ellis, Ibid.): BASIDIOMA: Pileus plano-convex, becoming depressed, fibrose-squamose, smoother at disk, fleshy; margin thin. Lamellae coarse and thick, unequal, distant, adnate with decurrent tooth, purple-violet, becoming dark brick red, white pulverulent. Stipe club-shaped, radicating, fibrillose, stuffed; flesh violet-purple; stipe base tomentose, covered with sand.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with widely scattered fascicles of $\pm$ perpendicular hyphae, fascicles usually composed of 10-25 hyphae; terminal cells of fascicular hyphae ($n=10$) $33-64.5 \times 8.3-13.8(-16) \mu\text{m}$, subclavate to clavate, occasionally broadly clavate, light yellowish brown in mass; walls up to $0.5 \mu\text{m}$ thick, light yellowish brown; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward

cuticle. LAMELLA: Trama parallel; hyphae mostly 6.4-14.7 μm diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 30-53 x 9.2-12.4 μm , L/W = 3.08-4.65, clavate, elongate, hyaline; sterigmata 4, up to 8.2 μm long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (n=30) (13.8-)14.7-21.6(-36.3) x (5.5-)6-7.8(-8.3) μm (mean dimensions - $18.9 \pm 4.0 \times 6.8 \pm 0.7 \mu\text{m}$), L/W = 1.99-3.31(-6.05) (mean L/W = 2.68 ± 0.7), subfusiform to fusiform-elliptical, hyaline, very finely roughened; hilar appendage 1.3-1.8 μm long, prominent, truncate; contents occasionally uniguttulate, rarely biguttulate. BASAL MYCELIUM: Hyphae mostly 2.8-14.7 μm diam, tightly interwoven, hyaline; cells long, undifferentiated to barrel-shaped.

OBSERVATIONS: Ellis (1874) did not designate a type. Two possible sources for a type exist: 1) the collection at NYS labelled COTYPE which included a note in Ellis's handwriting giving collection data and stating that it is a new species and 2) the specimens in Ellis's exsiccata "Fungi of North America." Since the exsiccata was not distributed until 1875-1885 (Stafleu and Cowan, 1976), there is no way of knowing if the included specimens of A. trullisatus were in Ellis's hands at the time he designated the species. For these reasons, I have chosen to designate the NYS collection as the lectotype and consider the material in the exsiccata as authentic material.

Laccaria tetraspora var. valdiviensis Singer. 1967. Bull. Soc. Mycol. France 83: 113.

Type specimen (HOLOTYPE): BAFC - Singer M3191; Chili: Valdivia, Cordillera Pelada, El Mirador. 28.III.1963. [!]

MACROMORPHOLOGY (Teste Singer, Ibid.): BASIDIOMA: Pileus 13-21 mm broad, soon concave (13 B 9/11). Lamellae broad, rounded, not decurrent (10 A 6). Stipe 43-56 x 2.3-3.5 mm, 5-10 mm broad at widest point, more or less ventricose, near (7 H 12). Basal mycelium white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with widely scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 10-20 hyphae; terminal cells of fascicular hyphae ($n=10$) 40-60 x 7.4-17.5 μm , subclavate to clavate; walls up to 0.5 μm thick, light yellowish brown; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae mostly 4-12.4 μm diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia ($n=15$) 34-48 x 10-13.5 μm , L/W = 2.71-4.19, clavate, elongate, hyaline; sterigmata 4, up to 9.2 μm long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) ($n=30$) (6.9-)7.8-9.2(-10) x (6.9-)7.8-9.2(-10) μm (mean dimensions - $8.4 \pm 0.6 \times 8.3 \pm 0.6 \mu\text{m}$), L/W = 1-1.06 (mean L/W = 1.0 ± 0.02), globose, rarely subglobose, hyaline, echinulate; spines 0.9-1.8 μm long, crowded; hilar appendage 1.3-1.8 μm long, prominent, truncate; plage present; contents

occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 2.3-4.6 μm diam, long-celled, undifferentiated, tightly interwoven, hyaline.

OBSERVATIONS: The type collection consists of only one damaged sporocarp. Many of the lamellae have been eaten.

Laccaria vinaceoavellanea Hongo. 1971. Mem. Shiga. Univ. 21: 62.

Type specimen (HOLOTYPE): HH - Hongo 4160; Japan: Nango-Imodani, Otsu. 11.VII.1970. [!]

MACROMORPHOLOGY (Teste Hongo, Ibid.): BASIDIOMA: Pileus 40-60 mm broad, convex becoming expanded occasionally umbilicate or depressed, not viscid, radially striate, subsulcate, furfuraceous especially at disc, brownish-vinaceous ("Russet-Vinaceous," "Vinaceous-Buff," etc.); flesh thin, firm, concolorous, with slight farinaceous odor. Lamellae 4-6 mm broad, distant, thick, adnate to subdecurrent, subconcolorous. Stipe 50-80 x 6-8 mm, equal, firm, fibrous, striate, concolorous with pileus, solid or hollow. Basal mycelium white. Spores in mass white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 5-10 hyphae; terminal cells of fascicular hyphae ($n=10$) 34.5-48 x 6-10.5 μm , undifferentiated to subclavate, occasionally clavate, light yellowish brown in mass; walls up to 0.5 μm thick, light yellowish brown; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle.

LAMELLA: Trama parallel; hyphae mostly 3.2-10 μm diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped.

Subhymenium undifferentiated. Basidia (n=15) 28.5-39 x 8.3-13.3 μ m, L/W = 2.49-3.99, clavate, elongate, hyaline, not rehydrating well; sterigmata 4, up to 7.8 μ m long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) (6.4-)7.4-9.2(-9.7) x (6.4-)7.4-9.2(-9.7) μ m (mean dimensions = $8.2 \pm 0.7 \times 8.06 \pm 0.7 \mu$ m), L/W = 1-1.06(-1.12) (mean L/W = 1.02 ± 0.03), globose to subglobose, hyaline, echinulate; spines 1.4-2.8(-3.2) μ m long, not crowded; hilar appendage 1.3-1.8 μ m long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 3.6-6.9 μ m diam, long-celled, undifferentiated, tightly interwoven, hyaline.

Laccaria vinaceo-brunnea Mueller. 1982. This paper p. 148.

Type specimen (HOLOTYPE): TENN - TENN No. 42525; USA: LA, Tammany Parish, Fontainebleu State Park, under Quercus virginiana. 9.XII.1980. [!]

MACROMORPHOLOGY (Mihi): BASIDIOMA: Pileus 7-26 mm broad (mean = 15 mm), convex, depressed, occasionally striate when wet, finely fibrillose, occasionally becoming finely scaly, hygrophanous, when young and fresh brownish vinaceous ("Dark Vinaceous-Brown" to "Hay's Brown") becoming reddish brown ("Walnut Brown" to "Cameo Brown"), fading lighter (near "Cinnamon-Rufous" to "Light Ochraceous-Buff"); margin decurved to plane, entire to eroded; context 1-2 mm thick, tapering quickly to margin, light brownish vinaceous ("Light Brownish Vinaceous" to "Vinaceous-Fawn"). Lamellae moderately deep to deep, thick, adnate to arcuate, subdistant, violaceous to vinaceous

("Purplish Lilac" to "Purplish Vinaceous"). Stipe 7-48 x 2-6 (mean = 25 x 3.5 mm), equal, occasionally bulbous, dry, fibrillose, some fibers recurved, not striate, subcolorous with pileus, when young and at apex ("Brownish Vinaceous" to "Deep Brownish Vinaceous"), some fading orange brown (near "Hazel"); ground color buff (near "Light Ochraceous Buff"); fibers darker ("Hazel" to "Vinaceous-Brown").
Basal mycelium violet. Spores in mass white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with very numerous $\pm$ perpendicular individual large hyphae, almost forming palisadoderm but hyphae not dense smooth; terminal cells (n=10) 42-50.5 x (4.6-)8.7-10 μ m, undifferentiated to clavate, hyaline to light vinaceous; walls up to 0.5 μ m thick; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline to light olive brown in mass. LAMELLA: Trama parallel; hyphae thin-walled, hyaline; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=10) 42-50.5 x (4.6-)8.7-10 μ m, L/W = 4.19-5.82(-10.5), clavate, elongate, hyaline; sterigmata 4, up to 8.7 μ m long. Pleurocystidia lacking. Cheilocystidia (n=10) 31.5-64.5 x 5.5-11 μ m, L/W = 2.85-10.06, undifferentiated to clavate, abundant, extending well beyond basidia and basidioles, hyaline. Basidiospores (excluding ornamentation) (n=30) (7.4-)8.3-10 x (6.4-)7-8.7(-9.2) μ m (mean dimensions - 9 ± 0.7 x 7.8 ± 0.6 μ m), L/W = 1.05-1.24 (mean L/W = 1.15 ± 0.05), subglobose to elliptical or amygdaliform, hyaline, echinulate; spines 0.9-1.8 μ m long, crowded; hilar appendage 1.3-1.9 μ m long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM:

Hyphae mostly 2.8-5.5 μm diam, tightly interwoven, long-celled, hyaline.

Agaricus (Clitocybe) laccatus var. [obscure] violacea Fries.

1836-1838. Epicr. Syst. Mycol. p. 79.

Type specimen (lacking).

MACROMORPHOLOGY (Teste Fries, Ibid.): BASIDIOMA: Pileus drying grayish.

OBSERVATIONS: Without micromorphological data it is impossible to clarify the concept of this taxon. Fries (1836-1838) places A. amethystinus in synonymy with this variety.

Laccaria violaceo-niger Stevenson. 1964. Kew Bull. 19: 4.

Type specimen (HOLOTYPE): K - Stevenson 506, New Zealand: Nelson, Dun Mt. tract. 25.IV.1949. [!]

MACROMORPHOLOGY (Teste Stevenson, Ibid.): BASIDIOMA: Pileus 15-35 mm broad, convex becoming plane, appearing velvety due to very small floccose scales, fuscous black; margin inrolled. Lamellae thick, adnexed to decurrent, purple to grayish lavender, often with white mealiness. Stipe 25-50 x 3-10 mm, swollen at base, floccose striate to subscaly; apex purple; base vinaceous brown.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with numerous scattered large fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 10-30 hyphae; terminal cells of fascicular hyphae (n=10) 24-67 x 7.8-11, undifferentiated to subclavate to clavate, occasionally appiculate, dark yellowish brown in mass; walls up to

0.5 μm thick, light yellowish brown; contents moderate to dark yellowish brown. Trama tightly interwoven undifferentiated, hyaline, light to moderate yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae mostly 3.2-10 μm diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 31-47 x 8.3-11.5 μm , L/W = 3.04-5.16, clavate, elongate, hyaline; sterigmata 4, up to 6 μm long. Pleurocystidia lacking. Cheilocystidia (n=10) (21-)29-39 x 2.3-6.4 μm , L/W = 5.03-15.22, thin, undifferentiated to subclavate, even to strangulose, scattered, extending a moderate distance beyond basidia and basidioles, hyaline; lamellar edge almost sterile. Basidiospores (excluding ornamentation) (n=30) (6.4-)6.9-7.8 x (6.4-)6.9-7.8 μm (mean dimensions = $7.4 \pm 0.4 \times 7.3 \pm 0.4 \mu\text{m}$), L/W = 1-1.07(-1.13) (mean L/W = 1.02 ± 0.03), globose, occasionally subglobose, hyaline, echinulate; spines 0.9-1.8(-2.3) μm long, crowded; hilar appendage 1.3-2.3 μm long, very prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 3.2-6.9 μm diam, long-celled, undifferentiated, tightly interwoven, hyaline; walls up to 0.5 μm thick.

Laccaria laccata var. vulcanica Singer ex Veselsky & Singer. 1977. Plant Syst. Evol. 126: 362-363.

Type specimen (HOLOTYPE): F - Veselsky; CSSR: Moravia, Ostrava, Halde Lucina. 30.VII.1968. [!]

MACROMORPHOLOGY (Teste Singer, Ibid.): BASIDIOMA: Pileus 17-45 mm broad, convex, applanate to centrally depressed or with

flat umbilicus, often umbonate in age and large size, finely fibrous-scaly or granular scaly, becoming scaly due to cuticular diffraction, slightly hygrophanous, moderately deep flesh-brown rust color (near 6 I 10); margin bright orange-brown to flesh color or subconcolorous. Lamellae up to 8 mm broad, subcrowded when young, becoming subdistant, ventricose, adnate to subdecurrent, whitish-flesh color at first, becoming pale purplish or pale lilac, covered with white spores. Stipe 25-90 x 2.5-14 mm, equal or tapering toward apex, almost glabrous when young, longitudinally striate when mature, subconcolorous with pileus. Basal mycelium white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered, large fascicles of $\pm$ perpendicular hyphae; fascicles usually composed of 15-30 hyphae; terminal cells of fascicular hyphae ($n=10$) 38-69 x 6.4-14.7 μm , undifferentiated to swollen, subclavate to clavate, light yellowish brown in mass; walls up to 0.5 μm thick, light yellowish brown; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel to subparallel; hyphae 2.5-9 μm diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia ($n=15$) 33-44 x 7.8-11 μm , L/W = 3.17-4.49, clavate, elongate, hyaline; sterigmata 4, up to 7 μm long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) ($n=30$) (7.4-)8.3-9.7(-11) x (6-)6.4-7.8(-8.7) μm (mean dimensions = $9 \pm 0.7 \times 7.1 \pm 0.5 \mu\text{m}$), L/W = (1.16-)1.2-1.33(-1.45) (mean L/W = 1.27 ± 0.06), broadly elliptical

to elliptical, hyaline, echinulate; spines (< 0.05 -) 0.7 - 1.4 (- 1.8) μm long, very crowded; hilar appendage 1.3 - 1.8 μm long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 4 - 21.6 μm diam, tightly interwoven, hyaline to light yellowish brown in mass; cells occasionally undifferentiated, most short, barrel-shaped.

OBSERVATIONS: Singer (1977) reported sparse cheilocystidia ("cystidiis vesiculosis inconstanter et sparse praesentibus"). The discrepancy between Singer's and my descriptions may be due to poor rehydration or to the absence of cheilocystidia in the preparations I examined.

Laccaria tetraspora var. xena Singer. 1967. Bull. Soc. Mycol. France 83: 116.

Representative specimen: BAFC - Singer M4063; Argentina: Neuquen, Rio Negro, Bahia Lopez. 22.XI.1964.

MACROMORPHOLOGY (Teste Singer, Ibid.): BASIDIOMA: Pileus 8 - 25 mm broad, hemispherical-convex at first, becoming slightly applanate or irregularly depressed, glabrous or nearly glabrous, slightly pellucid-striate, hygrophanous, dull flesh-colored rose to dull rose. Lamellae broad, distant, adnate, dull rose-colored. Stipe usually 60×5 mm, equal or compressed or irregular, subglabrous or slightly fibrillose, reddish brown-colored to rose brown-color. Basal mycelium white. Spores in mass white.

MICROMORPHOLOGY (Mihi): PILEUS: Cuticle interwoven with scattered fascicles of $\pm$ perpendicular hyphae; fascicles usually

composed of 5-15 hyphae; terminal cells of fascicular hyphae (n=10) 39-64 x 5.1-9.7 μ m, undifferentiated to subclavate, rarely clavate; walls up to 0.5 μ m thick, light yellowish brown; contents hyaline. Trama tightly interwoven, undifferentiated, hyaline, light yellowish brown toward cuticle. LAMELLA: Trama parallel; hyphae mostly 3.2-10.6 μ m diam, thin-walled, hyaline to light yellowish brown; cells long, barrel-shaped. Subhymenium undifferentiated. Basidia (n=15) 39-53 x 10-13 μ m, L/W = 3.27-5.24, clavate, elongate, hyaline; sterigmata 4, up to 9.7 μ m long. Pleurocystidia lacking. Cheilocystidia not observed. Basidiospores (excluding ornamentation) (n=30) (6.9-)7.8-9.7 x (6.9-)7.8-9.7 μ m (mean dimensions = $8.6 \pm 0.7 \times 8.6 \pm 0.7 \mu$ m), L/W = 1(-1.05) (mean L/W = 1 ± 0.01), globose, rarely subglobose, hyaline, echinulate; spines (0.9-)1.4-2.3 μ m long, crowded; hilar appendage 1.4-2 μ m long, prominent, truncate; plage present; contents occasionally uniguttulate. BASAL MYCELIUM: Hyphae mostly 2.3-4.6 μ m diam, long-celled, undifferentiated, tightly interwoven, hyaline.

OBSERVATIONS: Singer (1967) cited four collections that he had studied but failed to designate a type specimen. Of the three collections sent to me from BAFC, all cited by Singer, Singer M4063 had the largest number of sporocarps and was in the best condition, so it was chosen to serve as a representative specimen. In his text, Singer (1967) stated the locality as "Patagonie a Terre de Feu." The only collection labelled "Terre de Feu" (Singer (M202) mentioned by Singer (1967) was not sent to me from BAFC. This collection,

Singer M202, may be a better candidate for typification than the one I have chosen as a representative specimen. No typification will be proposed, therefore, at this time.

Singer (1967) reported the spore ornamentation length for this collection as "1,0-1,5 μ ." These measurements are smaller than those presented above. The major delimiting character between var. xena and var. tetraspora is that the former has relatively shorter spore ornamentation. The discrepancy between Singer's data and mine, therefore, becomes significant.

CHAPTER VIII

EXCLUDED TAXA

Clitocybe gruberi Smith. 1944. Mycologia 36: 245-246.

= Laccaria gruberi (Smith) Singer. 1949. Lilloa 22: 176.

= Cantharocybe gruberi (Smith) Bigelow and Smith. 1973.

Mycologia 55: 486-488.

Type specimen (HOLOTYPE): MICH - W.B. Gruber 26; USA: ID, Juliet. V.1943. [!]

OBSERVATIONS: Micromorphological analysis of this collection revealed the presence of very elongate, smooth basidiospores. I agree with Bigelow and Smith (1973), therefore, that this collection does not belong in Laccaria.

Laccaria kalosperma Beeli. 1933. Bull. Soc. Roy. Bot. Belg. 66: 22.

Type specimen (HOLOTYPE): BR - Goossens 859; Zaire: Binga. XII.1929. [!]

OBSERVATIONS: Micromorphological analysis of this collection revealed the presence of strongly reticulate, amyloid basidiospores. I agree with Hieinemen (1964), therefore, that this collection is in Lactarius section Pterosporii Heim.

Agaricus (Clitocybe) holoporphyrus Berkeley & Curtis. 1868. J. Linn. Soc. 10: 284.

Type specimen (HOLOTYPE): K - Write No. 12; Cuba. Before IV.1868. [!]

OBSERVATIONS: Micromorphological analysis of this collection revealed the presence of subfusiform, smooth, basidiospores. The original description stated that the spores are oblong and not subglobose as in C. laccata. Because of the basidiospore shape and lack of ornamentation, this collection is clearly not a Laccaria.

Agaricus (Clitocybe) porphyrodes Berkeley and Broome. 1871. J. Linn. Soc. 11: 519.

= Laccaria porphyrodes (Berk. & Br.) Cooke. 1884. Grevillea 12: 70.

Type specimen (HOLOTYPE): K - Berk. & Br. 840; Ceylon: Peradeniya. XI.1868. [!]

OBSERVATIONS: The type collection consists of only one basidiocarp. Micromorphological analysis of this specimen revealed the presence of globose, smooth basidiospores. Although Cooke (1884) included this name when he initially transferred taxa into the new genus Laccaria, the lack of echinulate or roughened basidiospores exclude it from the genus.

Clitocybe puiggarii Spegazzini. 1889. Bol. Acad. Ciencias Cordoba 11: 389.

= Russula puiggarii (Speg.) Singer. 1950. Lilloa 23:428.

Type specimen (HOLOTYPE): LPS - Speg. 16080; Brazil: Apiaty. IV.1888. [!]

OBSERVATIONS: The type collection consists of only part of one poorly preserved basidiocarp. Although pencil drawings on the

packet illustrate globose, echinulate basidiospores, all the basidiospores observed in this study were globose to oblong, reticulate, and amyloid. I agree, therefore, with Singer's (1950) view that this collection belongs in Russula.

Clitocybe pulchella Spegazzini. 1889. Bot. Acad. Ciencias Cordoba 11: 389-390.

= Laccaria pulchella Singer. 1943. Annales Mycology 41: 17. nom. inval.

= Marasmiellus pulchellus Singer. 1950. Lilloa 23: 190-191.

Type specimen (HOLOTYPE): LPS - Spegazzini 16084; Brazil: Apiahy. VI.1882. [!]

OBSERVATIONS: The type collection consists only of one small very moldy basidiocarp. Numerous small echinulate conidia were observed, however, no basidiospores could be found. Pencil sketches on the packet illustrate a typical Laccaria-shaped basidiocarp and globose basidiospores--some echinulate, others nodulose. Singer (1943) transferred this name to Laccaria but did not give the basionym. In 1950, Singer transferred the name to Marasmiellus stating that an examination of the type specimen revealed only echinulate conidia and no basidiospores. Singer (1950) based this new combination on a comparison of the type specimen with another collection, presumed contaxic, which had oblong, smooth spores.

Agaricus (Clitocybe) rudis Berkeley. 1856. J. Bot. (Hooker) 8: 131.

Type specimen (HOLOTYPE): K - Berk. 127; Brazil: Rio Negro, Panure. II.1853. [!]

OBSERVATIONS: Berkeley (1856) stated that although this taxon had the same habit of A. laccatus, it was obviously unique. Micro-morphological analysis of this collection revealed the presence of elongate, smooth basidiospores. The lack of echinulate or finely roughened basidiospores exclude it from Laccaria.

Agaricus (Clitocybe) sublaccatus Berkeley & Broome. 1871. J. Linn. Soc. 11: 519.

Type specimen (HOLOTYPE): K - Berk. 894; Ceylon: Peradeniya. I.1869. [!]

OBSERVATIONS: Micromorphological analysis of this collection revealed the presence of elliptical, smooth basidiospores. Although Cooke (1884) included this name when he initially transferred taxa into the new genus Laccaria, the lack of echinulate or finely roughened basidiospores exclude it from Laccaria.

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APPENDICES

APPENDIX A

SPECIMENS EXAMINED

LACCARIA ALTAICA

Canada

Nova Scotia. Kings Co., near Scotts Bay, Split Bay Trail, 28.VIII.1978, No. 42531 (TENN); Kings Co., Alysford Lake Road, 1.XI.1982, Nos. 42541, 42550 (TENN).

United States

Alaska. Barrow, between Elson Lagoon and Oil Well Road, 5.VII.1970, WK No. 4609 (TENN 43122); Fairbanks, Peger Road, 17.VIII.1981, WK No. 5323 (TENN 42551); Steese Highway (110 miles north of Fairbanks), Eagle Summit, 19.VIII.1971, WK No. 5355 (TENN 42549); NARL, USIBP Tundra Biome Site 1, 26.VIII.1978, Laursen No. 1398; DeLong Mountains, Driftwood Camp, 2.X.1978, Laursen No. 1424.

Colorado. Larimer Co., Rocky Mountain National Park, Bear Lake Road, 20.VII.1940, Mains No. 5115 (MICH); Larimer Co., Roosevelt National Forest, near Chambers Lake, 11.IX.1981, No. 42548 (TENN); Larimer Co., Roosevelt National Forest, Blue Lake Trail, 13.IX.1981, Nos. 42547, 42552, 42554-42558 (TENN); same locality, 16.IX.1981, No. 42553 (TENN).

Michigan. Cheboygan Co., Mud Lake Bog, 13.X.1934, Smith No. 1150 (MICH).

Washington. Clallam Co., Olympic Peninsula, Fort Flagler State Park, 16.X.1981, No. 42562 (TENN); Kittitas Co., Snoqualmie National Forest, near Kachess Lake, 14.X.1981, Nos. 42559-42562 (TENN).

Wyoming. Medicine Bow Mountains, 8.IX.1923, coll. Kauffman (MICH).

U.S.S.R.

Kuraika, 31.VII.1937, Singer No. A439 (LE) [HOLOTYPE].

LACCARIA AMETHYSTE0-0CCIDENTALIS

Canada

British Columbia. Victoria, Beaconhill Park, 17.XI.1941, No. 10686 (DAOM); same locality, 25.XI.1941, No. F10688 (DAOM); Victoria Island, Saanich, Braefoot, 1.XII.1941, F10687 (DAOM); Victoria, X.1956, No. 54064 (DAOM); Victoria, Thetis Park Nature Sanctuary, 7.X.1959, No. 67060 (DAOM); Rubble Creek, off Squamish Highway, 8.X.1966, coll. Flegel (NY); Alice Lake Provincial Park campground, 3.X.1981, No. 42526 (TENN) [HOLOTYPE]; Alice Lake Provincial Park campground, 7.X.1981, No. 42566 (TENN).

United States

California. Butte Co., Paradise, 26.XI.1968, Ripley No. 1626 (SAFU); Del Norte Co., Hwy. 199 at Oregon border, 29.X.1971, Thiers No. 28471 (SAFU); Marin Co., Muir Woods National Monument, 29.XII. 1966, Madden No. 835 (SAFU); Marin Co., Lucas Valley, Thiers No.

27112 (SAFU); Mendocino Co., near Mendocino, Jackson State Forest, 23.XI.1962, Thiers No. 9497 (NY); Mendocino Co., "Aleuria Glen," 24.XI.1967, Jordon No. 951 (SAFU); Mendocino Co., Jackson State Forest, 11.XII.1971, Bigelow No. 17034 (MASS); same locality, 2.XII.1972, Thiers No. 30872 (SAFU); same locality, 2.XII.1972, coll. Nivison (SAFU); same locality, Thiers No. 24247 (SAFU); Mendocino Co., 23.I.1979, Sundberg No. 4132 (SIU); Monterey Co., Pacific Grove, 25.I.1974, Thiers No. 32180 (SAFU); Monterey Co., Monterey, 10.III.1979, Thiers No. 39586 (SAFU); Santa Barbara Co., Keniven Branch, San Marcos Pass, 13.I.1979, No. 250738 (LAM); San Mateo Co., San Francisco Watershed, 30.XII.1968, Keller No. 292 (SAFU); same locality, 30.XII.1969, Thiers No. 24662 (SAFU); Sonoma Co., Salt Point State Park, 25.XI.1972, Thiers No. 30741 (SAFU); Trinity Co., Highway 299, Gray Falls campground, 18.XI.1972, Thiers No. 30639 (SAFU); Tuolumne Co., Don Pedro Lake, 15.XII.1974, Thiers No. 33227 (SAFU); Tuolumne Co., Moccasin Point Recreation Area, Don Pedro Lake, 8.III.1979, Thiers No. 39558 (SAFU); Berkeley Hills, 9.I.1914, coll. Yates (NY); San Francisco, Sutro Forest, 3.III.1913 (NY); 20.XII.1956, Smith No. 56901 (MICH); Patrick's Point State Park, 13.XI.1957, White No. 341 (MICH); Santa Barbara, Mission Canon, I-III.1913, coll. Oleson (NY); Santa Barbara, San Marco Pass, I-III.1913, coll. Oleson (NY).

Oregon. Benton Co., Corvalis, Avery Park, 3.XI.1981, Nos. 42585, 42587 (TENN); Benton Co., Mary's Peak, 5.XI.1981, Nos. 42586, 42589-42594 (TENN); Benton Co., W. L. Finley National Wildlife

Refuge, 5.XI.1981, No. 42595 (TENN); Benton Co., Corvallis, 1915, Gilbert No. 7194; Lane Co., Honeyman Memorial State Park, 4.XI.1981, No. 42588 (TENN); Lane Co., Willamette National Forest, Route 242, near Limberlast campground, 6.XI.1981, No. 42596 (TENN); Linn Co., Cascadia State Park, 7.XI.1981, No. 42597 (TENN); Willamette National Forest, near Fernview campground, 7.XI.1981, No. 42598 (TENN); Lincoln Co., South Beach State Park, 12.XI.1981, Nos. 42600, 42601 (TENN); Lincoln Co., 1.XI.1970, Smith No. 79354 (MICH); Tillamook Co., Cape Lookout State Park, 10.XI.1981, No. 42599 (TENN); Tillamook Co., Meriwether Dunes, near Cape Lookout, 13.XI.1981, No. 42602 (TENN); Mt. Hood, 25.IX.1922, coll. Kauffman (MICH); Takilma, 30.XI.1925, coll. Kauffman (MICH).

Washington. Clallam Co., Chimacum State Park, 17.X.1981, No. 42567 (TENN); Clallam Co., Teal Lake Road, near Port Ludlow, 17.X.1981, Nos. 42568, 42569 (TENN); Lewis Co., Cispus River, 19.X.1954, Bigelow No. 2313 (MASS); Lewis Co., Cyapus Pond, 19.X.1954, Smith No. 19266 (MICH); King Co., Watermain Woods, 24.X.1981, No. 42565 (TENN); King Co., Seattle, X-XI.1911, Murill No. 717 (NY); Mason Co., north of Mason Lake, near Sheldon, 27.X.1981, Nos. 42570-42584, 42563, 42564 (TENN); Pierce Co., Ashford, 22.X.1954, Bigelow No. 2371 (MASS); Tacoma Praires, 26.X.1911, Murill No. 717 (NY); 14.X.1915, coll. Kauffman (MICH); Bremerton, XI.1930, coll. Flett; Longmire, 11.X.1954, Smith No. 48860 (MICH); Randle, Cispus Env. Center, 22.X.1977, Thiers No. 38337 (SAFU).

LACCARIA AMETHYSTINACanada

New Brunswick. Pointe a Auguste, Kouchibouguac National Park, 5.VII.1978, No. 169587 (DAOM); Kouchibouguac National Park, Cape St. Louis, 14.VII.1978, Nos. 169583, 169585 (DAOM).

Nova Scotia. Kings Co., Aylesford Lake, 9.VIII.1936, No. 110936 (DAOM); same locality, 1.IX.1972, Harrison No. 11880; Kings Co., Vesuvius, 7.VII.1972, Harrison No. 11544 (MICH); Kentville, 25.VIII.1952, No. 111858 (DAOM); Paradise, 29.VIII.1953, No. 39102 (DAOM).

Ontario. Magnetawan, 6.IX.1921, coll. Kelly (MICH); Petawawa Forestry Experiment Station, 24.VII.1938, No. 8681 (DAOM); Ramsayville, 10.VIII.1962, No. 89296 (DAOM); Ottawa, Cromwell Drive, 18.VII.1967, coll. Groves and Dyer (SAFU); St. Lawrence Island National Park, Thwartway Island, 26.VII.1976, No. 154695 (DAOM); same locality, 19.VIII.1976, No. 154694 (DAOM); same locality, 20.VIII.1976, No. 154693 (DAOM).

Quebec. Gatineau Park, Black Lake, 4.X.1981, No. 84906 (DAOM).

Great Britain

Surrey. 16.IX.1951, No. 27779 (DAOM).

United States

Colorado. Apher, 26.VII.1956, Smith No. 52886 (MICH).

Florida. Alachua Co., near Newman's Lake, 31.VII.1947, Singer No. F3427 (FH); Highland Co., Highland Hammock State Park, 20.VIII.1942, Singer No. F324 (FH); Planera Hammock, 24.V.1938, No. 18205 (FLAS).

Illinois. Jackson Co., Giant City State Park, Devils Stand Table area, 12.V.1977, Mueller Nos. 30-32 (SIU); same locality, 8.VI.1981, No. 42956 (TENN); Jackson Co., Giant City State Park campground, 15.X.1977, Mueller No. 325 (SIU); Jackson Co., Sundberg Nos. 2663, 2665 (SIU); Jackson Co., Wujek No. 81 (SIU); Perry Co., Pyramid State Park, near Heron Pond, 16.X.1977, Mueller Nos. 347, 365, 366 (SIU); same locality, 23.X.1977, Mueller Nos. 377, 381 (SIU); Pope Co., Bell Smith Springs Recreation Area, 1.X.1977, Mueller Nos. 255, 264 (SIU); same locality, 9.VI.1981, No. 42544 (TENN) [Representative specimen]; Union Co., West Nos. 933, 973, 400 (SIU); Williamson Co., near Devil's Kitchen Lake, 24.IX.1977, Mueller Nos. 231, 232 (SIU); Chicago, VI.1913, Harper No. 3463 (F).

Iowa. Washington Co., near English River, 26.VII.1953, Welden No. C5531 (NO).

Louisiana. St. Tammany Parish, near Slidell on Military Road, 21.XI.1960, Welden No. 5532 (NO).

Maine. Penobscot Co., near Norcross, 29.VIII.1962, Bigelow No. 11366 (MASS); Waldo Co., Northport, Bayside Park, 9.VI.1975, Kimball No. 6420 (MAINE).

Maryland. Laurel, Bells Experimental Forest, 13.IX.1969, Miller No. 8069 (VPI).

Massachusetts. Stow, 24.VIII.1908, coll. Morris and Davis (NYS); Canton, 24.VIII.1925, Linder No. 1185 (FH); Harvard, 22-24.VI.1945, coll. Dadmun and Singer (FH); Conway State Forest, 11.VII.1967, Bigelow No. 15068 (MASS); Conway, South River area, 18.VII.1967, Bigelow No. 15107 (MASS); Waban, 21.VI.1945, coll. Southwick (FH) [Holotype of L. calospora].

Michigan. Chippewa Co., west of Detour, 23.VII.1949, Imshaug No. 3916 (MICH); Livingston Co., E. S. George Reserve, 12.VII.1968, Zehner No. 197 (MICH); Marquette Co., Huron Mt. Club, Salmon Trout River, 2.VII.1968, Gilliam No. 102 (MICH); Marquette Co., Harlow Creek, 30.VII.1968, Gilliam No. 304 (MICH); Washington Co., Winnaevana Lake, 11.VII.1970, Smith No. 78363 (MICH); Washington Co., Mud Lake Bog, 24.IX.1978, Smith No. 89333 (MICH); Washtenaw Co., Waterloo Recreation Area, 2.VII.1968, Hosenev No. 826 (MICH); Burt Lake, Colonial Point, 6.IX.1969, Bigelow No. 15862 (MASS).

Minnesota. Rice Co., Wheeling Township, Nerstrand State Park area, 14.VII.1965, Weaver No. 1185 (MICH).

Mississippi. Pearl River Co., Pearl River, 6.VI.1976, Bigelow No. 17693 (MASS).

North Carolina. Chapel Hill, University of North Carolina, 19.V.1922, Grant No. 5119 (NCU); same locality, 6.V.1922, Grant No. 5178 (NCU).

New Hampshire. Carroll Co., Redstone, 5.IX.1963, Bigelow No. 12479 (MASS); Chocorua, VIII.1918, coll. Farlow (FH).

New York. Albany Co., Menands, 2.VIII.1906, coll. Peck (NYS); Bronx Co., The New York Botanical Garden, 12.VI.1980, coll. Rogerson (NY); Cortland Co., south of Georgetown, near Stump Pond, 2.IX.1955, Smith No. 22061 (NYS); Washington Co., Lake George Region, Mt. Hope Woods, 5.IX.1917, No. 4440 (CUP); Cayuga Lake Basin, north of Varna, 19.VII.1917, No. 24217 (CUP); 10.VII.1915 (NY).

Pennsylvania. Mt. Gretna, 3.IX.1924, coll. Kauffman (MICH).

Rhode Island. Beach Pond Park, 20.VII.1967, Bigelow No. 15118 (MASS).

Virginia. Richmond, 10.IX.1934, coll. Linder and Smart (FH).

LACCARIA BICOLOR

Canada

British Columbia. Alice Lake Provincial Park campground, 3.X.1981, Nos. 42604, 42622-42624, 42627-42629 (TENN); same locality, 4.X.1981, Nos. 42612, 42613, 42618 (TENN); same locality, 5.X.1981, No. 42630 (TENN).

United States

Alaska. Girdwood, Alyeska Ski Area, 27.VIII.1964, WK No. 1399 (TENN 42620); Girdwood, Alyeska Ski Area, Winter Creek Trail, 18.IX.1969, WK No. 4277 (TENN 42658); same locality, 27.VIII.1980, WK No. 6396 (TENN 42659); Juneau, Mendenhall Glacier campground, 28.VII.1966, WK No. 1408 (TENN 42625); Kodiak Island, 14.IX.1966, WK No. 1411 (TENN 42626); Near Palmer, Finger Lake campground,

7.VIII.1967, WK No. 1415 (TENN 42657); Turnagain Pass, Seward Highway, 20.IX.1965, WK No. 1405 (TENN 42609); same locality, 4.VIII.1966, WK No. 1409 (TENN 42621).

Idaho. Bonner Co., Kaniksu National Forest, West Side Priest Lake Road, 25.IX.1981, No. 42617 (TENN); Bonner Co., Kaniksu National Park, Binarch Road, 26.IX.1981, Nos. 42607, 42608, 42615, 42616 (TENN); same locality, 27.IX.1981, No. 42619 (TENN); Boundary Co., Upper Priest River, 16.X.1972, Smith No. 82905 (MICH).

Oregon. Benton Co., Avery Park, 27.XI.1976, No. 38565 (OSC); Lane Co., Honeyman Memorial State Park, 4.XI.1981, No. 42656 (TENN); Lane Co., Williamette National Forest, near Limberlast campground, 6.XI.1981, Nos. 42660, 42661 (TENN); Linn Co., Cascadia State Park, 7.XI.1981, No. 42662 (TENN); Lincoln Co., South Beach State Park, 8.XI.1981, Nos. 42663-42666 (TENN); Maltnomah Co., Timberline Lodge Road, 9.X.1978, Hunt No. 018 (OSC); Tillamook Co., Cape Lookout State Park, 10.XI.1981, Nos. 42667, 42668 (TENN); Tillamook Co., Meriwether Dunes, 13.XI.1981, Nos. 42669, 42670, 42603 (TENN); Tillamook Co., Little Nestucca Park, 13.XI.1981, Nos. 42614, 42671 (TENN); Union Co., Starkey Expt. Forest and Range, 15.X.1976, Trappe No. 4755 (OSC); same locality, 16.X.1976, Trappe No. 4779 (OSC).

Washington. Clallam Co., near Port Ludlow, Teal Lake Road, 17.X.1981, Nos. 42637, 42638 (TENN); Grays Harbor Co., Ocean City State Park, 20.X.1981, Nos. 42640, 42641 (TENN); King Co., Snoqualmie National Forest, Asahel Curtis Nature Trail, 13.X.1981, No. 42633 (TENN); King Co., Snoqualmie National Forest, Annette Lake Trail, 13.X.1981, No. 42606 (TENN); King Co., near Redmond,

Watermain Woods, 24.X.1981, Nos. 42529 [REPRESENTATIVE MATERIAL], 42605, 42611, 42642-42644, 42647 (TENN); Kittitas Co., Snoqualmie National Forest, Pacific Crest Trail, Stampede Pass, 14.X.1981, Nos. 42634-42636 (TENN); Kittitas Co., Snoqualmie National Forest; near Cooper's Lake, 24.X.1981, Nos. 42645-42649 (TENN); Mason Co., near Sheldon, north of Mason Lake, 27.X.1981, Nos. 42650, 42651, 42653, 42654, 42610 (TENN); Whatmon Co., Ross National Recreation Area, Pyramid Lake Trail, 8.X.1981, No. 42631 (TENN); Kelceme, east of Silverton, 10.X.1981, No. 42632 (TENN).

LACCARIA GLABRIPES

Canada

Nova Scotia. Kings Co., Baxter Harbor, 31.VIII.1978, Nos. 42767, 42534, 42536 (TENN); Kings Co., Aylesford Lake Road, 1.IX.1978, Nos. 42768, 42769, 42542, 42543, 42538, 42773, 42540 (TENN); Kings Co., Cape Split, Split Bay Trail, 1.IX.1978, No. 42776 (TENN).

New Zealand

Nelson. Lake Daniels Track, 25.IV.1969, No. 29640 (PDD) [HOLOTYPE].

United States

Georgia. Rabun Co., Rabun Bald, 12.VIII.1980, Nos. 42849, 42850 (TENN).

Michigan. Cheboygan Co., University of Michigan Biological Station, 11.VII.1961, Charlton No. G36 (MICH); Neebish, IX.1916, coll. Harper (F).

North Carolina. Hendersonville Co., near Camp Green Cove, 14.IX.1980, No. 42865 (TENN); same locality, 17.IX.1980, Nos. 42770-42772 (TENN); same locality, 19.IX.1980, Nos. 42866, 42871 (TENN). Jackson Co., Whiteside Mt. Trail, 16.VII.1979, Nos. 42762, 42777-42779 (TENN); same locality, 9.IX.1979, Nos. 42798-42817 (TENN); same locality, 8.VIII.1980, Nos. 42838-42840 (TENN); same locality, 13.VIII.1980, Nos. 42852-42859 (TENN); Macon Co., Elicot Rock Trail, 18.VII.1979, Nos. 42774, 42775, 42780 (TENN); Macon Co., Nantahala National Forest, Wayah Bald, 11.IX.1979, Nos. 42818-42831 (TENN); same locality, 9.VIII.1980, Nos. 42841-42846 (TENN); Macon Co., Ravenel Park, 12.IX.1979, No. 42832 (TENN); Macon Co., Coweeta Hydrologic Research Station, 14.IX.1979, Nos. 42833-42837 (TENN); same locality, 11.VIII.1980, Nos. 42847, 42848 (TENN); Macon Co., Nantahala National Forest, Glen Falls, 13.VIII.1980, No. 42851 (TENN).

New York. Lake Piseco, VIII.1902, No. 14726 (CUP).

Tennessee. Blount Co., Great Smoky Mountain National Park (=GSMNP), Cades Cove, Parsons Branch Road, 28.IX.1980, Nos. 42867, 42868 (TENN); Carter Co., Cherokee National Forest, Roane Mt., 11.X.1980, Nos. 42869-42872 (TENN); Sevier Co., GSMNP, Mt. LeConte, 19.VI.1938 (FH); Sevier Co., GSMNP, Ramsey Cascade area, 31.VII.1979, Nos. 42781 (TENN); Sevier Co., GSMNP, Clingman's Dome, 1.IX.1979, Nos. 42761, 42783-42797 (TENN); same locality, 6.IX.1980, Nos. 42860-42865 (TENN); Sevier Co., GSMNP, Alum Cave Trail, 10.VII.1981, Nos. 42763, 42765 (TENN).

LACCARIA LACCATAArgentina

Neuquen, Parque Nacional de Nahuel Huapi, Camino a los Cantaros, 14.III.1959, Singer No. M1774 (BAFU) [Holotype of L. tetraspora var. aberrans]; Neuquen, Rio Negro, Bahia Lopez, 22.XI.1964, Singer No. M4063 (BAFU) [Representative specimen of L. tetraspora var. xena]; 30.VI.1980, Singer No. T3890 (FH).

Canada

British Columbia. Robson River, west of Jasper, 17.X.1974, No. 149408 (DAOM); Alice Lake Provincial Park, 3.X.1981, No. 43091 (TENN).

New Brunswick. Kouchibouguac National Park, 26.VI.1978, No. 169727 (DAOM).

Newfoundland. 17.VIII.1887, coll. Waghorne (NY).

Nova Scotia. Kings Co., Kentville, Ag. Station, 27.VIII.1978, No. 42530, 42965 (TENN); Kings Co., near Scott Bay, Split Bay Trail, 28.VIII.1978, No. 42533 (TENN); Kings Co., Aylesford Lake Road, 1.IX.1978, No. 42539, 42971 (TENN).

Ontario. Lake Tunagami, Sand Point, 5.IX.1938, Smith No. 4573 (MICH); Nipissing District, Algonquin Park, 24.VIII.1974, No. 152464 (DAOM).

Chile

Peulla, Logo, Jodos los Santos, 22.III.1959, Singer No. M1991 (BAFU) [Holotype of L. tetraspora var. peullensis]; Valdivia,

Cordillera Pelada, 28.III.1963, Singer No. M3191 (BAFU) [Holotype of L. tetraspora var. valdiviensis]; Valdivia, Mirador, Cordillera Pellada, 5.V.1965, Singer Nos. M5514 (BAFC) [Holotype of L. laccata var. chilensis], M5515 (BAFU) [Holotype of L. tetraspora var. peladae]; same locality, 6.V.1965, Singer No. 6738 (SGO) [Holotype of L. laccata var. gibba].

Č.S.S.R.

Moravia, Ostrava, Halde ^ÚLucina, 30.VIII.1968, coll. Veselsky (F) [Holotype of L. laccata var. vulcanica]; Moravia, Jeseniky, Rejůz near Jesenik, 24.VII.1974, Singer No. C5664 [Holotype of L. laccata var. intermedia]; Slovakia, Skalnaté pleso, 5.IX.1974, Singer No. C5878 (F) [Holotype of L. laccata var. subalpina]; Slovakia, Malá Studená dolina, 13.IX.1974, Singer No. C6001 (F) [Holotype of L. laccata var. tatrensis]; Statn, Prirodne Reservace near Bradlo, 10.IX.1970, Singer No. C5120 (F).

England

Kent, Bedgebury, National Pine Arboretum, 20.X.1960, Singer No. C3119 (BARC) [Holotype of L. laccata var. anglica].

Japan

Prov. Ishikari, Napporo Forest, 17.VII.1932, Imai No. 314 (SAP) [Holotype of L. laccata f. minuta].

Scotland

Lake Katrim, 1.VIII.1964, Singer No. C4002 (BAFC) [Holotype of L. tetraspora var. scotica].

Sweden

Femsjo, 17.VIII.1964, Singer No. C4083 (BAFC) [Proposed type of L. laccata].

Switzerland

Schweiz, ZH, Birmensdorf, 28.X.1965, No. 651338 (ZT).

United States

Alabama. Lee Co., Auburn, 6.XII.1896, coll. Earle (NY).

Alaska. Little Nelchina Campground, Glenn Highway between Eagle Summit and Lake Louise Road, 13.VII.1964, WK No. 1398 (TENN 43123); Chugach Mts., near Anchorage, 16.IX.1965, WK No. 1406 (TENN 43124); Airport Road, near Homer, 2.IX.1967, WK No. 1417 (TENN 43125); Talkeetna Junction, 4.VII.1966, WK No. 1421 (TENN 42969); Anchorage, Goose Lake, 6.X.1970, WK No. 4884 (TENN 42970); Girdwood, Alyeska Ski Area; 2.VII.1964, WK No. 1404 (TENN 42968); Potter, 11.IX.1971, WK No. 6170 (TENN 42967); Glacier Bay National Monument Headquarters, 26.IX.1978, No. 39146 (OSC).

Arizona. Grand Canyon National Park, North Rim, Point Sublime Road, 19.VIII.1971, Thiers No. 27748 (SAFU).

California. Del Norte Co., Hwy 199 at Oregon border, 29.X.1971, Thiers No. 28490 (SAFU); Mendocino Co., Jackson State Forest, 31.X.1972, Thiers No. 30413 (SAFU); same locality, 26.X.1975, Halling No. 975 (SAFU); Stanford University, 4.XII.1902, Copeland No. 8 (NYS).

Colorado. Jackson Co., Colorado State Forest, Cameron Pass, 15.IX.1981, No. 43090 (TENN); Larimer Co., Roosevelt National

Forest, Blue Lake Trail, 13.IX.1981, No. 43089 (TENN); San Juan Mts., Trout Lake, 16.VII.1956, Smith No. 53015 (MICH); Frying Pan River, 30 miles east of Basalt, 10.VII.1979, Thiers No. 40168 (SAFU).

Florida. Alachua Co., Gainesville, 5.I.1943, coll. West (FH); Highland Co., Highland Hammock State Park, 11.VIII.1942, Singer No. F160 (FH) [Holotype of L. tetraspora]; Marion Co., Ocala National Forest, Mill Dam Road, 24.VIII.1980, Nos. 43054-43057 (TENN); Marion Co., Ocala National Forest, fire road off 40, 24.VIII.1980, No. 43058 (TENN); Newman's Lake, Hatched Creek, 4.VII.1932, No. F16196 (FLAS).

Georgia. Rabun Co., Black Rock Mountain State Park, 14.IX.1979, Nos. 43034, 43035, 43037-43041, 43043, 43044, 43046 (TENN).

Idaho. Idaho Co., Selway National Forest, 30.VII.1936, Roszbach No. 218 (FH).

Illinois. Jackson Co., Fountain Bluff, near Gorham, 17.VIII.1977, Mueller No. 131 (SIU); Jackson Co., Little Grand Canyon, 3.IX.1977, Mueller No. 161 (SIU); Jackson Co., Sundberg No. 2374, 2594 (SIU); Jackson Co., Giant City State Park, Devils Stand Table area, 8.VI.1981, Nos. 43081-43086, 42962 (TENN). Jackson Co., Devils Kitchen Lake Recreation area, 9.VI.1981, Nos. 42546 [REPRESENTATIVE SPECIMEN], 42963 (TENN); Perry Co., Pyramid State Park, 7.VI.1981, No. 43080 (TENN); Pope Co., Bell Smith Springs, 1.X.1977, Mueller Nos. 259, 262, 267, 268, 270, 273, 275 (SIU); same locality, 9.V.1981, Nos. 43087, 43088 (TENN); Williamson Co., Crab Orchard Wildlife Refuge, 6.XI.1977, Mueller No. 390, 393 (SIU); River Forest, 21.VII.1902, coll. Harper (F).

Louisiana. St. Tammany Parish, Fontainebleau State Park, 8.XII.1980, No. 43076 (TENN); St. Tammany Parish, Honey Island Nature Trail, 10.XII.1980, Nos. 43077-43079 (TENN); Walker, 31.VII.1952, Stuntz No. 7296, 7308a (WASH).

Maine. Oxford Co., Canton Pt., 13.X.1942, No. 45856 (CUP); Penobscot Co., Old Town, College Ave., University of Maine, 13.VII.1972, Homola No. 5157 (MAINE); Penobscot Co., Orono, Bangor Bog, 8.X.1974, Kimball No. 6159 (MAINE); Northport, Bayside area, 8.IX.1974, Kimball No. 6036 (MAINE).

Maryland. Laurel, Beltsville Forest Dis. Lab., Telegraph Road, 16.X.1969, Miller No. 8228 (VPI).

Michigan. Jackson Co., Sharron Hollow, 26.VI.1937, Smith No. 6409 (MICH); Montmorency Co., 8.VII.1981, Thiers No. 22213 (SAFU); Washtenaw Co., Ann Arbor, 18.VIII.1943, Smith No. 18862 (TENN); Neebish, VIII.1911, Harper No. 3106 (F); Hartwig Pines, 13.VIII.1957, Stuntz No. 10568 (WASH).

Mississippi. Harrison Co., DeSoto National Forest, 6.XII.1980, No. 43075 (TENN).

New Jersey. Mammoth Co., 18.VI, coll. Ballou (NY); Newark, 1890, coll. Ellis (NY).

New York. Bronx Co., New York Botanical Garden, 13.VIII.1902, coll. Earle (NYS) [Holotype of C. tortilis gracilis]; same locality, coll. Murrill (NY); Warren Co., Bolton Landing, August, coll. Peck (NYS) [Holotype of C. laccata var. decurrens]; Washington Co., east of Tripoli, Lake George region, 7-14.X.1918, No. 4415 (CUP); Menands,

Piseco, 26.VIII.1928, coll. Peck (NYS); Newcomb, Huntington Wild Life Forest, 6-17.IX.1941, coll. Singer (FH); Catskill Mts., September, coll. Peck (NYS) [Holotype of C. laccata var. striatula]; Selkirk, Lake Mohonk, October, coll. Peck (NYS) [Holotype of C. laccata var. pallidifolia].

North Carolina. Hendersonville Co., near Camp Green Cove, 14.IX.1980, No. 43049 (TENN); same locality, 17.IX.1980, Nos. 43060, 43061 (TENN); Hendersonville Co., near Camp Green Cove, Davis Creek Trail, 15.IX.1980, Nos. 42959, 42960 (TENN); Hendersonville Co., near Camp Green Cove, Scheck property, 19.IX.1980, Nos. 43061-43068 (TENN); Hendersonville Co., near Camp Green Cove, 19.IX.1980, No. 43069 (TENN); same locality, 20.IX.1980, Nos. 43070-43074 (TENN); Jackson Co., Whiteside Mt. Trail, 16.VII.1979, Nos. 42979-42983 (TENN); same locality, 9.IX.1979, Nos. 42996-43002 (TENN); same locality, 8.VIII.1980, No. 42958 (TENN); Macon Co., Lamb Mt. Road, 13.VII.1979, Nos. 42972-42974 (TENN); Macon Co., near Highlands, Chiquapin Mt. Trail, 13.VII.1979, No. 42975 (TENN); Macon Co., Highlands, near Ilges Cottage, 14.VII.1979, Nos. 42976, 42977 (TENN); Macon Co., Elicot Rock Trail, 17.VII.1979, No. 42984 (TENN); Macon Co., Nantahala National Forest, Wayah Bald, 18.VII.1979, Nos. 42957, 42985-42991 (TENN); same locality, 11.IX.1979, Nos. 43007-43016 (TENN); Macon Co., Nantahala National Forest, near Highlands, off U.S. 64, 10.IX.1979, Nos. 43003, 43004 (TENN); Macon Co., Nantahala National Forest, Glen Falls area, 10.IX.1979, Nos. 43005, 43006 (TENN); Macon Co., Highlands, Ravenel Park, 12.IX.1979, Nos.

43017-43020 (TENN); Macon Co., near Highlands, Horse Cove, 13.IX.1979, Nos. 43021-43025 (TENN); same locality, 14.VII.1979, No. 42978 (TENN); Macon Co., Coweeta Hydrologic Research Station, 14.IX.1979, Nos. 43026-43033 (TENN); same locality, 11.VIII.1980, Nos. 43050, 43051 (TENN); Transylvania Co., Estate of G. W. Vanderbilt, 13-24.VII.1908, coll. Murill and House (NY).

Ohio. Carroll Co., near Leesville Lake, Old Scott Place, 28.IX.1979, Nos. 43047, 43048 (TENN); Columbus, coll. Sullivan (NY) [Holotype of A. ohiensis].

Oregon. Benton Co., Corvallis, 3.XI.1981, No. 43109 (TENN); Lane Co., Honeyman Memorial State Park, 4.XI.1981, Nos. 43111-43116 (TENN); Lincoln Co., Siuslaw National Forest, Tricullum campground, 7.XI.1981, No. 43117 (TENN); Lincoln Co., South Beach State Park, 8.XI.1981, No. 43118 (TENN); same locality, 12.XI.1981, Nos. 43119-43121, 42964 (TENN); Tillamook Co., Camp Meriwether, 12.XI.1976, Thier No. 36956 (SAFU).

Tennessee. Sevier Co., Great Smoky Mountains National Park, Ramsey Cascade area, 30.VII.1979, Nos. 42992-42995 (TENN).

Utah. Wasatch National Forest, between Bald Mountain Pass and Evanston, 4.VIII.1970, Thiers No. 26698 (SAFU).

Washington. Grays Harbor Co., Ocean City State Park, 20.X.1981, Nos. 43096-43098 (TENN); same locality, 21.X.1981, Nos. 43099-43103 (TENN); King Co., Seattle, Woodland Park, 11.X.1981, Nos. 43092, 43093 (TENN); King Co., Snoqualmie National Forest, Asahel Curtis Nature Trail, 13.X.1981, No. 43094 (TENN); Kittitas Co., Snoqualmie

National Forest, Pacific Crest Trail, Stampede Pass, 14.X.1981, No. 43095 (TENN); Kittitas Co., Snoqualmie National Forest, near Cooper's Lake, 24.X.1981, Nos. 43104, 43106 (TENN); Mason Co., near Sheldon, north of Mason Lake. 27.X.1981, Nos. 43106-43108 (TENN); Pierce Co., Mt. Rainier National Park, Caibon River, 22.VII.1948, Smith No. 29255 (MICH).

Vermont. Starksboro, 2.IX.1880, coll. Pringle (FH); Wallingford, Elfin Lake, 6.X.1952, No. 38894 (CUP).

Virginia. Mountain Lake, 8-14.VII.1909, coll. Murrill (NY).

West Virginia. Pocahontas Co., Cranberry Backcountry, 9.IX.1981, No. 43126 (TENN); Randolph Co., Monongahela National Forest, Stuart Recreation Area campground, 3.VIII.1980, No. 43049 (TENN).

Wisconsin. Devil's Lake, VI.1911, Harper No. 3397 (F).

Wyoming. Carbon Co., Medicine Bow Mts., 15.VIII.1950, Solheim No. 45768.

LACCARIA LATERITIA

United States

Maine. Piscataquis Co., Baxter State Park, Katahdin Lake Trail, 1.IX.1962, Bigelow No. 11473 (MASS).

Uruguay

Montevideo, 1927, No. 2800 (MPU) [REPRESENTATIVE SPECIMEN].

Zaire

Ori, Nioka, V.1926, Goossens No. 558 (BR).

LACCARIA LAVENDIPESCanada

New Brunswick. Kouchibouquac National Park, Temporary Pond,
21.IX.1978, No. 169575 (DAOM).

Ontario. Nipissing Dist., Algonquin Park, 11.VI.1974, No.
152411 (DAOM).

United States

Illinois. Alexander Co., West Nos. 878, 889 (SUI); Pope Co.,
Bell Smith Springs Recreation Area, 1.X.1977, Mueller No. 257 (SIU);
Union Co., Union Co. Forest Reserve, 30.X.1977, Mueller No. 388
(SIU); Union Co., West No. 931 (SIU); Williamson Co., Crab Orchard
Wildlife Refuge, 6.X.1977, Mueller No. 394 (SIU).

Louisiana. Tangipahoa Parish, Chappelpeela Creek, 5.VI.1976,
Bigelow No. 17668 (TENN).

North Carolina. Hendersonville Co., near Camp Green Cove,
Davis Creek Trail, 17.IX.1980, No. 42752 (TENN); Hendersonville Co.,
Scheck property, 19.IX.1980, No. 42753 (TENN); Macon Co., Highlands,
Ravenel Park, 12.IX.1979, No. 42756 (TENN).

Tennessee. Knox Co., I. C. King Park, 7.VI.1979, No. 42760
(TENN); Sevier Co., Great Smoky Mountains National Park, Clingman's
Dome, 6.IX.1980, Nos. 42521 [HOLOTYPE], 42754, 42754, 42758, 42759
(TENN).

Washington. Kittitas Co., Snoqualmie National Forest, near
Cooper's Lake, 24.X.1981, No. 42755 (TENN).

West Virginia. Tucker Co., Blackwater Falls area, 4.VIII.
1980, No. 42757 (TENN).

LACCARIA MICROSPORA

United States

Tennessee. Blount Co., Great Smoky Mountains National Park,
Cades Cove, 13.IX.1979, No. 42528 (TENN) [HOLOTYPE].

LACCARIA MOELLERI

U.S.S.R.

Near Trebon, 30.IX.1970, Singer No. C5227 (F) [HOLOTYPE].

United States

Colorado. Jackson Co., Colorado State Forest, Cameron Pass,
15.IX.1981, No. 42875, 42876 (TENN).

Illinois. Perry Co., Pyramid State Park, 16.X.1977,
Mueller No. 353, 373, 359, 375, 376, 361 (SIU).

North Carolina. Hendersonville Co., Camp Green Cove,
20.IX.1980, Nos. 42873, 42874 (TENN).

LACCARIA MONTANA

Canada

British Columbia. Alice Lake Provincial Park, near Vancouver,
5.X.1981, No. 42885 (TENN).

Faeroe Islands

Ostero, Slottorotinde, 17.VII.1938, coll. Møller (C) [Holotype of L. laccata var. montana].

Switzerland

Valais, Borgne de Fepecle, 11.VII.1971, Singer No. 5464 (F) [HOLOTYPE].

United States

Alaska. Navy Arctic Research Lab, USIBP Tundra Biome Sites, 4.VIII.1977, Laursen No. 1172; same locality, 26.VIII.1978, Laursen No. 1397, same locality, 28.VII.1979, Laursen No. 1500.

Colorado. Jackson Co., Colorado State Forest, Cameron Pass, 15.IX.1981, Nos. 42879-42881 (TENN); Larimer Co., Roosevelt National Forest, Blue Lake Trail, 13.IX.1981, Nos. 42877, 42878 (TENN); San Juan Mts., Trout Lake, 16.VIII.1956, Smith No. 52298 (MICH).

Idaho. Bonner Co., Kaniksu National Forest, West Side Priest Lake Road, 28.IX.1981, Nos. 42882-42884 (TENN).

Montana. Avalanche Campground, 20.VII.1979, Miller No. 18092 (VPI).

Washington. Clallam Co., Fort Flagler State Park, 16.X.1981, No. 42892 (TENN); Kittitas Co., Snoqualmie National Forest, near Kachess Lake, 14.X.1981, Nos. 42887-42891 (TENN); King Co., Snoqualmie National Forest, Asahel Curtis Nature Trail, 13.X.1981, No. 42886 (TENN).

Wyoming. Pole Mts., 19.VII.1950, Smith No. 34945 (MICH).

LACCARIA NOBILISCanada

Nova Scotia. Kings Co., Scotts Bay, Split Cape, 28.VIII.1978, No. 42532 (TENN).

United States

Colorado. Jackson Co., Colorado State Forest, Cameron Pass, 15.IX.1981, Nos. 42901, 42902 (TENN); Larimer Co., near Chambers Lake, Roosevelt National Forest, 11.IX.1981, No. 42897 (TENN); Larimer Co., Roosevelt National Forest, Blue Lake Trail, 12.IX.1981, No. 42898 (TENN); same locality, 13.IX.1981, No. 42527 [HOLOTYPE], 42893-42896, 42899, 42900 (TENN); same locality, 16.IX.1981, Nos. 42903, 42904 (TENN).

Idaho. Boundary Co., 13.VIII.1958, Smith No. 60046 (MICH).

New Mexico. Mountains near Santa Fe, 11.VII.1981, Potter No. 282 (MICH).

New York. Newcomb, Huntington Wild Life Forest, 17.VI.1941, coll. Singer (FH).

Washington. Kittitas Co., Snoqualmie National Forest, Cooper's Lake, 24.X.1981, Nos. 42905, 42906 (TENN).

LACCARIA OBLONGOSPORAUnited States

Mississippi. Harrison Co., DeSoto National Forest, Road H-6, 6.XII.1980, Nos. 42673, 42674, 42676, 42677 (TENN); Harrison Co.,

DeSoto National Forest, Road H-8, 7.XII.1980, Nos. 42522 [HOLOTYPE], 42524, 42675, 42679-42702 (TENN).

LACCARIA OCHROPURPUREA

Canada

Nova Scotia. Kentville, 1.IX.1950, No. 111857 (DAOM).

Ontario. Lake Musdoda, Creighton's Point, 28.VIII.1940, No. 10147 (DAOM); near Ottawa, Green's Creek, 22.VIII.1927, No. 40933 (DAOM); same locality, 10.IX.1928, No. 40931 (DAOM); St. Lawrence Island National Park, McDonald Island, No. 154703 (DAOM); same locality, 29.IX.1976, No. 158826 (DAOM).

P.Q. Mt. Burnet, 5.X.1935, No. F5968 (DAOM); near Chelsea, Gilmour's Grove, 2.VIII.1923, No. 40932 (DAOM).

United States

Alabama. Montgomery, Johnson Woods, 4.X.1942, coll. Burke (MICH); Montgomery, coll. Burke (NY).

Florida. Planera Hammock, 3.I.1939, No. 19516 (FLAS).

Illinois. Alexander Co., West Nos. 887, 896 (SIU); Jackson Co., Burton No. 156 (SIU); Jackson Co., Little Grand Canyon, 3.IX.1977, Mueller Nos. 158, 159 (SIU); Jackson Co., Giant City State Park, near Devils Stand Table, 9.IX.1977, Mueller Nos. 179, 180, 181, 182, 185 (SIU); Jackson Co., Lake Murphysboro, 2.X.1977, Mueller No. 307 (SIU); Jackson Co., Giant City State Park, Devils Stand Table trail, 5.X.1977, Mueller Nos. 311, 312, 314, 315 (SIU); Jackson Co., Sundberg Nos. 2576, 2871, 2876, 2936 (SIU); Perry Co., Pyramid State

Park, near Heron Pond, 16.X.1977, Mueller Nos. 367 (SIU); Union Co., West Nos. 819, 842, 937 (SIU); Williamson Co., Jones No. 136 (SIU); Williamson Co., near Devils Kitchen Lake, 24.X.1977, Mueller No. 238 (SIU); Williamson Co., near Little Grassy Lake, 5.X.1977, Mueller No. 320 (SIU); Williamson Co., Sundberg No. 2956 (SIU); Glencoe, X.1909, Harper No. 2640 (F); Glen Ellen, X.1902, coll. Harper (F).

Iowa. Iowa City, 12.IX.1938, No. 33863 (CUP).

Kentucky. Middlesboro, 1.X.1914 (NY).

Maine. Penobscot Co., Old Town, Country Road, 20.VIII.1971, Homola No. 5018 (MAINE).

Maryland. Baltimore Co., Gunpowder Region, 27.IX.1919, Kelly No. 207 (FH); Laurel, 6.IX.1965, Miller No. 3532 (VPI).

North Carolina. Haywood Co., Great Smoky Mountains National Park, Big Creek area, 27.IX.1979, Nos. 42911, 42912 (TENN); Hendersonville Co., near Camp Green Cove, 13.IX.1980, Nos. 42908, 42913, 42914 (TENN); same locality, 17.IX.1980, Nos. 42915, 42916, 42917 (TENN); same locality, 19.IX.1980, Nos. 42918, 42909 (TENN); Transylvania Co., Piscah National Forest, Davidson Creek campbround, 7.IX.1980, No. 42907 (TENN).

Ohio. Carroll Co., Air Strip Trail area, 29.IX.1979, No. 42910 (TENN); Highland Co., Fort Hill, 14.X.1961, Cooke No. 32898 (MICH); Cincinnati, Lea No. 261 (K) [HOLOTYPE].

Pennsylvania. Warren Co., near Brookston Tronesta Tract, 25.VII.1940, Henry No. 3878 (FH).

South Carolina. Near Charleston, Folly Island, 16.II.1916, coll. Small and Bragg (NY).

Texas. Houston, 14.I.1942, coll. Fisher (F); no. 8140 (CUP).

Vermont. Lamoille Co., near Mt. Mansfield, Ranch Brook,
27.VII.1964, Bigelow No. 13088 (MASS); Dummerston, Dutton Pines,
23.IX.1961, Bigelow No. 9843 (MASS).

Virginia. Giles Co., Mountain Lake, 2-4.IX.1936, coll. Linder
(FH); Near Mountain Lake, White Pine Lodge, VIII.1947, coll. Wilson
(FH); Grayson Co., Jefferson National Forest, Lewis Fork Trail,
9.IX.1981, No. 43127 (TENN).

West Virginia. Cabell Co., Huntington, Enslow Addition,
6.X.1938, coll. Balser (FH); Greenbrier Co., 12.IX.1980, No. 43128
(TENN).

Wisconsin. Lodi, 1.X.1977, No. 166267 (DAOM); 8.IX.1939,
coll. Olmsted (F).

LACCARIA PROXIMA

Canada

Nova Scotia. Kings Co., near Scotts Bay, Split Bay Trail,
28.VIII.1978, No. 42537 (TENN).

British Columbia. Alice Lake Provincial Park, 3.X.1981, No.
42942 (TENN); Garibaldi Provincial Park, 5.X.1981, Nos. 42945-42947
(TENN).

Chile

Valdivia, Cordillera Pelada, 30.III.1963, No. 27156 (BAFC)
[Paratype of L. proximella].

France

Montmorency, Chestnut Hill, 20.X.1903, coll. Atkinson (CUP);
 Montmorency, XI.1904, coll. Boudier (PC) [NEOTYPE]; St. Die Vosges,
 21.VIII.1910, coll. Atkinson, No. 24995 (CUP).

Italy

Trento, X.1899, Bresadola (NYBG).

United States

Alaska. Point Barrow, Navy Arctic Research Lab, I.B.P. site,
 3.VIII.1970, WK No. 4573 (TENN 42928); Arctic Valley, 31.VIII.1971,
 WK No. 5404 (TENN 42929); NARL, USIBP Tundra Biome Site 3, 28.III.1979,
 Laursen No. 1499.

Florida. Alachua Co., Gainesville, 29.XII.1942, No. F1672
 (FLAS); same locality, 1.I.1949, No. F45770 (FLAS); Marion Co., Ocala
 National Forest, near Mill Dam Road, 24.VIII.1980, No. 42939 (TENN);
 Sarasota Co., Sarasota, XII.1980, Williams No. 1000 (TENN); same
 locality, 16.XII.1981, Williams No. 1006 (TENN).

Idaho. Bonner Co., Kaniksu National Forest, Binarch Creek
 Road, 26.IX.1981, No. 42920 (TENN); same locality, 27.IX.1981, No.
 42921, 42943 (TENN); Bonner Co., Kaniksu National Forest, 27.IX.1981,
 No. 42944 (TENN); Bonner Co., Kaniksu National Forest, West Side
 Priest Lake Road, 28.IX.1981, No. 42922 (TENN).

Michigan. Washtenaw Co., Whitmore Lake, 4.IX.1977, Smith No.
 87798 (MICH).

Mississippi. Harrison Co., DeSoto National Forest, Airey Lake,
 6.XII.1980, Nos. 42940, 42941 (TENN).

North Carolina. Jackson Co., Whiteside Mountain, 9.IX.1979, Nos. 42919, 42930-42932 (TENN); Macon Co., Nantahala National Forest, Wayah Bald, 11.IX.1979, Nos. 42933, 42934 (TENN); Macon Co., near Highlands, Horse Cove, 13.IX.1979, No. 42935 (TENN).

Ohio. Carroll Co., Air Strip Trail area, 29.IX.1979, Nos. 42936-42938 (TENN).

Oregon. Benton Co., Corvallis, Oregon State University campus, 2.XI.1981, No. 42951 (TENN); Lincoln Co., Siuslaw National Forest, Trillicum campground, 8.XI.1981, No. 42952 (TENN); Lincoln Co., South Beach State Park, 12.XI.1981, No. 42927, 42953 (TENN); Tillamook Co., Meriwether Dunes, 13.XI.1981, No. 42954 (TENN); Tillamook Co., Southside Sand Lake, 20.XI.1978, Hunt No. 027 (OSC).

Washington. King Co., Snoqualmie National Forest, Asahel Curtis Nature Trail, 13.X.1981, No. 42923 (TENN); King Co., near Redmond, Watermain Woods, 24.X.1981, No. 42924 (TENN); Kittitas Co., Snoqualmie National Forest, near Cooper's Lake, 24.IX.1981, No. 42925 (TENN); Mason Co., near Sheldon, north of Mason Lake, 27.X.1981, Nos. 42926, 42949, 42950 (TENN); Whatcom Co., Ross National Recreation Area, Pyramid Lake Trail, 8.X.1981, No. 42948 (TENN).

LACCARIA TORTILIS

Argentina

La Baea, V.1880, Spegazzini No. 2891 (LPS) [Holotype of A. (Clitocybe) echinosporus].

Canada

Ontario. Grenadier Island, St. Lawrence Island National Park, 10.VII.1975, Redhead No. 1619; Leeward Island, St. Lawrence National Park, 22.VII.1976, No. 159029 (DAOM).

Scotland

Yorkshire, Tanfield Lodge, 6.IX.1969, Orton No. 3642 (E) [NEOTYPE]; I of Mull, near Quinish House, 7.IX.1976, Watling No. 12479 (E); Norfolk, Surlingham Wood, 25.VIII.1969, Orton No. 3641 (E); Perthshire, 17.VIII.1972, Watling No. 9465 (E), Perthshire, Inver, 27.X.1975, Watling No. 11347 (E); Yorkshire, Bishop Wood, 26.IX.1971, Watling No. 8947 (E).

United States

Maine. Penobscot Co., Orono, Bangor Bog, 8.X.1974, Homola No. 6158 (MAINE); Penobscot Co., Newburgh, Bog Brook area, 15.IX.1974, Kimball No. 6078 (MAINE).

Massachusetts. Hamilton Co., Amherst, Sunset Ave., 16.V.1976, Baroni No. 2445 (MASS).

Michigan. Cheboygan Co., Burt Lake, Colonial Point, 1.X.1960, Smith No. 63093 (MICH); Cheboygan Co., Colonial Point, 6.IX.1969, Ammirati 3845 (MICH); Marquette, 4.IX.1933, Smith No. 33862 (MICH); Neebish, VIII.1909, Harper No. 2372 (F); Neebish, IX.1917, coll. Harper (F).

New York. Sand Lake, August, coll. Peck (NYS).

Oregon. Benton Co., Corvallis, Oregon State University, 2.XI.1981, No. 42955 (TENN).

Washington. Smith No. 14296 (MICH).

Wyoming. N.E. Pole Mt. area, 7.VIII.1950, Smith No. 34564 (MICH).

The Netherlands

Noord-Brabant, Ulvenhout near Breda, 18.VIII.1959, Maas Geesteranus No. 12908 (MICH).

LACCARIA TRICHODERMOPHORA

United States

Alabama. Montgomery, coll. Burke (NY).

Louisiana. St. Tammany Parish, Fontainebleau State Park, 8.XII.1980, Nos. 42722-42725 (TENN); St. Tammany Parish, Honey Island Nature Trail, 10.XI.1980, No. 42732 (TENN).

Mississippi. Hancock Co., NASA Test Site, 9.XII.1980, Nos. 42730, 42731 (TENN); Harrison Co., DeSoto National Forest, Road H-6, 5.XII.1980, Nos. 42523 [HOLOTYPE], 42703-42705, 42708-42711, 42733 (TENN); same locality, 6.XII.1980, Nos. 42716-42718 (TENN); Harrison Co., DeSoto National Forest, near Airey Lake, 6.XII.1980, Nos. 42719, 42706 (TENN); Harrison Co., DeSoto National Forest, trail to P.O.W. Camp, 6.XII.1980, Nos. 42712-42715 (TENN); Harrison Co., DeSoto National Forest, near Harrison Experimental Forest Office, 7.XII.1980, Nos. 42720, 42721 (TENN); Pearl River Co., Picayune, woods behind Bill Cibula's home, 9.XII.1980, Nos. 42726-42729 (TENN).

Washington. Kittitas Co., Snoqualmie National Forest, near Cooper's Lake, 24.X.1981, No. 42707 (TENN).

LACCARIA TRULLISATACanada

New Brunswick. Kouchibouguac National Park, 3.X.1978, No. 169941 (DAOM); Kouchibouguac National Park, Kelly's Beach, 7.IX.1978, No. 169582 (DAOM).

United States

Connecticut. Deep River, Cockaponsett State Park, 18.IX.1966, coll. Lucas (MASS).

Florida. Levy Co., Cedar Keys, Way Key, 22.I.1949 (F).

Illinois. Peoria, IX.1969, coll. Grundy (MASS).

Indiana. Deaverly Shores, Singer No. N1815.

Maine. Oxford Co., near Brownfield, 28.X.1973, Homola No. 5879 (MAINE).

Maryland. Talbot Co., Choptemk River, 24.IX.1922, coll. Fisher (MICH); Hoffman Hill Road, Beltsville Exp. Forest, 6.XI.1968, Miller No. 7109 (VPI); Laurel, Beltsville Exp. Forest, 12.IX.1969, Miller No. 8071 (VPI); same locality, 14.X.1969, Miller No. 8225 (VPI).

Massachusetts. Franklin Co., Sunderland, 24.IX.1957, Bigelow No. 6314 (MASS), No. 82782 (DAOM); Franklin Co., Montague Center, 4.X.1966, Bigelow No. 14916 (MASS); Cape Cod, near Marson's Mill, 26.VIII.1945, coll. Linder (FH); Westport, Horseneck Beach, 27.X.1973, Bigelow No. 17299 (MASS).

Michigan. Baraga Co., near mouth of Huron River, 16.X.1970, Ammirati No. 5687 (MICH); Chippewa Co., Whitefish Point, 9.IX.1951, Smith No. 38574 (MICH); Muskegon Co., Cedar Creek Twp., S.E. corner sect. 31, 16.IX.1979, coll. Reznicek and Keddy (MICH).

New Jersey. Newfield, before 1874, coll. Ellis (NYS) [LECTOTYPE]; Seaside Park, 29.VIII.1902, Harshberger (NYS); Browns Mills, 29.IX.1945, coll. Aide; North American fungi 101 (NY, NYS, CUP).

New York. Albany Co., Karner, 14.X.1917, coll. House (NYS), Suffolk Co., Wading River, VIII.1905, coll. Peck (NYS); Suffolk Co., Orient Point, 13.XI.1911, coll. Latham (CUP); Long Island, 30.IX.1956, coll. Wetzel (NY).

North Carolina. Bogue, 31.X.1977, Randall No. 106 (NCSC).

Pennsylvania. Philadelphia, coll. Phettaas (FH).

Wisconsin. Trempealeau Co., near Osseo, 18.IX.1977, Mueller No. 127 (SIU).

LACCARIA VINACEO-BRUNNEA

United States

Louisiana. St. Tammany Parish, Fontainebleau State Park, 8.XII.1980, Nos. 42734, 42736-42748, 42751 (TENN); same locality, 9.XII.1980, Nos. 42525 [HOLOTYPE], 42735, 42739 (TENN); St. Tammany Parish, Honey Island Nature Trail, 10.XII.1980, Nos. 42749, 42750 (TENN).

Mississippi. Hancock Co., Pass Christian, 28.XII.1972, Smith No. 17772 (MICH).

APPENDIX B

ILLUSTRATIONS OF REPRESENTATIVE BASIDIOSPORES FROM LACCARIA TYPE SPECIMENS OR REPRESENTATIVE MATERIAL

Figure 24. Representative basidiospores from holotype of Laccaria tetraspora var. aberrans.

Figure 25. Representative basidiospores from holotype of Laccaria laccata var. affinis.

Figure 26. Representative basidiospores from holotype of Laccaria altaica.

Figure 27. Representative basidiospores from representative material of Laccaria amethystinus.

Figure 28. Representative basidiospores from holotype of Laccaria amethysteo-occidentalis.

Figure 29. Representative basidiospores from holotype of Laccaria laccata var. anglica.

Figure 30. Representative basidiospores from representative material of Laccaria laccata var. bicolor.

Figure 31. Representative basidiospores from holotype of Laccaria masonii var. brevispinosa.

Figure 32. Representative basidiospores from holotype of Laccaria calospora.

Figure 33. Representative basidiospores from holotype of Agaricus (Laccaria) canaliculata.

Figure 34. Representative basidiospores from holotype of Laccaria chibinensis.

Figure 35. Representative basidiospores from holotype of Laccaria laccata var. chilensis.

Figure 36. Representative basidiospores from holotype of Clitocybe laccata var. decurrens.

Figure 37. Representative basidiospores from holotype of Agaricus (Clitocybe) echinosporus.

Figure 38. Representative basidiospores from holotype of Laccaria fibrillosa.

Figure 39. Representative basidiospores from holotype of Agaricus fraternus.

Figure 40. Representative basidiospores from holotype of Laccaria galerinoides.

Figure 41. Representative basidiospores from holotype of Laccaria laccata var. gibba.

Figure 42. Representative basidiospores from holotype of Laccaria glabripes.

Figure 43. Representative basidiospores from holotype of Naucoria goossensiae.

NOTE: Reference line = 20 μm .

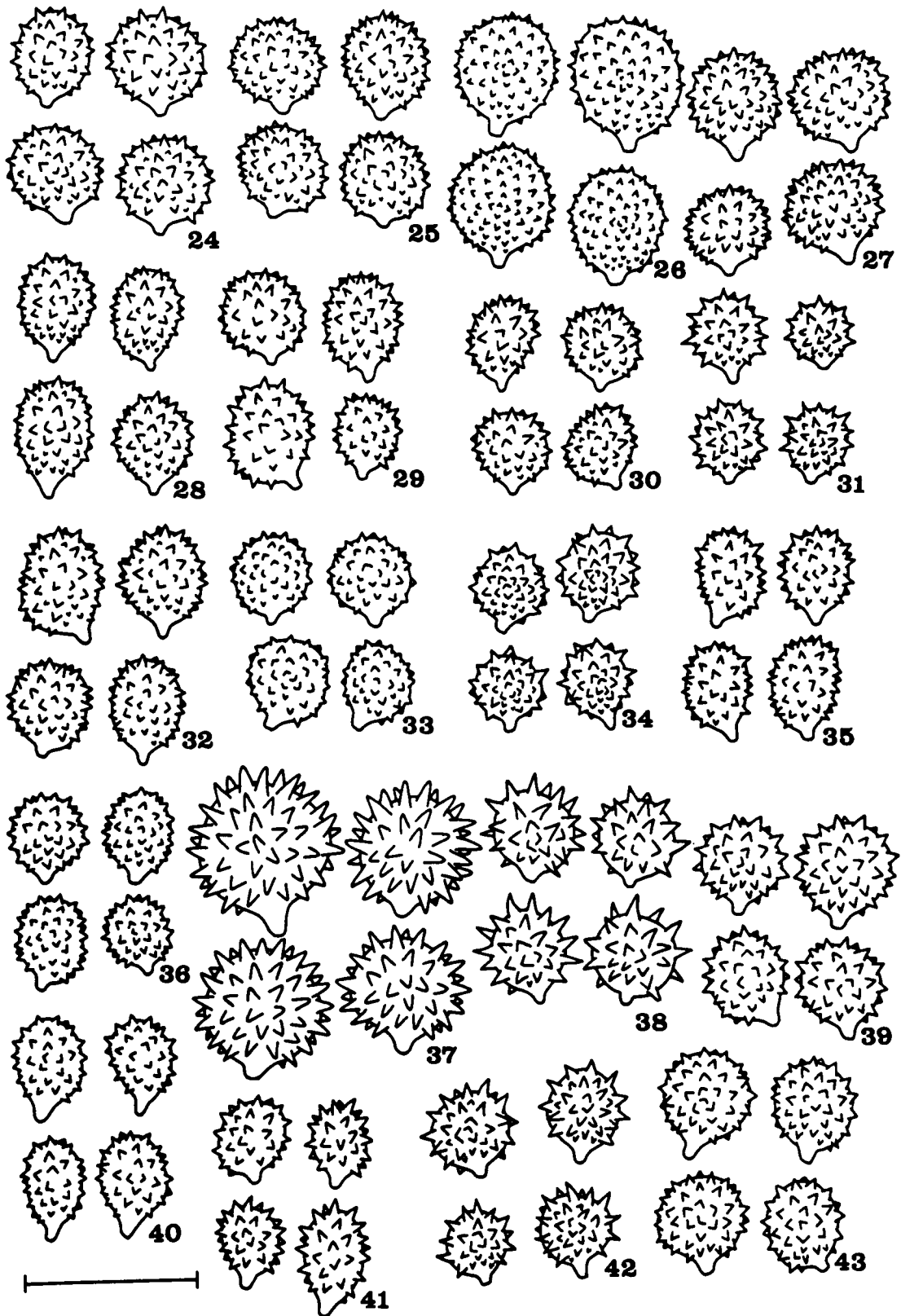


Figure 44. Representative basidiospores from holotype of Clitocybe tortilis var. gracilis.

Figure 45. Representative basidiospores from holotype of Laccaria laccata var. intermedia.

Figure 46. Representative basidiospores from authentic material of Laccaria lateritia.

Figure 47. Representative basidiospores from holotype of Laccaria lavendipes.

Figure 48. Representative basidiospores from holotype of Laccaria lilacina.

Figure 49. Representative basidiospores from representative material of Laccaria laccata.

Figure 50. Representative basidiospores from holotype of Laccaria masonii.

Figure 51. Representative basidiospores from holotype of Laccaria microspora.

Figure 52. Representative basidiospores from holotype of Laccaria laccata var. minuta.

Figure 53. Representative basidiospores from holotype of Laccaria laccata var. moelleri.

Figure 54. Representative basidiospores from holotype of Laccaria laccata var. montana.

Figure 55. Representative basidiospores from holotype of Laccaria montana.

Figure 56. Representative basidiospores from holotype of Laccaria nana.

Figure 57. Representative basidiospores from holotype of Laccaria nigra.

Figure 58. Representative basidiospores from holotype of Laccaria nobilis.

Figure 59. Representative basidiospores from holotype of Laccaria oblongospora.

Figure 60. Representative basidiospores from holotype of Agaricus ochro-purpureus.

Figure 61. Representative basidiospores from holotype of Agaricus ohiensis.

Figure 62. Representative basidiospores from holotype of Clitocybe laccata var. pallidifolia.

Figure 63. Representative basidiospores from holotype of Laccaria ohiensis var. paraphysata.

NOTE: Reference line = 20 μ m.

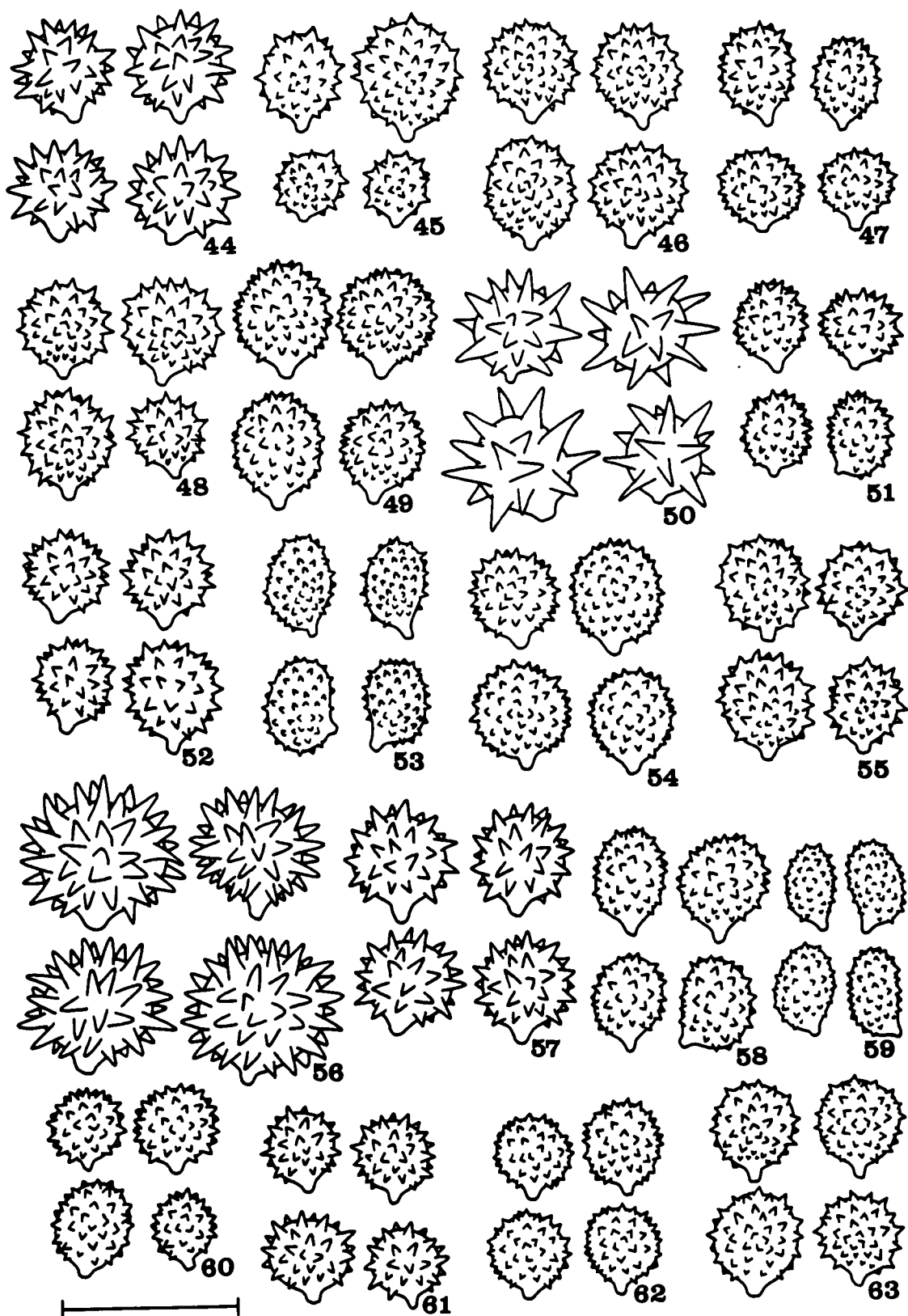


Figure 64. Representative basidiospores from holotype of Laccaria tetraspora var. peladae.

Figure 65. Representative basidiospores from holotype of Laccaria tetraspora var. peullensis.

Figure 66. Representative basidiospores from neotype of Laccaria proxima.

Figure 67. Representative basidiospores from holotype of Laccaria proximella.

Figure 68. Representative basidiospores from holotype of Laccaria purpureo-badia.

Figure 69. Representative basidiospores from holotype of Laccaria trullisata f. rugulospora.

Figure 70. Representative basidiospores from holotype of Laccaria tetraspora var. scotica.

Figure 71. Representative basidiospores from holotype of Clitocybe laccata var. striatula.

Figure 72. Representative basidiospores from holotype of Laccaria laccata var. subalpina.

Figure 73. Representative basidiospores from holotype of Laccaria laccata var. tatrensis.

Figure 74. Representative basidiospores from holotype of Laccaria tetraspora.

Figure 75. Representative basidiospores from neotype of Laccaria tortilis.

Figure 76. Representative basidiospores from holotype of Laccaria trichodermophora.

Figure 77. Representative basidiospores from lectotype of Agaricus trullissatus.

Figure 78. Representative basidiospores from holotype of Laccaria tetraspora var. valdiviensis.

Figure 79. Representative basidiospores from holotype of Laccaria vinaceo-brunnea.

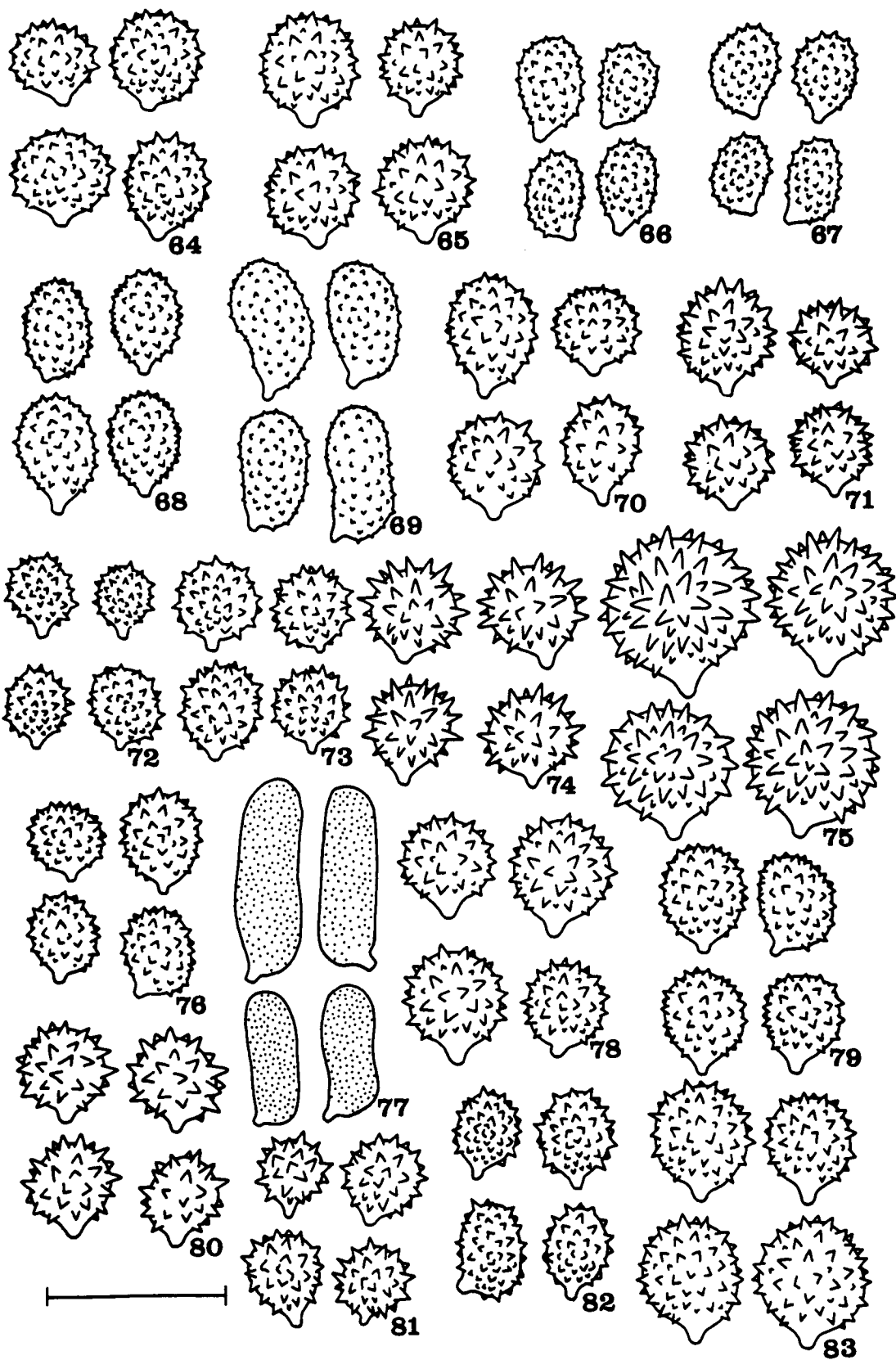
Figure 80. Representative basidiospores from holotype of Laccaria vinaceoavellanea.

Figure 81. Representative basidiospores from holotype of Laccaria violaceo-niger.

Figure 82. Representative basidiospores from holotype of Laccaria laccata var. vulcanica.

Figure 83. Representative basidiospores from representative material of Laccaria laccata var. xena.

NOTE: Reference line = 20 μ m.



APPENDIX C

ILLUSTRATIONS OF "BOXPLOTS" SHOWING MEAN, MEDIAN, RANGE, AND STANDARD DEVIATION OF BASIDIOSPORE MEASUREMENTS FOR LACCARIA TYPE AND REPRESENTATIVE SPECIMENS

Figure 84. "Boxplots" illustrating the mean, median, range and standard deviation of basidiospore length-width ratios for each Laccaria type or representative specimen. Refer to Figure 11, page 31, for further explanation. The small numbers represent the different taxa:

- 1 = L. tetraspora var. aberrans
- 2 = L. laccata var. affinis
- 3 = L. laccata var. anglica
- 4 = L. laccata var. intermedia
- 5 = L. laccata f. minuta
- 6 = L. tetraspora var. peladae
- 7 = L. tetraspora var. peullensis
- 8 = L. tetraspora var. scotica
- 9 = C. laccata var. striatula
- 10 = L. laccata var. tatrensis
- 11 = L. tetraspora
- 12 = L. tetraspora var. valdiviensis
- 13 = L. laccata var. xena
- 14 = L. glabripes
- 15 = C. tortilis var. gracilis
- 16 = L. microspora
- 17 = A. ohiensis
- 18 = L. laccata var. chilensis
- 19 = C. laccata var. decurrens
- 20 = L. laccata
- 21 = C. laccata var. pallidifolia
- 22 = L. laccata var. subalpina
- 23 = L. laccata var. gibba
- 24 = L. laccata var. vulcanica
- 25 = L. chibinensis
- 26 = L. vinaceoavellanea
- 27 = L. nobilis
- 28 = L. trichodermophora
- 29 = L. laccata var. bicolor
- 30 = L. lavendipes
- 31 = L. laccata var. moelleri
- 32 = L. oblongospora
- 33 = L. proxima
- 34 = L. proximella

- 35 = N. goosensiae
- 36 = L. lateritia
- 37 = L. ohiensis var. paraphysata
- 38 = A. canaliculata
- 39 = L. laccata var. montana
- 40 = L. montana
- 41 = L. altaica
- 42 = A. fraternus
- 43 = A. echinosporous
- 44 = L. nana
- 45 = A. tortilis
- 46 = L. masonii var. brevispinosa
- 47 = L. fibrillosa
- 48 = L. galerinoides
- 49 = L. lilacina
- 50 = L. masonii
- 51 = L. nigra
- 52 = L. purpureo-badia
- 53 = L. violaceo-niger
- 54 = A. ochro-purpureus
- 55 = L. amethystinus
- 56 = L. amethysteo-occidentalis
- 57 = L. calospora
- 58 = L. vinaceo-brunnea
- 59 = L. trullisata var. rugulospora
- 60 = A. trullisatus

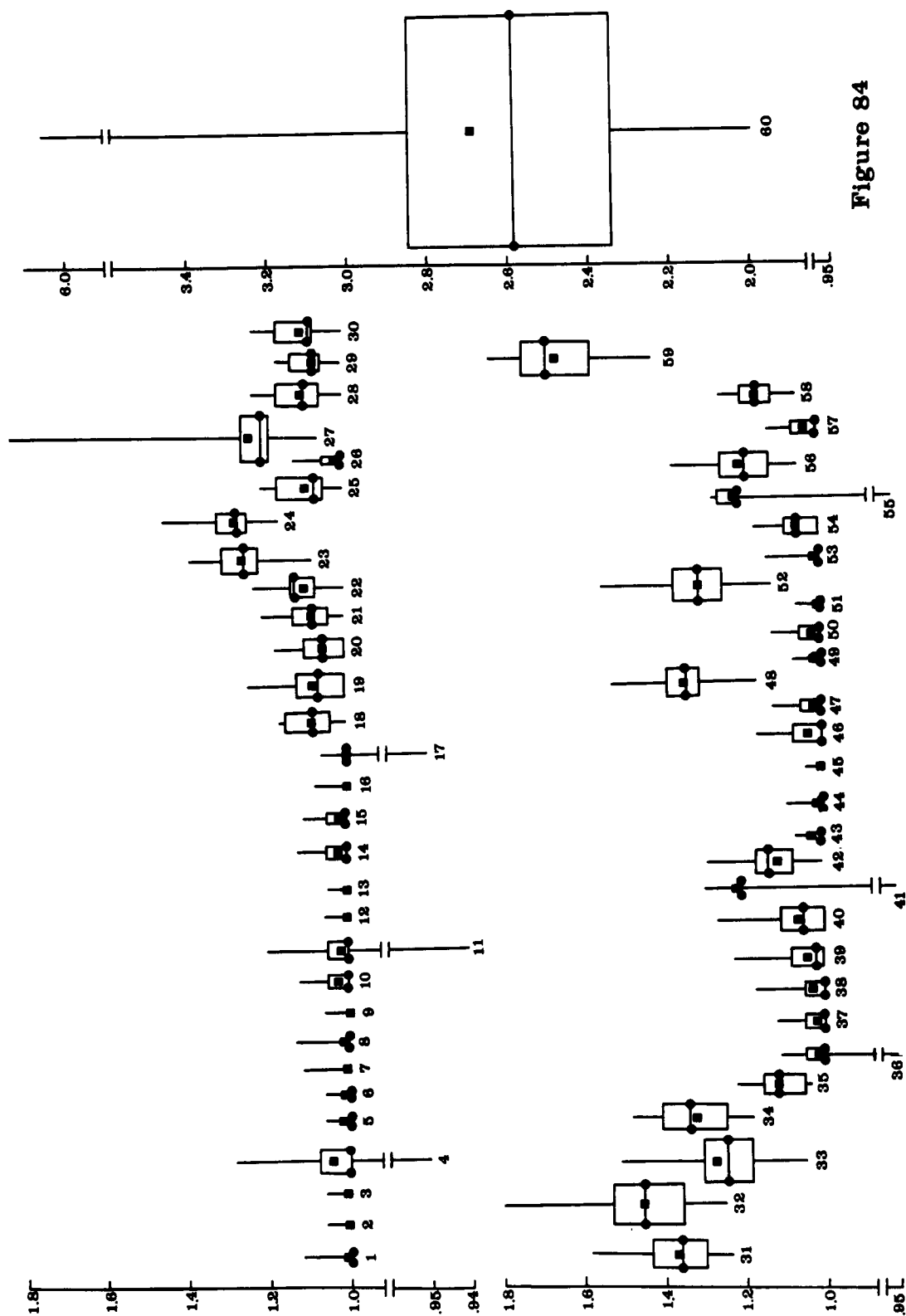


Figure 85. "Boxplots" illustrating the mean, median, range, and standard deviation of basidiospore ornamentation length for each Laccaria type or representative specimen. The small numbers represent the different taxa (see Figure 84, page 327).

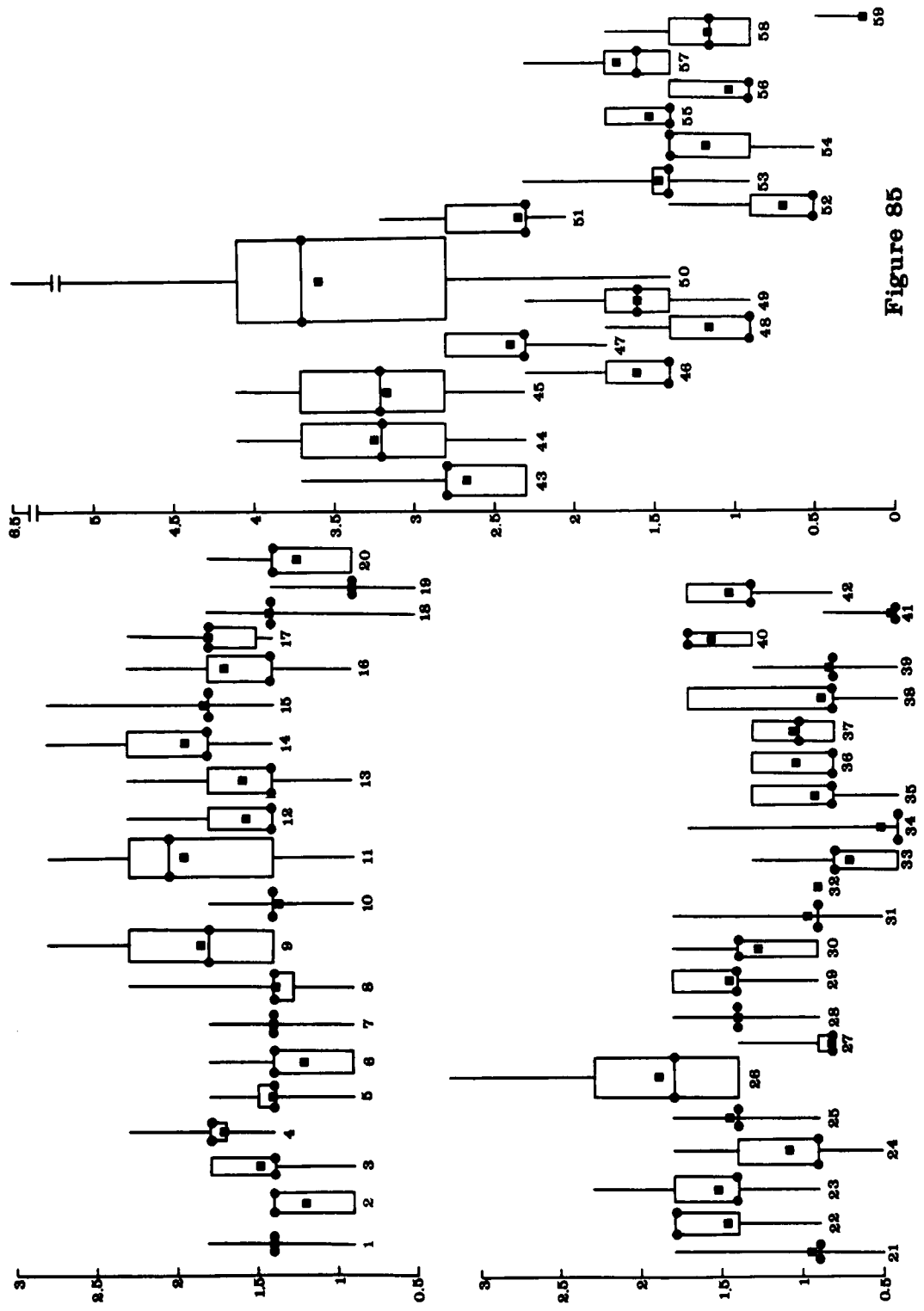


Figure 85

APPENDIX D

PHOTOGRAPHS OF REPRESENTATIVE NORTH AMERICAN TAXA

OF LACCARIA

Figure 86. Photograph of "typical laccata" macromorphology: Laccaria proxima. (TENN 42948). x 1.

Figure 87. Photograph of L. nobilis. (TENN 42893). x 1/2.

Figure 88. Photograph of "typical" 2-sterigmate Laccaria: L. altaica. (TENN 42548). x 1 1/4.

Figure 89. Photograph of L. bicolor. (TENN 42613). x 3/4.

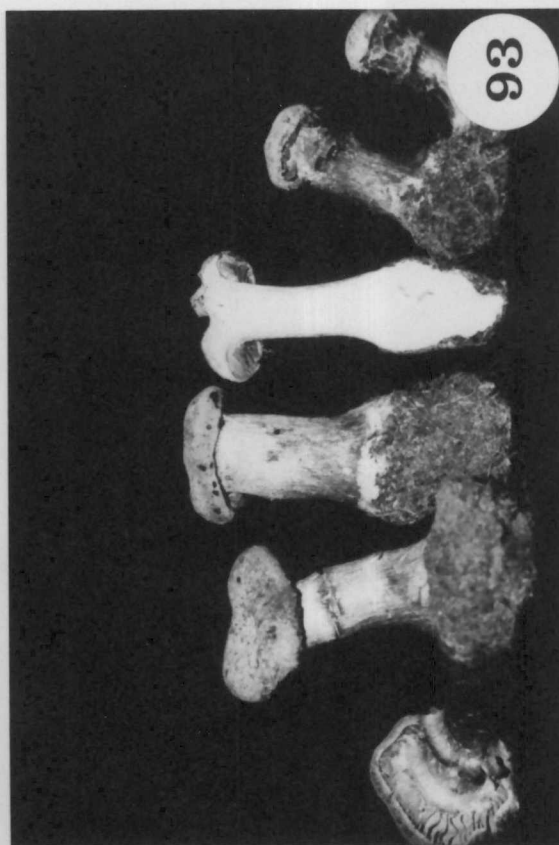


Figure 90. Photograph of L. amethystina. (Mueller No. 231).
x 1.

Figure 91. Photograph of L. amethysteo-occidentalis. (TENN 42526). x 3/4.

Figure 92. Photograph of L. ochropurpurea. (TENN 42908).
x 1/2.

Figure 93. Photograph of L. trullisata. (Mueller No. 192).
Note sand adhering to base of stipe and rupture of the outer stipe
tissue at apex. x 1/2.



APPENDIX E

PHOTOGRAPHS OF FOUR-WEEK-OLD SOMATIC CULTURE MATS OF THE 10 LACCARIA TAXA WHICH WERE SUCCESSFULLY CULTURED DURING THIS STUDY

Figure 94. Photograph of four-week-old somatic culture mats of L. laccata. (TENN 42961).

Figure 95. Photograph of four-week-old somatic culture mats of L. altaica. (TENN 42547).

Figure 96. Photograph of four-week-old somatic culture mats of L. trichodermophora. (TENN 42705).

Figure 97. Photograph of four-week-old somatic culture mats of L. lavendipes. (TENN 42752).

Figure 98. Photograph of four-week-old somatic culture mats of L. oblongospora. (TENN 42672).

Figure 99. Photograph of four-week-old somatic culture mats of L. proxima. (TENN 42920)

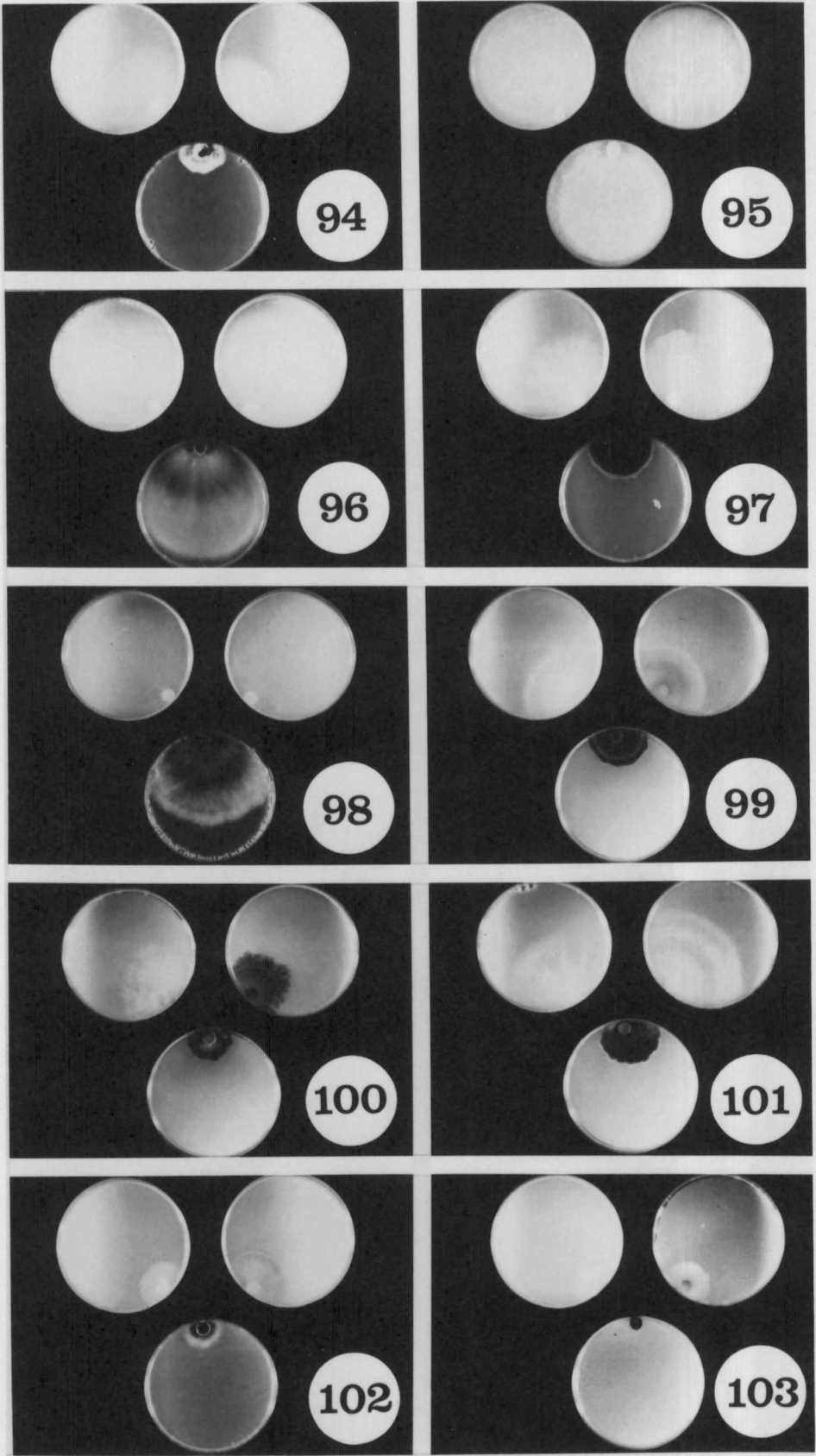
Figure 100. Photograph of four-week-old somatic culture mats of L. bicolor. (TENN 42606).

Figure 101. Photograph of four-week-old somatic culture mats of L. nobilis. (TENN 42893).

Figure 102. Photograph of four-week-old somatic culture mats of L. ochropurpurea. (TENN 42915).

Figure 103. Photograph of four-week-old somatic culture mats of L. amethysteo-occidentalis. (TENN 42526).

NOTE: In each figure, the upper left-hand isolate is growing on ME, the upper right-hand isolate is growing on MNM, and the bottom isolate is growing on PDA.



APPENDIX F

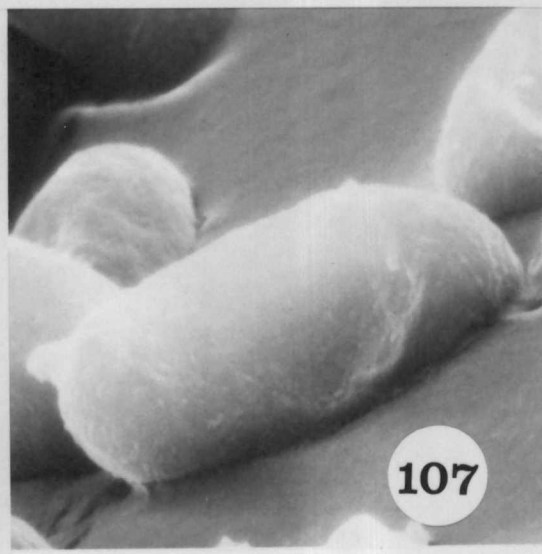
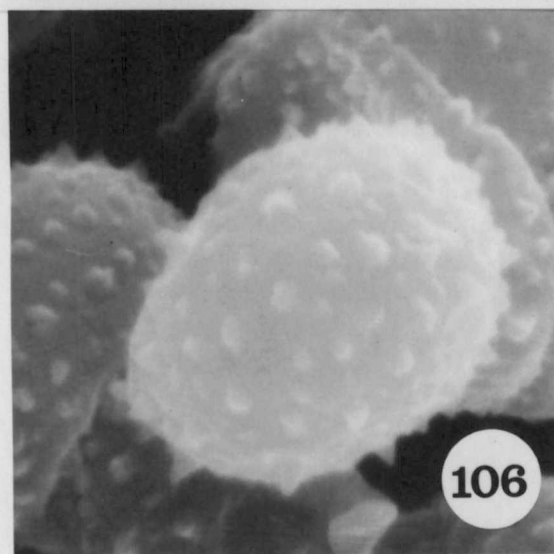
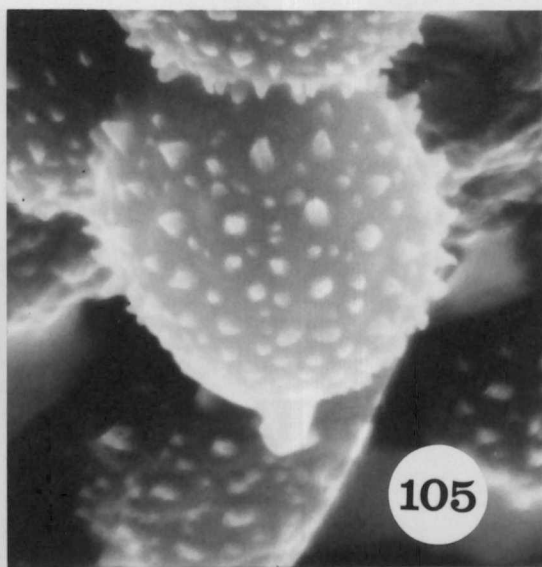
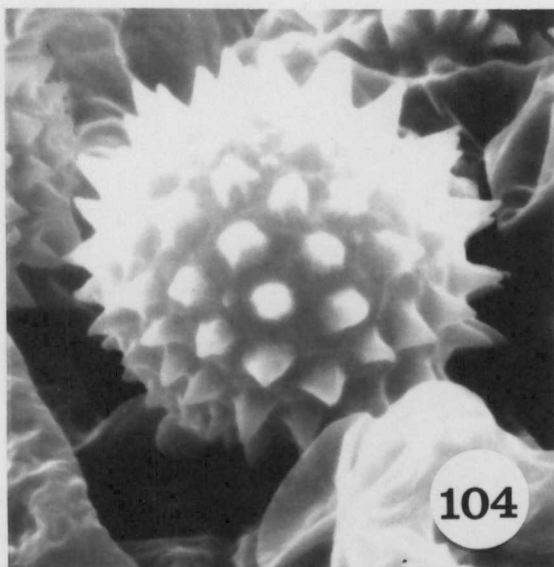
SCANNING ELECTRON MICROGRAPHS OF REPRESENTATIVE BASIDIOSPORES FOR NORTH AMERICAN TAXA OF LACCARIA

Figure 104. Scanning electron micrograph of L. tortilis basidiospores. (A. H. Smith No. 63093). x 3920.

Figure 105. Scanning electron micrograph of L. altaica basidiospores. (TENN 42554). x 3300.

Figure 106. Scanning electron micrograph of L. oblongospora basidiospores. (TENN 42675). x 5200.

Figure 107. Scanning electron micrograph of L. trullisata basidiospores. (Mueller No. 192). x 1300.



VITA

Gregory Michael Mueller was born in East St. Louis, Illinois on June 22, 1953. He was raised and attended elementary schools in Belleville, Illinois, where he graduated from Belleville Township East High School in 1971. He attended Southern Illinois University, Edwardsville as a Music Education major from Fall 1971 to Spring 1973. He then attended Belleville Area College where he was awarded an Associate of Arts degree in Biology in May 1974. Mr. Mueller received his Bachelor of Arts and Master of Science degrees in Botany at Southern Illinois University, Carbondale in 1976 and 1979, respectively.

In the fall of 1978 he entered The Graduate School of The University of Tennessee, Knoxville to study with Professor Ronald H. Petersen in the Department of Botany. He received the Doctor of Philosophy degree with a major in Botany in December 1982. During this time, Mr. Mueller undertook extensive field work throughout the southeastern and northwestern United States and Nova Scotia and British Columbia, Canada. Additionally, he presented papers at numerous professional meetings including the 1981 AIBS meetings at Bloomington, Indiana, where he was awarded the Graduate Research Prize by the Mycological Society of America for best paper presented by a graduate student.

The author will be a visiting researcher at the Institute of Physiological Botany, Uppsala University, Uppsala, Sweden from September 1982 through February 1983.

He is married to Betty A. Strack who shares his interest in mycology and has a Master of Science degree in Biology from Southern Illinois University, Carbondale.