To the Graduate Council:

I am submitting herewith a dissertation written by Dennis Edmund Desjardin entitled "The genus *Marasmius* from the southern Appalachian Mountains." 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.

Ronald H. Petersen, Major Professor

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and recommend its acceptance:

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Vice Provost
and Dean of The Graduate School

# THE GENUS *MARASMIUS*

# FROM THE

# SOUTHERN APPALACHIAN MOUNTAINS

A Dissertation

Presented for the

Doctor of Philosophy

Degree

The University of Tennessee, Knoxville

Dennis Edmund Desjardin

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This dissertation is dedicated to my parents, Alice and Edmund Desjardin, Jr., whose loving support and consistent encouragement have greatly influenced my development as a mycologist.

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## ABSTRACT

The genus *Marasmius* (Tricholomataceae, Agaricales, Basidiomycotina) constitutes one of the larger genera of litter-decomposing and litter-binding mushrooms, represented worldwide by approximately 500 species. Thirty-eight taxa representing eight sections of the genus are recognized as occurring in the southern Appalachian Mountains. Seven of these taxa are new to science, while an additional 14 are reported for the first time from the study area. In addition, one new section is proposed.

Descriptions of southern Appalachian species of *Marasmius* have been compiled from data on macro- and micromorphological features of basidiomata, supplemented with data on geographical and ecological distribution. Details on nomenclature and comparisons with phenetically similar taxa are provided, as are illustrations of diagnostic micromorphological characters. Dichotomous keys to the sections and species of southern Appalachian *Marasmius* are presented, and a preliminary key to *Marasmius* from North America is offered.

The taxonomic potential of cultural morphology and spot tests for phenoloxidase activity have been analyzed. Descriptions of culture mat morphology of 29 taxa grown on Malt Extract Agar (MEA) and Potato Dextrose Agar (PDA) are presented, and a synoptic key to aid in their diagnosis is provided. These studies indicated that culture mat morphology as developed on MEA was similar for most taxa, and consequently of limited taxonomic value. Conversely, culture mat morphology developed on PDA was distinctive and taxonomically useful

for each taxon examined. Results of spot tests for phenoloxidase activity indicate that cultures of all taxa examined showed laccase activity, while basidiomata of the same taxa showed no laccase activity. In comparison, cultures and corresponding basidiomata of some species showed tyrosinase activity, while other taxa showed no tyrosinase activity. Spot tests for tyrosinase activity proved taxonomically useful.

To clarify the taxonomy and nomenclature of southern Appalachian *Marasmius* extant type specimens, authentic material or representative material of 217 species have been examined and their correct taxonomic disposition determined. Neotype or lectotype specimens are designated, and new combinations are proposed where appropriate.

# TABLE OF CONTENTS


| CHAPTER | PAGE |
|---|---|
| I. INTRODUCTION | 1 |
| Taxonomic and Nomenclatural History | 6 |
| Sectional Concepts | 10 |
| Infrageneric Classification of Southern Appalachian Taxa | 11 |
| II. MATERIALS AND METHODS | 13 |
| Taxonomic Studies | 13 |
| Culture Mat Analyses | 19 |
| Phenoloxidase Analyses | 21 |
| Spot Tests on Cultures | 22 |
| Spot Tests on Basidiomata | 22 |
| III. DISCUSSION OF TAXONOMIC CHARACTERS | 24 |
| Macromorphological Features | 24 |
| Basidiome Stature and Size | 24 |
| Basidiome Development | 26 |
| Pileus Features | 26 |
| Size and shape | 26 |
| Surface | 27 |
| Color | 28 |
| Pileus context | 29 |
| Lamellar Features | 29 |
| Attachment | 29 |
| Spacing | 30 |
| Width | 32 |
| Color | 32 |
| Lamellulae | 33 |
| Stipe Features | 33 |
| Size and shape | 33 |
| Texture | 34 |
| Surface | 35 |
| Color | 36 |
| Attachment to the substrate | 36 |
| Rhizomorphs | 38 |
| Odor and Taste | 39 |
| Substrate Affinity | 39 |
| Micromorphological Features | 40 |
| Basidiospores | 40 |
| Basidia | 43 |
| Basidioles | 44 |
| Pleurocystidia | 44 |
| Cheilocystidia | 45 |
| Hymenial Setae | 46 |
| Pileipellis Arrangement and Cell-type | 47 |
| Pileus Trama | 50 |
| Lamellar Trama | 51 |

Stipe Tissues ..... 52
Cortical hyphae ..... 52
Medullary hyphae ..... 53
Stipe vesture ..... 53
Clamp Connections ..... 54

IV. SOUTHERN APPALACHIAN TAXA ..... 56
*Marasmius* ..... 56
Key to the Sections of *Marasmius* ..... 60
Keys to Southern Appalachian Species of *Marasmius* ..... 62
Sect. *Rhizomorphigena* ..... 62
Sect. *Androsacei* ..... 62
Sect. *Marasmius* ..... 63
Sect. *Epiphylli* ..... 63
Sect. *Globulares* ..... 64
Sect. *Alliacei* ..... 66
Sect. *Hygrometrici* ..... 66
Sect. *Sicci* ..... 67
Ser. *Spinulosi* ..... 67
Ser. *Atrorubenses* ..... 68
Ser. *Haematocephali* ..... 69
Ser. *Leonini* ..... 71
*Marasmius* sect. *Rhizomorphigena* ..... 73
1. *Marasmius brevipes* ..... 73
*Marasmius* sect. *Androsacei* ..... 81
2. *Marasmius straminipes* var. *straminipes* ..... 81
3. *Marasmius straminipes* var. *fibulatus* ..... 86
4. *Marasmius pallidocephalus* ..... 90
5. *Marasmius androsaceus* ..... 94
*Marasmius* sect. *Marasmius* ..... 100
Subsect. *Penicillati* ..... 100
6. *Marasmius graminum* ..... 101
Subsect. *Marasmius* ..... 106
7. *Marasmius capillaris* ..... 106
8. *Marasmius rotula* ..... 110
*Marasmius* sect. *Epiphylli* ..... 115
9. *Marasmius epifagus* ..... 115
10. *Marasmius epiphyllus* ..... 119
11. *Marasmius felix* ..... 124
*Marasmius* sect. *Globulares* ..... 130
12. *Marasmius decipiens* ..... 130
13. *Marasmius nigrodiscus* ..... 136
14. *Marasmius cystidiosus* ..... 141
15. *Marasmius oreades* ..... 147
16. *Marasmius albogriseoides* ..... 151
17. *Marasmius strictipes* ..... 154
*Marasmius* sect. *Alliacei* ..... 160
18. *Marasmius pyrrhocephalus* ..... 161
19. *Marasmius scorodonius* ..... 165
20. *Marasmius copelandii* var. *olidus* ..... 170

*Marasmius* sect. *Hygrometrici* ..... 175
21. *Marasmius minutus* ..... 175
*Marasmius* sect. *Sicci* ..... 180
Ser. *Spinulosi* ..... 181
22. *Marasmius delectans* ..... 181
23. *Marasmius cohaerens* var. *cohaerens* ..... 185
24. *Marasmius cohaerens* var. *lachnophyllus* ..... 190
Ser. *Atrorubenses* ..... 198
25. *Marasmius ciliatomarginatus* ..... 198
Ser. *Haematocephali* ..... 204
26. *Marasmius falcatipes* ..... 204
27. *Marasmius spissus* ..... 209
28. *Marasmius sullivantii* ..... 214
29. *Marasmius glabellus* ..... 219
30. *Marasmius floridanus* var. *floridanus* ..... 224
31. *Marasmius floridanus* var. *virginianus* ..... 229
32. *Marasmius pseudobambusinus* ..... 232
33. *Marasmius haematocephalus* var. *haematocephalus* .... 237
34. *Marasmius haematocephalus* var. *anomaloides* ..... 242
35. *Marasmius siccus* ..... 246
36. *Marasmius pulcherripes* ..... 251
Ser. *Leonini* ..... 257
37. *Marasmius bellipes* ..... 257
38. *Marasmius fulvoferrugineus* ..... 261

V. PRELIMINARY KEY TO *MARASMIUS* FROM NORTH AMERICA ..... 266
Sect. *Rhizomorphigena* ..... 266
Sect. *Androsacei* ..... 266
Sect. *Marasmius* ..... 269
Subsect. *Marasmius* ..... 269
Subsect. *Penicillati* ..... 270
Sect. *Epiphylli* ..... 271
Sect. *Globulares* ..... 272
Sect. *Alliacei* ..... 275
Sect. *Hygrometrici* ..... 278
Sect. *Sicci* ..... 279
Ser. *Spinulosi* ..... 279
Ser. *Atrorubenses* ..... 279
Ser. *Haematocephali* ..... 281
Ser. *Leonini* ..... 285

VI. CULTURAL STUDIES ..... 290
Cultural Characters ..... 293
Macromorphological Characters ..... 295
MEA-grown isolates ..... 295
PDA-grown isolates ..... 295
Mean growth rate ..... 295
Culture mat coloration ..... 296
Culture mat texture ..... 297
Reverse color ..... 298

Odor of cultures ..... 300
Basidiomata production in culture ..... 300
Micromorphological Characters ..... 301
MEA-grown isolates ..... 305
PDA-grown isolates ..... 306
Culture mat tissue-types ..... 306
Other differentiated elements ..... 307
Clamp connection formation ..... 308
Crystal formation ..... 309
Descriptions of Cultural Morphology ..... 310
*Marasmius brevipes* ..... 313
*Marasmius straminipes* var. *straminipes* ..... 315
*Marasmius straminipes* var. *fibulatus* ..... 317
*Marasmius pallidocephalus* ..... 319
*Marasmius androsaceus* ..... 320
*Marasmius graminum* ..... 325
*Marasmius capillaris* ..... 327
*Marasmius rotula* ..... 330
*Marasmius felix* ..... 332
*Marasmius decipiens* ..... 334
*Marasmius nigrodiscus* ..... 336
*Marasmius cystidiosus* ..... 339
*Marasmius oreades* ..... 341
*Marasmius strictipes* ..... 343
*Marasmius pyrrhocephalus* ..... 346
*Marasmius scorodonius* ..... 348
*Marasmius delectans* ..... 351
*Marasmius cohaerens* var. *cohaerens* ..... 353
*Marasmius cohaerens* var. *lachnophyllus* ..... 355
*Marasmius ciliatomarginatus* ..... 358
*Marasmius falcatipes* ..... 360
*Marasmius spissus* ..... 362
*Marasmius sullivantii* ..... 364
*Marasmius pseudobambusinus* ..... 367
*Marasmius haematocephalus* var. *haematocephalus* ..... 368
*Marasmius haematocephalus* var. *anomaloides* ..... 370
*Marasmius siccus* ..... 372
*Marasmius pulcherripes* ..... 374
*Marasmius fulvoferrugineus* ..... 377
Synoptic Key ..... 379
MEA-Grown Isolates ..... 380
PDA-Grown Isolates ..... 381

VII. PHENOLOXIDASE STUDIES ..... 385
Results and Discussion ..... 389
Spot Tests on Cultures ..... 391
Laccase activity ..... 393
Tyrosinase activity ..... 396
Peroxidase activity ..... 399
Spot Tests on Basidiomata ..... 402
Conclusions ..... 406

VIII. STUDIES OF TYPE SPECIMENS AND REPRESENTATIVE MATERIAL ..... 408
*Marasmius acerinus* ..... 409
*Marasmius actinopus* ..... 410
*Marasmius alachuanus* ..... 413
*Marasmius albiceps* ..... 415
*Collybia albogrisea* ..... 416
*Marasmius albomarginatus* ..... 418
*Marasmius alienus* ..... 418
*Agaricus androsaceus* ..... 419
*Marasmius anomalus* Lasch ..... 421
*Marasmius anomalus* Peck ..... 423
*Marasmius applanatipes* ..... 425
*Marasmius armeniacus* ..... 426
*Marasmius atlanticus* ..... 428
*Agaricus atrorubens* ..... 429
*Gymnopus aurantiacus* ..... 431
*Marasmius aztecus* ..... 433
*Marasmius badiceps* ..... 435
*Marasmius badius* ..... 435
*Marasmius bahamensis* ..... 437
*Agaricus bambusinus* ..... 439
*Marasmius bambusiniformis* ..... 440
*Marasmius bellipes* ..... 441
*Marasmius biformis* ..... 444
*Marasmius borealis* ..... 445
*Marasmius brevipes* ..... 447
*Marasmius bulliardii* ..... 449
*Marasmius buxi* ..... 450
*Marasmius caesius* ..... 452
*Marasmius caespitosus* ..... 453
*Marasmius calami* ..... 455
*Marasmius callicarpellus* ..... 456
*Marasmius campanulatus* ..... 458
*Marasmius resinosus* var. *candidissimus* ..... 460
*Marasmius capillaris* ..... 460
*Marasmius caricicola* ..... 462
*Marasmius castaneicolor* ..... 463
*Marasmius chiapasensis* ..... 466
*Marasmius ciliatomarginatus* ..... 468
*Marasmius clavaeformis* ..... 468
*Marasmius clementsianus* ..... 470
*Agaricus cohaerens* ..... 470
*Marasmius concinnus* ..... 472
*Marasmius contrarius* ..... 474
*Marasmius copelandii* ..... 475
*Marasmius coprophilus* ..... 476
*Marasmius crescentiae* ..... 478
*Marasmius cryptotrichus* ..... 480
*Marasmius cucullatus* ..... 482
*Marasmius cucurbitula* ..... 483

*Marasmius cyrillidis* ..... 484
*Collybia cystidiosa* ..... 485
*Marasmius decipiens* ..... 487
*Marasmius decurrens* ..... 487
*Marasmius delectans* ..... 489
*Collybia delicata* ..... 491
*Marasmius dichrous* ..... 492
*Marasmius domesticus* ..... 494
*Marasmius elongatipes* ..... 496
*Marasmius epifagus* ..... 496
*Androsaceus epiphylloides* ..... 497
*Agaricus epiphyllus* ..... 500
*Marasmius epodius* ..... 502
*Marasmius fagineus* ..... 504
*Marasmius falcatipes* ..... 505
*Marasmius fasciatus* ..... 506
*Marasmius felix* ..... 506
*Marasmius ferrugineus* ..... 508
*Marasmius straminipes* var. *fibulatus* ..... 511
*Marasmius filopes* ..... 512
*Gymnopus floridanus* ..... 513
*Marasmius floridanus* ..... 515
*Marasmius fulviceps* ..... 517
*Marasmius fulvoferrugineus* ..... 519
*Marasmius glabellus* ..... 520
*Gymnopus glatfelteri* ..... 523
*Marasmius pusio* var. *graminivorus* ..... 525
*Agaricus graminum* ..... 526
*Marasmius gregarius* ..... 528
*Agaricus haematocephalus* ..... 529
*Marasmius heliomyces* ..... 530
*Marasmius hemisphaericus* ..... 532
*Marasmius hirtipes* ..... 533
*Agaricus hudsonii* ..... 535
*Marasmius ilicicola* ..... 537
*Marasmius ilicis* ..... 537
*Marasmius insipidus* ..... 538
*Marasmius isabellinus* ..... 541
*Marasmius juglandis* ..... 543
*Agaricus lachnophyllus* ..... 544
*Marasmius leighii* ..... 546
*Marasmius leoninus* ..... 548
*Marasmius leptopus* ..... 550
*Marasmius leucocephalus* ..... 551
*Collybia lilacina* ..... 553
*Marasmius limonispora* ..... 555
*Marasmius liquidambari* ..... 556
*Marasmius longipes* ..... 558
*Marasmius longistriatus* ..... 560
*Gymnopus ludovicianus* ..... 562

*Marasmius macrorrhizus* ..... 563
*Marasmius magnisporus* ..... 564
*Marasmius magnoliae* ..... 566
*Marasmius salignus* var. *major* ..... 568
*Marasmius melanopus* ..... 569
*Marasmius minutissimus* ..... 571
*Marasmius minutus* ..... 573
*Marasmius multifolius* ..... 575
*Marasmius multivenosus* ..... 576
*Collybia nigrodisca* ..... 578
*Marasmius resinosus* var. *niveus* ..... 580
*Marasmius nolaneiformis* ..... 582
*Marasmius nucicola* ..... 583
*Marasmius nummularius* ..... 586
*Marasmius nuptialis* ..... 588
*Marasmius octifolius* ..... 589
*Marasmius olidus* ..... 590
*Marasmius olivascenticeps* ..... 592
*Marasmius olneii* ..... 594
*Marasmius opacus* ..... 596
*Agaricus oreades* ..... 598
*Marasmius ostryae* ..... 600
*Marasmius pallidiceps* ..... 601
*Marasmius pallidocephalus* ..... 603
*Marasmius paludigenus* ..... 604
*Marasmius papillatus* ..... 605
*Marasmius papillosus* ..... 608
*Marasmius parasiticus* Ellis & Everhart ..... 610
*Marasmius parasiticus* Stevens & Hawkes ..... 610
*Marasmius petersii* ..... 610
*Marasmius petiolorum* ..... 610
*Marasmius phyllophilus* ..... 612
*Marasmius piceina* ..... 614
*Marasmius pinastris* ..... 615
*Marasmius pithyophilus* ..... 617
*Marasmius plicatulus* ..... 619
*Marasmius polycystis* ..... 619
*Marasmius polyphylla* ..... 621
*Marasmius porphyreticus* ..... 622
*Marasmius praeacutus* ..... 623
*Marasmius pruinatus* ..... 624
*Marasmius pruinosipes* ..... 626
*Marasmius pseudimpudicus* ..... 628
*Marasmius pulcherripes* ..... 629
*Marasmius puniceus* ..... 632
*Marasmius pusio* ..... 633
*Marasmius pyrinus* ..... 635
*Marasmius pyrrhocephalus* ..... 637
*Marasmius quercophilus* ..... 638
*Marasmius quercuum* ..... 638

*Marasmius ramulinus* ..... 640
*Marasmius resinosus* ..... 641
*Marasmius rigidus* ..... 641
*Marasmius robinianus* ..... 643
*Agaricus rotula* ..... 645
*Marasmius rubrophyllus* ..... 647
*Marasmius ruforotula* ..... 647
*Marasmius salalis* ..... 649
*Marasmius salignus* ..... 649
*Agaricus scabellus* ..... 651
*Agaricus scorodonius* ..... 652
*Marasmius scototephrodes* ..... 653
*Marasmius semihirtipes* ..... 655
*Marasmius semisquarrosus* ..... 656
*Marasmius senescens* ..... 658
*Marasmius sessiliaffinis* ..... 659
*Gymnopus setulosus* ..... 662
*Marasmius setulosus* ..... 665
*Marasmius candidus* var. *setulosus* ..... 667
*Marasmius sicciformis* ..... 670
*Agaricus siccus* ..... 671
*Marasmius similis* ..... 674
*Marasmius spadiceus* ..... 675
*Agaricus spaniophyllus* ..... 677
*Agaricus spinulifer* ..... 678
*Marasmius spissus* ..... 681
*Marasmius spongiosus* ..... 683
*Marasmius squamosidiscus* ..... 684
*Marasmius stenophylloides* ..... 686
*Marasmius straminipes* ..... 688
*Marasmius striatipes* ..... 688
*Collybia strictipes* ..... 690
*Gymnopus subagricola* ..... 692
*Marasmius subalbiceps* ..... 693
*Marasmius subarchyropus* ..... 695
*Marasmius subcretaceus* ..... 696
*Marasmius subgraminis* ..... 697
*Marasmius subnigricans* ..... 699
*Marasmius subnudus* ..... 700
*Marasmius subpilosus* ..... 702
*Marasmius subprasiosmus* ..... 703
*Marasmius substenophyllus* ..... 705
*Marasmius subsynodicus* ..... 707
*Marasmius subtomentosus* ..... 708
*Marasmius subvenosus* ..... 710
*Marasmius sullivantii* ..... 712
*Marasmius superabundans* ..... 713
*Marasmius sutliffae* ..... 715
*Marasmius tenebrarum* ..... 717
*Marasmius tenerrimus* ..... 719

*Gymnopus tenuifolius* ..... 720
*Marasmius testaceiceps* ..... 722
*Marasmius thiersii* ..... 723
*Marasmius thujinus* ..... 724
*Marasmius tomentellus* ..... 725
*Marasmius tomentosipes* ..... 726
*Marasmius tomentosus* ..... 728
*Marasmius tritici* ..... 729
*Marasmius trullisatipes* ..... 730
*Marasmius umbilicatus* ..... 732
*Marasmius umbonatus* ..... 733
*Marasmius velutipes* ..... 734
*Marasmius vialis* ..... 736
*Marasmius virginianus* ..... 738
*Marasmius viticola* ..... 738
*Marasmius washingtonensis* ..... 740
*Marasmius westii* ..... 741
*Marasmius wettsteinii* ..... 743
*Marasmius wilsonii* ..... 746

LITERATURE CITED ..... 748

APPENDICES ..... 766

A. SPECIMENS EXAMINED ..... 767

B. CULTURE MEDIA ..... 835

VITA ..... 836

## LIST OF FIGURES

FIGURE PAGE

1 A-F. Features of *Marasmius brevipes*. A. Basidiomata, X3 (Desjardin no. 4367). B1-B3. Basidiospores. B1. Ravenel no. 1527 (holotype). B2. Desjardin no. 4367. B3. Dennis no. 114. C. Basidium and basidioles. D. Cheilocystidia. E. Pileipellis elements. F1-F2. Heterogeneous stipe medullary hyphae. F1. Thin-walled, branched, binding-type hyphae. F2. Skeletalized, unbranched hyphae. Standard bar = 5 µm for A; 10 µm for C-F (drawn from holotype) .... 74

2 A-D. Features of *Marasmius straminipes* var. *straminipes* (Peck, Oct. 1872, holotype). A. Basidiospores. B. Basidium and basidioles. C. Cheilocystidia. D. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-D ..... 83

3 A-D. Features of *Marasmius straminipes* var. *fibulatus* (Desjardin no. 3948, holotype). A. Basidiospores. B. Basidium and basidioles. C. Cheilocystidia. D. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-D ..... 88

4 A-C. Features of *Marasmius pallidocephalus* (Desjardin no. 3581). A. Basidiospores. B. Basidia and basidioles. C. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-C ..... 91

5 A-D. Features of *Marasmius androsaceus* (Desjardin no. 4328). A. Basidiospores. B. Basidium and basidioles. C. Cheilocystidia. D. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-D ..... 96

6 A-D. Features of *Marasmius graminum* (Desjardin no. 4386). A. Basidiospores. B. Basidium and basidioles. C. Cheilocystidia. D. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-D ..... 103

7 A-D. Features of *Marasmius capillaris* (Desjardin no. 4345). A. Basidiospores. B. Basidia and basidioles. C. Cheilocystidia. D. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-D ..... 108

8 A-D. Features of *Marasmius rotula* (Desjardin no. 4241). A. Basidiospores. B. Basidia and basidioles. C. Cheilocystidia. D. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-D ..... 112

9 A-F. Features of *Marasmius epifagus* (Vilgalys no. 82/342). A. Basidiospores. B. Basidium and basidioles. C. Hymenial cystidia. D. Pileipellis elements. E. Pilocystidia. F. Caulocystidia. Standard bar = 5 µm for A; 10 µm for B-F ..... 117

10 A-F. Features of *Marasmius epiphyllus* (Romell, 1911). A. Basidiospores. B. Basidia and basidioles. C. Hymenial cystidia. D. Pileipellis elements. E. Pilocystidia. F. Caulocystidia. Standard bar = 5 µm for A; 10 µm for B-F ..... 121

11 A-G. Features of *Marasmius felix*. A1-A2. Basidiospores. A1. Desjardin no. 4528. A2. Desjardin no. 4486. B. Basidium and basidioles. C. Cystidioles. D. Hymenial cystidia. E. Pileipellis elements. F. Pilocystidia. G. Caulocystidia. Standard bar = 5 µm for A; 10 µm for B-G (drawn from Desjardin no. 4486) ..... 126

12 A-E. Features of *Marasmius decipiens* (Desjardin no. 4608). A. Basidiospores. B. Basidium and basidioles. C. Cheilocystidia. D. Pileipellis elements. E. Caulocystidia from stipe apex. Standard bar = 5 µm for A; 10 µm for B-E ..... 132

13 A-F. Features of *Marasmius nigrodiscus* (Desjardin no. 4301). A. Basidiospores. B. Basidium and basidioles. C. Pleurocystidia. D. Cheilocystidia. E. Pileipellis elements. F. Caulocystidia. Standard bar = 5 µm for A; 10 µm for B-F ..... 138

14 A-E. Features of *Marasmius cystidiosus* (Desjardin no. 4594). A. Basidiospores. B. Basidia and basidioles. C. Pleurocystidia. D. Cheilocystidia. E. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-E ..... 143

15 A-D. Features of *Marasmius oreades* (Massee, 1899). A. Basidiospores. B. Basidium and basidioles. C. Pileipellis elements. D. Caulocystidia. Standard bar = 5 µm for A; 10 µm for B-D ..... 149

16 A-E. Features of *Marasmius albogriseoides* (Desjardin no. 4147). A. Basidiospores. B. Basidia and basidioles. C. Cheilocystidia. D. Pileipellis elements. E. Caulocystidia. Standard bar = 5 µm for A; 10 µm for B-E ..... 153

17 A-E. Features of *Marasmius strictipes* (Desjardin no. 4439). A. Basidiospores. B. Basidium and basidioles. C. Cheilocystidia. D. Pileipellis elements. E. Caulocystidia. Standard bar = 5 µm for A; 10 µm for B-E ..... 156

18 A-E. Features of *Marasmius pyrrhocephalus* (Desjardin no. 4467). A. Basidiospores. B. Basidium and basidioles. C. Hymenial cystidia. D. Pileipellis elements. E. Caulocystidia. Standard bar = 5 µm for A; 10 µm for B-D; 20 µm for E ..... 163

19 A-D. Features of *Marasmius scorodonius* (Desjardin no. 4339). A. Basidiospores. B. Basidia and basidioles. C. Cheilocystidia. D. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-D ..... 167

20 A-E. Features of *Marasmius copelandii* var. *olidus* (Hesler, TENN 14441). A. Basidiospores. B. Basidia and basidioles. C. Cheilocystidia. D. Pileipellis elements. E. Caulocystidia. Standard bar = 5 µm for A; 10 µm for B-D; 20 µm for E ..... 172

21 A-D. Features of *Marasmius minutus* (Peck, East Berne). A. Basidiospores. B. Basidia and basidioles. C. Hymenial cystidia. D. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-D ..... 177

22 A-F. Features of *Marasmius delectans* (Desjardin no. 4518). A. Basidiospores. B. Basidia and basidioles. C. Pleurosetae. D. Cheilocystidia (cheilosetae, *Siccus*-type broom cells and elements intermediate in morphology). E. Pileipellis elements (*Siccus*-type broom cells and non-setulose elements). F. Transitional elements from pileipellis. Standard bar = 5 µm for A; 10 µm for B-F ..... 183

23 A-G. Features of *Marasmius cohaerens* var. *cohaerens* (Miller no. 9577). A. Basidiospores. B. Basidium and basidioles. C. Hymenial setae. D. Cheilocystidia. E. *Siccus*-type pileipellis elements. F. Pilosetae. G. Caulosetae. Standard bar = 5 µm for A; 10 µm for B-F; 20 µm for G ... 188

24 A-H. Features of *Marasmius cohaerens* var. *lachnophyllus* (Lea, 1844, holotype). A. Basidiospores. B. Basidium and basidioles. C. Hymenial setae. D. Cheilocystidia. E. *Siccus*-type pileipellis elements. F. Pilosetae. G. Transitional elements from pileipellis. H. Caulosetae. Standard bar = 5 µm for A; 10 µm for B-G; 20 µm for H ..... 193

25 A-E. Features of *Marasmius ciliatomarginatus* (Desjardin no. 4414, holotype). A. Basidiospores. B. Basidia and basidioles. C1. Gloeocystidioid cheilocystidia. C2. *Siccus*-type cheilocystidia. D. Pileipellis elements. E1. Caulocystidia from stipe apex. E2. Caulocystidia from stipe base. Standard bar = 5 µm for A; 10 µm for B-E ..... 200

26 A-F. Features of *Marasmius falcatipes* (Desjardin no. 4415, holotype). A. Basidiospores. B. Basidia and basidioles. C. Pleurocystidia. D. Cheilocystidia. E. Pileipellis elements. F. Elements of stipe vesture (thick-walled elements from stipe base). Standard bar = 5 µm for A; 10 µm for B-F ..... 206

27 A-F. Features of *Marasmius spissus* (Smith no. 62486, holotype). A. Basidiospores. B. Basidium and basidioles. C. Pleurocystidia. D1. *Siccus*-type cheilocystidia. D2. Refractive, non-setulose cheilocystidia. E. Pileipellis elements. F. Dendrotrichomoid elements from stipe base. Standard bar = 5 µm for A; 10 µm for B-F ..... 212

28 A-F. Features of *Marasmius sullivantii* (Sullivant no. 174, holotype). A. Basidiospores. B. Basidium and basidioles. C. Pleurocystidia. D. Cheilocystidia. E. Pileipellis elements. F1. *Siccus*-type caulocystidia. F2. Non-setulose caulocystidia. Standard bar = 5 µm for A; 10 µm for B-F ..... 217

29 A-E. Features of *Marasmius glabellus* (Desjardin no. 4125). A. Basidiospores. B. Basidia and basidioles. C. Pleurocystidia. D. Cheilocystidia. E. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-E ..... 221

30 A-E. Features of *Marasmius floridanus* var. *floridanus* (TENN 10219). A. Basidiospores. B. Basidium and basidioles. C. Pleurocystidia. D. Cheilocystidia. E. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-E ..... 225

31 A-E. Features of *Marasmius floridanus* var. *virginianus* (Linder, 1934, holotype). A. Basidiospores. B. Basidium and basidioles. C. Pleurocystidia. D. Cheilocystidia. E. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-E ..... 231

32 A-E. Features of *Marasmius pseudobambusinus* (Desjardin no. 4353, holotype). A. Basidiospores. B. Basidium and basidioles. C. Pleurocystidia. D. Cheilocystidia. E. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-E ..... 234

33 A-E. Features of *Marasmius haematocephalus* var. *haematocephalus* (Desjardin no. 4321). A. Basidiospores. B. Basidium and basidioles. C. Pleurocystidia. D. Cheilocystidia. E. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-E ..... 239

34 A-E. Features of *Marasmius haematocephalus* var. *anomaloides* (Desjardin no. 4322, holotype). A. Basidiospores. B. Basidium and basidioles. C. Pleurocystidia. D. Cheilocystidia. E. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-E ..... 243

35 A-E. Features of *Marasmius siccus* (Schweinitz, holotype). A. Basidiospores. B. Basidium and basidioles. C. Pleurocystidia. D. Cheilocystidia. E. Pileipellis elements. Standard bar = 5 µm for A; 10 m for B-E ..... 248

36 A-E. Features of *Marasmius pulcherripes* (Desjardin no. 4343). A. Basidiospores. B. Basidium and basidioles. C. Pleurocystidia. D. Cheilocystidia. E. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-E ..... 254

37 A-E. Features of *Marasmius bellipes* (Morgan, 1905, lectotype). A. basidiospores. B. Basidium and basidioles. C. Cheilocystidia. D. Pileipellis elements. E. Stipe vesture. Standard bar = 5 µm for A; 10 µm for B-E ..... 259

38 A-D. Features of *Marasmius fulvoferrugineus* (Gilliam no. 1557, holotype). A. Basidiospores. B. Basidium and basidioles. C. Cheilocystidia. D. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-D ..... 263

39 A-B. Micromorphological Features of Axenic Cultures of *Marasmius*. A. Diverticulate hyphae. B. Staghorn-like hyphae. Standard bar = 10 µm ..... 302

40 A-D. Culture Mat Tissues of *Marasmius*. A. *Textura globulosa*. B. *Textura angularis*. C. *Textura intricata*. D. *Textura epidermoidea*. Standard bar = 10 µm ..... 303

41. Dendrotrichomoid Elements from Culture Mats of *Marasmius*. Standard bar = 5 µm ..... 305

# LIST OF TABLES


| TABLE | | PAGE |
|---|---|---|
| 1. | Isolates of Selected *Marasmius* Species Utilized in Preliminary Study of Cultural Morphology ..... | 291 |
| 2. | Isolates of *Marasmius* Species Utilized in Cultural Studies ..... | 294 |
| 3. | Additions or Clarifications to Nobles' and Stalpers' Species Codes Utilized in Descriptions of Cultural Morphology ..... | 312 |
| 4. | Collections of *Marasmius* Species from which Basidiomata were Spot Tested for Phenoloxidase Production ..... | 390 |
| 5. | Results of Spot Tests for Laccase Activity in Cultures of *Marasmius* Species ..... | 395 |
| 6. | Results of Spot Tests for Tyrosinase Activity in Cultures of *Marasmius* Species ..... | 398 |
| 7. | Results of Spot Tests with Hydrogen Peroxide plus Pyrogallol on Cultures of *Marasmius* Species ..... | 401 |
| 8. | Results of Spot Tests for Laccase and Tyrosinase Activity in Basidiomata of *Marasmius* Species ..... | 404 |

VOLUME 1

# CHAPTER I

## INTRODUCTION

The genus *Marasmius* Fr. (Tricholomataceae, Agaricales, Basidiomycotina) constitutes one of the larger genera of litter-decomposing and litter-binding mushrooms, represented worldwide by approximately 500 species. These fungi play an extremely important role in nutrient retention and recycling in tropical, subtropical and temperate regions of the world. Although species of *Marasmius* have been reported from all continents, the greatest diversity of species occurs in tropical areas. Singer (1976) reported about 300 species from the neotropics, Petch (1947) cited 56 species from Sri Lanka, and Singer (1964) and Pegler (1977) reported 105 species from Africa (a number of these species have since been transferred to other genera). About 10% of these species are pantropical. Fewer taxa are known from temperate regions of the world. Approximately 35 species have been reported from Europe (Moser, 1983; Noordeloos, 1987), 45 species were cited by Singer (1969) and Singer and Digilio (1952) from southern South America and Antarctica, and about 90 taxa are known from North America (Desjardin, unpubl. data). Relatively few species are circumboreal. Some species are restricted to high altitude zones (up to 5000 m elev.), while others are found only in lowland environments. The majority of species are mesophytic, although a few are restricted to xerophytic regions.

Most species of *Marasmius* are saprophytic, degrading leafy or woody debris of coniferous, monocotyledonous or dicotyledonous plants.

Occasionally, taxa may utilize senescent material of various pteridophytes or bryophytes. Some species are unspecialized and capable of utilizing senescent material of a number of different types of plants, while other species are highly substrate specific, capable of degrading organic material from only a single host genus or family (Singer, 1976; Desjardin, 1985a,b; Desjardin & Petersen, 1989a-d). Because of these factors, in many cases distribution patterns of *Marasmius* are directly correlated with the distribution of host plants.

A few species are parasitic and may cause diseases of economically important plants, such as rubber, tea, coffee, sugarcane, wheat, or various turf grasses. One species, *M. androsaceus* (L.: Fr.) Fr., is the primary cause of dying-out of heather in Scotland (MacDonald, 1949), while a number of species cause horse-hair blight of various trees and shrubs (Petch, 1915; Seaver, 1944). The fairy ring mushroom, *M. oreades* (Bolt.: Fr.) Fr., is a common disease-causing agaric of grasslands throughout the world (Lebeau & Hawn, 1961, 1963). Lichenization is unknown in *Marasmius*, and none are known to be ectomycorrhizal, although Singer (1965) suggested a probable endotrophic association of *Marasmius* with South American orchids. The latter hypothesis has never been proven.

Unlike most agarics that form basidiomata with short life spans during which spore production is continuous, the reproductive strategy of many *Marasmius* species is quite different. Many of these fungi form basidiomata that dessicate *in situ*, then revive when sufficient moisture is available and continue spore production, a condition termed marcescent. This cyclic pattern of spore production can be repeated

numerous times during the life span of an individual basidiome. Some species have been reported to form basidiomata that live and produce viable spores for three weeks or more (Gilliam, 1975c). Because most Marasmii are litter-decomposers, inhabiting niches with frequent alternating wet/dry periods, this mode of spore production appears to be adapted for this type of environment.

*Marasmius* differs from other genera in the Tricholomataceae by a combination of macromorphology, spore characteristics and pileipellis morphology. Species of *Marasmius* usually form small basidiomata with convex or campanulate, striate pilei, adnate or adnexed, pallid lamellae, and narrow, cartilaginous stipes. Spores are thin-walled, smooth, hyaline, inamyloid and acyanophilous. In addition, basidia lack siderophilous granules. Pileipelli exhibit two possible morphologies: 1) a hymeniform layer of smooth (non-setulose) or setulose elements (broom cells); or 2) a non-hymeniform layer of interwoven, diverticulate hyphae with broom cell-like terminal cells. For a comparison of *Marasmius* to closely allied genera (*e.g., Collybia, Crinipellis, Marasmiellus, Micromphale*), and for keys to aid in separating these genera, refer to Desjardin (1987b) and Largent and Baroni (1988).

A taxonomic treatment of North American species of *Marasmius* has only recently been undertaken, resulting in several regional monographs. The genus has been surveyed by Gilliam (1975a,b, 1976) for northeastern United States and adjacent Canada, and for western United States by Desjardin (1985a,b, 1987a,b). No modern regional taxonomic

survey has been published for southeastern United States, nor for the central states, southwestern states, Alaska, or Canada.

The purpose of this study was threefold: first, to provide a taxonomic monograph of *Marasmius* from the southern Appalachian Mountains; second, to clarify and stabilize the nomenclature and taxonomy of taxa described in *Marasmius* and allied genera based on material originally collected in North America; and third, to determine the usefulness of culture morphology and spot tests for extracellular phenoloxidase activity in the taxonomy of *Marasmius*.

To accomplish the goals outlined above, extensive field work and herbarium studies were undertaken. The study area, designated the southern Appalachian Mountains, included nearly all of the Blue Ridge Province and a portion of the Ridge and Valley Province as defined by Fenneman (1938). The region is bordered in the west by the Cumberland Plateau (but included the Cumberland Mts. in the north), and bordered in the east by the Piedmont Province. The study area extended in the south to the northernmost tip of Talladega National Forest, and included Oconee National Forest. The New River which runs through south-central West Virginia and western Virginia was chosen as the northern border. When political boundaries are considered, the study area encompassed most of eastern Tennessee, the southeastern portion of Kentucky, southern West Virginia, western Virginia and North Carolina, northwestern South Carolina, and the northernmost portions of Georgia and Alabama.

This project entailed three years of extensive fieldwork in a wide variety of habitats throughout the southern Appalachian region.

Hundreds of specimens of *Marasmius* were collected and preserved, and over 125 axenic tissue isolates representing 29 species of *Marasmius* were obtained. In addition, 13 North American herbaria were visited where pertinent specimens were selected for loan. Moreover, material was borrowed from 18 international herbaria. To clarify the nomenclature and taxonomy of southern Appalachian *Marasmius*, it was necessary to examine extant type specimens of all epithets based on North American collections and originally described in *Marasmius*, epithets transferred to *Marasmius* by other workers, and species with protologues suggesting affinities with *Marasmius*. Type specimens of numerous taxa described from material collected in the neotropics and tropics were also examined. When type material was unavailable for examination, a "representative" specimen was chosen (from topotype material when possible) on which the species concept was based. Results of the type specimen studies are presented in Chapter VIII. Data from fieldwork and herbarium studies have been collated into a monograph of southern Appalachian *Marasmius* presented in Chapter IV, and a key to species of *Marasmius* known to occur in North America (excluding Mexico) is presented in Chapter V. Axenic tissue isolates were grown on several media and described accordingly. Analyses of cultural morphology and a discussion of the taxonomic potential of culture characters are presented in Chapter VI. Spot tests for phenoloxidase activity were performed on freshly obtained basidiomata and on axenic tissue isolates. Results of these tests are presented in Chapter VII.

## TAXONOMIC AND NOMENCLATURAL HISTORY

The name *Marasmius* was first proposed by Elias Magnus Fries in *Floram Scanicam* (1835). A more thorough coverage of the genus was presented subsequently by Fries in his *Genera Hymenomycetum* (1836) and *Epicrisis Systematis Mycologici* (1838). Based exclusively on macromorphology, Fries' original concept of *Marasmius* included species with the combination of white spores, central cartilaginous stipes, sulcate or corrugated pilei and reviving basidiomata. In addition, Fries (1838) established *Agaricus* tribe *Collybia* [*Collybia* was later adopted at generic rank by Staude (1857)] which differed from *Marasmius* in the formation of non-reviving basidiomata. The adoption and prolonged use of these delimitations of *Marasmius* and *Collybia* by early mycologists trained in Friesian concepts have led to many taxonomic inconsistencies. Indeed, over 1500 epithets have been published in *Marasmius* to date. As noted by Romagnesi (1952), Singer (1958b, 1965), Gilliam (1976) and Desjardin (1985a), the primary objection to the use of Fries' concept involves the subjectivity of determining the ability of basidiomata to revive. Moreover, several species of *Collybia* revive *in situ* or when remoistened in the laboratory (Arnold, 1935; pers. observ.), while several species of *Marasmius* fail to revive (Gilliam, 1976; pers. observ.). Inconsistencies of this sort indicate that basidiome revivability is of limited taxonomic value, and have led agaric taxonomists to emphasize microscopic features in generic delimitations.

Patouillard (1887, 1900) was one of the first to recognize the importance of microscopic features in *Marasmius*, in particular cellular morphology of the pileipellis layer. Unfortunately, pioneering works on *Marasmius* in North America by Morgan (1905, 1906), Pennington (1915a,b) and Kauffman (1918) included few details on microscopic characters. Since a generic type species was not designated by Fries, early generic concepts varied (*cf.*, Fries, 1838; Quélet, 1872; Patouillard, 1900). To clarify the taxonomic boundaries of *Marasmius*, Singer and Smith (1946) proposed *M. rotula* (L: Fr.) Fr. as lectotype, and proposed conservation of the genus over *Micromphale* S. F. Gray (1821). *Marasmius* was subsequently conserved by the Paris Congress (see Taxon 2: 29-30, 1953). For a further discussion on the nomenclature and typification of *Marasmius* and *Micromphale*, see Donk (1949a,b, 1962) and Singer and Smith (1946).

Many extant type specimens of South American Marasmii were re-examined by Singer (1950, 1951, 1952, 1961a), while a number of southeastern United States type specimens were re-examined by Hesler (1957, 1959b). These studies established the framework for a new delimitation of *Marasmius* through the transfer of many species to other genera (*e.g., Collybia, Crinipellis, Oudemansiella, Marasmiellus*) and the segregation of *Marasmius sensu lato* into a number of allied genera (*e.g., Chaetocalathus, Mycenella, Physocystidium, Strobilurus*). Recent publications on *Collybia* (Halling, 1980, 1983a), *Crinipellis* (Singer, 1942; Redhead, 1986), *Strobilurus* (Redhead, 1980b; Desjardin 1987b), *Micromphale* (Desjardin, 1985b; Desjardin & Petersen, 1988, 1989c), *Marasmiellus* (Singer, 1973a; Desjardin, 1987a,b; Halling, 1987) and

*Marasmius* (Gilliam, 1973, 1976; Singer, 1965, 1976; Halling, 1983b; Desjardin, 1985a,b, 1987a,b) have helped much in clarifying the taxonomic delimitations of these closely allied genera.

In recent years, considerable attention has been paid to the Marasmii of tropical areas. Petch (1915, 1945, 1947) reported many *Marasmius* species from Sri Lanka, Pegler (1966, 1968, 1977) surveyed the agaric flora of East Africa reporting a number of Marasmii, while Singer (1964) monographed the Marasmii of the Congo. South America and the neotropics have received the most intensive investigations. Dennis (1951a-d, 1957, 1970) studied *Marasmius* from the West Indies and Venezuela, and Pegler (1983, 1987, 1988) reported many species from the Lesser Antilles and Cuba. Singer spent nearly twenty years studying the marasmioid fungi (as well as other agarics and boletes) of South America and the neotropics (1958a, 1960, 1965, 1976). Marasmii of the Asian tropics are known only from a key to the species from Dinghu Mt., Guangdong Province, China (Bi & Zheng, 1985).

Limited information has been published on *Marasmius* from temperate regions. Stevenson (1964) reported 13 species from New Zealand [many of which were transferred to other genera by Horak (1971); Desjardin & Petersen (1989d) recently described two new species from those islands], while Singer monographed the genus for the southern portion of South America and Antarctica (Singer & Digilio, 1952; Singer, 1969). Publications presenting a fairly thorough coverage of species of *Marasmius* from Europe are those by Kühner (1933), Moser (1978), Clémençon (1982) and Noordeloos (1981, 1987). A number of species have been reported from Canada (Redhead, 1981, 1982; Redhead *et al.*, 1982),

although a regional monograph has not been published. Modern treatments of *Marasmius* from the United States are those by Gilliam (1973, 1975a,b, 1976) for the northeastern states, Halling (1983b - sect. *Globulares*), Desjardin (1985a,b, 1987a,b) for California, and Desjardin and Petersen (1989a-c) for the southern Appalachian region. No surveys of the marasmioid mycota have been published for the eastern seaboard states, Gulf Coast states, central states, southwestern states, Rocky Mts. or Pacific Northwest. Consequently, no modern monographic treatment of *Marasmius* for North America has been heretofore attempted.

The earliest account of the occurrence in the southeastern United States of species presently considered in *Marasmius* was by Schweinitz (1822), in which six species were reported from North Carolina. Since that time, well over 100 epithets in *Marasmius* have been reported from southeastern United States (Berkeley & Curtis, 1849, 1853, 1859; Atkinson, 1897; Earle, 1901; Pennington, 1915b; Kauffman, 1917; Murrill, 1920, 1939, 1940, 1945a,b, 1946a,b, 1951; Coker, 1927, 1929; Coker & Beardslee, 1921; Hesler, 1937a,b, 1943, 1945a,b, 1951, 1952, 1957, 1959b, 1960, 1962; Overholts, 1938; Wolf, 1938, 1953; Smith & Hesler, 1940; Hanlin, 1966; Grand *et al.*, 1975; Gilliam, 1975a,b, 1976; Singer, 1976; Halling, 1983b; Halling *et al.*, 1985; Desjardin & Petersen, 1989a-c). Because of recent clarifications in the generic concept of *Marasmius*, many of the species reported from southeastern United States are now thought to belong in other genera. As part of this project, the taxonomic disposition of binomials treated in the

publications listed above was evaluated. The results of these studies are presented in Chapter VIII.

**Sectional Concepts.**

Sectional concepts have varied in the past (*cf.*, Saccardo, 1887; Quélet, 1888; Lange, 1936), but those in current usage were originally established by Kühner (1933), who proposed sects. *Alliateae, Androsaceae, Epiphylleae, Globularinae, Gloeonemae, Hygrometriceae, Peronateae, Ramealinae*, and *Rotulae*. As noted by Singer (1949), Kühner's classification was proposed without due regard to the conservation of previously published sectional names. Fries (1838) subdivided *Marasmius* into two subgenera: subgen. *Collybia* with sects. *Scortei, Tergini*, and *Calopodes*; and subgen. *Mycena* with sects. *Chordales* and *Rotulae*. No type species were designated by Fries for the infrageneric taxa. To preserve Kühner's classification scheme, Singer (1949, 1962) designated lectotype species for Fries' infrageneric taxa as follows:

sect. *Scortei: M. urens* (Fr.) Fr.

sect. *Tergini: M. fuscopurpureus* (Pers.: Fr.) Fr.

sect. *Calopodes: M. calopus* (Pers.: Fr.) Fr.

sect. *Chordales: M. cauticinalis* Fr.

sect. *Rotulae: M. rotula* (Scop.: Fr.) Fr.

As a consequence of Singer's typifications, sects. *Scortei* and *Tergini* became synonyms of *Collybia* sect. *Vestipedes*, and sect. *Chordales* became a synonym of *Xeromphalina*. Because *M. calopus* is considered a *nomen dubium* by contemporary agaricologists, sect.

*Calopodes* will remain a *nomen dubium* until the binomial is neotypified. And because the genus *Marasmius* was lectotypified by *M. rotula*, sect. *Rotulae* is a superfluous name. Singer's proposal very neatly disposed of Fries' (1838) infrageneric classification and allowed for preservation of Kühner's names. Singer (1949) emended the generic concept, included several additional sections, and designated lectotype species for a number of Kühner's sections [Kühner (1933) did not explicitly designate type species for his sections]. Several of Kühner's sections circumscribe taxa currently placed in other genera [*viz., Micromphale (Gloeonemae), Collybia (Peronateae), Marasmiellus (Ramealinae)*]. Singer (1958b) again emended the genus, and recognized 10 sections. In recent years, several sections have been subdivided (Singer 1965, 1976; Clémençon, 1982), and several new sections have been added to the genus (Noordeloos, 1981; Desjardin & Petersen, 1989c).

Species of *Marasmius* occurring in the southern Appalachian Mountains represent eight sections. The infrageneric classification accepted in this treatise is outlined below.

**Infrageneric Classification of Southern Appalachian Taxa.**

sect. *Rhizomorphigena* (Singer) Desjardin & Petersen (1989c)

sect. *Androsacei* Kühner (1933)

sect. *Marasmius* [≡ sect. *Rotulae* Fries *nom. superfl.* (1838)]

subsect. *Marasmius* [= subsect. *Pararotulae* Singer (1976)]

subsect. *Penicillati* Singer (1976)

sect. *Epiphylli* Kühner (1933)

sect. *Globulares* Kühner (1933)

sect. *Alliacei* Kühner (1933) [= sect. *Chordales sensu* Gilliam (1976)]

sect. *Hygrometrici* Kühner (1933)

sect. *Sicci* Singer (1958b)

subsect. *Siccini* Singer (1958a)

ser. *Spinulosi* (Clémençon) Desjardin *stat. nov.*

ser. *Atrorubenses* Desjardin *ser. nov.*

ser. *Haematocephali* Singer (1976)

ser. *Leonini* Singer (1976)

# CHAPTER II

# MATERIALS AND METHODS

## TAXONOMIC STUDIES

This study entailed examination of living basidiomata collected by the author in a wide variety of habitats throughout the study area, as well as examination of dried specimens housed in the Herbarium of the Department of Botany, University of Tennessee, Knoxville (TENN) and borrowed from cooperating herbaria.

Living basidiomata were collected in the field and dried using standard techniques (Smith, 1949; Largent, 1973). Because the manner of attachment of the stipe to the substrate and the type of substrate are of utmost importance in sectional and specific delimitations, particular care was taken to insure that the stipe base and part of the substrate were included in each collection. While in the field, mental note was made as to whether basidiomata were putrescent or dried *in situ* (*i.e.*, marcescent). In addition, brief notes were taken on vascular plant associates, habitat-type, and on ephemeral features such as odor and pileus coloration. Whenever possible, color photographs were taken of suitable basidiomata *in situ*. Collections were transported back to the laboratory wrapped in wax paper or enclosed in plastic boxes.

Once in the laboratory, all freshly obtained basidiomata were studied immediately. Spore deposits were obtained on glass microscope slides or white bond paper and examined after 24 hours to determine

spore color. In a few collections, spore deposits were obtained in sterile Petri plates for future studies of single spore isolates and mating phenomena. Axenic tissue cultures and/or multispore isolates were obtained from all suitable collections (see below), and spot tests for phenoloxidase production were performed on basidiomata of all suitable collections using methodologies described below. Color photographs of all pertinent specimens were taken with a Nikon FE2 35 mm camera plus flash attachment, through a 55 mm Nikkor Micro lens (often with a Teleconverter) using Kodachrome 64 color slide film. In addition, all pertinent specimens were illustrated with line drawings.

Descriptions of macromorphological features were recorded for each collection, with special attention given to: size, shape, coloration and surface features of pileus and stipe; attachment, spacing, breadth and coloration of lamellae, presence or absence of a collarium, lamellar discoloration; odor and taste; stipe attachment to the substrate; type of substrate; and presence or absence of rhizomorphs. Descriptive terminology was taken from Singer (1965, 1976), Snell and Dick (1971) and Largent *et. al* (1977). Colors were recorded using terminology and notations from several sources. Unless otherwise noted, alphanumeric references within parentheses in the descriptions below are from Kornerup and Wanscher (1978), while those in quotation marks are from Ridgway (1912). Color terms without parentheses and quotation marks are those of the author. After descriptions of macromorphological features were compiled, all specimens were dried and deposited in the Fungus Herbarium, University of Tennessee, Knoxville (TENN).

Descriptions of micromorphological features were compiled using standard techniques and terminology (Singer, 1965, 1973a; Largent *et al.*, 1977). It was impossible to determine all micromorphological features from examining a single section of tissue. A minimum of four types of sections, as outlined below and similar to those suggested by Singer (1973a), were made and examined for each collection (when adequate material was available for study). Free-hand sections of dried material were made using a double-edged razor blade with the aid of a binocular dissecting microscope. If the material to be sectioned was delicate and fragile, it was first revived in alcohol and water and then sectioned in pith. Otherwise all material was sectioned dry. Sections were reconstituted in 95% ethanol followed by distilled water. Separate microscopic examinations of each type of section outlined below were made in distilled water, 3% KOH, Melzer's reagent and 3% KOH plus Congo Red. Hyphal colors were recorded as they appeared in distilled water.

Symbols denoting spore statistics determined were as follows: $\bar{x}$, the arithmetic means of spore length (L) and spore width (W) [± standard deviation] in a sample (specimen); $\bar{\bar{x}}$, the mean of means (grand mean) where more than one specimen was available; E, the quotient of L divided by W in any one spore, indicated as a range of variation in n-spores measured; Q, the mean of E-values [± standard deviation] in a sample; $\bar{Q}$, the mean of Q-values where more than one specimen was available. Where seven or more specimens of each taxon were available for a comparison of intraspecific variation, I have followed the suggestion of Parmasto and Parmasto (1987: 111) and

calculated the 90%-expected tolerance limits of mean spore size ($\bar{x}$) and length/width ratio (Q) at 90% probability level [TL90(90%)].

Types of sections examined included: 1) Pileus tangential or radial section: Care was taken to include a portion of the extreme margin of the pileus plus the region on or nearest the disc. This section was essential for determining the cell-type and arrangement of pileipellis elements, and features of the pileal and lamellar tramal tissues, including cellular organization and microchemical reactions. In addition, this section was helpful in determining the occurrence and morphology of the following features: basidia, basidioles, pleurocystidia, pilocystidia, gelatinization, pigment localization, clamp connections and oleiferous hyphae.

2) Pileus scalp section: A scalp section provided information on distribution of various types of pileipellis elements, *e.g.*, setae, thick-walled *vs.* thin-walled broom cells, smooth cells *vs.* broom cells, etc. In addition, discharged spores were often observed adhered to the pileipellis elements and provided a good source for spore measurements.

3) Lamella edge section: A small section of the lamellar edge was mounted to determine presence or absence of cheilocystidia. After initial observations on relative abundance and distribution of cheilocystidia and on distance they projected (if at all) beyond the hymenium, gentle pressure was applied to the cover slip to separate the hymenial elements. These squash mounts were essential for describing and illustrating morphology of cheilocystidia, basidia, basidioles, pleurocystidia and spores.

4) Longitudinal sections of the stipe apex and base: These sections were essential for determining features of the stipe cortical and medullary tissues, and occurrence, morphology and distribution of caulocystidia. Whenever possible, spore measurements were taken from spore deposits on the surface of the stipe apex.

If the material examined was extremely scanty, fragile or fragmented, as was often the case with type specimens, most of the essential micromorphological features were observed from small scalp sections of the pileus, lamellar edge fragments and stipe apex sections. All microscopic examinations were made using a Leitz Laborlux D binocular compound microscope using bright field and interference-contrast (Nomarski) optics. Illustrations of diagnostic micromorphological characters were prepared to scale with the aid of a drawing tube.

Herbaria containing specimens made available for this study are as follows (titles and abbreviations are taken from Holmgren *et al.*, 1981): U. S. National Fungus Collections, Beltsville, Maryland (BPI); Herbarium, Jardin Botanique National de Belgique, Meise, Belgium (BR); National Mycological Herbarium, Biosystematics Research Institute, Agriculture Canada, Ottawa, Ontario, Canada (DAOM); Stover Herbarium, Dept. of Botany, Eastern Illinois University, Charleston, Illinois (EIU); John G. Searle Herbarium, Field Museum of Natural History, Chicago, Illinois (F); Farlow Reference Library and Herbarium of Cryptogamic Botany, Harvard University, Cambridge, Massachusetts (FH); Herbarium, Dept. of Botany, University of Florida, Gainesville, Florida (FLAS); Herbarium, Dept. of Biology, Humboldt State University,

Arcata, California (HSC); Herbarium, Dept. of Botany, University of Illinois at Urbana-Champaign, Urbana, Illinois (ILL); Herbarium, Dept. of Botany, Iowa State University, Ames, Iowa (ISC); The Herbarium, Royal Botanic Gardens, Kew, Richmond, Surrey, England (K); Natural History Museum of Los Angeles County, Los Angeles, California (LAM); Herbario, Instituto de Botánica "C. Spegazzini," La Plata, Buenos Aires, Argentina (LPS); Herbarium of the University of Michigan, Ann Arbor, Michigan (MICH); Willard Sherman, Turrell Herbarium, Dept. of Botany, Miami University, Oxford, Ohio (MU); Herbarium, Dept. of Botany, University of North Carolina, Chapel Hill, North Carolina (NCU); C. E. Bessey Herbarium, University of Nebraska State Museum, Lincoln, Nebraska (NEB); Herbarium, New York Botanical Garden, Bronx, New York (NY); Herbarium, New York State Museum, Biological Survey, Albany, New York (NYS); Muséum National d'Histoire Naturelle, Laboratoire de Cryptogamie, Paris, France (PC); Herbarium, University of Pennsylvania, incorporated in PH (PENN at PH); Herbarium, Academy of Natural Sciences of Philadelphia, Philadelphia, Pennsylvania (PH); Mycological Dept. of the National Museum, Praha, Czechoslovakia (PRM); Herbarium, Dept. of Biological Sciences, San Francisco State University, San Francisco, California (SFSU); Herbarium, Dept. of Botany, Southern Illinois University, Carbondale, Illinois (SIU); Herbarium, Dept. of Environmental and Forest Biology, College of Environmental Science and Forestry, State University of New York, Syracuse, New York (SYRF); Herbarium, Dept. of Botany, University of Tennessee, Knoxville, Tennessee (TENN); Cryptogamic Herbarium, Dept. of Botany, University of Toronto, Toronto, Ontario, Canada (TRTC);

Herbarium, Dept. of Botany, University of California, Berkeley, California (UC); Massey Herbarium, Dept. of Biology, Virginia Polytechnic Institute and State University, Blacksburg, Virginia (VPI); Herbarium, Dept. of Botany, University of Washington, Seattle, Washington (WTU).

## CULTURE MAT ANALYSES

The following procedure was employed to obtain dikaryotic tissue cultures of *Marasmius*. Fresh, young basidiomata from suitable collections were selected for culturing. Small portions of clean lamellae or lamellulae, preferably chosen from areas nearest the stipe/pileus juncture, were excised using sterile, fine-pointed forceps, and aseptically transferred to 60 X 15 mm Petri plates (4-6 lamellar fragments per plate) containing malt extract agar (= MEA, Nobles, 1948) plus *o*-phenylphenol (*o*-hydroxy diphenyl) [10 mg/L, added as 1 ml of a 1% soln. made by dissolving 1 g *o*-phenylphenol in 100 ml of 50% ethanol] and streptomycin sulfate (50 mg/L). Although initial attempts were made at extracting sterile tramal tissues from pilei and stipes that had been torn open, this proved impractical and often physically impossible with the tiny basidiomata characteristic on many *Marasmii*. In addition, attempts to extract tissue from surface sterilized stipes were unsatisfactory. With the use of young, clean lamellar fragments, axenic tissue cultures were obtained from approximately 85-90% of all basidiomata sampled. Spore deposits were obtained on the inoculation medium for some collections, and subsequent

multisporous cultures were isolated. *o*-phenylphenol was added to reduce growth of ascomycetous and deuteromycetous contaminants, while streptomycin sulfate was added to inhibit growth of bacterial contaminants. Russell (1956) suggested using 60 mg/L *o*-phenylphenol in media for isolation of wood-rotting fungi, but I found that this concentration inhibited mycelial growth of all marasmioid/collybioid fungi tested (*e.g.*, numerous species of *Collybia, Marasmiellus, Marasmius, Micromphale, Mycena, Xeromphalina,* etc.). Ten mg/L successfully inhibited growth of fungal contaminants while allowing adequate mycelial growth of species of *Marasmius* and allied genera. Both *o*-phenylphenol and streptomycin sulfate were added to agar after autoclaving, just prior to pouring of plates.

After 2-7 days growth in the dark at 20-23° C, each plate was examined and mycelia were subcultured as required onto MEA lacking contaminant inhibitors. If necessary, subsequent subculturing was performed to isolate desired hyphae from contaminants. Once axenic tissue cultures were obtained, they were transferred to 125 X 16 mm test tubes containing MEA (a minimum of 2 replicates per isolate) and stored in the dark at 4° C. Each isolate was given a number matching the collection number and all voucher collections were dried and deposited in TENN. Isolates utilized in the culture studies are listed in Table 2, Chapter VI.

Culture mat analyses were based on the principles pioneered by Davidson *et al*. (1942), Nobles (1948, 1965) and Stalpers (1978). To standardize the physiological age of isolates examined, 100 X 15 mm Petri plates (actual width = 90 mm) containing MEA were inoculated

separately with mycelium of each isolate and incubated in the dark at 20-23° C. A separate standardized stock culture was grown for each isolate of each species. For most species, at 10 days the advancing zone had developed sufficiently for removal of a number of inoculum plugs. In a few slow-growing species, 20 days growth was required for sufficient development of the advancing zone. From each 10 day-old, or rarely 20 day-old stock culture, eight 5 mm square inoculum plugs were removed from the advancing zone and transferred, mycelium side down, to the edge of 100 X 15 mm Petri plates containing either MEA or Potato Dextrose Agar (= PDA). Four replicates of each isolate on each medium were incubated in the dark at 20-23° C for six weeks. Growth rate and culture mat macromorphology were recorded for all replicates of all isolates on both media every seven days using the terminology of Nobles (1948, 1965) and Stalpers (1978). Advancing zone micromorphology was recorded at Week II. Aerial and submerged hyphal micromorphologies were recorded at Week VI. In addition, spot tests for phenoloxidase production were performed at Weeks II and VI, following the methodology described below. Data obtained from the culture mat analyses are presented in Chapter VI.

## PHENOLOXIDASE ANALYSES

Spot tests for presence or absence of laccase, tyrosinase and peroxidase were performed on cultures of all isolates grown on MEA and PDA, and spot tests for laccase and tyrosinase were performed on living basidiomata of corresponding collections, following procedures outlined

below. The following substrate-specific reagents were used: 1) For laccase: syringaldazine (Harkin & Obst, 1973) and α-naphthol (Stalpers, 1978); 2) For tyrosinase: L-tyrosine (Marr, 1979) and *p*-cresol (Marr, 1979); 3) For peroxidase: hydrogen peroxide plus pyrogallol (Stalpers, 1978). Control spot tests with distilled water and 95% ethanol were performed on all isolates and basidiomata.

**Spot Tests on Cultures.**

One MEA-grown replicate and one PDA-grown replicate of each isolate were used at Week II in spot tests for phenoloxidase activity. The remaining three replicates on each medium were allowed to grow through Week VI. At Week VI, one MEA-grown replicate and one PDA-grown replicate of each isolate were used in spot tests. Each replicate to be spot-tested for phenoloxidase activity was cut into seven pie-shaped wedges, and each wedge was placed in a separate 35 X 10 mm Petri plate. Each of the seven agar/mycelium wedges was flooded with a different reagent (*i.e.*, 5 enzyme-specific reagents and 2 control reagents) and reactions were recorded at 5, 10, 15, 30 and 60 minutes, and at 3 and 24 hours. Results of over 2500 reactions were recorded during this study. Data obtained from spot tests on cultures and discussions of the taxonomic potential of these data are presented in Chapter VII.

**Spot Tests on Basidiomata.**

Several intact basidiomata from each collection to be tested were split in half longitudinally and each half was placed in a separate Petri plate. Each plate was flooded with a different reagent and reactions were recorded at 15, 30 and 60 minutes. Reagents used were syringaldazine, L-tyrosine, *p*-cresol, distilled water and ethanol.

Reactions were recorded as weakly positive (small portions of the external surface or basal mycelium positive), positive (all or nearly all of the external surface, and/or basal mycelium, and often internal tissues positive), and negative (no reactions observed on basidiomata or basal mycelium). Data obtained from spot tests on basidiomata are presented and discussed in Chapter VII.

# CHAPTER III

## DISCUSSION OF TAXONOMIC CHARACTERS

No single morphological character may be used to clearly differentiate all species of *Marasmius*. It is important to recognize a combination of characters or the absence of specific characters in order to achieve accurate diagnoses. Presented below is a discussion of variation observed in macromorphological and micromorphological characters of basidiomata of *Marasmius*, plus a brief synopsis of the taxonomic significance of each character or character state. Unless otherwise indicated, descriptive terminology was taken from Singer (1965, 1976), Snell and Dick (1971), Largent (1973), and Largent *et al.* (1977).

## MACROMORPHOLOGICAL FEATURES

### Basidiome Stature and Size.

Through the years, various descriptive terms that characterize basidiome stature have surfaced in literature on agarics (Largent, 1973). For example, basidiomata with stature reminiscent of the majority of *Clitocybe* species are said to be "clitocyboid." Those similar in macromorphology to *Collybia* species are called "collybioid." Likewise, the terms "omphalinoid" (*Omphalina*-like), "tricholomatoid" (*Tricholoma*-like), "pleurotoid" (*Pleurotus*-like), and "mycenoid" (*Mycena*-like) are a few other descriptive terms used to characterize basidiomata of white-spored agarics. The term "marasmioid" has been used commonly to describe mushrooms reminiscent of *Marasmius* species.

In general, the term has been applied to basidiomata with the following combination of features: a) convex or campanulate, striate or sulcate pilei with tough or membranous texture; b) marcescent and reviving; c) adnate or adnexed, pallid lamellae; and d) narrow, cartilaginous or wiry stipes. In other words, the term was used to describe *Marasmius* in the classical, Friesian sense. It must be emphasized, however, that the contemporary circumscription of *Marasmius* encompasses taxa with marasmioid, collybioid [*M. oreades* (Bolt.: Fr.) Fr., *M. nigrodiscus* (Pk.) Halling], omphalinoid (*M. calhouniae* Sing.), pleurotoid (*M. neosessiles* Sing., *M. polycystis* Sing.), and nearly cyphelloid (*M. pusillissimus* Desj. & Pet.) statures. Because stature is a reflection of an entire suite of characters (*i.e.*, pileus shape, lamellar attachment, stipe shape and size), it has taxonomic significance.

Basidiomata of southern Appalachian *Marasmii* range in size from tiny (*M. epifagus* Gilliam, with pilei ≈ 1 mm diam, stipes ≈ 5 X 0.1 mm) to robust (*M. nigrodiscus*, with pilei up to 100 mm diam, stipes 45-100 X 3.5-6 mm). Basidiome size is of limited taxonomic value when considering closely allied taxa. Many North American members of sect. *Sicci* form basidiomata that fall within the same size range, and consequently size may be of little value in separating species. In a few cases, size has been used as a supportive character to segregate taxa. For example, basidiomata of *M. fulvoferrugineus* Gilliam tend to be larger on the average than those of *M. siccus* (Schw.) Fr., and in cases where pileus pigmentation in these two species is similar, basidiome size may be a useful field character. Basidiome size is one criterion segregating *M. copelandii* var. *olidus* (Gilliam) Desjardin,

from var. *copelandii* Pk. (see Desjardin, 1987a). It must be remembered, however, that size is also a function of basidiome age, and only mature basidiomata should be considered when comparing taxa.

**Basidiome Development**.

Very few data have been published on development of basidiomata in *Marasmius*. Reijnders (1963) reported that *M. rotula* (Scop.: Fr.) Fr., *M. bulliardii* Quél., and *M. pahouinensis* de Seynes were paravelangiocarpous, while Singer (1986) reported these species to be also pileostipiticarpous. Singer (1986) further suggested gymnocarpous development in *M. floriceps* Berk. & Curt. Basidiome ontogeny must be studied *in vitro* in many more species of *Marasmius* before the taxonomic and phylogenetic significance of development can be evaluated.

**Pileus Features**.

**Size and Shape**. Pilei range in size from less than 1 mm to well over 100 mm in diameter. The majority of southern Appalachian *Marasmii* form pilei ranging from 10-30 mm diam. When comparing closely allied taxa, size difference is usually inconsequential.

Immature pilei range in shape from hemispheric, trapezoidal, or convex, to obtusely conic or campanulate. As pilei mature, the marginal region expands and the shape becomes broadly convex, broadly conic, broadly campanulate, plano-convex, plano-campanulate, plano-depressed, or sometimes plane. The disc region at maturity may be plane, depressed, umbilicate, umbonate or papillate. In addition, the disc is generally even in immature basidiomata, but may become rugulose

at maturity. The margin is usually decurved or sometimes incurved or inrolled in immature basidiomata, but as pilei mature the margin expands and may remain decurved or become uplifted in age. Moreover, the extreme margin may be even, wavy, crenate, scalloped or rarely split at maturity. In immature basidiomata, the marginal region is usually even or weakly striate. As pilei mature, this area may remain even, or become striate, sulcate, plicate, rugulose-striate or irregularly ridged.

Pileus shape is a very important taxonomic character. Character comparisons often useful in separating closely allied taxa include: disc plane *vs.* disc depressed or umbilicate; papillate or umbonate *vs.* non-papillate or non-umbonate; margin even *vs.* margin striate, sulcate or plicate. These features are particularly important in separating species in sect. *Sicci*.

**Surface**. The pileus surface is typically dull and dry in those species with hymeniform pileipelli formed of broom cells (sects. *Hygrometrici, Marasmius, Sicci*) or with non-hymeniform pileipelli (sects. *Androsacei, Rhizomorphigena*). In comparison, the surface may be dull or shiny, and dry or moist and sometimes subhygrophanous in those species with hymeniform pileipelli of non-setulose elements (sects. *Alliacei, Epiphylli, Globulares*). In addition, the surface may be glabrous (smooth), pruinose, minutely granulose or subvelutinous. Very rarely the surface appears minutely squamulose, the result of clusters of erect chains of broom-cell-like elements (*M. magnoliae* Sing.). Pilei of most Marasmii are opaque, although a few species with very thin pileus context may be somewhat translucent or pellucid-

striate when young and moist. Pileus surface features are taxonomically important to the extent that they are a direct reflection of pileipellis morphology. A glabrous, waxy or lubricous surface indicates a hymeniform pileipellis formed of non-setulose elements, whereas a dull, subvelutinous surface signifies a hymeniform pileipellis of broom cells. Pileipellis morphology is significant at the sectional or subsectional level.

**Color**. Pileus coloration is quite variable in *Marasmius* and may be taxonomically significant at the specific or infraspecific levels. Pigmentation ranges from white or buff, to various shades and mixtures of yellow, orange, red, purple, olive, grey or brown. Although within taxa pileus coloration is fairly constant, it must be emphasized that basidiome age and environmental conditions influence pigmentation. In the majority of taxa with pigmented pilei, the pileus is more deeply pigmented when young, with colors fading in age. Often, mature pilei show more deeply pigmented disc regions and paler marginal regions. Sometimes striae are much paler than interstriale regions (especially in dried material) and pilei appear radially striped (*e.g., M. bellipes* Morg.). In a few taxa, pilei become more deeply pigmented as they mature (*e.g., M. pyrrhocephalus* Berk.) or become maculate with darker or differently pigmented patches scattered over a paler background [*e.g., M. strictipes* (Pk.) Sing.]. One species, *M. sullivantii* Mont., develops white, soredioid spots on the margin of mature pilei. Sometimes basidiomata that form under an obstruction, such as leaves or woody debris, show paler pilei than corresponding basidiomata that form exposed to sunlight (*e.g., M. felix* Morg.).

For diagnostic purposes, degree of pigmentation is not as important as the tones of pigments involved; for example, yellow tones *vs.* orange *vs.* red *vs.* olivaceous *vs.* purple *vs.* brown. There are taxa in sect. *Sicci* that consistently form red-pigmented pilei (lacking yellow tones), whereas other taxa form yellow or brownish orange pilei (lacking red tones). Still others are consistently olivaceous or brown, lacking red, yellow or orange tones.

In most species, pileus coloration is the result of intraparietal pigments of pileipellis cells. In some cases (sect. *Androsacei*), pigments are both intraparietal and incrusting. The chemical compositions of pigments involved have not been elucidated.

**Pileus Context**. Thickness, color and texture of the pileus context are of limited taxonomic value. In some members of sect. *Globulares*, the context is thick and soft. In nearly all other taxa, contextual tissue is thin and membranous. There are no staining reactions when cut or bruised.

**Lamellar Features**.

Lamellae are typically well-developed in the majority of Marasmii, although in some species (sect. *Epiphylli*) lamellae are absent or poorly-developed, present as veins or ridge-like outgrowths.

**Attachment**. Lamellae range from adnate to adnexed or nearly free. Only rarely are lamellae subdecurrent (*e.g., M. calhouniae* Sing. *ined.*). All species in sect. *Marasmius* develop a ring of tissue surrounding the stipe apex and contiguous with the lamellae. This collar of tissue is termed a "collarium" and is developmentally derived

from pileus tramal tissues (as are the lamellae), not from stipe tissue. Well-developed collaria are entirely free from the stipe apex in mature basidiomata and are easily determined as such. In some cases, collaria are less well-developed and remain partially or in rare cases wholly adherent to the stipe apex. In these instances, it may be difficult to determine the presence of a collarium, and confusion may arise concerning proper taxonomic disposition. For example, in some populations of *M. graminum* (Lib.) Berk. & Br., some basidiomata show poorly developed collaria and one might try to key the organism in sect. *Sicci*. If enough basidiomata are sampled, however, easily discernable collaria should be observed. In immature pilei of some species, lamellae adhere to each other at the point of attachment to the stipe, superficially resembling a collarium. As pilei mature and expand, however, lamellar ends separate from each other (and often the stipe), and a true collarium is not present. Presence or absence of a collarium is significant at the sectional level.

**Spacing**. Lamellar spacing in mature pilei ranges from crowded or close, to subdistant, distant or remote. Determination of spacing has been traditionally somewhat arbitrary. One method that has been used is to document the number of complete lamellae per basidiome. This method may give an accurate accounting of lamellar spacing in taxa with few or no lamellulae, but gives misleading results for species with many series of lamellulae. For example, a species with no or few lamellulae may have 20 complete lamellae and be recorded as forming subdistant lamellae. A second species with 3-4 series of lamellulae may also show only 20 complete lamellae, but would be reported by most

mycologists as forming crowded lamellae. A more accurate approach is to determine spacing as the number of interlamellar spaces per radian, counted at the pileus margin. Interlamellar spaces are defined as the regions between lamellae and major lamellulae, with major lamellulae defined as lamellulae that reach from the margin at least half way to the stipe. A radian is an angle at the center of a circle, subtending an arc equal in length to the radius (= 57.2958°; *i.e.*, approx. 6 radians per circle). In this scheme, definitions for spacing terms are as follows: remote = 1-2 interlamellar spaces per radian; distant = 3-5; subdistant = 6-8; close = 9-12; crowded = >12. In some instances, spacing is intermediate between the values given above or is variable within a population. Accordingly, spacing should be indicated as a range in variation, *e.g.*, subdistant or distant.

Lamellar spacing is often useful in separating taxa, and has been used as a key character. Obviously it is easier to evaluate crowded or close *vs.* distant, than it is to compare subdistant *vs.* distant. Nonetheless, the number of interlamellar spaces per radian or the number of complete lamellae per basidiome are taxonomically significant features.

In some species, interlamellar spaces are venose, and the lamellae are then described as "intervenose." The venosity can be quite well-developed in some taxa, forming a merulioid or nearly poroid hymenophore (*e.g., M. cladophyllus* Berk.). Likewise, in some cases, portions of lamellae anastomose, especially nearest the margin, and the lamellae are termed "forked." In many taxa, older basidiomata develop weakly venose interlamellar spaces especially near the pileus margin,

and a feature as such is taxonomically insignificant. The presence of strongly intervenose lamellae throughout development, however, is taxonomically significant.

**Width**. Lamellae range in width from narrow to moderately broad or broad. Narrow was defined in this study as having a width less than 1/4 the lamellar length. Moderately broad lamellae were 1/4 - 1/3 as wide as long, while broad lamellae were 1/3 or more as wide as long. Only mature, complete lamellae were considered. Lamellar width may be a useful supportive character, especially when comparing taxa with lamellae at opposite ends of the range. For example, *M. glabellus* Pk. can be separated easily from *M. siccus* in the field by broad lamellae in the former compared to narrow lamellae in the latter. It is often more difficult to distinguish narrow from moderately broad, or moderately broad from broad, especially if lamellar width is intermediate to these arbitrarily chosen delimitations.

**Color**. Lamellae are typically white or buff-colored when young, and remain so in age or develop pale yellow, orange or pink tones. Rarely, lamellae are greyish or pale brownish (*e.g., M. androsaceus, M. brevipes*). If lamellar edges are colored differently from lamellar faces, the lamellae are said to be "marginate." Presence or absence of marginate lamellae may be taxonomically significant, but this feature must be carefully assessed. In a few species, most basidiomata form non-marginate lamellae, but a few older basidiomata may show weakly marginate lamellae. In such cases, little emphasis should be placed on lamellar edge pigmentation. In other species, the majority of basidiomata in a population show marginate lamellae throughout

development. Singer (1976) has used marginate *vs*. non-marginate lamellae as a differentiating character at species or infraspecific ranks. In the majority of taxa with marginate lamellae, pigments are intraparietal in the setulae of cheilocystidia. In rare instances, coloration is the result of pigmented, resinous cellular contents (*e.g., M. ciliatomarginatus* Desjardin).

**Lamellulae**. Presence or absence of lamellulae is of limited taxonomic value. Lamellulae are characteristically absent in members of sect. *Marasmius* (very rarely with one or more per basidiome), whereas in the majority of other species, lamellulae are present in 1-4 series.

**Stipe Features**.

Stipes are present and usually well-developed in all known southern Appalachian Marasmii. In a number of tropical species, stipes are absent or rudimentary, and pilei are laterally attached to the substrate [sect. *Neosessiles sensu* Singer (1958b, 1976)]. Stipes are centrally attached to pilei in most species, although they may be eccentrically located in some taxa (*e.g., M. falcatipes, M. brevipes*).

**Size and Shape**. Stipes range in length from 1 mm to over 100 mm, and range in thickness from 0.1 mm to more than 6 mm. Wiry or bristle-like stipes usually range from 0.1-1 mm thick (*e.g.*, sects. *Androsacei, Marasmius*), tough and cartilaginous stipes are typically 1-2 mm thick (*e.g.*, sect. *Sicci*), while fleshy stipes are often 2-6 mm thick (*e.g.*, sect. *Globulares*). Only in a few cases can closely allied taxa be separated based on stipe thickness or length.

The majority of Marasmii form stipes that are round in cross-section (termed "terete"), although in some taxa stipes are compressed (*i.e.*, ellipsoid in cross-section) and/or once-cleft. Additionally, most species form cylindric stipes, equal in diameter from top to bottom (termed "equal"), although some stipes may broaden abruptly at the apex ("flared") or enlarge slightly near the base. A few species form stipes that are rooted in the substrate, narrowing below the surface of the substrate (termed "radicating"). Stipes may be straight or curved, and some are twisted. Stipe shape is of little taxonomic value in *Marasmius*.

**Texture**. Stipe texture is directly related to the thickness of the stipe, which in turn is a reflection of medulla thickness and cortex thickness, as well as cell wall thickness in cortical or medullary hyphae. Immature stipes are typically solid, but become hollow in age. Many taxa form stipes that are corticated with thicker-walled, more deeply pigmented, narrow hyphae surrounding thin-walled, broader medullary hyphae. This outer layer gives the stipe a tough, pliant texture. Many other taxa form non-corticated stipes which are not as tough and pliant as corticated ones.

Stipe texture has been used in the past to differentiate several infrageneric categories. Lange (1936) established subsects. *Fibrosi* and *Cartilaginei* in sect. *Radicosi* [following Quélet's (1888) classification, not Kühner's (1933)] to accommodate those species with tough but not cartilaginous stipes, and cartilaginous to horny stipes, respectively. He further proposed subsect. *Setacei* in sect. *Insititii* for those species with bristle-like stipes. Here, "tough" is defined

as flexible and not breaking when bent; "cartilaginous" as flexible but breaking when bent; and "bristle-like" as very narrow, tough and wiry. In our contemporary classification of *Marasmius*, stipe texture is of limited taxonomic significance due in part to the subjectivity involved in determining stipe texture. Where is the line drawn between tough and bristle-like? Are bristle-like stipes not tough? How much can a stipe bend before breaking and still be considered tough? When utilizing other taxonomic features for infrageneric delimitation, various taxa within a section may show the full range of stipe texture defined above.

**Surface**. Features of the stipe surface are very useful in species diagnosis and have been used taxonomically at the series or species levels. The stipe surface ranges from dull to shiny, and from glabrous to pruinose, pubescent, felty, subvelutinous, hispid or tomentose. Glabrous stipes lack a stipe vesture, while ornamented stipes form stipe vestures composed of various types of tissues or cystidiiform elements. Ornamentation may be located at the stipe apex only, at the stipe base only, or cover the entire stipe. To the naked eye, a stipe may appear glabrous, but with the aid of a 10X hand lens, it may be minutely pruinose. Care must be taken when diagnosing presence or absence and distribution of stipe ornamentation. Stipe surface features are taxonomically important because they correlate with the presence or absence of specific microscopic features. In sect. *Sicci*, several series have been defined based in part on stipe surface features.

**Color**. Stipe coloration varies with age of basidiomata. In general, the stipe is paler in immature basidiomata, and often darkens from the base upward (termed "hysterochroic") through maturation. In some species, the stipe is unpigmented and remains so throughout development. In a few other species, pigments develop in the stipe cortical hyphae soon after primordial initiation and the stipe appears darkly pigmented throughout development (*e.g., M. brevipes*). In mature basidiomata of many species, the stipe is somewhat bicolorous, *i.e.*, with pallid apical region and darkly pigmented basal area. Colors of stipe apices range from white or buff, to various tones or mixtures of yellow, orange, pink, red, purple or brown. Stipe bases range in color from white or buff, to yellow, brownish orange, reddish brown, brown or black. Taxonomic importance has been placed on stipe apex color (*e.g.*, white, buff or pale yellow *vs.* pink, red or purple), but one must consider the influence of basidiome age and environmental conditions on pigmentation.

**Attachment to the Substrate**. Attachment of the stipe base to the substrate is a feature of substantial taxonomic importance in marasmioid fungi, used at the generic and sectional levels. Two modes of attachment are recognized: 1) If the stipe base arises naked from the substrate, *i.e.*, without visible basal mycelium or radiating mycelial fibril, the stipe is termed "insititious;" 2) If the stipe base arises from copious basal mycelium that binds the substrate together, or arises from a small pad of downy, strigose, tomentose or radiating mycelium, the stipe is termed "non-insititious." In these definitions, substrate refers to leafy or woody debris, not to soil.

All taxa with basidiomata arising directly from soil form non-insititious stipes. Within *Marasmius*, members of sects. *Androsacei, Epiphylli, Hygrometrici, Marasmius*, and *Rhizomorphigena* form insititious stipes, while members of sects. *Alliacei, Globulares*, and *Sicci*, form non-insititious stipes. All members of the genera *Micromphale* and *Marasmiellus* form insititious stipes (rarely subinsititious, *i.e.*, arising directly from the substrate but with a few inconspicuous basal fibrils). Many taxa with insititious stipes are also rhizomorph-formers, whereas no taxa with non-insititious stipes form rhizomorphs.

There appear to be distinct physiological differences between taxa with insititious stipes versus those with non-insititious stipes. In many (but by no means all) cases, taxa with insititious stipes are highly substrate specific (*e.g., M. felix* on *Platanus*; *M. ilicicola* on *Ilex*; *M. buxi* on *Buxus*). In comparison, taxa with non-insititious stipes are more often capable of utilizing the debris of various host plants. In addition, insititious taxa form basidiomata on debris in the uppermost litter layers (L and $F_1$ layers), in niches with frequent alternating wet/dry periods. Some insititious taxa are arboreal (*e.g., M. brevipes*). In comparison, non-insititious taxa tend to fruit from debris deeper in the litter ($F_1$ and $F_2$ layers) or from the soil ($A_1$ horizon), areas that retain moisture for longer periods of time. Such conditions allow for the development and proliferation of copious basal mycelium.

**Rhizomorphs.**

Many insititious taxa form rhizomorphs. In *Marasmius*, rhizomorphs are narrow, wiry, typically darkly pigmented strands of tightly packed mycelium similar in micromorphology to stipe tissue. They are often found closely associated with stipe bases, and in some cases, basidiomata arise directly from rhizomorphs. Rhizomorphs function as an overwintering stage in the life cycle, as well as a dispersal or proliferation agent. Rhizomorphs can be collected from the litter layer year-round, although basidiomata develop only during specific periods of the year. In addition, rhizomorphs are corticated with tightly packed, thick-walled, darkly pigmented, long-celled, cylindric hyphae which protect and inhibit dessication of the thinner-walled, broader, unpigmented medullary hyphae. Rhizomorphs may be frequently branched, and are attached to the substrate at various intervals along the length of the strand by small mycelial pads (adhesion zones). Hyphae grow from these attachment points into or over the substrate where substrate-degradation and nutrient uptake occur. This structural arrangement allows rhizomorphs to inhabit the uppermost, driest litter layers (L and $F_1$ layers), and even grow upward from the litter layer into arboreal regions. Aerial rhizomorphs have been observed to grow up to 8 mm in length per day (Hedger, 1985). Rhizomorphs function also to "capture" senescent material at the source in the aerial zone, and to bind terrestrial litter layers together. Such roles are important in nutrient retention in the biome. Presence or absence of rhizomorphs, and rhizomorph pigmentation and surface ornamentation are important taxonomic characters.

**Odor and Taste.**

Odor and taste of most Marasmii are not distinctive, or at most slightly fungal. There are, however, a number of taxa with quite distinct odor and taste. Several species form odors similar to cyanic acid or chlorine, and a few are spermatic or somewhat fruity. Although taste is generally mild, basidiomata of several taxa taste bitter or have a raphanoid (radish-like) component. Some marasmioid fungi have a strong alliaceous odor and taste. Alliaceous is generally interpreted as onion-like or garlic-like, but because human perceptions of taste and smell are so subjective, alliaceous odors have been variously reported as skunk-like, cabbage-like, rancid or fetid. This odor may be very strong, enabling one to detect it from great distances (it may permeate the forest), or it may be apparent only after crushing the basidiome. Likewise, an alliaceous taste may be immediately apparent or develop only after chewing for several minutes. Alliaceous odors are known to be produced by members of sects. *Alliacei* and *Androsacei*. The compound responsible for an alliaceous odor has recently been isolated (Gmelin *et al.*, 1976). This substance, gamma-glutamyl-marasmine, is a natural dipeptide with a cysteine sulphoxide moiety. When enzymatically cleaved in a two-step process, an unstable sulphur compound results which decomposes to form the odorous secondary products.

**Substrate Affinity.**

As mentioned above, many species of *Marasmius* are highly substrate-specific, and consequently, substrate affinity is a valuable

taxonomic feature. Basidiome formation in some taxa is restricted to coniferous debris, in others to monocotyledonous debris, and in others to dicotyledonous debris. Some species are restricted even further, and capable of utilizing the senescent material of only a single family (*e.g., Fagaceae*) or genus (*e.g., Quercus*). Many taxa can utilize only leafy material, while others are restricted to woody material. Rarely, basidiomata may form only on leaf petioles, never on leaf blades, or only on bark and not on decorticated wood. Few species can utilize both monocotyledonous or dicotyledonous debris, or both gymnospermous and angiospermous material. It is important to collect enough substrate in the field to allow for accurate diagnosis of the host material. When accompanied by other supportive features, substrate specificity is a valuable taxonomic character at the specific or infraspecific level.

## MICROMORPHOLOGICAL FEATURES

### Basidiospores.

Basidiospores of *Marasmius* species are hyaline, inamyloid and acyanophilous. Spore walls are smooth and thin, although occasionally very mature spores may develop firm walls (up to 0.3 µm thick). Many spores are often collapsed in artificially revived material. Very mature spores lodged on the surface of the pileus or stipe rarely show a secondary septum. The ultrastructure of spore walls has not been elucidated.

Most species produce white basidiospore deposits, although spore

color may range from white or buff, to pale yellow, cream, pale olivaceous or rarely greyish red. Basidiospore color should be determined from fresh, thick deposits on glass slides placed over white paper. Deposits obtained directly on white paper vary in color depending on quality of paper used. Presumably some compound(s) in the paper influence pigmentation. In addition, spore prints housed in herbaria for a number of years are differently pigmented than fresh deposits, often showing yellowish tones. Spore color is of little taxonomic value in *Marasmius*. Refer to the commentary on *M. decipiens* in Chapter IV for a discussion of infraspecific variability in spore color.

Basidiospore shape and size are diagnostically valuable characters, and have been used taxonomically at the specific and infraspecific levels. In southern Appalachian Marasmii, spores range in shape from ovoid or broadly ellipsoid, to ellipsoid, amygdaliform, lacrymoid, elongate-ellipsoid, subfusiform or clavate. They are often inequilateral in profile and have a distinct hilar appendage. Clavate spores are often curved. Basidiospores are typically round in transverse section, rarely slightly ovoid.

Basidiospore size is a very useful diagnostic feature if data are based on a sample size of 20 or more spores per specimen (Parmasto & Parmasto, 1987). It must be emphasized that basidiome age, environmental conditions and possibly substrate-type influence spore size. A sample size of less than 20 basidiospores is inadequate to accurately assess range of variation or mean spore size in a given specimen. For an accurate assessment of basidiospore size in a given

species, spore size data from many specimens representing different populations (and preferably collected at different times during the season) are needed. My studies have indicated that basidiospore mean length, mean width and/or mean length/width ratio can be used to separate species of *Marasmius*.

Basidiospore mean length of southern Appalachian Marasmii ranged from 6.6 µm (*M. spissus*) to 22.7 µm (*M. decipiens*), while mean width ranged from 3.2 µm (*M. floridanus, M. minutus, M. spissus*) to 5.0 µm (*M. oreades*). Some infraspecific spore size variation was observed. As a general rule, basidiospores of short-spored taxa varied less in length within species than spores of long-spored taxa. For example, many short-spored species formed spores that ranged in length from approximately 6.5-9 µm, a range spanning 2.5 µm. Intermediate-spored species formed spores 8-11 µm or 12-16 µm long (a 3-4 µm span), while many long-spored species formed spores 16-22 µm long (a 6 µm span). This pattern of variation was not observed in spore width data, where basidiospores of narrow-spored taxa varied as much as those of broad-spored taxa. These observations indicate the need for large sample sizes when determining mean spore size, especially in long-spored taxa. The data also suggest that when comparing short-spored taxa, a variation in mean spore length of 1-2 µm may be more significant than a similar variation in long-spored taxa.

The length/width ratio of a single spore is termed the "E-value," and is cited as a range of variation in the spore population measured. The arithmetic mean of E-values is termed the "Q-value" and is often a statistically significant measure reflecting average spore shape.

Approximately 2/3 of all known southern Appalachian Marasmii have a Q-value of 2.0 ± 0.2. About 1/6 have a Q-value from 2.5-4.0, while the remaining 1/6 show values >4.0. Relating these values to spore shape, the majority of southern Appalachian Marasmii form ellipsoid, amygdaliform or lacrymoid spores, while a small percentage form elongate-ellipsoid spores, and some form long-clavate spores. Q-value data may be valuable when comparing taxa with spores showing overlapping size ranges, but should not be used to compare taxa that differ greatly in spore size. For example, a species with mean spore size of 6 X 3 µm will have the same Q-value as a species with mean spore size of 10 X 5 µm.

**Basidia.**

Basidia of southern Appalachian Marasmii were typically tetrasporic, although a few taxa formed both tetrasporic and bisporic basidia. Only two species known to occur in North America are bisporic, *viz., M. tremulae* Vel. and *M. limosus* Quél. Basidia shape ranged from cylindric to clavate, and size ranged from approximately 20-40 X 5-8 µm. Some taxa formed short and broad basidia, while other taxa formed long and narrow basidia, and still other taxa were intermediate in size or showed sizes overlapping these values. In the taxa examined, basidia size, shape and number of sterigmata were not taxonomically significant.

**Basidioles**.

Basidioles are defined as immature basidia. They are described as hymenial elements that arise from the same level as basidia, are of the same approximate size as basidia, and are thin-walled, non-refractive and hyaline. Basidioles may differ in shape from basidia, ranging from cylindric to clavate or commonly fusoid or ventricose. Formation of fusoid basidioles is characteristic of many marasmioid and collybioid fungi. Occasionally, the apical region of basidioles may collapse in dried material and when artificially revived the basidioles appear mucronate. Such structures have been misinterpreted as pleurocystidia by some workers. Basidiole morphology is of little taxonomic value in *Marasmius*.

**Pleurocystidia**.

Pleurocystidia are interpreted here as sterile, differentiated cells located on the sides of lamellae. The term implies location rather than morphology. If based on morphology, pleurocystidia of *Marasmius* species may be further categorized as leptocystidia, lamprocystidia, setae, pseudocystidia or gloeocystidia. In the species descriptions in Chapters IV and VIII, hymenial cystidia are classified only as pleurocystidia or pleurosetae. Developmentally, pleurocystidia typically arise from deeper in the subhymenium than basidia or basidioles, or arise from the lamellar trama. Moreover, pleurocystidia usually project well beyond the upper surface of the hymenium, although sometimes they project little beyond the level of the basidioles and are somewhat inconspicuous. In a few species, pleurocystidia arise

from the same level of the subhymenium as other hymenial elements, but then show distinctly different shapes and project well beyond the basidioles. Pleurocystidia are often highly optically refractive due to oily cytoplasmic contents. They may be thin-walled or firm-walled (if very thick-walled and acuminate they are called setae), and are usually hyaline or pale yellowish. Pleurocystidial shape ranges from cylindric or flexuous, to clavate, fusoid, fusoid-ventricose, strangulate, or lageniform, and apices may be obtuse, acute, capitate, mucronate or appendiculate.

Pleurocystidia are absent in members of sects. *Androsacei*, *Marasmius* and *Rhizomorphigena*, and are present or absent in the remaining sections of *Marasmius*. Several series in sect. *Sicci* are distinguished by presence or absence of pleurocystidia, and consequently it is extremely important to determine the occurrence of these elements in specimens diagnosed as belonging to this section. Members of ser. *Haematocephali* typically form conspicuous, refractive pleurocystidia (a few species form non-refractive pleurocystidia), while members of ser. *Leonini* lack pleurocystidia.

**Cheilocystidia**.

Cheilocystidia are defined as sterile, differentiated elements located on the edges of lamellae. Here, too, the term implies location rather than morphology. The lamellar edge may be sterile and composed entirely of cheilocystidia, or cheilocystidia may be scattered along a fertile lamellar edge or absent altogether. When present, cheilocystidial morphology is usually similar to the morphology of

pileipellis elements. For example, if *Siccus*-type or *Rotalis*-type pileipellis elements are present, cheilocystidia are usually *Siccus*-type or *Rotalis*-type broom cells, respectively. If pileipelli are formed of broadly clavate, non-setulose cells, then cheilocystidia are usually similar. Rarely, taxa with broom-cell-type pileipellis elements form non-setulose cheilocystidia (*e.g.*, *M. ciliatomarginatus*). Taxa with non-setulose pileipellis elements, however, have never been observed to form setulose cheilocystidia. Where cheilocystidia and pleurocystidia are morphologically indistinguishable, the elements are called "hymenial cystidia." Occurrence and type of cheilocystidia are diagnostically important.

**Hymenial Setae.**

Hymenial setae are a specialized type of cystidia. They are usually acuminate or lanceolate, although some may approach ventricose-mucronate, and are very thick-walled (1-5 μm). They arise from deep in the lamellar trama and project up to 25 μm or more beyond the basidioles. Often cell walls of setae are pigmented reddish or brownish and show a dextrinoid reaction in Melzer's reagent (*e.g.*, *M. cohaerens*). Hymenial setae may be located on lamellar sides, termed "pleurosetae," or may also occur on the lamellar edge, wherein they are termed "cheilosetae." If the morphologies of pleurosetae and cheilosetae are indistinguishable, the elements are simply termed "hymenial setae." The presence of pleurosetae signifies inclusion in ser. *Spinulosi* of sect. *Sicci*. Three southern Appalachian taxa develop pleurosetae. Setae may occur also in the pileipellis ("pilosetae") or

on the stipe surface ("caulosetae"). Occurrence of setae is taxonomically significant.

**Pileipellis Arrangement and Cell-type.**

One of the primary taxonomic characters in *Marasmius*, significant at the sectional or subsectional levels, is the arrangement and type of cells forming the cuticular layer of the pileus (termed the "pileipellis"). Cells forming the pileipellis layer in species of *Marasmius* may be organized in one of two possible arrangements: 1) a non-hymeniform layer of interwoven, repent, diverticulate hyphae with broom cell-type or coralloid terminal cells (and then with dextrinoid stipe cortical hyphae, insititious stipe and rhizomorphs); or 2) a hymeniform layer of smooth (non-setulose) or setulose (broom-cell-type) elements.

Species forming non-hymeniform pileipelli of the first type described above belong to sects. *Androsacei* and *Rhizomorphigena*. In this group of species, pileipellis elements form knob-like, rod-like or irregular diverticula located on lateral or terminal regions of the cells, and in some cases pileipelli approximate what has been called a *Rameales*-structure [see Singer (1973) and Desjardin (1987b) for descriptions and illustrations of this pileipellis-type diagnostic of *Marasmiellus*]. Terminal cells are usually erect and strongly diverticulate, setulose or coralloid, and are similar in some taxa to *Siccus*-type broom cells. Often, pileipellis elements have darkly pigmented cell walls and/or are heavily incrusted with dark pigment deposits. Pileipelli exhibiting the combination of features outlined

above have been termed *Androsaceus*-type pileipelli. Recently, Antonin (1987) segregated sect. *Androsacei* from *Marasmius* as the new genus *Setulipes* based entirely on formation of non-hymeniform pileipelli. He restricted *Marasmius* to species with hymeniform pileipelli. I do not accept at present the exclusion of sect. *Androsacei* from *Marasmius* based on this criterion. A number of species in sect. *Androsacei* show immature pilei (or the disc region of mature pilei) formed of a subhymeniform or nearly hymeniform arrangement of broom-cell-type elements. As pilei of these taxa mature, the terminal elements become more widely spaced and the pileipellis appears non-hymeniform with scattered broom cell-type terminal cells. In comparison, in some taxa in sect. *Marasmius*, where members show well-developed hymeniform pileipelli composed of broom cells, as pilei mature the broom cells may become widely spaced and the cuticle appears subhymeniform or non-hymeniform. When comparing selected taxa from these two sections, it is difficult to find a distinct hiatus between non-hymeniform and hymeniform arrangement of pileipellis elements. Moreover, taxa in both sects. *Androsacei* and *Marasmius* form bristle-like, wiry, darkly pigmented stipes, black rhizomorphs, spores usually in the range 6.5-10 X 3-4.5 μm, and lack pleurocystidia. Based on these observations, I consider members of sect. *Androsacei* congeneric with members of the type section of *Marasmius*.

Hymeniform pileipelli may be formed of a number of different types of cells. If elements are smooth (*i.e.*, lacking diverticulate or setulose outgrowths), and range in shape from cylindric or clavate, to ventricose, vesiculose or sphaeropedunculate, they form what I term a

*Globularis*-type pileipellis [after *M. globularis* Fr. *in* Quél., type species of sect. *Globulares*]. This type of pileipellis is diagnostic for sects. *Alliacei, Epiphylli* and *Globulares*. If pileipellis elements possess thick-walled outgrowths of various shapes [termed "setulae;" *fide* Singer (1976)], several types of arrangements are possible.

If pileipellis elements are covered on the lateral and apical regions with divergent, thick-walled or solid, pigmented or unpigmented, rod-like outgrowths ("divergent setulae"), they form what is called a *Rotalis*-type pileipellis [*fide* Singer (1976); after *M. rotalis* Berk. & Br.]. *Rotalis*-type pileipelli are diagnostic for sect. *Marasmius* subsect. *Marasmius* and sect. *Hygrometrici*. Divergent setulae of this cell-type are nearly always cylindric and broadly obtuse ("rod-like"), never conic and acute, and never long and irregular in outline. They may be sparse and scattered over the upper half of cells, densely crowded over the upper 1/2 or 1/3, or in isolated clusters over various portions of the upper half of cells.

If pileipellis elements show strictly apical, cylindric, conic or irregular outgrowths that are typically pigmented and thick-walled or solid ("apical setulae"), the arrangement is called a *Siccus*-type pileipellis [*fide* Singer (1976); after *M. siccus*]. *Siccus*-type pileipelli are diagnostic for sect. *Marasmius* subsect. *Penicillati* and sect. *Sicci*. Apical setulae of this cell-type range from narrowly cylindric to conic, wavy or irregular in outline, with obtuse, subacute or acute apices. In addition, setulae may be verrucose and/or branched. There is wide variation in setula morphology of *Siccus*-type elements. Some taxa form short, broad, irregular setulae (*M.*

*graminum*), others show densely crowded, narrow, moderately long, irregular and verrucose setulae (*M. similis* Berk. & Curt.), while other taxa form long, conic, acute, smooth setulae (*M. floridanus*). Setulae morphology is a useful taxonomic character.

Pileus coloration in taxa forming hymeniform pileipelli of setulose elements is the result of intraparietal pigments located in setulae and in the apical portion of the cells. The basal portion of pileipellis cells is typically hyaline and thin-walled.

Pilocystidia or pilosetae occur in some taxa, and when present are similar in morphology to corresponding hymenial cystidia or hymenial setae. Presence or absence of these elements is taxonomically significant at the series or species levels.

**Pileus Trama.**

Hyphae comprising the pileus trama of *Marasmius* species are interwoven in arrangement, and consequently the tramal tissue has been described as "interwoven." Hyphae are usually frequently-branched, and cylindric or inflated but never pseudoparenchymatous as in some *Mycena* species. Cell walls are generally hyaline and smooth, but in a few species in sect. *Androsacei*, walls may be pigment-incrusted. In addition, walls are usually thin, although on occasion they may be up to 0.5 µm thick and herein termed "firm-walled." Tramal tissue is invariably non-gelatinous, one feature distinguishing *Marasmius sensu stricto* from *Micromphale* and *Gloiocephala*.

An important feature of tramal hyphae is the reaction to Melzers reagent, an iodine-chloral hydrate solution. If tramal tissues mounted

in Melzer's reagent become dark tawny, red or reddish brown, they are said to be "dextrinoid." If no reaction occurs (*i.e.*, hyphae remain unchanged), hyphae are said to be "inamyloid." Results of the reaction are important in separating sect. *Alliacei* (tramal hyphae inamyloid) from sect. *Globulares* (tramal hyphae dextrinoid). Singer (1958a) subdivided sect. *Sicci* into subsect. *Inaequales* (inamyloid) and subsect. *Siccini* (dextrinoid), and subdivided sect. *Epiphylli* into subsect. *Epiphyllini* [Singer (1965); inamyloid] and subsect. *Eufoliatini* [Singer (1976); dextrinoid]. It should be noted that different species show varied degrees of dextrinoidity, and care must be taken when evaluating results of the reaction. Sometimes a pretreatment in 3% ammonium hydroxide (**not** potassium hydroxide) followed by treatment in Melzers will yield more striking results.

**Lamellar Trama**.

Hyphae comprising the lamellar trama of *Marasmius* species are parallel or subparallel in arrangement, with the outermost hyphae curving slightly outward and becoming ramified and short-celled in the subhymenium. This type of organization has been termed "regular" (*fide* Singer, 1949). There is never a well-delimited, narrow mediostratum surrounded by broad lateral strata of divergent hyphae (*i.e.*, bilateral trama) characteristic of *Pseudohiatula*. Regular tramal tissue is a generic character and therefore, deviations from this type of arrangement are taxonomically significant. In all other features, lamellar tramal hyphae are similar to pileus tramal hyphae.

**Stipe Tissues**.

Stipe tissues are monomitic in all known species of *Marasmius*. No skeletal or binding hyphae (*sensu* Corner, 1932, 1953) have been observed, although occasionally medullary hyphae become heavily skeletalized, especially near the stipe base. In many species, the stipe is corticated with a layer of thick-walled, often deeply pigmented hyphae, in striking contrast to interior hyphae that are often slightly broader, and typically thinner-walled and hyaline. In such cases, the outermost hyphae have been termed "cortical hyphae," while the innermost hyphae are called "medullary hyphae." In cases where there is not a morphological distinction between the outermost and innermost hyphae, the stipe tissue is reported as "cortical and medullary hyphae undifferentiated." The reaction to Melzer's reagent exhibited by pileus and lamellar tramal hyphae is often paralleled by hyphae forming the stipe.

**Cortical Hyphae**. The outermost layer of tissue is formed of parallel, cylindric, long-celled hyphae with cell walls that are typically smooth (non-incrusted) and 0.5-2.5 µm thick. Walls range in pigmentation from hyaline through various shades of yellow, orange, reddish or brownish, and may be inamyloid or dextrinoid. Cortical hyphae range in width from 2.5-8(-10) µm. Few species form incrusted hyphae, and the presence of such elements is taxonomically important.

If a stipe vesture is present (discussed below), component elements arise as terminal cells, intercalary outgrowths or branches from cortical hyphae.

**Medullary Hyphae**. The stipe medulla is formed of parallel or subparallel, cylindric or seldom slightly inflated, long-celled hyphae with cell walls that are smooth and typically thin-walled or firm-walled. Rarely, medullary tissue is heterogeneous, composed of very narrow, thin-walled hyphae plus broad, very thick-walled hyphae. The latter arrangement is diagnostic for sect. *Rhizomorphigena*. Refer to the commentary on *M. brevipes* in Chapter IV for a further discussion. Medullary hyphae range in width from 2.5-16 µm, are generally hyaline, and may be inamyloid or dextrinoid. In some taxa, optically refractive oleiferous hyphae are interspersed among normal medullary hyphae. Unless medullary tissue is heterogeneous, features of medullary hyphae are of limited taxonomic value.

**Stipe Vesture**. The stipe vesture in southern Appalachian Marasmii may be formed of scattered or dense, erect cystidiiform elements that arise directly from cortical hyphae, or may constitute a layer of loosely interwoven hyphae which overlays cortical hyphae or undifferentiated stipe tissue and gives rise to cystidiiform elements.

Cystidiiform stipe surface elements are termed "caulocystidia" if they are morphologically or chemically differentiated from other stipe hyphae, and "caulosetae" if they are lanceolate or acuminate and very thick-walled. Caulocystidia, like cheilocystidia, are often similar in morphology to corresponding pileipellis elements. They range in shape from cylindric, clavate or sphaeropedunculate and non-setulose, to *Siccus*-type broom cells. Taxa that form hymenial setae and/or pilosetae, often form caulosetae of similar morphology. In a few species, cortical hyphae are covered on their outermost surface with

numerous erect setulae or diverticula (*e.g., M. minutus*). Several species form structures that I have termed "dendrotrichomoid elements." These elements are hyaline or slightly pigmented, dextrinoid, short, broad-based side-branches of cortical hyphae that give rise apically and subapically to a cluster of unbranched, long, aseptate, thick-walled, filiform "arms." The structures are reminescent of leaf trichomes of various Fagaceous trees. Similar structures with longer arms are found in tissue cultures of several species (refer to Chapter VI for examples).

A stipe vesture may be located on the stipe apex only, on the stipe base only, or form over the entire stipe surface. The occurrence, distribution and type of cystidiiform stipe elements are taxonomically significant at the series or species levels.

**Clamp Connections.**

In *Marasmius*, clamp connections are consistently present in members of all sections except sects. *Androsacei* and *Epiphylli*. In the latter sections, clamp connections are present in the majority of species, but may be absent in a number of taxa. In addition, in some taxa, clamps are present but not in all tissues of basidiomata. If clamps are present, they are easily observed in pileus tramal tissue and stipe medullary tissue, and are invariably present at the base of basidia. If clamps are seemingly absent, all tissues of basidiomata must be checked to verify the supposition. Occurrence of clamp connections is taxonomically important in sects. *Androsacei* and *Epiphylli*.

For additional comments on micromorphological features of marasmioid fungi, refer to Singer (1965, 1973), Gilliam (1976), and Desjardin (1985a).

# CHAPTER IV

## SOUTHERN APPALACHIAN TAXA

***MARASMIUS*** E. M. Fries, Fl. Scan. 339. 1835

LECTOTYPE SPECIES: *Agaricus rotula* Scopoli: E. M. Fries, Syst. Mycol. 1: 136. 1821. [≡ *Agaricus rotula* Scopoli, Fl. Carniol. 2: 456. 1772.]

≡ *Androsaceus* (Persoon) Patouillard, Hyménomyc. Eur. 105. 1887.

TYPE: *Agaricus rotula* Scop.: Fr., *ibid.*

= *Heliomyces* Léveillé, Ann. Sci. Nat. Bot. III, 2: 177. 1844

TYPE: *Heliomyces elegans* Léveillé, *ibid.*

= *Chamaeceras* Rebentisch *sensu* O. Kuntze, Rev. Gen. Pl. 3, 2: 454. 1898.

TYPE: *Agaricus androsaceus* Linnaeus: Fries, Syst. Mycol. 1: 137. 1821.

= *Collybiopsis* (Schroeter *in* Cohn) Earle *sensu* Singer, Agaricales Mod. Tax. 417. 1962; *non sensu* Earle, Bull. New York Bot. Gard. 5: 415. 1909. [≡ *Marasmius* subgen. *Collybiopsis* Schroeter *in* Cohn, Krypt.-Fl. Schlesien 3(1), 5: 559. 1889]

TYPE: *Agaricus calopus* Persoon: Fries, Syst. Mycol. 1: 130. 1821.

= *Mycenitis* Earle, Bull. New York Bot. Gard. 5: 414. 1909.

TYPE: *Agaricus alliaceus* Jacquin: Fries, Syst. Mycol. 1: 140. 1821.

= *Scorteus* Earle, Bull. New York Bot. Gard. 5: 415. 1909.

TYPE: *Agaricus oreades* Bolton: Fries, Syst. Mycol. 1: 127. 1821.

= *Tephrophana* Earle, Bull. New York Bot. Gard. 5: 427. 1909.

TYPE: *Collybia fimicola* Earle, Bull. New York Bot. Gard. 3: 298. 1904.

= *Polymarasmius* Murrill, N. Amer. Fl. 9: 286. 1915.

TYPE: *Marasmius multiceps* Berkeley & Curtis, J. Linn. Soc., Bot. 10: 298. 1869.

= *Setulipes* Antonin, Ceská Mykol. 41: 85. 1987.

TYPE: *Agaricus androsaceus* L.: Fr., *ibid.*

**Pileus** small or large (0.5-100$^{+}$ mm diam), campanulate, obtusely conic, convex or plane, sometimes depressed or umbilicate, sometimes papillate or umbonate, even, rugulose, striate, sulcate or plicate; surface typically dry and opaque, sometimes moist and subtranslucent, rarely hygrophanous, glabrous, pruinose, hispid or subvelutinous; coloration variable, from white or buff to various shades and mixtures of yellow, orange, olive, red, purple and brown; odor and taste mildly fungal, alliaceous, or not distinctive, rarely raphanoid or of cyanide; taste rarely bitter. **Lamellae** typically well-developed, rarely vein-like, sometimes intervenose or anastomosing, adnexed, adnate or short-decurrent, with or without a collarium, crowded, close, subdistant, distant or remote, narrow, moderately broad or broad; coloration variable, from white, buff or cream-colored, to pale yellow, pale pink, pale orange, greyish red or pale brown; edges even or crystalline-granulose, concolorous with lamellar sides, or often colored like the pileus; lamellulae absent or in 1-4 series. **Stipe** central or eccentric, rarely lateral or absent, terete or compressed, even, cleft or striate, equal, or enlarged above or below, rarely narrowed to a

radicating base, insititious, subinsititious or non-insititious; texture soft, tough, cartilaginous, or bristle-like; surface dull or shiny, glabrous, pruinose, pubescent, hispid, velutinous or tomentose, basal mycelium often strigose; coloration variable, from white or buff, to various shades of cream, yellow, orange, red, brown or black; rhizomorphs present or absent.

**Basidiospores** smooth, hyaline, inamyloid, acyanophilous, ellipsoid, amygdaliform, limoniform, subfusoid or clavate, sometimes curved, often inequilateral in profile, typically white in deposit, rarely yellow, cream, pale olivaceous or greyish red. **Basidia** subcylindric, subclavate or clavate, (2)- or 4-spored, lacking siderophilous granules, hyaline, inamyloid, thin-walled. **Basidioles** cylindric, clavate, fusoid or ventricose, hyaline, inamyloid, thin-walled. **Pleurocystidia** present or absent, cylindric, flexuous, clavate, fusoid or ventricose, sometimes mucronate or apically constricted, non-setulose, refractive or non-refractive, hyaline or yellowish, inamyloid, thin-walled or firm-walled. **Cheilocystidia** typically present (absent in some species), cylindric, clavate, acuminate, fusoid, ventricose, or irregular in outline, rarely capitate, with or without apical or divergent setulae; main body thin-walled or firm-walled, rarely thick-walled, hyaline or weakly pigmented. **Hymenial setae** present in some species, lanceolate, acute, thick-walled, hyaline, pale yellowish, ochraceous, brownish orange or reddish, inamyloid or more commonly dextrinoid. **Pileipellis** of two possible morphologies: 1) a hymeniform layer of smooth (non-setulose) or setulose elements (broom cells); main body cylindric, clavate,

turbinate, or subvesiculose, sometimes lobed, typically thin-walled or firm-walled, hyaline or weakly pigmented; setulae divergent or apical, knob-like, rod-like, conic or irregular in outline, obtuse or acute, even or verrucose, thick-walled or solid, ranging from hyaline to deeply pigmented; **or** 2) a non-hymeniform layer of interwoven, repent, diverticulate hyphae with broom cell-like terminal cells (and then with dextrinoid stipe cortical hyphae, insititious stipe and rhizomorphs); hyphae irregular in outline, usually pigment-incrusted, non-gelatinous. **Pileus trama** composed of interwoven hyphae; **lamellar trama** of subparallel hyphae (*i.e.*, "regular"); hyphae cylindric or inflated, smooth or weakly incrusted, non-gelatinous, thin-walled or firm-walled, hyaline or weakly pigmented, inamyloid or dextrinoid. **Stipe tissue** monomitic; **cortical hyphae** parallel or subparallel, cylindric, smooth or pigment-incrusted, thin-walled or thick-walled, inamyloid or dextrinoid, ranging from hyaline to pale yellow, brownish orange, olivaceous, reddish brown or brown; **medullary hyphae** homogeneous or rarely heterogeneous, parallel or subparallel, cylindric or inflated, smooth, thin-walled or thick-walled, inamyloid or dextrinoid, hyaline or weakly pigmented. **Stipe vesture** present or absent, composed of non-setulose elements, broom cells, setae or dendrotrichomoid elements. **Clamp connections** present or absent.

**Habitat** on or amongst decaying leaves or wood of conifers, monocotyledonous or dicotyledonous plants, occasionally on soil, saprophytic, rarely parasitic, none known to be mycorrhizal.

## KEY TO THE SECTIONS OF *MARASMIUS*

1. Pileipellis not hymeniform, composed of interwoven, diverticulate and often heavily incrusted hyphae with coralloid terminal cells; stipe insititious; rhizomorphs typically well-developed ..... 2

1. Pileipellis hymeniform, composed of a monolayer of cylindric, clavate or sphaeropedunculate cells with or without setulae; stipe insititious or non-insititious; rhizomorphs present or absent ..... 3

2 (1). Stipe eccentric or central; stipe length / pileus width ratio ≈ 1:1; stipe medullary hyphae heterogeneous, of narrow, thin-walled, much-branched binding-type hyphae plus broad, thick-walled, unbranched hyphae ..... ..... sect. *Rhizomorphigena*

2. Stipe central; stipe length / pileus width ratio >2:1; stipe medullary hyphae homogeneous, of thin- or firm-walled, unbranched hyphae (*i.e.*, lacking binding-type hyphae in combination with skeletalized hyphae) ..... ..... sect. *Androsacei*

3 (1). Lamellae with a collarium; stipe insititious ..... ..... sect. *Marasmius*

3. Lamellae lacking a collarium; stipe insititious or non-insititious ..... 4

4 (3). Pileipellis composed of non-setulose elements, typically entire or rarely lobed (Figs. 15C, 18D) ..... 5

4. Pileipellis composed of broom cells of the *Rotalis*-type (Fig. 7D) or *Siccus*-type (Fig. 35E) ..... 7

5 (4). Stipe insititious; pileus and stipe apex at maturity typically white or pallid, not deeply pigmented; pileus generally <8 mm broad; lamellae often poorly developed ..... sect. *Epiphylli*

5. Stipe non-insititious; pileus typically more deeply pigmented; pileus generally >8 mm broad; lamellae always well-developed ..... 6

6 (5). Tramal hyphae dextrinoid ..... sect. *Globulares*

6. Tramal hyphae inamyloid ..... sect. *Alliacei*

7 (4). Stipe insititious; pileipellis composed of *Rotalis*-type elements ..... sect. *Hygrometrici*

7. Stipe non-insititious; pileipellis composed of *Siccus*-type elements, or rarely with a few non-diverticulate elements ..... sect. *Sicci*

## KEYS TO SOUTHERN APPALACHIAN SPECIES OF *MARASMIUS*

### Sect. *RHIZOMORPHIGENA*

One species within the range. Pileus brown, 2-6 mm broad; lamellae brownish grey, distant; stipe <3 mm long, often arising directly from rhizomorphs ..... 1. *M. brevipes*

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### Sect. *ANDROSACEI*

1. Stipe and rhizomorphs stramineous or golden-melleous ..... 2
1. Stipe and rhizomorphs reddish brown, brown or black ..... 3

2 (1). Clamp connections absent; basidiomata formed on coniferous needles (generally *Pinus*) ..... ..... 2. *M. straminipes* var. *straminipes*

2. Clamp connections present; basidiomata formed on oak leaves ..... 3. *M. straminipes* var. *fibulatus*

3 (1). Clamp connections absent; cheilocystidia absent; pileus margin greyish orange or pallid ..... 4. *M. pallidocephalus*

3. Clamp connections present; cheilocystidia present; pileus margin brown or greyish brown ..... 5. *M. androsaceus*

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Sect. ***MARASMIUS***

1. Pileipellis of *Siccus*-type elements (Fig. ); basidiomata on decayed grasses; pileus reddish brown or brownish orange, sulcate, umbilicate, 3-8 mm broad [subsect. *Penicillati*] ..... 6. *M. graminum*

1. Pileipellis of *Rotalis*-type elements (Fig. ); basidiomata on hardwood leaves or wood [subsect. *Marasmius*] ..... 2

2 (1). Basidiomata formed on hardwood leaves, typically oak; pileus margin cream-colored, ochraceous or pale brown; pileus disc with a pallid zone surrounding a dark central spot; stipe <0.4 mm thick ..... 7. *M. capillaris*

2. Basidiomata formed on hardwood logs or sticks; pileus dingy white overall except for dark central spot (*i.e.*, margin lacking brown tones); stipe typically >0.4 mm thick ..... 8. *M. rotula*

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Sect. ***EPIPHYLLI***

1. Pileipellis elements mainly lobed, *i.e.*, with 1-4 subconic obtuse projections; pileus <2 mm broad, pale yellow or pale orange when young; basidiomata formed on *Fagus* leaves ..... 9. *M. epifagus*

1. Pileipellis elements entire, lacking projections; pileus generally >2 mm broad, differently colored; substratum different than above ..... 2

2 (1). Pileus white or cream-colored; pileipellis elements hyaline; basidiomata formed on leaf blades or petioles of Betulaceae, *Fraxinus*, *Populus*, or *Cornus* (extralimital) ..... 10. *M. epiphyllus*

2. Pileus pinkish white or pale orange-white; pileipellis elements hyaline, yellow and pale brown; basidiomata formed on petioles of *Platanus* or *Liquidambar* ..... ..... 11. *M. felix*

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Sect. ***GLOBULARES***

1. Spores clavate, 19.5-28 µm long ($\bar{L} \approx 23$ µm); pileus sulcate; basidiomata similar in macromorphology to species in sect. *Sicci* ..... 12. *M. decipiens*

1. Spores ellipsoid, 5.6-10 µm long ($\bar{L} \approx 6.5$-8.5 µm); pileus even or seldom short-striate, never sulcate; basidiomata collybioid ..... 2

2 (1). Hymenium with conspicuous fusoid or ventricose-mucronate pleurocystidia, projecting well beyond basidia ..... 3

2. Hymenium lacking pleurocystidia ..... 4

3 (2). Stipe white or buff-colored overall and drying pallid; opaque, striate, pruinose or pulverulent at apex; pileus disc brown, margin cream-colored; caulocystidia abundant; spore $\bar{x} \approx 7.5 \times 4.4$ µm, $\bar{Q} \approx 1.7$ ..... 13. *M. nigrodiscus*

3. Stipe white above, brown below, drying reddish brown; polished and translucent, not striate, glabrous overall; pileus disc ochraceous-tawny, margin pinkish buff; caulocystidia absent; spore $\bar{x} \approx 8.6 \times 3.6$ µm, $\bar{Q} \approx 2.4$ ..... 14. *M. cystidiosus*

4 (2). Cheilocystidia absent; pileipellis with many lobed elements; odor of chlorine or cyanic acid; basidiomata formed in lawns or open grassy areas ..... 15. *M. oreades*

4. Cheilocystidia present; pileipellis elements not lobed; odor variable but not of chlorine or cyanic acid; basidiomata formed in wooded areas ..... 5

5 (4). Pileus 10-25 mm broad, disc greyish brown, margin buff; spores 5.6-7.2 µm long ($\bar{L} \approx 6.5$ µm); cheilocystidia broadly clavate ..... 16. *M. "albogriseoides"*

5. Pileus 10-60 mm broad, disc yellow, often with rusty brown splotches, margin yellow; spores 6.5-10 µm long ($\bar{L} \approx 8.4$ µm); cheilocystidia cylindric, often lobed ..... 17. *M. strictipes*

Sect. ***ALLIACEI***

1. Odor mild, not alliaceous; pleurocystidia conspicuous, capitate; stipe pubescent, often rooting, 20-170 mm long ..... 18. *M. pyrrhocephalus*

1. Odor alliaceous; pleurocystidia absent; stipe glabrous or pubescent, not rooting, generally <60 mm long ..... 2

2 (1). Stipe glabrous; spores 7-10 µm long ..... ..... 19. *M. scorodonius*

2. Stipe pubescent; spores 12.8-17.2 µm long ..... ..... 20. *M. copelandii* var. *olidus*

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Sect. ***HYGROMETRICI***

One species within the range. Pileus brown or greyish brown, <3.5 mm broad; lamellae distant, pallid; stipe glabrous but cortical hyphae diverticulate; hymenial cystidia and pilocystidia subcapitate; basidiomata formed on leaves of *Fraxinus* or *Pyrus* ..... 21. *M. minutus*

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## Sect. *SICCI*

**KEY TO SERIES:**

1. Lanceolate, thick-walled setae present on hymenophore ..... ..... ser. *Spinulosi* [= ser. *Actinopodes* Singer *pro parte*]

1. Setae absent on hymenophore ..... 2

2 (1). Stipe pruinose or pubescent overall, due to numerous cylindric or clavate caulocystidia ..... ser. *Atrorubenses* [= ser. *Actinopodes* Singer *pro parte*]

2. Stipe glabrous overall, or pruinose only at apex or extreme base, pruinosity due to broom cells or dendro-trichomoid elements ..... 3

3 (2). Pleurocystidia present, typically refractive and conspicuous, rarely non-refractive ..... ser. *Haematocephali*

3. Pleurocystidia absent ..... ser. *Leonini*

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## Sect. *SICCI* ser. *SPINULOSI*

1. Pileus dingy white or cream-colored overall; hymenial setae hyaline or rarely pale yellow ..... 22. *M. delectans*

1. Pileus brown, reddish brown or yellowish brown, darkest over disc; hymenial setae ochraceous, brownish orange or reddish brown ..... 2

2 (1). Lamellae subdistant or distant, broad; stipe glabrous or weakly pruinose at the apex ..... ..... 23. *M. cohaerens* var. *cohaerens*

2. Lamellae close or crowded, narrow; stipe pruinose or subvelutinous overall ..... ..... 24. *M. cohaerens* var. *lachnophyllus*

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Sect. ***SICCI*** ser. ***ATRORUBENSES***

1. Stipe <3 mm long, typically eccentric, curved, white overall; pileus brownish orange, brownish grey or yellowish brown, 1-7 mm broad (ser. *Haematocephali*) ..... 26. *M. falcatipes*

1. Stipe >10 mm long, central, straight, base brown or reddish brown; pileus reddish brown or brownish orange, 5-25 mm broad ..... 2

2 (1). Spores 13.5-18 µm long ($\bar{L} \approx 15.7$ µm); cheilocystidia mostly gloeocystidioid, flexuous, with reddish orange contents; pleurocystidia absent; caulocystidia cylindric or strangulate-contorted; broom cells absent on stipe surface ..... 25. *M. ciliatomarginatus*

2. Spores 6.4-9.6 µm long ($\bar{L} \approx 7.6$ µm); all cheilocystidia *Siccus*-type broom cells; pleurocystidia present; caulocystidia of cylindric cells plus *Siccus*-type broom cells (ser. *Haematocephali*) ..... 28. *M. sullivantii*

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Sect. ***SICCI*** ser. ***HAEMATOCEPHALI***

1. Stipe pruinose at apex or extreme base due to numerous setulose or dendrotrichomoid elements ..... 2
1. Stipe glabrous overall, typically shiny ..... 4

2 (1). Pileus 1-7 mm broad, brownish orange, brownish grey or yellowish brown; stipe <3 mm long, eccentric, white overall ..... 26. *M. falcatipes*
2. Pileus 8-35 mm broad, reddish brown, pinkish brown or pinkish orange; stipe >10 mm long, central, apex white or buff, base brown ..... 3

3 (2). Pileus pinkish brown or pinkish orange, 10-35 mm broad; lamellae crowded, narrow, soredioid spots absent; stipe pruinose at base only; spores 5.8-8.0 µm long ($\bar{L} \approx 6.6$ µm); pleurocystidia narrowly cylindric, flexuous, non-refractive ..... 27. *M. spissus*
3. Pileus reddish brown, 8-25 mm broad; lamellae close, moderately broad, often with soredioid spots when dried; stipe pruinose overall; spores 6.4-9.6 µm long ($\bar{L} \approx 7.6$ µm); pleurocystidia ventricose, refractive ..... 28. *M. sullivantii*

4. Spores <12 µm long ($\bar{L} \approx 9$ µm or less) ..... 5
4. Spores >12 µm long ($\bar{L} > 13.3$ µm) ..... 8

5 (4). Basidiomata formed on decayed grasses; pileus <10 mm broad (sect. *Marasmius*) ..... 6. *M. graminum*

5. Basidiomata formed on hardwood leaves or wood; pileus >10 mm broad ..... 6

6 (5). Lamellae distant or remote, broad; pileus striate or plicate, typically 10-20 mm broad; spores 4-5.6 µm broad (Q ≈ 2.0) ..... 29. *M. glabellus*

6. Lamellae close, narrow or moderately broad; pileus smooth or striatulate, typically 20-30 mm broad; spores 2.8-3.6 µm broad (Q ≈ 2.4-2.9) ..... 7

7 (6). Lamellae distinctly intervenose near pileus margin; spores 6.4-8.4 µm long ($\bar{L}$ ≈ 7.4 µm) ..... ..... 31. *M. floridanus* var. *virginianus*

7. Lamellae not intervenose; spores 7.2-11.2 µm long ($\bar{L}$ ≈ 9 µm) ..... 30. *M. floridanus* var. *floridanus*

8 (4). Basidiomata formed on decayed grasses; pileus 1.5-4.5 mm broad, deep reddish orange or brownish orange; smooth (non-striate)..... 32. *M. pseudobambusinus*

8. Basidiomata formed on hardwood debris, rarely grass leaves; pileus typically broader, striate or sulcate ..... 9

9 (8). Lamellae remote, broad ..... 10

9. Lamellae subdistant or distant, narrow ..... 11

10 (9). Pileus deep purplish red or deep red; lamellar edge red-marginate or non-marginate; stipe apex pinkish red or purplish red; spores 16-22 µm long ($\bar{L}$ ≈ 18.6 µm) ..... 33. *M. haematocephalus* var. *haematocephalus*

10. Pileus pale brownish orange or orange-white; lamellae non-marginate; stipe apex white; spores 14.4-19.2 µm long ($\bar{L}$ ≈ 16.8 µm) ..... 34. *M. haematocephalus* var. *anomaloides*

11 (9). Spores 15.2-20.8 µm long ($\bar{L}$ ≈ 18.0 µm; Q ≈ 4.7); pileus deep orange or brownish orange; lamellae distant; stipe apex white or pale yellow; pleurocystidia yellow-refractive, conspicuous ..... 35. *M. siccus*

11. Spores 12-16 µm long ($\bar{L}$ ≈ 13.3 µm; Q ≈ 3.4); pileus red, pink or yellowish brown; lamellae subdistant; stipe apex pink, rarely pale yellow; pleurocystidia hyaline, non-refractive, inconspicuous ..... 36. *M. pulcherripes*

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Sect. ***SICCI*** ser. ***LEONINI***

1. Spores <9 µm long ($\bar{L}$ ≈ 6.6 µm); pileus 10-40 mm broad, non-striate; lamellae crowded, narrow; stipe with numerous dendrotrichomoid elements (ser. *Haematocephali*) ..... 27. *M. spissus*

1. Spores >9 µm long; basidiomata without the above combination of characters ..... 2

2 (1). Spores 8-12 µm long ($\bar{L} \approx 10.2$ µm); pileus 4-15 mm broad, deep purplish red; lamellae distant, broad; stipe apex purplish red ..... 37. *M. bellipes*

2. Spores generally >12 µm long ($\bar{L} > 13.8$ µm); basidiomata without the above combination of characters ..... 3

3 (2). Spores 12-16 µm long ($\bar{L} \approx 13.8$ µm); pileus 3-15 mm broad, striate, yellowish brown or pinkish red; lamellae subdistant, narrow (ser. *Haematocephali*) ..... 36. *M. pulcherripes*

3. Spores 14.8-19.2 µm long ($\bar{L} \approx 17$ µm); pileus 15-45 mm broad, sulcate, deep reddish brown; lamellae distant, broad ..... 38. *M. fulvoferrugineus*

***MARASMIUS*** sect. ***RHIZOMORPHIGENA*** (Singer) Desjardin & Petersen, Mycologia 81: 76. 1989.

≡ *Micromphale* sect. *Rhizomorphigena* Singer, Sydowia 2: 32. 1948.

TYPE SPECIES: *Marasmius westii* Murrill, Proc. Florida Acad. Sci. 7: 110. 1945.

Pileipellis non-hymeniform, composed of interwoven, diverticulate hyphae with coralloid or broom cell-like terminal cells; hyphae non-gelatinous, pigment-incrusted. Tramal hyphae inamyloid, clamped, often thick-walled. Pleurocystidia absent. Stipe central or often eccentric, glabrous, insititious. Stipe cortical hyphae dextrinoid. Stipe medullary tissue heterogeneous, composed of narrow, much-branched, thin-walled binding-type hyphae *plus* broad, unbranched, heavily skeletalized hyphae. Rhizomorphs well-developed, often giving rise directly to basidiomata.

1. ***MARASMIUS BREVIPES*** Berkeley & Ravenel *in* Berkeley & Curtis, Ann. Mag. Nat. Hist. ser. 2, 12: 426. 1853.

≡ *Micromphale brevipes* (Berk. & Rav. *in* Berk. & Curt.) Singer *in* Dennis, Kew Bull. 8: 42. 1953.

= *Marasmius westii* Murrill, Proc. Florida Acad. Sci. 7: 110. 1945.

≡ *Micromphale westii* (Murr.) Singer, Sydowia 2: 32. 1948.

**HOLOTYPE:** United States, South Carolina, Santee Canal, June, Ravenel no. 1527 [also numbered 1922], dead twigs of oak (K!).

**Basidiomata** (Fig. 1A) marcescent. **Pileus** 2-6 mm diam, convex or plano-convex, sometimes undulate in age; disc smooth or weakly rugulose; margin even or striate; surface dull, dry, opaque, glabrous

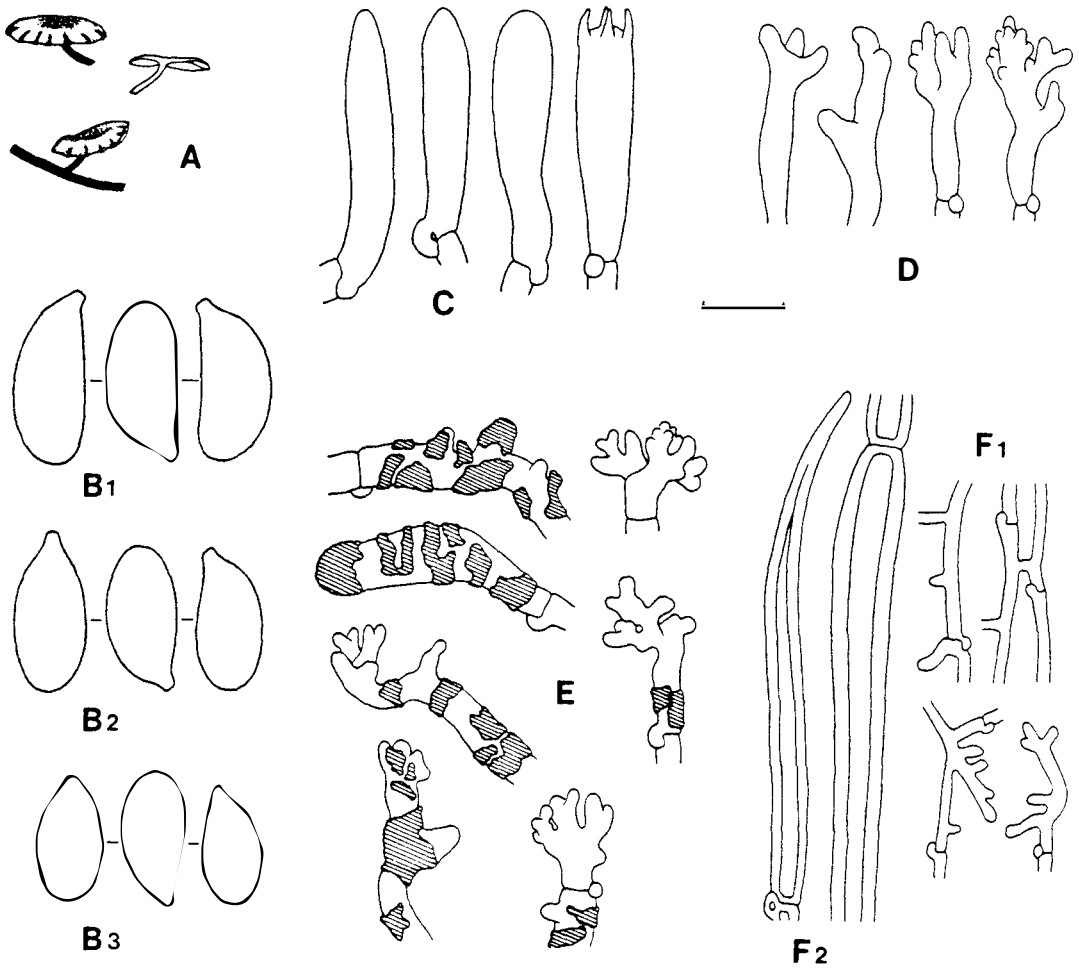



**Figure 1 A-F.** Features of *Marasmius brevipes*. A. Basidiomata, X3 (Desjardin no. 4367). B1-B3. Basidiospores. B1. Ravenel no. 1527 (holotype). B2. Desjardin no. 4367. B3. Dennis no. 114. C. Basidium and basidioles. D. Cheilocystidia. E. Pileipellis elements. F1-F2. Heterogeneous stipe medullary hyphae. F1. Thin-walled, branched, binding-type hyphae. F2. Skeletalized, unbranched hyphae. Standard bar = 5 μm for A; 10 μm for C-F (drawn from holotype).

or minutely suede-like, brown (7E5-7) or dark reddish brown overall, or with a slightly darker disc (to 7-8F5), fading somewhat in age. Context thin, buff-brown. **Lamellae** adnate, distant (8-10 complete lamellae), narrow or moderately broad (up to 1 mm), sometimes forked,

rarely weakly intervenose at maturity, brownish grey (6C3) when young, darkening to light brown (7D4-5) in age, edges concolorous. **Stipe** central or eccentric (never lateral), 1-2.5 X <0.5 mm, terete, equal or narrowed slightly at the base, curved, glabrous, dull or shiny, solid, dark reddish brown (8F6-8) or black overall, insititious, arising from the bark of hardwoods or from rhizomorphs. **Rhizomorphs** abundant, branched, wiry, black. **Odor** not distinctive. **Taste** mild or weakly astringent.

**Basidiospores** (Figs. 1 B1-B3) 6.4-10(-10.8) X 3-5 µm [$\bar{\bar{x}}$ = 8.3 ± 0.6 X 4 ± 0.2 µm, E = 1.8-2.6, $\bar{Q}$ = 2.1 ± 0.1; TL90(90%): $\bar{x}$ = 7.2-9.4 X 3.7-4.4 µm, Q = 1.9-2.2; n = 10-40 spores per 13 specimens], ellipsoid or amygdaliform, with a prominent hilar appendix, smooth, hyaline, inamyloid, white in deposit. **Basidia** (Fig. 1 C) 18-27 X 5.5-8 µm, cylindric or clavate, 4-spored, readily collapsing after spore discharge. **Basidioles** (Fig. 1 C) clavate or cylindric-acuminate. **Pleurocystidia** absent. **Cheilocystidia** (Fig. 1 D) not differentiated on some lamellae, scattered or rather common on others and then more common nearest the pileus margin, 12-30 X 3.5-7 µm, ranging from basidiomorphous to irregularly cylindric and diverticulate, sometimes lobed, typically hyaline and thin-walled, rarely pale brown and moderately thick-walled; diverticula 1-5 X 1-2.5 µm, irregular in outline, obtuse. **Pileipellis** not hymeniform, composed of interwoven, repent hyphae; hyphae 3-8 µm diam, irregular in outline, heavily incrusted with brown pigment deposits, sparcely diverticulate, non-gelatinous, thick-walled (0.5-2 µm), hyaline or pale brown, inamyloid, clamped; diverticula 1-5 X 0.5-2.5 µm, knob-like or irregular in

outline, obtuse; terminal cells (Fig. 1 E) irregularly lobed, diverticulate or coralloid, some broom cell-like. **Hypodermium** of interwoven, heavily incrusted hyphae 2.5-6.5 µm diam, frequently-branched, moderately thick-walled; incrustations granular, plaque-like, helical or amorphous, colored ochraceous, brown or dark brown. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-9 µm diam, cylindric, smooth or weakly incrusted, non-gelatinous, hyaline or pale brown, inamyloid, with walls up to 2 µm thick. **Stipe tissue** monomitic, but composed of three distinct types of generative hyphae: 1) **cortical hyphae** 2.5-7 µm diam, parallel, cylindric, heavily incrusted with granular brown pigments; walls brown, strongly dextrinoid, up to 2 µm thick; 2) thin-walled **medullary hyphae** (Fig. 1 F1) 2.5-4.5 µm diam, short-celled, frequently-branched, cylindric, smooth, hyaline, inamyloid; and 3) skeletalized **medullary hyphae** (Fig. 1 F2) up to 1000 X 6-20 µm, parallel, cylindric or inflated, unbranched, smooth or roughened, hyaline, inamyloid, with walls up to 5 µm thick; terminal cells sometimes acuminate. **Stipe vesture** absent. **Rhizomorphic tissue** similar to that of the stipe, *i.e.*, with three types of generative hyphae. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Scattered or gregarious on sticks of *Quercus, Rhododendron* or other hardwoods in mixed woodlands. April - October. Locally abundant. Southeastern United States, West Indies and Colombia.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** Features diagnostic for *Marasmius brevipes* include: a) small, dark brown, convex pileus; b) distant, pale brown lamellae;

c) short, eccentric, glabrous, black stipe which often arises directly from black rhizomorphs. In addition, distinctive micromorphology includes: d) diverticulate and brown pigment-incrusted pileipellis elements; e) moderately thick-walled, inamyloid contextual hyphae; f) diverticulate cheilocystidia; g) dextrinoid stipe cortical hyphae; and h) stipe tissue composed of three distinct types of generative hyphae. Discussions of taxonomically important characters are itemized below.

1. Pileipellis morphology. In young basidiomata, the pileipellis is composed of numerous diverticulate hyphae with coralloid terminal cells (Fig. ), forming a layer similar in morphology to pileipelli of members of sect. *Androsacei*. In age, however, the diverticulate elements become widely dispersed and the surface layer is formed from generally non-diverticulate, heavily incrusted hypodermal elements. Oversight of this ontogenetic sequence is possibly responsible for the various interpretations of pileipellis morphology cited in the literature [*cf*. Dennis (1953), Pegler (1983)].

2. Spore variability. *Marasmius brevipes* exhibits substantial intrabasidiome and infraspecific spore size variability. Within a single basidiome, spore length may range from 6.4-9.6 µm, and within the species from 6.4-10.8 µm. Mean spore length ranges from 7.2 µm in a collection from Trinidad (Dennis no. 114), to ≈ 9 µm from the type specimens of *M. brevipes* from South Carolina (Ravenel no. 1527), and *M. westii* Murr. from Florida (West no. 17211). Intermediate values were observed in collections from North Carolina (Desjardin no. 3813), Mississippi (Desjardin no. 4367), and Texas (Lewis no. 276).

Overlapping spore size ranges do not justify recognition of infraspecific taxa.

3. Stipe tissue morphology. The stipe is composed of three types of generative hyphae arranged in two distinct layers. The exterior or cortical layer is composed of cylindric (*i.e.*, non-inflated), pigment-incrusted, dark brown, dextrinoid hyphae with moderately thick walls (up to 2 µm). The interior or medullary layer is composed of two types of generative hyphae: 1) very narrow (<5 µm), frequently-branched, thin-walled, hyaline, inamyloid hyphae that are interspersed among and appear to bind together the second type of hyphae; 2) inflated (6-20 µm diam), very long-celled (up to 1000 µm), unbranched, hyaline, inamyloid hyphae with walls up to 5 µm thick. Although this morphology is analogous to that described by Redhead (1987)for members of the Xerulaceae, I hesitate to call the arrangement "sarcodimitic" as defined by Corner (1966) and amended by Redhead (1987). The inflated hyphae of the stipe medulla in the sarcodimitic condition typically have only slightly thickened walls (*i.e.*, not over 1-1.5 µm thick), and voluminous lumens. In *M. brevipes*, walls of inflated medullary hyphae are commonly 4-5 µm thick (often with occluded lumen), a feature presumably responsible for the toughness of the stipe. I conclude that *M. brevipes* is not closely allied to genera with sarcodimitic tissues. I also hesitate to call the stipe tissue dimitic or trimitic as defined by Corner (1932, 1953). Dimitic tissue is composed of generative hyphae plus thick-walled, terminal, non-septate "skeletal hyphae," while trimitic tissue is formed of generative hyphae, skeletal hyphae, and thick-walled, profusely branched, slender, rarely septate "binding

hyphae" of limited growth. In *M. brevipes*, the hyphae which presumably serve a binding function are entirely thin-walled, frequently-septate and much less coralloid than those present in fungi described with typical trimitic tissue (*e.g.*, aphyllophoraceous fungi). In addition, skeletalization of medullary hyphae in *M. brevipes* is not restricted to the terminal cell, as in the dimitic condition, but usually occurs in successive cells as well. The distinctive heterogeneous stipe medullary tissue of *M. brevipes* is an important diagnostic feature of sect. *Rhizomorphigena*, clearly separating members of this section from members of sect. *Androsacei*.

4. Odor and taste. There is some question about the presence or absence of a discernible odor in *M. brevipes*. Berkeley and Ravenel (*in* Berkeley and Curtis, 1853) made no mention of odor and taste. The first mention of a distinctive odor was by Singer (*in* Dennis, 1953), where it was described as "slight or distinct, of sauerkraut (like that of *Micromphale foetidum*)." Pegler (1983) again noted a sauerkraut odor. I have not noticed an odor in any of the fresh material collected, nor in any of the reconstituted fragments of herbarium specimens. Moreover, Murrill (1945a) indicated *M. westii* as odorless, but with an astringent taste. In most of the fresh material I examined, the taste was not distinctive, but several basidiomata were slightly astringent.

The protologue of *Marasmius brevipes* cited a single collection, *viz.*, Ravenel no. 1527 from Santee Canal, South Carolina, undoubtedly the holotype specimen. There are, however, several other specimens numbered 1527 deposited at various herbaria which were collected at

different locations. For example, a collection in the Curtis Herbarium (FH) and a duplicate in BPI are labeled "Sulphur Springs, North Carolina, Aest. 1852, Ravenel no. 1527." Furthermore, two collections deposited at Kew are labeled "Pineville, South Carolina, no. 1527" (Pegler, pers. comm.). One may presume from these label data that the number "1527" was a "taxon" number and not exclusively a "collection" number. All of Ravenel's material numbered 1527, but not from Santee Canal, are considered only as authentic material.

Although originally described in *Marasmius*, *M. brevipes* was transferred to the genus *Micromphale* by Singer (*in* Dennis, 1953). For a discussion of our reasons for retaining *M. brevipes* in *Marasmius*, see Desjardin and Petersen (1989c).

***MARASMIUS*** sect. ***ANDROSACEI*** Kühner, Le Botaniste 25: 91. 1933.

≡ *Setulipes* Antonin, Ceská Mykol. 41: 85. 1987.

TYPE SPECIES [implied, Kühner (1933)]: *Agaricus androsaceus* Linnaeus: Fries, Syst. Mycol. 1: 137. 1821.

Pileipellis non-hymeniform or rarely subhymeniform (and then usually only in immature pilei), composed of interwoven, diverticulate hyphae with coralloid or broom cell-like terminal cells; hyphae non-gelatinous, non-incrusted or more often pigment-incrusted. Tramal hyphae inamyloid or seldom weakly dextrinoid, thin-walled or firm-walled. Pleurocystidia absent. Stipe central, glabrous, pruinose or pubescent, insititious. Stipe cortical hyphae dextrinoid. Stipe medulla homogeneous; hyphae unbranched, thin- or thick-walled (medulla lacking thin-walled binding-type hyphae in combination with heavily skeletalized hyphae). Clamp connections present or absent. Rhizomorphs well-developed.

2. ***MARASMIUS STRAMINIPES*** var. ***STRAMINIPES*** Peck, Bull. Buffalo Soc. Nat. Sci. 1: 59. 1873.

**HOLOTYPE:** United States, New York, Albany Co., Center (= Karner), Oct. 1872, C. H. Peck (NYS!).

**Basidiomata** marcescent, reviving. **Pileus** 1.5-6 mm diam, hemispherical or convex, expanding to plano-convex; disc smooth or weakly rugulose; margin rugulose-striate; surface dull, dry, opaque, glabrous or minutely suede-like; context thin, buff; color light brown (7D4-5) or pale greyish brown (7D3) overall when young, disc soon fading to pale brownish orange (7C3) or pale brownish grey (6C3),

margin soon fading to greyish orange (6C2) or pale greyish orange (5B2), in age disc with a hint of grey and margin buff, or faded to off-white, buff or pinkish buff overall. **Lamellae** adnate, subdistant, narrow, white or buff when young, becoming greyish buff or pale brownish grey (6C3) in age; edges even or crystalline-fimbriate, not intervenose or anastomosing; **lamellulae** in 1-2 series. **Stipe** 10-35 X <0.5 mm, terete, equal, tough, wiry, glabrous, shiny, hollow, insititious; yellow (4A5-6) overall when young or with a slightly paler apex, darkening overall with age to stramineous, golden-melleous or brownish orange (5-6C4); base sometimes becoming slightly more brown at maturity, never dark brown or black. **Rhizomorphs** uncommon or abundant, hair-like (narrower than the stipe), often branched, glabrous, pale yellow or stramineous. **Odor and taste** not distinctive.

**Basidiospores** (Fig. 2 A) 6.5-9.5 X 3.2-4.5 µm [$\bar{\bar{x}}$ = 8 ± 0.2 X 4 ± 0.1 µm, E = 1.7-2.4, $\bar{Q}$ = 2 ± 0.1; TL90(90%): $\bar{x}$ = 7.6-8.4 X 3.7-4.3 µm, Q = 1.9-2.1; n = 30 spores per 10 specimens], ellipsoid or amygdaliform, hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 2 B) 19-27 X 6.4-9 µm, clavate, 4-spored, rarely 2-spored. **Basidioles** (Fig. 2 B) clavate or fusoid-ventricose. **Pleurocystidia** not differentiated. **Cheilocystidia** (Fig. 2 C) abundant, 13-23 X 4.5-8(-11) µm, cylindric, clavate or irregular in outline, often lobed, diverticulate, hyaline, inamyloid, thin-walled; diverticula 1-4 X 0.5-2 µm, irregular in outline, obtuse, sometimes lobed, nodulose or not, hyaline, thin-walled. **Pileipellis** not hymeniform, composed of a well-developed *Rameales*-structure, of interwoven diverticulate hyphae with repent or erect broom cell-type terminal cells (Fig. 2 D); hyphae

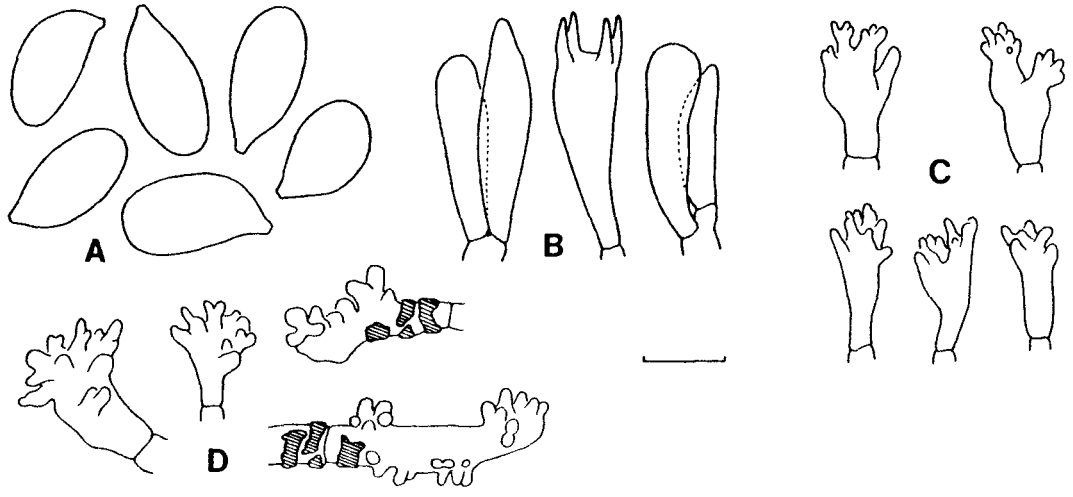



**Figure 2 A-D.** Features of *Marasmius straminipes* var. *straminipes* (Peck, Oct. 1872, holotype). A Basidiospores. B. Basidium and basidioles. C. Cheilocystidia. D. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-D.

2.5-8(-12) µm diam, irregular in outline, often lobed, smooth or pigment-incrusted, hyaline or pale brown, inamyloid; diverticula 1-8 X 1-3 µm, knob-like or irregular in outline, obtuse, thin-walled; diverticulate elements often widely spaced at pileus maturity and interspersed among tramal hyphae. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2-8(-11) µm diam, cylindric or inflated, smooth or pigment-incrusted, hyaline, inamyloid, thin-walled; incrustations granular or often helical, yellow or pale brown. **Stipe tissue** monomitic; **cortical hyphae** 2.5-6.5 µm diam, parallel, cylindric, smooth, yellow or pale brownish orange, dextrinoid; walls up to 2.5 µm thick; **medullary hyphae** 2-10 µm diam, subparallel, hyaline, inamyloid; walls up to 2 µm thick. **Stipe vesture** absent. **Rhizomorphic tissue**

similar to that of the stipe, with dextrinoid cortical hyphae. **Clamp connections** absent on all tissues.

**Habit, habitat, and distribution.** Scattered or gregarious on senescent coniferous leaves (*Pinus, Picea*) or rarely on spruce cone scales, in pine, pine-hardwood or spruce-fir woodlands. June - October; uncommon. Eastern United States (AL, NC, NJ, NY, OH, TN, VA).

**Specimens Examined.** Refer to Appendix A.

**Commentary.** *Marasmius straminipes* var. *straminipes* is characterized by: a) small, pallid, rugulose-striate pileus; b) subdistant, narrow, buff-colored lamellae; c) glabrous, stramineous, insititious stipe; d) stramineous rhizomorphs; e) absence of clamp connections; and f) fruiting on coniferous leaves. Although the protologue states "pileus ... whitish," I have found that the pileus fades to whitish only in very mature basidiomata. More typically, the disc region retains some shade of greyish brown or avellaneous-grey surrounded by a buff-colored margin. The glabrous and shiny straw-colored stipe and rhizomorphs are excellent field characters. No other North American marasmii exhibit this combination of features, and consequently, *M. straminipes* is not likely to be confused with other taxa.

*Marasmius straminipes* var. *straminipes* was first recognized as a distinct taxon by M. J. Berkeley and M. A. Curtis, and provisionally named *Marasmius subcretaceus* (*nom. herb.*, Curtis Herbarium, FH!). Material seen by Berkeley and Curtis was collected by J. M. Peters in Alabama in 1864. The species was not validly published until July 1873, when Peck (1873) described it as *Marasmius straminipes* from

material collected by him in Center, Albany Co., New York. The protologue was published again unaltered (Peck, 1874) with the addition of the following observation: "The pale yellow stem becomes pallid in the dry state and is sometimes tinted with brown at the base." In Peck's notebook for 1871-1873 (archived at NYS), entry number 110, from which he derived the protologue, adds the following note: "Very distinct by its dull yellowish stem. At first sight it might be taken for small *M. rotula*." Peck (1873) indicated the substrate as "fallen leaves of the pitch pine, *Pinus rigida*," and all subsequent reports of this species cite the same substrate (Morgan, 1905; Peck, 1874; Pennington, 1915a, 1915b). In addition, J. B. Ellis distributed material collected on pine leaves from Newfield, New Jersey in his North American Fungi Exsiccati (as no. 701, issued 1882). My herbarium research and extensive field studies in the southern Appalachian Mountains indicate that although the most common substrate for variety *straminipes* is pine leaves, basidiomata may also develop on spruce leaves (*Picea rubens* Sarg.). When fruiting on spruce, however, the basidiomata are typically only about half the size of those found on pine.

Since Pennington (1915a), only two brief mentions of *M. straminipes* have been recorded. Gilliam (1976) noted a few details of the macro- and micromorphology of the holotype specimen and suggested that *M. straminipes* belonged in the genus *Marasmiellus* because of its pileipellis of "narrow hyaline diverticulate hyphae." Subsequently, Redhead (1984) was the first to indicate that *M. straminipes* lacked clamp connections and belonged in sect. *Androsacei* of *Marasmius* because

of the "presence of rhizomorphs and a glabrous insititious wiry stipe." I concur with Redhead's diagnosis. An additional character more indicative of *Marasmius* than *Marasmiellus* is the glabrous, wiry stipe with dextrinoid cortical hyphae. Because of the paucity of published data on *M. straminipes*, we recently redescribed the species (Desjardin and Petersen, 1989a).

During field studies in the southern Appalachian Mountains, I encountered several anomalous specimens fruiting on oak leaves rather than a coniferous substrate. Careful scrutiny of this material revealed abundant clamp connections localized on the hymenial elements and stipe tramal hyphae (rare elsewhere). [When grown in culture, clamp connections were also present, but inconstant; *e.g.*, clamps were present but not at every septum in aerial hyphae and rhizomorphic tissue, whereas clamps were absent in submerged hyphae.] All other macro- and micromorphological features of basidiomata were indistinguishable from those of the type variety of *M. straminipes* on coniferous leaves. To emphasize the significance of clamp formation and substrate-type in the species, we described the clamped, oak leaf-degrading taxon as a distinct variety of *M. straminipes*.

3. ***MARASMIUS STRAMINIPES*** var. ***FIBULATUS*** Desjardin & Petersen, Mem. New York Bot. Gard. 49: 184. 1989.

**HOLOTYPE:** United States, North Carolina, Transylvania Co., Pisgah National Forest, Black Mt. trail N of Brevard, 24 July 1986, D. E. Desjardin no. 3948 (TENN 47644!).

**Basidiomata** marcescent, reviving. **Pileus** 2-5 mm diam, convex; disc even or shallowly depressed; margin rugulose-striate in age; surface dull, dry, opaque, granulose or suede-like; context thin, buff; disc color brown (7E3) or pale brown (7D4) when young, soon fading to brownish grey (6-7E3) or nearly pinkish grey in age, margin brownish grey (6E3) when young, fading in age to pinkish buff, buff or nearly white, most commonly buff with an avellaneous-grey disc. **Lamellae** adnate, subdistant, moderately broad (to 1.5 mm), white, buff or pale greyish orange (<5B3); margin white-crystalline, not forked nor intervenose; **lamellulae** in 1-2 series. **Stipe** 11-22 X <0.5 mm, terete, equal, bristle-like, shiny, glabrous, insititious, hollow; apex at first translucent, yellowish white (4A2) or pinkish buff, deep yellow (4A5-6) below, in age greyish orange (5B4), golden-melleous or brownish yellow (5C5-7) overall. **Rhizomorphs** common, thin, wiry, stramineous. **Odor and taste** not distinctive.

**Basidiospores** (Fig. 3 A) 6.4-9.5 X 3.2-4.7 µm [$\bar{\bar{x}}$ 8.2 ± 0.5 X 3.9 ± 0.2 µm, E = 1.8-2.3, $\bar{Q}$ = 2.1 ± 0.1; n = 30 spores per 4 specimens], amygdaliform, hyaline, inamyloid, smooth. **Basidia** (Fig. 3 B) 18-28 X 7-9 µm, clavate, 4-spored, rarely 2-spored. **Basidioles** (Fig. 3 B) broadly clavate or fusoid-ventricose. **Pleurocystidia** absent. **Cheilocystidia** (Fig. 3 C) numerous, (8.5-)10-16(-24) X 4.5-6.5(-9) µm, irregularly cylindric or clavate, diverticulate, hyaline, inamyloid; diverticula 2-6 X 1-2 µm, irregularly cylindric-contorted, obtuse, sometimes branched, thin-walled. **Pileipellis** not hymeniform, in immature pilei composed of a well-developed *Rameales*-structure plus broom cell-type terminal cells (Fig. 3 D); hyphae 4-12 µm diam, highly

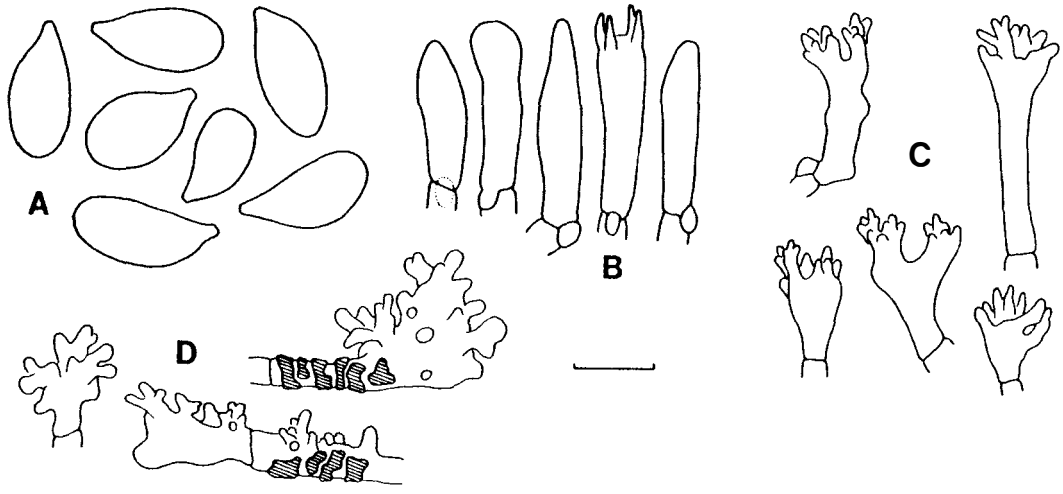



**Figure 3 A-D.** Features of *Marasmius straminipes* var. *fibulatus* (Desjardin no. 3948, holotype). A. Basidiospores. B. Basidium and basidioles. C. Cheilocystidia. D. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-D.

irregular in outline, densely diverticulate, smooth or weakly pigment-incrusted, hyaline, inamyloid; diverticula 2-9 X 1.5-4 µm, knob-like or irregular in outline, obtuse, sometimes branched, hyaline, thin-walled; terminal cells similar to the cheilocystidia; pileipellis of mature pilei with scattered diverticulate elements interspersed among tramal hyphae. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-11 µm diam cylindric or rarely inflated up to 22 µm diam in the lamellar trama, smooth or pigment-incrusted, non-gelatinous, hyaline, inamyloid; clamps absent or rare; incrustations granular, pale brownish. **Stipe tissue** monomitic; **cortical hyphae** 2-5 µm diam, parallel, cylindric, smooth, ochraceous, dextrinoid, unclamped; walls up to 2.5 µm thick; **medullary hyphae** 2-8 µm diam, subparallel,

hyaline, inamyloid; walls up to 1.5 µm thick; clamps common. **Stipe vesture** generally absent, except for rare, scattered, irregularly cylindric, ochraceous, thick-walled caulocystidia located only near the stipe base. **Rhizomorphic tissue** similar to the stipe tissue. **Clamp connections** common on basidia, basidioles and stipe medullary hyphae, absent or exceedingly rare elsewhere.

**Habit, habitat, and distribution.** Solitary or scattered on senescent leaves of *Quercus* sp. in mixed deciduous woodlands. July - September. Uncommon. North Carolina, South Carolina, Tennessee.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** *Marasmius straminipes* var. *fibulatus* is macromorphologically indistinguishable from var. *straminipes*, but differs in the presence of clamp connections and fruiting on oak leaves. Basidiomata of variety *straminipes* lack clamp connections and form on coniferous leaves. In areas where conifers and oaks are sympatric, all appropriate basidiomata located on coniferous leaves lacked clamp connections (= var. *straminipes*), while all those located on oak leaves were clamped (= var. *fibulatus*).

*Marasmius straminipes* var. *fibulatus* is similar to *M. quercophilus* Pouzar (PRM!), another clamped, oak leaf-degrading member of sect. *Androsacei*, but the latter differs in having a reddish brown, pruinose stipe, reddish brown rhizomorphs, and more densely diverticulate pileipellis elements. *Marasmius quercophilus*, known from Europe (Pouzar, 1982) and western North America (Desjardin, 1987a, 1987b), is thus far unknown from eastern North America.

4. ***MARASMIUS PALLIDOCEPHALUS*** Gilliam, Mycologia 67: 818. 1975.

**HOLOTYPE:** United States, Michigan, Chippewa Co., Tahquamenon Falls State Park, Lower Falls, 22 July 1971, M. S. Gilliam no. 1165 (MICH!).

**Basidiomata** marcescent, reviving. **Pileus** 2.5-6(-10) mm diam, convex when young, becoming plano-convex or rarely plane in age, sometimes with a shallow central depression, seldom papillate; disc even; margin decurved and even when young, in age becoming striate or rugulose-striate, rarely uplifted; surface dull, dry, opaque, glabrous or minutely suede-like; when young colored brown (7E4-6), light brown (6-7D4-6) or light greyish brown (7D3) overall, or with a slightly paler margin, in age the disc remains light brown or greyish brown, or fades slightly to pale brownish grey (6C3), and the margin fades to greyish orange (5-6B2-4), pale yellowish white (4A2), pale orange white (5A3) or buff, typically older pilei with greyish brown disc and pallid margin. Context thin, pale greyish orange or buff. **Lamellae** adnate, subdistant (8-15 complete lamellae), narrow (up to 1 mm), not forked nor intervenose; white or buff-colored at first, becoming pale orange white (5A2) or pale greyish orange (<5B2-3) in age, edges concolorous; **lamellulae** in 1-2 series. **Stipe** 15-40 X 0.5-0.8 mm, central, terete, equal, glabrous, shiny, bristle-like, solid when young, becoming hollow in age, insititious; apex at first pale brownish grey (6C3) or greyish brown (6-7D-E3), becoming brown (7D5-6) in age; base brown or dark brown (7F4-8) throughout maturation. **Rhizomorphs** scattered, narrower than the stipes, frequently-branched, dark brown or black. **Odor and taste** not distinctive.

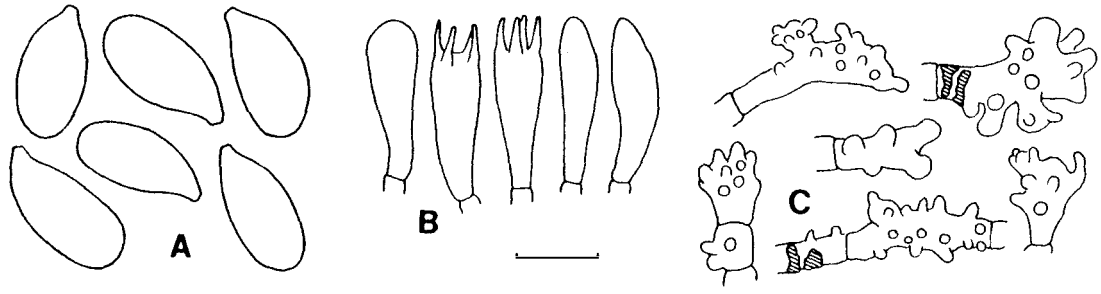



**Figure 4 A-C.** Features of *Marasmius pallidocephalus* (Desjardin no. 3581). A. Basidiospores. B. Basidia and basidioles. C. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-C.

**Basidiospores** (Fig. 4 A) 6.4-9(-9.6) X 3.2-4.4 µm [$\bar{\bar{x}}$ = 7.6 ± 0.3 X 3.7 ± 0.1 µm, E = 1.6-2.5, $\bar{Q}$ = 2.1 ± 0.1; TL90(90%): $\bar{x}$ = 7.1-8.1 X 3.6-3.8 µm, Q = 2-2.2; n = 13-25 spores per 10 specimens], ellipsoid or subamygdaliform, inequilateral in profile, hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 4 B) 18.5-24 X 5-7 µm, clavate, 4-spored, very rarely 2-spored. **Basidioles** (Fig. 4 B) clavate, fusoid or ventricose. **Pleurocystidia** absent. **Cheilocystidia** absent; lamellar edge fertile. **Pileipellis** not hymeniform, composed of a well-developed *Rameales*-structure with contorted, lobed or broom cell-like terminal cells (Fig. 4 C); hyphae 3-6(-8) µm diam, interwoven (not radially arranged), frequently-branched, irregular in outline, densely diverticulate, non-gelatinous, smooth or incrusted with granular or plaque-like, pale brown pigment deposits (cells on pileus disc commonly incrusted, whereas cells from pileus margin typically non-incrusted); walls hyaline, subhyaline or pale brown (disc region), inamyloid, up to 1 µm thick; diverticula 1.5-4(-6) X 1-

3.5 µm, knob-like, rod-like or irregular in outline, obtuse, rarely lobed, thin-walled; terminal cells 8-35 X 5-16 µm, repent, suberect or erect, cylindric, clavate, vesiculose or highly irregular in outline, lobed and diverticulate. **Hypodermium** of heavily incrusted, non-diverticulate hyphae 3-8 µm diam, irregular in outline, frequently-branched, non-gelatinous. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2-9.5 µm diam, cylindric or inflated, smooth or weakly incrusted, non-gelatinous, hyaline, inamyloid, thin-walled or firm-walled. **Stipe tissue** monomitic; **cortical hyphae** 2.5-5 µm diam, parallel, cylindric, outermost hyphae incrusted with granular, pale brown pigment deposits; walls subhyaline (at stipe apex), dark ochraceous or brown (stipe base), strongly dextrinoid, up to 1.5 µm thick; **medullary hyphae** 2-9.5 µm diam, parallel, smooth, hyaline or pale yellow, inamyloid or weakly dextrinoid, with walls up to 1 µm thick. **Stipe vesture** absent. **Rhizomorphic tissue** similar to the stipe tissue. **Clamp connections** absent in all tissues.

**Habit, habitat, and distribution.** Gregarious or densely gregarious, sometimes in troops on leaves (needles) of *Picea rubens* Sarg. and *Abies fraseri* (Pursh) Poiret. April - September. Locally abundant. Northeastern North America, spruce-fir zone of southeastern United States, and the Pacific Northwest.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** Diagnostic features of *M. pallidocephalus* include: a) small, striate pilei with greyish brown disc and pale greyish orange or buff-colored margin; b) non-collariate, subdistant, narrow lamellae; c) glabrous, wiry, dark brown, insititious stipe accompanied

by dark brown rhizomorphs; and d) habit on spruce or fir needles. In addition, absence of clamp connections and hymenial cystidia, plus pigment-incrusted stipe cortical hyphae are distinctive.

*Marasmius pallidocephalus* has been commonly misdetermined as *M. androsaceus* (L.: Fr.) Fr. Micromorphologically, basidiomata of *M. androsaceus* differ in forming clamp connections in all tissues, numerous diverticulate cheilocystidia, and generally non-incrusted stipe cortical hyphae. In addition, pilei of *M. androsaceus* are typically darkly pigmented overall, and only rarely show a pallid margin surrounding a dark disc. In the southern Appalachian Mountains, substrate preference may be a useful field character to separate *M. androsaceus*, fruiting on leaves of *Pinus, Quercus*, or various other hardwoods, from *M. pallidocephalus*, restricted to spruce or fir needles. *Marasmius pallidocephalus* is also similar to another clampless, coniferophilous taxon, *viz., Marasmius straminipes* var. *straminipes*. The latter taxon differs, however, in forming basidiomata with stramineous or golden melleous stipes and rhizomorphs, and in forming cheilocystidia and non-incrusted stipe cortical hyphae.

*Marasmius pallidocephalus* is one of the more commonly collected early-fruiting litter-decomposing agarics in the spruce-fir zone of the southern Appalachians. Basidiomata have been collected as early as late April, oftentimes forming dense troops soon after spring rains. In northeastern North America, *M. pallidocephalus* fruits from July to September on needles of spruce or hemlock (Gilliam, 1976), while in California, the species fruits from September to December on needles of spruce, fir, hemlock or Douglas fir (Desjardin, 1987b).

5. ***MARASMIUS ANDROSACEUS*** (L.: Fr.) Fries, Epicr. Syst. Mycol. 385. 1838.

≡ *Agaricus androsaceus* L.: Fries, Syst. Mycol. 1: 137. 1821. [*Agaricus androsaceus* Linnaeus, Sp. Pl. 1175. 1753]

≡ *Chamaeceras androsaceus* (L.: Fr.) O. Kuntze, Revis. Gen. Pl. Pars 3(2): 454. 1898.

≡ *Setulipes androsaceus* (L.: Fr.) Antonin, Ceská Mykol. 41(2): 86. 1987.

= *Marasmius melanopus* Morgan, J. Cincinnati Soc. Nat. Hist. 18: 36. 1895.

**TYPE SPECIMEN:** Not located.

**Basidiomata** marcescent, reviving. **Pileus** 3-10(-12) mm diam, convex or plano-convex, sometimes centrally depressed and rarely papillate at maturity; disc smooth or weakly rugulose; margin even or weakly striate when young, becoming rugulose-striate in age; surface dull, dry, opaque, glabrous or minutely suede-like; disc colored dark brown (7F4-8) or dark reddish brown (8F4-8) when young, remaining so in age or fading to brown (7E4-6), light brown (7D4) or reddish brown (8E4-6); margin colored brown (7-8E4-5) when young, fading slightly in age to greyish brown (7D3), brownish grey (6C-D3) or greyish orange (5-6B3), rarely fading to buff or greyish buff; context thin, buff or pale greyish brown. **Lamellae** adnate or rarely slightly adnexed, subdistant, narrow (up to 1 mm), not forked nor intervenose; cream-buff (4A2), orange white (5A2) or pale greyish orange (5-6B2-3) when young, becoming pale brownish grey (6C2-3) or greyish brown (6-7D3) in age, edges concolorous with the sides or sometimes white-crystalline;

**lamellulae** in 1-2 series. **Stipe** 15-50 X 0.5-1 mm, central, terete or seldom compressed, equal, shiny, glabrous, bristle-like, solid when young, becoming hollow in age, insititious; apex at first concolorous with the lamellae or brown (7E7-8) to reddish brown (8E7-8), darkening in age to dark brown; base dark brown, dark reddish brown (8-9F6-8) or black throughout development. **Rhizomorphs** scarce or abundant, wiry, narrower than the stipe, branched, glabrous, black. **Odor and taste** not distinctive.

**Basidiospores** (Fig. 5 A) 6.4-8.8(-9.2) X 3-4(-4.4) µm [$\bar{\bar{x}}$ = 7.4 ± 0.2 X 3.6 ± 0.1 µm, E = 1.8-2.5, $\bar{Q}$ = 2.1 ± 0.1; TL90(90%): $\bar{x}$ = 7.1-7.7 X 3.5-3.7 µm, Q = 2-2.2; n = 12-25 spores per 10 specimens], ellipsoid or amygdaliform, inequilateral in profile, hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 5 B) 17.5-24 X 5-8 µm, 4-spored, clavate. **Basidioles** (Fig. 5 B) clavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** (Fig. 5 C) abundant on some basidiomata and then lamellar edge sterile, scarce on other basidiomata and lamellar edge composed of cystidia, basidioles and few basidia; main body 12-24 X 5-12(-16) µm, cylindric, clavate, turbinate or irregular in outline, often lobed, diverticulate, hyaline, inamyloid, thin-walled; diverticula 1.5-5 X 0.5-2.5 µm, typically apical, seldom divergent, cylindric or more often irregular in outline, often lobed, obtuse, thin-walled, hyaline. **Pileipellis** not hymeniform or seldom subhymeniform, composed of a well-developed *Rameales*-type structure with erect broom cell-like or coralloid terminal cells (Fig. 5 D); hyphae 3.5-8 µm diam, interwoven, irregular in outline, frequently-branched, densely or sparcely diverticulate, smooth or more often

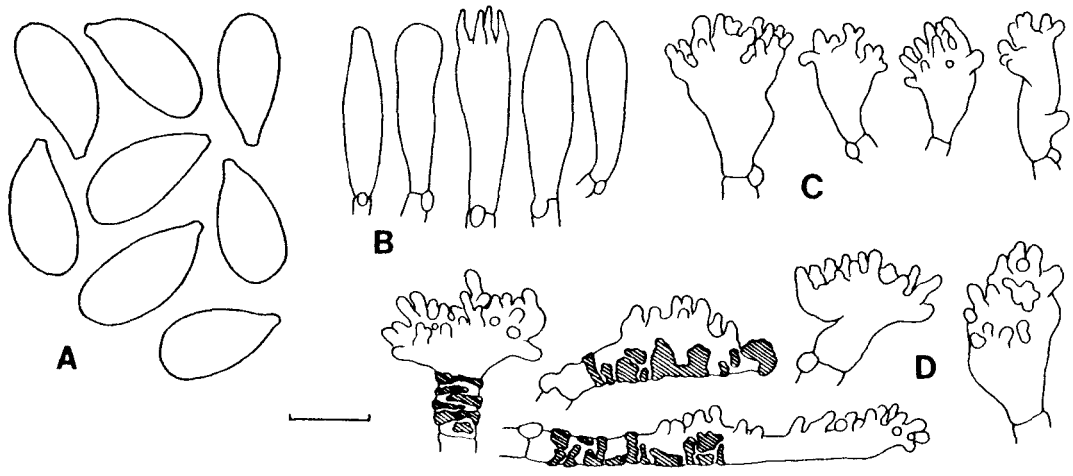



**Figure 5 A-D.** Features of *Marasmius androsaceus* (Desjardin no. 4328). A. Basidiospores. B. Basidium and basidioles. C. Cheilocystidia. D. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-D.

incrusted with granular or amorphous brown-pigment deposits, non-gelatinous, thin-walled or with walls up to 1 µm thick, hyaline or pale brown; diverticula 1.5-5(-7) X 1-3.5 µm, divergent along length of hyphae or clustered terminally, irregular in outline, often lobed, obtuse, thin-walled, smooth or incrusted, hyaline or pale brown. **Hypodermium** composed of interwoven, frequently-branched, typically non-diverticulate hyphae; hyphae 2.5-10 µm diam, cylindric or irregular in outline, usually heavily incrusted with brown pigment deposits, non-gelatinous, inamyloid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-10 µm diam, cylindric or inflated, smooth, non-gelatinous, hyaline, inamyloid, thin-walled or firm-walled. **Stipe tissue** monomitic; **cortical hyphae** 3-6.5 µm diam, parallel, cylindric, smooth or weakly incrusted, brown or dark brown, strongly dextrinoid,

with walls up to 2 µm thick; **medullary hyphae** 2.5-8 µm diam, parallel, smooth, hyaline, inamyloid or weakly dextrinoid, thin-walled. **Stipe vesture** absent. **Rhizomorphic tissue** similar to that of the stipe. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Scattered or gregarious, sometimes in troops, most commonly forming on leaves of *Quercus*, seldom on leaves of *Fagus, Rhododendron* or other hardwoods, rarely on *Pinus, Tsuga,* or *Picea*, rarely on sticks of these plants, or on fern rachises. May - September in the southern Appalachian Mts. Common throughout North America, Europe and north-temperate regions of Asia.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** Basidiomata of *Marasmius androsaceus* are characterized by: a) reddish brown, brown or dark brown, rugulose-striate pilei; b) greyish orange to greyish brown, non-collariate lamellae; c) black, glabrous, insititious stipes accompanied by wiry, black rhizomorphs; d) indistinctive odor and taste; and e) habitat on oak leaves. Diagnostic micromorphological features include: f) non-hymeniform or subhymeniform pileipellis of diverticulate hyphae and broom cell-like terminal cells; g) abundant clamp connections; h) broom cell-like cheilocystidia; and i) monomitic stipe tissue with dextrinoid, typically non-incrusted stipe cortical hyphae.

In North America, *M. androsaceus* might be confused with *M. pallidocephalus* Gilliam, *M. thiersii* Desjardin, and *M. quercophilus* Pouzar. For a comparison of *M. androsaceus* with *M. pallidocephalus* refer to the commentary on the latter species. *Marasmius thiersii* differs in forming basidiomata with minutely velutinous and slightly

broader (1-3 mm) stipes, alliaceous odor and taste, habit on pine needles, and absence of cheilocystidia (Desjardin, 1987a). *Marasmius quercophilus* differs in forming pilei colored light brown on the disc and greyish orange or pinkish buff on the margin, white lamellae, pruinose stipes and slightly longer spores (Desjardin, 1987a).

*Marasmius androsaceus* is one of the few temperate species with insititious stipes that is not highly substrate-specific. The species is commonly collected on needles of various conifers (*Pinus, Picea, Juniperus, Sequoia*) in western and northeastern North America (Gilliam, 1976; Desjardin, 1987b), and Europe (Linnaeus, 1753; Fries, 1821; Saccardo, 1887; Lange, 1936; Ryman & Holmåsen, 1984). In addition, the species has been reported from leaves of *Betula, Fagus, Olea, Quercus, Rubus and Scirpus* (Fries, 1821; Saccardo, 1887; Dennis, 1948), as well as various ferns and mosses (Hooker, 1821; Massee, 1893; Desjardin, 1987b). Macdonald (1949) reported *M. androsaceus* as parasitic on heather (*Calluna, Erica*), being the primary cause of dying-out of heather in Scotland. In the southern Appalachian Mts., oak leaves are the most common substrate for this fungus, although basidiomata have been collected occasionally on pine, hemlock or spruce needles, various deciduous leaves and fern rachises. Apparently, physiological requirements for basidiomata formation are not as restricted in *M. androsaceus* as they are in other taxa with insititious stipes. Indeed, culture studies on this species indicate that at least three distinct culture mat morphologies were formed by different isolates collected in the southern Appalachians (refer to Chapter VI for details). This variability in cultural morphology, unusual in

*Marasmius*, warrants further investigation. Mating studies on selected populations of *M. androsaceus*, as well as electrophoretic investigations and analysis of restriction-fragment length polymorphisms, may yield valuable data to aid in elucidating genetic divergence in this species.

***MARASMIUS*** sect. ***MARASMIUS***

≡ sect. *Collariati* Bataille, Fl. Monogr. Marasmes d'Europe 26. 1919.

≡ sect. *Rotulae* Kühner, Botaniste 25: 98. 1933.

= tribus *Mycena* subtribus *Rotulae* Fries, Epicr. Syst. Mycol. 384. 1838.

= [subgen.] *Insititii* [sect.] *Setipedes* [subsect.] *Stipiticolae* Quélet, Fl. Mycol. France 312. 1888.

= [subgen.] *Mycena* [sect.] *Insititii* Morgan, J. Mycol. 11: 244. 1905.

= sect. *Pararotulae* Singer, Sydowia 18: 339. 1965. [T: *Marasmius pararotula* Singer]

TYPE SPECIES: As for the genus.

Pileus convex, sulcate, usually umbilicate, often papillate. Lamellae with an indistinct or well-developed collarium. Stipe central, insititious, glabrous, darkly pigmented. Rhizomorphs present or absent. Pleurocystidia absent. Cheilocystidia present and similar to the pileipellis elements. Pileipellis hymeniform, composed of *Rotalis*-type or *Siccus*-type elements. Tramal hyphae inamyloid or weakly dextrinoid. Stipe tissue monomitic; cortical hyphae dextrinoid. Clamp connections present.

***MARASMIUS*** sect. ***MARASMIUS*** subsect. ***PENICILLATI*** Singer, Fl. Neotrop. 17: 121. 1976.

TYPE SPECIES: *Marasmius graminum* (Lib.) Berkeley & Broome

Pileipellis composed of *Siccus*-type elements. Lamellae with an indistinct or well-developed collarium.

**6. *MARASMIUS GRAMINUM*** (Lib.) Berkeley & Broome *in* Berkeley, Outl. Brit. Fungol. 222. 1860.

≡ *Agaricus graminum* Libert, Pl. Crypt. Arduennae II. no. 119. 1832.

= *Marasmius curreyi* Berkeley & Broome, Ann. Mag. Nat. Hist. 3: 209. 1879.

= *Marasmius tritici* Young, Phytopathology 15: 118. 1925.

= *Marasmius culmisedus* Singer *in* Singer & Digilio, Lilloa 25: 193. 1952.

**LECTOTYPE:** Belgium, Pl. Crypt. Arduennae, Fasc. II, no. 119, Libert (FH!).

**Basidiomata** marcescent, reviving. **Pileus** 1.5-9 mm diam, convex at first, soon expanding to plano-convex with a central umbilicus, with or without a central papilla; margin striate when young, becoming sulcate or plicate in age, often scalloped, sometimes uplifted; surface dull, dry, opaque, minutely granulose or subvelutinous; disc with or without a dark central dot colored reddish brown (8-9E-F7-8); pileus colored reddish brown (8D-E6-8) or brownish orange (6-7C6-7) overall when young; area surrounding central dot fading slightly in age; margin remaining brownish orange in age or becoming light brown (6D6-8), greyish orange (5-6B-C3-5), or fading to orange white (5A2-3), often margin streaked with paler sulcae; context thin, buff-colored. **Lamellae** adnate to a thin, free collarium, or sometimes merely anastomosing at stipe juncture, distant (10-15 complete lamellae), moderately broad (up to 1.5 mm), not forked, rarely weakly intervenose in age; white when young, becoming yellowish white (4A2) or pale cream (4A3) in age, non-marginate; **lamellulae** absent. **Stipe** (5-)10-30 X

0.1-0.5 mm, terete, equal, shiny, glabrous, bristle-like, insititious; apex buff, cream-colored or pale greyish orange (5B3) when young, becoming brown (6E4-6) in age; base dark brown (6-7F4-6) throughout maturation; substrate often becoming black around stipe insertion. **Rhizomorphs** absent or poorly developed, short, wiry, dark brown; sterile stipes absent or rare. **Odor and taste** not distinctive.

**Basidiospores** (Fig. 6 A) 7.2-10.6(-11.2) X 4-5.6 µm [$\bar{\bar{x}}$ = 8.8 ± 0.5 X 4.6 ± 0.2 µm, E = 1.5-2.4, $\bar{Q}$ = 1.9 ± 0.1; TL90(90%): $\bar{x}$ = 8-9.6 X 4.2-5 µm, Q = 1.7-2.1; n = 10-25 spores per 12 specimens], ellipsoid or amygdaliform, inequilateral in profile, hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 6 B) 14.5-24(-28) X 5.5-8.5 µm, 4-spored, clavate. **Basidioles** (Fig. 6 B) clavate or broadly ventricose. **Pleurocystidia** absent. **Cheilocystidia** (Fig. 6 C) abundant, similar to the *Siccus*-type pileipellis elements; main body 10-16 X 6-10 µm, cylindric, clavate or irregular in outline, hyaline, thin-walled; apical setulae 1-4 X 0.5-1.5 µm, rod-like or more commonly irregular in outline, often lobed, obtuse, hyaline, ranging from thin-walled to thick-walled. **Pileipellis** hymeniform, not mottled or weakly mottled, of *Siccus*-type broom cells (Fig. 6 D); main body 8-18 X 5-12.5 µm, cylindric, clavate or subvesiculose, basal portion of cells typically hyaline and thin-walled, apical portion firm-walled or thick-walled and ranging from hyaline to yellowish orange, golden or tawny, inamyloid; apical setulae 1.5-4(-6) X 0.5-1.5(-2.5) µm, numerous and crowded on most cells, infrequent on some cells, knob-like, rod-like or irregular in outline, often lobed, obtuse, thick-walled or solid, colored subhyaline, yellowish orange, golden or tawny; some elements thicker-

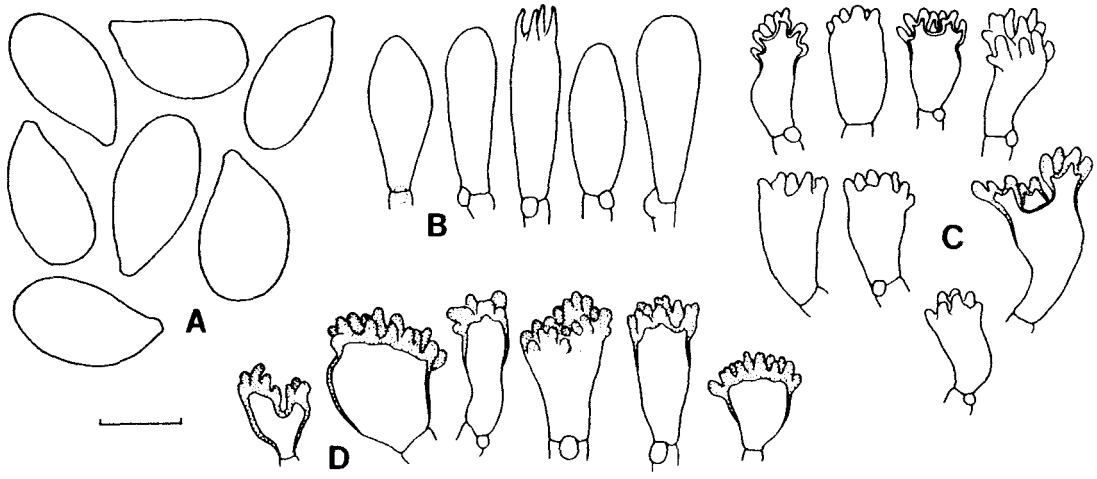



**Figure 6 A-D.** Features of *Marasmius graminum* (Desjardin no. 4386). A. Basidiospores. B. Basidium and basidioles. C. Cheilocystidia. D. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-D.

walled, more deeply pigmented and with fewer setulae. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-8(-12) µm diam, frequently-branched, cylindric, non-gelatinous, smooth, hyaline, inamyloid or weakly dextrinoid, thin-walled or with walls up to 0.8 µm thick. **Stipe tissue** monomitic; **cortical hyphae** 2-5.5 µm diam, parallel, cylindric, smooth or with few pigment incrustations, dark ochraceous or brown, dextrinoid, with walls up to 1 µm thick; **medullary hyphae** 3-6.5 µm diam, parallel, hyaline, inamyloid, thin-walled. **Stipe vesture** absent. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Solitary, scattered or gregarious on senescent leaves of various grasses, rarely on leaves of *Carex, Carya* or fern rachises; in mixed woodlands, marshy areas or open grasslands. May - August in the southern Appalachian Mts. Common

throughout eastern North America, Europe and temperate Asia, less common in the neotropics.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** In the field, *M. graminum* is distinguished by a) small, sulcate, umbilicate pilei colored reddish brown or brownish orange and often with a dark central dot; b) collariate lamellae; c) shiny, glabrous, dark brown insititious stipe; and d) habit on grass leaves. Micromorphologically, the species is characterized by *Siccus*-type pileipellis elements, spore size and absence of a stipe vesture.

Singer (1958) proposed a number of provisional varieties of *M. graminum* based primarily on spore size, habit and reaction of the tramal tissues to Melzer's reagent. He also indicated variability in these characters within a population and noted that there was not enough information available to propose formally the taxa as distinct varieties. Based on my knowledge of *M. graminum* from eastern North America and Europe, I concur that *M. graminum* is morphologically variable. Variable features include spore size, tissue amyloidity, length of setulae on pileipellis elements, and pileus coloration.

In basidiomata collected from the southeastern United States, mean spore size ranged from 8.2 X 4.7 µm (L = 6.8-9.6 µm) [Ravenel Exs. no. 105, SC (PH)] to 9.7 X 4.8 µm (L = 8-11.2 µm) [Hesler no. 3784, TN (TENN)]. Some populations, or some basidiomata comprising a population, showed inamyloid tramal tissues, while other basidiomata showed a dextrinoid reaction. In many specimens, apical setulae on pileipellis elements were short and knob-like, whereas in other specimens, setulae were longer and rod-like. Pileus coloration varied

from deep reddish brown to pale brownish orange, or rarely orange white. Because no distinct character combinations could be established at the infraspecific level to clearly separate various populations, I cannot at present support recognition of infraspecific taxa.

In the southeastern United States, *M. graminum* might be confused with several other graminicolous species, *viz.*, *M. octifolius* Murr., and *M. pseudobambusinus* Desjardin. *Marasmius octifolius*, provisionally accepted as a distinct species, differs from *M. graminum* in forming consistently smaller pilei (2-3 mm diam), each with a prominent, conic, black central papilla. *Marasmius pseudobambusinus* differs in forming non-sulcate pilei, non-collariate lamellae, non-insititious stipe, conspicuous pleurocystidia, and much larger spores (13.6-19.2 X 3.6-5.2 μm).

Singer (1958a, 1965, 1976) considered *M. pruinatus* Berk. & Curt., a species originally collected in New England, as a synonym of *M. graminum*. My re-examination of the holotype specimen of *M. pruinatus* indicated that the latter is not conspecific with *M. graminum*. *Marasmius pruinatus* differs in forming non-collariate lamellae, non-insititious stipe and longer spores (L = 11.2-14.4 μm; $\bar{L}$ = 12.6 μm). Refer to Chapter VIII for a description and discussion of *M. pruinatus*.

I have observed occasional basidiomata formed on leaves of living grass plants. In such cases, basidiomata were located on decaying leaf blade tips, not on living leaf blade bases. Whether *M. graminum* was the cause of leaf decay or only a secondary invader is unknown. Young (1925) reported that *M. graminum* was parasitic on wheat and other small grain crops.

***MARASMIUS*** sect. ***MARASMIUS*** subsect. ***MARASMIUS***

= sect. *Pararotulae* Singer, Sydowia 18: 339. 1965

≡ subsect. *Pararotulae* (Sing.) Singer, Fl. Neotrop. 17: 92. 1976.

TYPE SPECIES: As for the genus.

Pileipellis composed of *Rotalis*-type elements. Lamellae with a well-developed collarium.

**7. *MARASMIUS CAPILLARIS*** Morgan, J. Cincinnati Soc. Nat. Hist. 6: 194. 1883.

**NEOTYPE:** United States, Ohio, Montgomery Co., Preston, Oct. 1890, Morgan (ISC!), [designated as lectotype by Gilliam (1976: 121)].

**Basidiomata** marcescent, reviving. **Pileus** 2-7 mm diam, at first truncate-convex or trapezoidal, umbilicate, expanding in age to plano-convex, remaining umbilicate, with or without a bluntly conic papilla; surface dull, dry, opaque, granulose; disc non-striate, buff colored, or with a dark brown or black central dot surrounded by a zone colored buff or pale cream (4A2-3); margin decurved and striate at first, becoming sulcate or plicate, sometimes scalloped in age, colored yellowish brown (5D4-5) or greyish brown (6C-D3-4), sometimes slightly paler when wet, but darkening when dried; context very thin, buff or beige. **Lamellae** adnate to a well-developed, free collarium, distant (13-18 complete lamellae), broad (up to 2 mm), not forked nor intervenose; white or buff-colored when young, buff or pale yellowish white (4A2) in age, non-marginate; **lamellulae** absent. **Stipe** 15-45 X <0.3 mm, terete, equal, shiny, glabrous, bristle-like, hollow in age, insititious; apex concolorous with the lamellae at first, becoming

dark brown (6-8F4-5) in age; base dark brown or black throughout maturation. **Rhizomorphs** rare or abundant, wiry (0.1-0.2 mm diam), black. **Odor and taste** not distinctive.

**Basidiospores** (Fig. 7 A) 7.2-11.2 X 3.4-5 µm [$\bar{\bar{x}}$ = 8.5 ± 0.7 X 4.1 ± 0.2 µm, E = 1.7-2.7, $\bar{Q}$ = 2.1 ± 0.2; TL90(90%): $\bar{x}$ = 7.2-9.7 X 3.8-4.4 µm, Q = 1.8-2.4; n = 20-30 spores per 10 specimens], ellipsoid or amygdaliform, inequilateral in profile, hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 7 B) (16-)20-28 X 5-8.5 µm, 4-spored, clavate. **Basidioles** (Fig. 7 B) cylindric, clavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** (Fig. 7 C) numerous, similar to the *Rotalis*-type pileipellis elements; main body 8-24 X 5-19.5 µm, cylindric, clavate, turbinate or subvesiculose, typically thin-walled or rarely firm-walled, hyaline, inamyloid; divergent setulae 0.5-2 X 0.5-1.5 µm, rod-like, obtuse, thick-walled or solid, hyaline. **Pileipellis** hymeniform, not mottled, of *Rotalis*-type broom cells (Fig. 7 D); main body 9.5-24 X 6-24, cylindric, clavate, turbinate, subvesiculose or sphaeropedunculate, ranging from thin-walled and hyaline, to thick-walled and ochraceous or pale brown, inamyloid; divergent setulae 1-2.5 X 0.5-1.5 µm, knob-like or rod-like, obtuse, thick-walled or solid, subhyaline, ochraceous or pale brown. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2-10 µm diam, cylindric or rarely inflated, smooth, non-gelatinous, hyaline, inamyloid, thin-walled. **Stipe tissue** monomitic; **cortical hyphae** 3.5-8 µm diam, parallel, cylindric, smooth, ochraceous (stipe apex) or brown (stipe base), strongly dextrinoid, with walls up to 2 µm diam; **medullary hyphae** 2-8 µm diam, parallel, hyaline, inamyloid or weakly

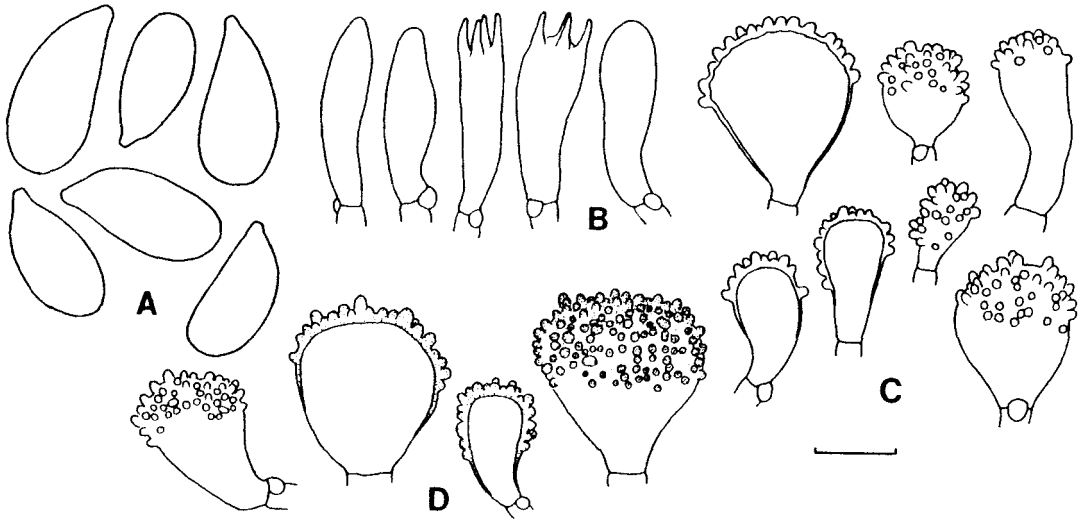



**Figure 7 A-D.** Features of *Marasmius capillaris* (Desjardin no. 4345). A. Basidiospores. B. Basidia and basidioles. C. Cheilocystidia. D. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-D.

dextrinoid, with walls up to 1 µm thick. **Stipe vesture** absent. **Rhizomorphic tissue** similar to that of the stipe. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Gregarious or densely gregarious on leaves of *Quercus*, rarely on leaves or sticks of other deciduous hardwoods; in mixed hardwood forests (*Quercus, Acer, Carya, Liquidambar*, etc.). May - September in the southern Appalachian Mts. Common in oak woods throughout eastern North America.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** *Marasmius capillaris* has been misdiagnosed commonly as *M. rotula* (Scop.: Fr.) Fr. Diagnostic features of *M. capillaris* include: a) small, convex, umbilicate, sulcate pilei with a pallid central zone and greyish brown margin; b) broad, pallid, non-

marginate, collariate lamellae; c) black, glabrous, insititious stipe and black rhizomorphs; and d) habit on oak leaves. In comparison, basidiomata of *M. rotula* are characterized by pilei colored entirely white or buff (*i.e.*, lacking greyish brown margin) and habit on bark or wood of various hardwoods. In addition, stipes of basidiomata of *M. rotula* are generally thicker than those formed by *M. capillaris* (*viz.*, 0.5-1 mm *vs.* <0.3 mm). Gilliam (1976) reported a number of specimens of *M. capillaris* that fruited on needles of conifers. After re-examination of these specimens, I consider the coniferophilous basidiomata to represent *M. wettsteinii* Sacc. & Sydow. Refer to Chapter VIII for a description and discussion of the latter species.

Gilliam (1976) aptly described the morphological variation exhibited by specimens of *M. capillaris* and *M. rotula* from northeastern North America, and noted that occasionally basidiomata were encountered with morphology intermediate between the two species. She suggested that perhaps culture studies could supply additional diagnostic data, useful in separating problematic specimens. The same patterns of variation described by Gilliam (1976) occur in basidiomata collected from the southern Appalachians. Studies on axenic tissue cultures of both species indicated that culture morphology is useful in separating taxa. PDA-grown isolates of *M. capillaris* formed crustose, often zonate culture mats colored "clay" or "cinnamon," (*i.e.*, with orange tints), whereas PDA-grown isolates of *M. rotula* formed azonate crustose mats colored "avellaneous," "fawn color" or "wood brown" (*i.e.*, with pink to drab tints, lacking orange shades). Refer to Chapter VI for descriptions of culture morphology.

Several other phenetically similar species occur in North America that may be confused with *M. capillaris, viz., M. limosus* Quél. and *M. ilicicola* Desjardin *in* Desjardin & Petersen. *Marasmius limosus* differs in forming consistently bisporic basidia and in fruiting on monocotyledonous debris in marshy environments (*fide* Quélet, 1877; Redhead, 1981). *Marasmius ilicicola* differs in forming pilei that lack a pallid central zone (*i.e.*, pilei evenly pigmented light brown), fewer lamellae, and fruiting on leaves of *Ilex opaca* (Desjardin & Petersen, 1989b). I have encountered one herbarium specimen that differs from *M. capillaris* only in pileus coloration. Jennings 13 Aug 1905 (NY!), collected at Finleyville, Pennsylvania, contains basidiomata with pilei evenly pigmented brownish orange or ferruginous. I have provisionally named the latter specimen *M. ferrugineocapillaris nom. prov.* and included it in the key to North American species of *Marasmius* (Chapter V). More material should be collected and compared with *M. capillaris* before the taxon is proposed formally as distinct.

**8. *MARASMIUS ROTULA*** (Scop.: Fr.) Fries, Epicr. Syst. Mycol. 385. 1838.

≡ *Agaricus rotula* Scop. : Fries, Syst. Mycol. 1: 136. 1821.

[*Agaricus rotula* Scopoli, Fl. Carniol. 2: 456. 1772.]

≡ *Androsaceus rotula* (Scop.: Fr.) Patouillard, Essai Tax. Hyménomyc. 141. 1900.

**TYPE SPECIMEN:** None located.

**Basidiomata** marcescent, reviving. **Pileus** 4-16 mm diam, at first convex or bluntly conic, very rarely with a small central papilla, in age becoming flattened-convex or bluntly campanulate, umbilicate;

surface dull, dry, opaque, minutely granulose; central depression even, colored buff or pale cream-buff, or seldom with a dark greyish brown (6F3-4) central spot; margin striate, sulcate or plicate to edge of central depression, becoming scalloped in age, colored pale yellowish white (4A2), cream-buff (4A3) or pale greyish orange (5-6B3-4), sometimes with paler sulcae, often fading to buff or white overall in age; context thin, buff-colored. **Lamellae** adnate or arcuate-adnate to a well-developed, free collarium, distant (16-26 complete lamellae), broad (up to 3 mm), not forked nor intervenose; white or buff at first, often cream (4A3) in age, non-marginate; **lamellulae** absent or rarely in 1 series. **Stipe** 20-80 X 0.5-1.25(-2) mm, terete or seldom compressed, equal or sometimes narrowed downward, shiny, glabrous, bristle-like, hollow, insititious; apex at first concolorous with the lamellae, darkening in age to brown or dark brown (7E-F5-8); base dark brown (7F5-8) or black throughout maturation. **Rhizomorphs** rare or abundant, wiry, often contorted, dark brown or black. **Odor** not distinctive. **Taste** not distinctive or mildly bitter.

**Basidiospores** (Fig. 8 A) 6.4-9.6(-10.4) X 3.2-4.4(-4.8) µm [$\bar{\bar{x}}$ = 8.0 ± 0.3 X 3.8 ± 0.2 µm, E = 1.7-2.6, $\bar{Q}$ = 2.1 ± 0.1; TL90(90%): $\bar{x}$ = 7.4-8.6 X 3.5-4.2 µm, Q = 1.9-2.3; n = 20-30 spores per 12 specimens], ellipsoid or amygdaliform, inequilateral in profile, hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 8 B) 20-32 X 5-8 µm, 4-spored, subclavate or clavate. **Basidioles** (Fig. 8 B) cylindric-acuminate, subclavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** (Fig. 8 C) numerous, similar to the *Rotalis*-type pileipellis elements; main body 10-28(-32) X 6-18(-20) µm, cylindric,

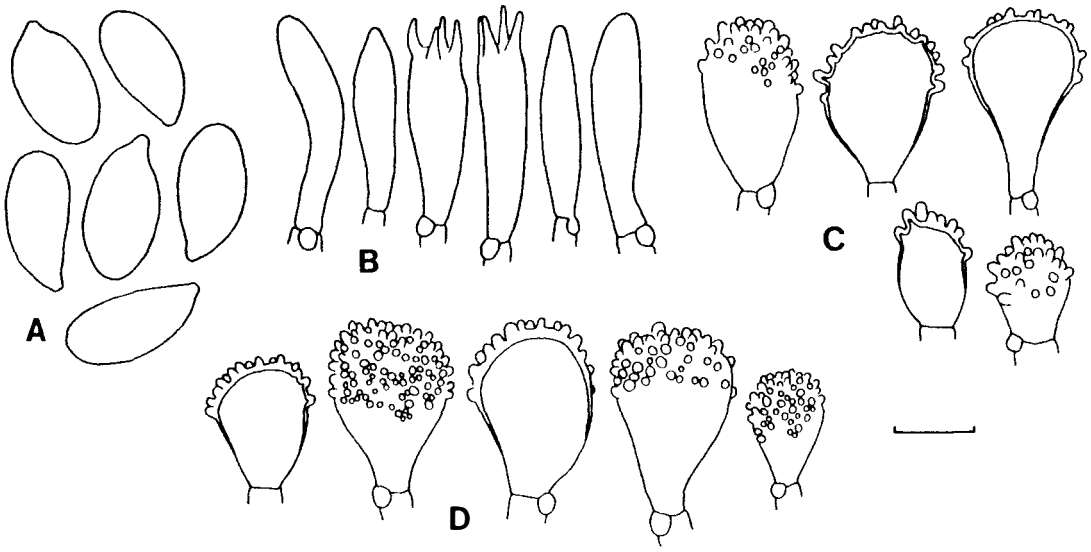



**Figure 8 A-D.** Features of *Marasmius rotula* (Desjardin no. 4241). A. Basidiospores. B. Basidia and basidioles. C. Cheilocystidia. D. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-D.

clavate or sphaeropedunculate, basally thin-walled, apically firm-walled, hyaline, inamyloid; divergent setulae 0.5-3 X 0.5-1.5 µm, knob-like or rod-like, thick-walled, hyaline. **Pileipellis** hymeniform, not mottled or weakly mottled, of *Rotalis*-type broom cells (Fig. 8 D); main body 9-30 X 6-20 µm, cylindric, clavate, broadly clavate, turbinate, subvesiculose or sphaeropedunculate; majority of elements thin-walled or firm-walled, hyaline or pale yellowish; few elements thick-walled, yellow or pale brown, these interspersed among paler elements resulting in a weakly mottled appearance with low magnification; divergent setulae 0.5-3.5 X 0.5-1.5 µm, numerous and crowded over upper 1/3 - 1/2 of cell, knob-like or rod-like, thick-walled or solid, hyaline, pale yellow or pale brown; all elements

inamyloid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-10(-14) µm diam, cylindric or inflated, frequently-branched, smooth or weakly roughened, hyaline, inamyloid, thin-walled or with walls up to 1 µm thick. **Stipe tissue** monomitic; **cortical hyphae** 2.5-6 µm diam, parallel, cylindric, smooth, ochraceous, brownish orange or brown, inamyloid or weakly dextrinoid, with walls up to 1.5 µm thick; **medullary hyphae** 2.5-9 µm diam, parallel, hyaline, inamyloid or weakly dextrinoid, with walls up to 1 µm thick. **Stipe vesture** absent. **Rhizomorphic tissue** similar to that of the stipe. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Gregarious or densely gregarious, sometimes in troops, on decayed bark or wood of various deciduous hardwoods (*Quercus, Acer, Carya, Betula, Ulmus*), rarely on stems of *Rubus*, in mixed hardwood forests. May - September in the southern Appalachian Mts. Common throughout eastern North America and Europe.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** *Marasmius rotula* is one of the more commonly encountered species of *Marasmius* in the southern Appalachians, fruiting in great abundance on decayed bark or wood of various hardwoods. Basidiomata of this species are characterized by: a) flattened-convex, sulcate, umbilicate pilei colored cream-buff or white overall in age; b) buff-colored, non-marginate, collariate lamellae; c) shiny, bristle-like, glabrous, insititious stipe up to 1.25 mm thick; and d) lignicolous habit.

Although no type specimen exists for *M. rotula* (representative material from Europe has been chosen and is described in Chapter VIII), a well-characterized species circumscription has been established and accepted for many years in European and American literature. North American material matching this circumscription is conspecific with European material. I concur with Gilliam's (1976) observations that North American specimens of *M. rotula*, as well as European material, show variation in macro- and micromorphology. Variation between populations occurs in basidiomata size, pileus coloration and spore size. In the southern Appalachians, basidiomata of *M. rotula* are generally well-characterized by the diagnostic features outlined above, in combination with spores ranging in mean length from 7.4-8.6 µm. If, however, specimens collected show smaller, bicolorous pilei, narrower stipes and foliicolous habit, they should be compared with *M. capillaris*. Refer to the commentary on that species for a comparison with *M. rotula*.

Gilliam (1975c) investigated the periodicity of spore release in *M. rotula* and reported that spore discharge did not follow the circadian rhythm found in other agarics and boletes, but showed a rain-dependent pattern. As with many other species of *Marasmius*, basidiomata of *M. rotula* can dry out *in situ* and revive when sufficient moisture in the form of rain or high humidity is available. In her study (Gilliam, 1975c), basidiomata were capable of spore discharge over a period of at least three weeks.

***MARASMIUS*** sect. ***EPIPHYLLI*** Kühner, Botaniste 25: 93. 1933 [*ut Epiphylleae*].

TYPE SPECIES [implied, Kühner (1933)]: *Agaricus epiphyllus* Persoon: Fries, Syst. Mycol. 1: 139. 1821.

Pileus small (<7 mm diam), white, buff, pink, pale yellow or orange-white, not deeply pigmented, even or weakly striate. Lamellae poorly developed and vein-like or well-developed, rarely absent, non-collariate, pallid, non-marginate. Stipe central, pruinose, insititious, brown. Rhizomorphs absent. Basidia 2- or 4-spored. Hymenial cystidia typically present, fusoid, fusoid-ventricose or ventricose-rostrate. Pileipellis hymeniform, composed of non-diverticulate, non-setulose cells; cells clavate, ventricose, lageniform, vesiculose or irregular in outline, sometimes lobed, thin-walled or thick-walled; pilocystidia present or absent. Tramal hyphae inamyloid or weakly dextrinoid; clamp connections present or absent.

**9. *MARASMIUS EPIFAGUS*** Gilliam, Mycologia 67: 821. 1975.

Fresh material not seen. Description of macromorphological features compiled from Gilliam (1975a, 1976) and from dried herbarium specimens.

**Pileus** 0.2-2 mm diam, convex or plano-convex, even or weakly rugulose-striate in age; surface dull, dry, opaque at first, translucent in age, pruinose; color pale yellow, moderate orange yellow, avellaneous or light yellowish pink when young, becoming yellowish white or white in age; context thin, white. **Lamellae** absent or poorly developed, vein-like, remote (1-7 reach the stipe), narrow,

pruinose, not intervenose, white. **Stipe** 1-9 X 0.1-0.2 mm, central or slightly eccentric, terete, equal, white-pruinose, insititious; white overall when young, hysterochroic, base becoming brown, reddish brown or dark brown in age. **Sterile stipes and rhizomorphs** absent. **Odor and taste** not recorded.

**Basidiospores** (Fig. 9 A) 8.8-9.6 X 3.8-4 µm (4 recovered), ellipsoid or amygdaliform, hyaline, inamyloid, smooth. **Basidia** (Fig. 9 B) 18-28 X 5-8 µm, 4-spored, clavate. **Basidioles** (Fig. 9 B) cylindric or clavate. **Hymenial cystidia** (Fig. 9 C) numerous on lamellar sides and edges, 28-54 X 6.5-9 µm, fusoid or fusoid-ventricose, not capitate, arising from the subhymenium and projecting up to 26 µm beyond the basidioles, non-refractive, thin-walled apically and basally, thick-walled centrally (up to 1 µm), hyaline, inamyloid. **Pileipellis** hymeniform, not mottled, composed of versiform elements (Fig. 9 D); main body 12-32 X 6.5-19 µm, ranging from clavate to ventricose, lageniform, vesiculose or sphaeropedunculate, often with 2-5 cylindric or conic, obtuse apical projections, these 4-10 X 3.5-7 µm; cell surface smooth or with apical portion incrusted or coated with resinous or subgelatinous exudate; elements inamyloid, mostly thin-walled and hyaline or pale yellow, with a few thick-walled and yellowish orange or golden elements interspersed, few with refractive walls or refractive contents. **Pilocystidia** (Fig. 9 E) rare, interspersed, similar to the hymenial cystidia; walls smooth or roughened. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 1.5-8 µm diam, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled or with walls up to 1 µm thick. **Stipe tissue** monomitic; **cortical hyphae** 1.5-7 µm

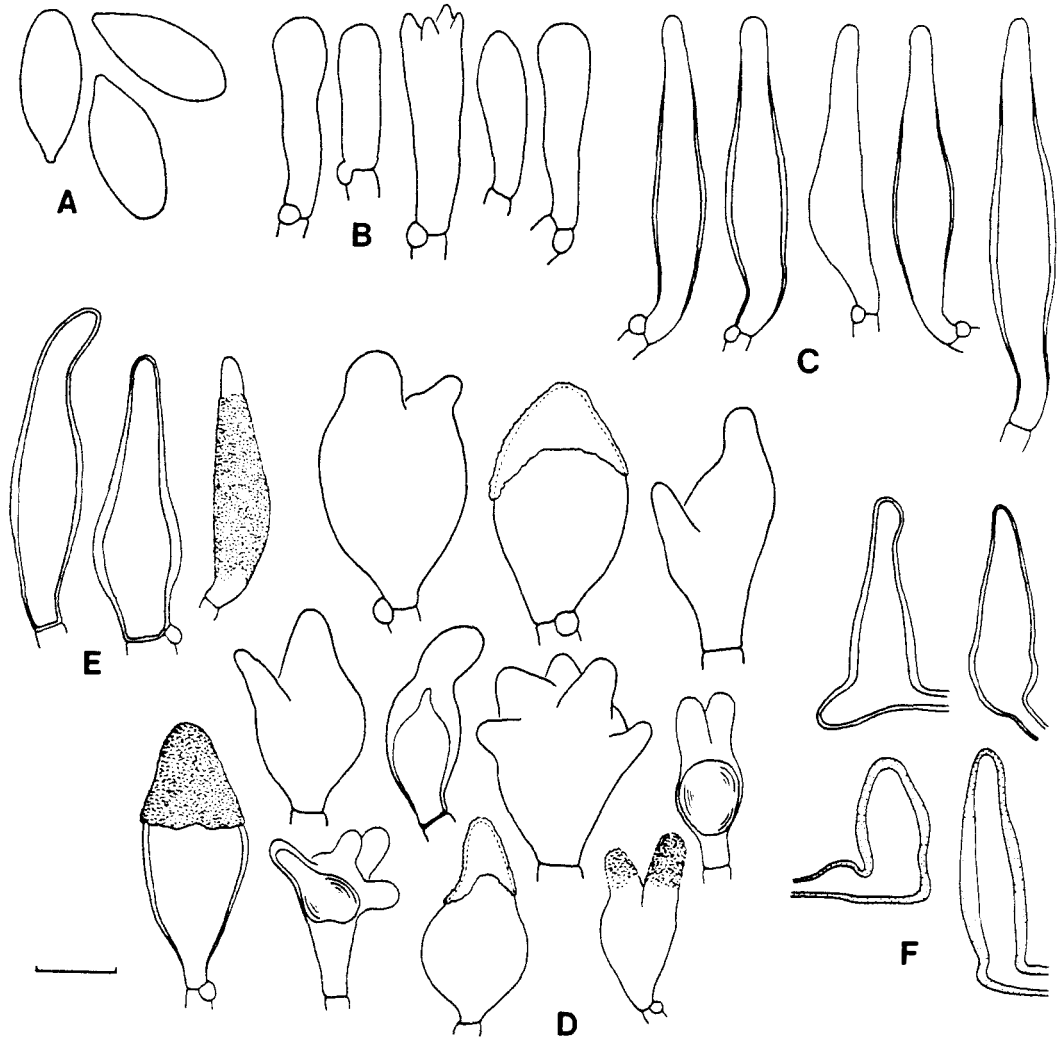



**Figure 9 A-F.** Features of *Marasmius epifagus* (Vilgalys no. 82/342). A. Basidiospores. B. Basidium and basidioles. C. Hymenial cystidia. D. Pileipellis elements. E. Pilocystidia. F. Caulocystidia. Standard bar = 5 µm for A; 10 µm for B-F.

diam, parallel, cylindric, smooth, hyaline (stipe apex) or brown (stipe base), inamyloid, with walls up to 1.5 µm thick; **medullary hyphae** 2.5-10 µm diam, similar but hyaline and thinner-walled. **Stipe vesture** of numerous versiform **caulocystidia** (Fig. 9 F) 8-30 X 5-10 µm, cylindric, conic, clavate, ventricose or irregular in outline, rarely subcapitate,

hyaline at stipe apex, ochraceous or pale brown at stipe base, inamyloid, with walls up to 2 μm thick. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Scattered or gregarious on leaves of *Fagus* in beech-maple woodlands. Rare. June - October. Northeastern United States from Massachusetts to Michigan and southward to Virginia.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** *Marasmius epifagus*, known to date from seven specimens, produces tiny, rarely collected basidiomata. I suspect that the species may be more common than herbarium records indicate, but due to the small size of basidiomata, the species may be easily overlooked in the field. The southernmost known distribution is Botecourt County, Virginia. *Marasmius epifagus* is characterized by the following features: a) pale yellow or yellowish pink pilei less than 2 mm broad; b) poorly developed hymenophore; c) pruinose, brownish, short, insititious stipe; and d) habit on beech leaves. In addition, pileipellis morphology is distinctive. The majority of pileipellis elements have 2-5 conic or cylindric apical outgrowths (not setulae nor diverticula), and are often apically incrusted or coated with resinous or subgelatinous exudates. This morphology is unlike any other known species of *Marasmius*. *Marasmius epiphylloides* (Rea) Sacc. & Sydow, accepted by many authors in sect. *Epiphylli* (Kühner, 1933; Kühner & Romagnesi, 1953; Singer, 1943; Clémençon, 1982; Noordeloos, 1987), forms pileipelli composed of elements with apical outgrowths, but here the elements are distinctly *Rotalis*-type cells.

Singer (1986) suggested that *M. epifagus* belongs in the genus *Gloiocephala*. I concur with Gilliam (1975a, 1976) that the species is best placed in *Marasmius* sect. *Epiphylli*. I restrict *Gloiocephala* to species with capitate, metuloid, oleocystidioid or long-rostrate (often pigmented) pilocystidia, and/or gelatinous tissues. Recently, Noordeloos (1981) re-evaluated the criteria used by Singer (1976) to separate *Gloiocephala* from *Marasmius* and concluded that *Gloiocephala* was best considered as a section of *Marasmius* (based in part on Gilliam's observations on *M. epifagus*). Unfortunately, when transferring *Gloiocephala* as *Marasmius* sect. *Gloiocephala*, Jansen and Noordeloos (in Noordeloos, 1981) failed to validly transfer the type species of *Gloiocephala* (*viz., G. epiphylla* Massee) to *Marasmius*. A transfer of *G. epiphylla* to *Marasmius* would require a name change, because the epithet is preempted by *M. epiphyllus* (Pers.: Fr.) Fr. Until an in-depth examination of the worldwide species of *Gloiocephala sensu* Singer and *Marasmius* sect. *Epiphylli sensu mihi* is undertaken, I choose to retain *Gloiocephala* as a genus distinct from *Marasmius*.

**10. *MARASMIUS EPIPHYLLUS*** (Pers.: Fr.) Fries, Epicr. Syst. Mycol. 386. 1838.

≡ *Agaricus epiphyllus* Pers.: Fries, Syst. Mycol. 1: 139. 1821. [*Agaricus epiphyllus* Persoon, Syn. Meth. Fung. 468. 1801.]

≡ *Androsaceus epiphyllus* (Pers.: Fr.) Patouillard, Essai Tax. Hyménomyc. 141. 1900.

= *Marasmius subvenosus* Peck, Annual Rep. New York State Mus. 23: 125. 1869 (1872).

**NEOTYPE:** Sweden, Ulfült, near Femsjö, 19 Aug. 1964, Singer no. C4130 (BAFC).

**Basidiomata** fragile when young, becoming membranous in age; marcescent. **Pileus** 1-10 mm diam, convex at first, expanding to plano-convex or plane, sometimes slightly depressed in age; surface dull, dry, opaque or rarely translucent in age, minutely pruinose; disc even or slightly rugulose; margin even or obscurely striate or crenate; color white or yellowish white (2-4A2) overall when young, disc darkening slightly in age to pale yellow (4A3) or light yellowish orange (4A4); context thin, buff or pale yellow. **Lamellae** poorly developed or well-developed, adnate or slightly subdecurrent, rarely attached to a thin, adherent partial collar of tissue, distant (5-10 complete lamellae) or sometimes absent or vein-like, narrow, sometimes intervenose; white or pale yellowish white when fresh, drying yellow, non-marginate; **lamellulae** 1-5, vein-like. **Stipe** 6-20 X 0.2-1 mm, terete, equal or slightly enlarged at both or either end, shiny, translucent when young, base becoming opaque in age, hollow, insititious, pruinose overall with pruinae colored yellowish white (4A2) at stipe apex or reddish brown (7D4-5) at stipe base; surface color yellowish white overall when young, hysterochroic, apex remaining yellowish white in age, base becoming pale yellowish brown (5D4-5), yellowish brown (5E4-5), reddish brown (7D4-5) or dark brown (6F5-6). **Sterile stipes** rare; **rhizomorphs** absent. **Odor and taste** not distinctive.

**Basidiospores** (Fig. 10 A) 8.4-12.8(-13.6) X 3.6-4.8(-5.4) µm [$\bar{\bar{x}}$ = 11.0 ± 0.9 X 4.2 ± 0.3 µm, E = 2.2-3.1, $\bar{Q}$ = 2.6 ± 0.1, n = 15-30 spores

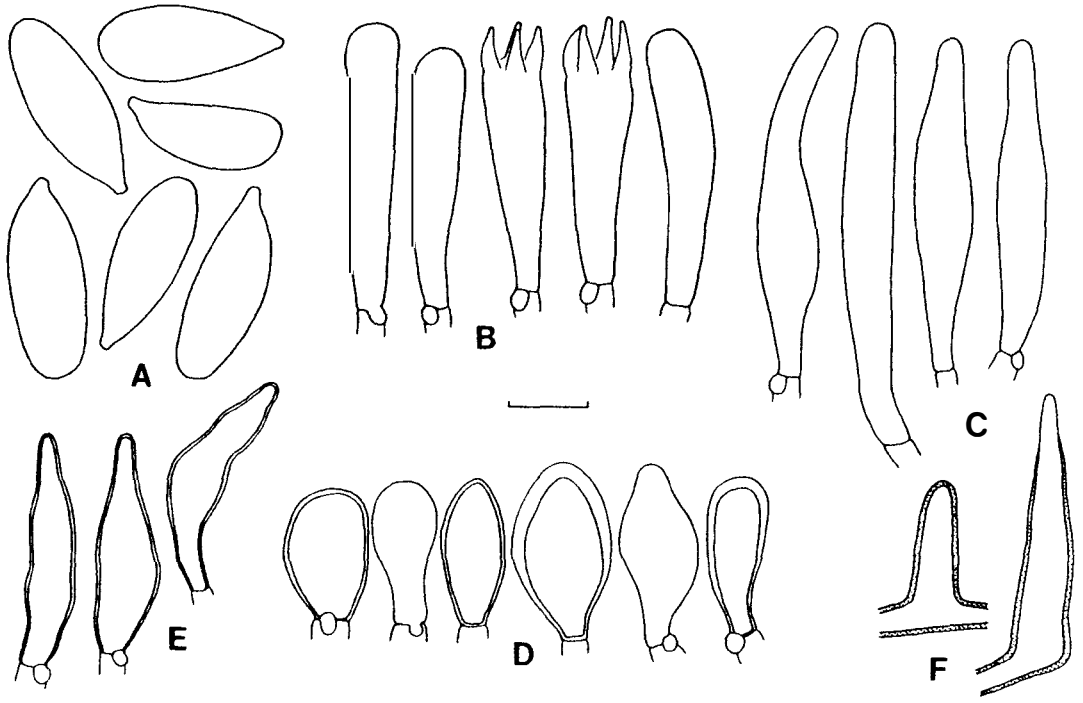



**Figure 10 A-F.** Features of *Marasmius epiphyllus* (Romell, 1911). A. Basidiospores. B. Basidia and basidioles. C. Hymenial cystidia. D. Pileipellis elements. E. Pilocystidia. F. Caulocystidia. Standard bar = 5 µm for A; 10 µm for B-F.

per 6 specimens], elongate-ellipsoid, subclavate or ventricose, hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 10 B) 20-35 X (5-)7-10 µm, 4-spored, clavate. **Basidioles** (Fig. 10 B) cylindric or subclavate. **Hymenial cystidia** (Fig. 10 C) common on lamellar sides and edges, 28.5-48 X 6-9 µm, fusoid-ventricose, narrowly lageniform or narrowly ventricose-rostrate, obtuse, not capitate, arising from the subhymenium and projecting well beyond the basidioles, non-refractive, hyaline, inamyloid, typically thin-walled, sometimes firm-walled (up to 0.8 µm) in central or basal portion of cell. **Pileipellis** hymeniform, not mottled, composed of versiform elements plus scattered pilocystidia; **versiform elements** (Fig. 10 D) 12-30 X 7-13(-20) µm,

cylindric, clavate, subvesiculose, ventricose, broadly lageniform, turbinate or sphaeropedunculate, non-gelatinous, hyaline or pale yellow, inamyloid; in some specimens nearly all pileipellis elements thick-walled (0.5-1 µm), in other specimens, elements mostly thick-walled with thin-walled cells interspersed, yet in other specimens, elements mostly thin-walled with thick-walled cells interspersed; **pilocystidia** (Fig. 10 E) 24-36 X 6-10.5 µm, fusoid-ventricose, narrowly lageniform or irregularly fusoid, projecting, thin-walled or more commonly with walls 0.5-1 µm thick, hyaline. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2-8 µm diam, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled. **Stipe tissue** monomitic; **cortical hyphae** 2.5-6.5 µm diam, parallel, cylindric, smooth, hyaline or pale yellow at stipe apex, ochraceous, brownish orange or brown at stipe base, inamyloid, with walls up to 2 µm thick; **medullary hyphae** 2-8 µm diam, similar but hyaline and thinner-walled, with few oleiferous hyphae interspersed. **Stipe vesture** of scattered **caulocystidia** (Fig. 10 F) 8-36 X 4-8 µm, cylindric, clavate, ventricose or acuminate, obtuse or subacute, hyaline (stipe apex) or pale brown (stipe base), inamyloid, with walls 0.5-1.5 µm thick. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Scattered or gregarious on leaves of *Betula, Fraxinus, Cornus, Populus* or rarely *Quercus*. August - October. Common in montane regions of western North America, the Rocky Mts., and northern United States and Canada.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** Although to date no specimens accurately diagnosed as *M. epiphyllus* have been discovered from the southern Appalachian Mts., I include the species here because I suspect that it occurs in this region. *Marasmius epiphyllus* is commonly collected on leaves of birch, ash, dogwood, poplar, aspen or rarely oak in montane regions of western and northeastern North America and quite possibly extends southward along the Appalachian chain. It should be looked for in cooler, higher elevation areas populated by the tree species mentioned above.

Diagnostic features of *M. epiphyllus* include: a) small, white, convex, even or obscurely striate pilei; b) distant, poorly developed lamellae; c) pruinose, insititious, apically white and basally brown stipe; and d) habit on leaves of birch, ash, dogwood, poplar or oak. In addition, tetrasporic basidia, inamyloid tramal tissues, clamp connections and spore size are characteristic.

In North America, *M. epiphyllus* may be confused with *M. tremulae* Velenovsky and *M. felix* Morgan. *Marasmius tremulae*, recently reported for the first time from North America (Redhead, pers. comm.), differs in forming bisporic basidia and lacking clamp connections. *Marasmius felix* differs by forming pinkish white or orange-white pilei, more deeply pigmented pileipellis elements (yellow, ochraceous or brownish orange), subcapitate hymenial cystidia, slightly shorter spores ($\bar{L}$ = 9.6 µm), and habit on leaf petioles of *Platanus* or *Liquidambar*.

Because no type specimen of *Agaricus epiphyllus* Pers.: Fr. was known to exist, Singer (1969) designated a specimen collected from Femsjö, Sweden as neotype. Until recently, the circumscription of *Marasmius epiphyllus* encompassed taxa with thick-walled pileipellis

elements as well as those with thin-walled elements. The species commonly encountered in the environs of Femsjö, Fries' collecting area, possesses thick-walled pileipellis elements and consequently, this is the form chosen by Singer to represent *M. epiphyllus*. The taxon with thin-walled pileipellis elements, which also grows in Europe (as well as South America, *fide* Singer, 1969, 1976), was described by Singer (1969) as *M. tenuiparietalis* Sing. It should be noted that cells comprising the pileipellis of basidiomata of the holotype specimen of *M. subvenosus* Pk. [collected from New York and considered by me a synonym of *M. epiphyllus*], ranged from thick-walled to thin-walled, with some basidiomata exhibiting mostly thin-walled elements with thick-walled cells interspersed, while other basidiomata showed mostly thick-walled elements. This infrapopulation phenomenon must be considered when evaluating the taxonomic disposition of *M. tenuiparietalis*.

11. ***MARASMIUS FELIX*** Morgan, J. Mycol. 12: 2. 1906

**NEOTYPE:** United States, Ohio, Montgomery Co., Preston, 1906, A. P. & L. V. Morgan no. 129 (ISC!) [ISONEOTYPE: ISC!].

**Basidiomata** marcescent, reviving. **Pileus** 0.5-5(-7) mm diam, convex, often expanding to plano-convex, with or without a shallow central depression; disc even when young, remaining so in age or becoming slightly rugulose; margin even at first, soon striate or rugulose-striate; surface dull, dry, opaque, minutely granular or pruinose; coloration when young pale orange white (5A2-3), pinkish white (7A2), pinkish buff or pale greyish red (7B3-4) overall, disc

remaining so colored in age or fading slightly, margin fading to pale orange white, pinkish white or buff in age, rarely margin colored greyish orange (6B-C3-4), sometimes fading overall in age to buff or nearly white; dried material often with pale brownish orange or pale reddish brown shades; context thin, buff-colored. **Lamellae** well-developed, adnate, often attached to a thin, complete, adherent collar of tissue (not a true collarium, never free), subdistant or distant (7-12 complete lamellae), narrow or moderately broad (up to 0.5 mm), sometimes forked, sometimes weakly intervenose, edges pruinose or crystalline-fimbriate; buff, pale orange white (5A2) or pale pinkish white (6-7A2), rarely with pale orange spots; with or without several short lamellulae. **Stipe** 10-55(-115) X <0.5 mm, terete, equal, bristle-like, pruinose overall, insititious; upper half at first white, pale orange white (5A2) or pinkish buff, lower half brown (7E4-8), in age upper few mm remaining white, pale orange white or pinkish buff, base becoming dark brown (7-8F4-8) or nearly black. **Sterile stipes** absent or rare; **rhizomorphs** absent. **Odor and taste** not distinctive.

**Basidiospores** (Fig. 11 A1-A2) (7.2-)8-11.4 X (3.2-)4-4.8(-5.6) µm [$\bar{\bar{x}}$ = 9.6 ± 0.6 X 4.1 ± 0.3 µm, E = 1.6-2.9, $\bar{Q}$ = 2.3 ± 0.2; TL90(90%): $\bar{x}$ = 8.5-10.7 X 3.5-4.7 µm, Q = 1.9-2.7; n = 15-30 spores per 10 specimens], ellipsoid, elongate-ellipsoid, subamygdaliform, inequilateral in profile, hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 11 B) (18.5-)24-32 X 5.5-8(-9) µm, 4-spored, clavate. **Basidioles** (Fig. 11 B) subcylindric or clavate. **Cystidioles** (Fig. 11 C) fusoid or narrowly ventricose-rostrate. **Hymenial cystidia** (Fig. 11 D) common on lamellar edges, common or uncommon on lamellar sides,

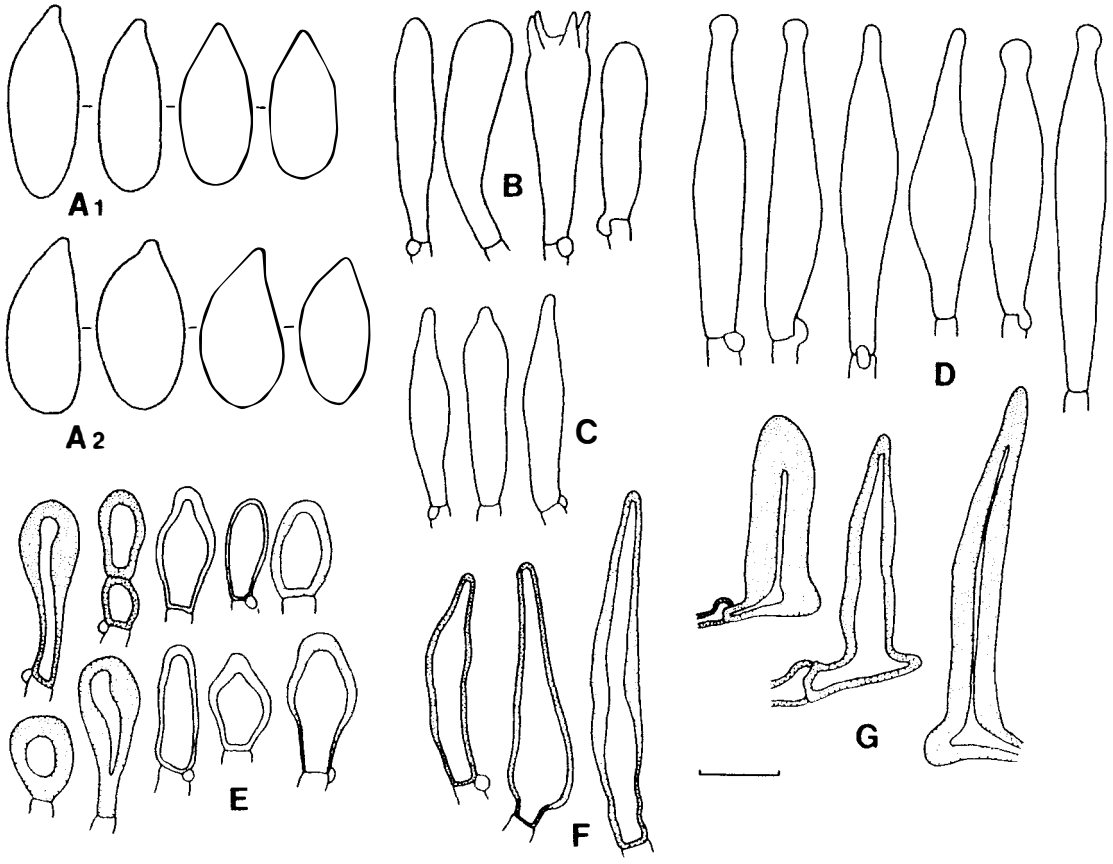



**Figure 11 A-G.** Features of *Marasmius felix*. A1-A2. Basidiospores. A1. Desjardin no. 4528. A2. Desjardin no. 4486. B. Basidium and basidioles. C. Cystidioles. D. Hymenial cystidia. E. Pileipellis elements. F. Pilocystidia. G. Caulocystidia. Standard bar = 5 µm for A; 10 µm for B-G (drawn from Desjardin no. 4486)

32-54 X 5.5-8(-10) µm, fusoid, ventricose or ventricose-rostrate, usually subcapitate, some non-capitate, arising from the subhymenium and projecting well beyond the basidioles, non-refractive, thin-walled or with walls up to 0.5 µm thick, hyaline, inamyloid. **Pileipellis** hymeniform, weakly mottled, composed of clavate, ventricose, broadly lageniform or vesiculose elements (Fig. 11 E) 10-20 X 4.5-18 µm; walls ranging from 0.5-4 µm thick, apical region of cell often thicker-walled

than basal portion, non-gelatinous, hyaline, yellow or brownish orange, inamyloid; thicker-walled and deeper pigmented elements interspersed; **pilocystidia** (Fig. 11 F) scattered, 20-32(-44) X 5.5-9 µm, fusoid, ventricose or ventricose-rostrate, thick-walled, smooth or occasionally roughened, ochraceous or brownish orange. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2-8 µm diam, cylindric, frequently-branched, non-gelatinous, thin-walled or with walls up to 0.8 µm thick, hyaline, inamyloid. **Stipe tissue** monomitic; **cortical hyphae** 1.5-5 µm diam, parallel, cylindric, smooth, hyaline (stipe apex) or brownish orange to brown (stipe base), inamyloid, with walls up to 2 µm thick; **medullary hyphae** 2-9 µm diam, similar but hyaline and thinner-walled. **Stipe vesture** of numerous **caulocystidia** (Fig. 11 G) 8-45(-60) X 4.5-8 µm, cylindric, clavate, acuminate, fusoid or ventricose, obtuse or acute, sometimes subcapitate, hyaline (stipe apex), ochraceous or brownish orange (stipe base), inamyloid, with walls 1-4 µm thick. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Solitary or scattered on leaf petioles of *Platanus* (southern Appalachians northward) or *Liquidambar* (Florida) in riparian habitats. July - December. Uncommon. Eastern United States from Ohio southward to Florida.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** Diagnostic field characters for *M. felix* include: a) small, orange-white, pinkish or greyish red pilei; b) distant, narrow, pallid, usually well-developed lamellae; c) pruinose, insititious, wiry stipe with a pallid apex and brownish base; and d) habit on leaf petioles of sycamore or sweet gum. Micromorphologically, *M. felix* is

distinct because of pigmented pileipellis elements and subcapitate hymenial cystidia.

Basidiomata formation of *Marasmius felix* is highly substrate-specific. In the southern Appalachian Mts. and regions northward, *M. felix* fruits on senescent leaf petioles of sycamore, while in Florida, the species fruits on sweet gum petioles. Although I have collected the species on numerous occasions, I have never observed basidiomata arising from debris of any other vascular plants, or from any other type of sycamore or sweet gum debris. Apparently, basidiome formation is restricted to the petiole region of senescent leaves. Interestingly, in the southern Appalachians in areas where sycamore and sweet gum are sympatric, *M. felix* is known only from sycamore petioles, while in Florida where both trees also occur, *M. felix* is known only from sweet gum petioles.

Although spore size may be a valuable character in separating phenetically similar taxa, spore size in *M. felix* may vary considerably within a population or even within an individual fruiting under varied conditions. The following examples are provided to illustrate the degree of variation in spore size exhibited by *M. felix*. A specimen collected in Knox County, Tennessee during November, 1986 (Desjardin no. 4219, TENN), showed spores 8.8-11.2 X 4-4.8 µm [$\bar{x}$ = 10.1 X 4.2 µm, n = 16]. During the same month of the following year, another specimen collected at the same site (Methven, s.n., TENN) yielded spores 7.2-10.4 X 3.4-4.2 µm [$\bar{x}$ = 8.5 X 3.8 µm, n = 22]. In September, 1987, a specimen collected in Buncombe County, North Carolina (Desjardin 4471, TENN) yielded spores 8.8-10.8 X 3.8-4.2 µm [$\bar{x}$ = 10.1 X 4.0 µm, n = 20].

Axenic tissue cultures were obtained from basidiomata of this specimen and maintained on malt extract agar. After nine weeks growth in the dark at 20-23° C, basidiomata with pinhead-sized pilei formed. The isolate was removed from the dark and placed in a room with natural light, and after one week pilei expanded and spores were formed and discharged. These spores measured 7.4-9.6 X 3.8-4.6 µm [$\bar{x}$ = 9.0 X 4.2 µm, n = 30]. Hence, within a single individual, mean spore length may vary from 9.0-10.1 µm, dictated presumably by growth conditions. Consequently, spore size measurements alone may be insufficient to separate *M. felix* from phenetically similar taxa, such as *M. epiphyllus*. If, however, a specimen shows pigmented pilei, subcapitate hymenial cystidia, mean spore length of 9.6 ± 0.6 µm, and growth on sycamore or sweet gum petioles, it may be assigned to *M. felix*. In comparison, if the specimen shows non-pigmented pilei, non-capitate hymenial cystidia, mean spore length of 11.0 ± 0.9 µm, and growth on leaves of various other deciduous trees, it may be assigned to *M. epiphyllus*.

***MARASMIUS*** sect. ***GLOBULARES*** Kühner, Botaniste 25: 100. 1933 [*ut Globularinae*].

= *Scorteus* Earle, Bull. New York Bot. Gard. 5: 415. 1909 [T: *M. oreades* (Bolt.: Fr.) Fr.].

= *Marasmius* sect. *Globulares* subsect. *Collini* Singer, Agar. Mod. Taxon. 326. 1949 [T: *M. collinus* (Scop.: Fr.) Sing.].

TYPE SPECIES [implied, Kühner (1933)]: *Marasmius globularis* Fr. *in* Quélet, Mem. Soc. Emul. Montbéliard II, 5: 220. 1872 [= *Marasmius wynnei* Berkeley & Broome *fide* Singer (1951)].

Pileus medium-sized or large, sometimes umbonate, mostly even or rarely sulcate, sometimes hygrophanous, often fleshy and putrescent, variously colored. Lamellae well-developed, non-collariate, often broad, distant to crowded, pallid. Stipe central, stout, not bristle-like, glabrous to pubescent, non-insititious, often pallid. Rhizomorphs absent. Spores ellipsoid to clavate. Pleurocystidia present or absent. Cheilocystidia present or absent. Pileipellis a hymeniform layer of non-diverticulate, non-setulose cells ranging from cylindric or clavate to turbinate, vesiculose or sphaeropedunculate (*i.e.*, *Globulares*-type elements). Tramal hyphae dextrinoid. Stipe tissue monomitic, dextrinoid. Stipe vesture present or absent. Clamp connections present.

**12.** ***MARASMIUS DECIPIENS*** Halling, Desjardin & Tish, Mycotaxon 22: 474. 1985.

**HOLOTYPE:** United States, North Carolina, Transylvania Co., Cedar Mt. near Brevard, Sherwood Forest, 19 June 1980, Tish no. 1602-F (NY!).

**Basidiomata** marcescent or slightly putrescent. **Pileus** 8-25(-35) mm diam, convex, bluntly conic or campanulate when young, expanding to broadly convex or plano-convex in age, often with a broad, low umbo; surface dull, dry or moist and subhygrophanous, opaque, glabrous; disc even or rugulose, colored "avellaneous," watery greyish brown (6D-E3), brownish grey (7-8D-E2-3) or light brown (7D4-6); margin at first sulcate, becoming deeply plicate, rugulose-plicate or radially irregularly-ridged in age, colored light yellowish brown (5D4), pale brownish orange (5C3-4), greyish orange (5B3) or dingy yellowish grey (4B3), often fading in age to dirty buff or tan; context thin, buff. **Lamellae** adnexed, seceding in age, distant or remote (12-16 complete lamellae), broad (1-4 mm), thick, not intervenose; dingy buff-colored or pale greyish orange (5B2-3), sometimes slightly darker in age, non-marginate; **lamellulae** absent or in 1-series. **Stipe** 45-75 X 1-2.5 mm, terete, equal or sometimes with a flared apex and/or slightly enlarged base, cartilaginous, hollow, upper 1/3 or 1/2 glabrous, lower portion pubescent or tomentose, non-insititious; apex concolorous with the lamellae, base brown (6-7E5-8) or dark brown (6-7F5-8), tomentum colored buff, orange white (5A2), greyish orange (5B3) or brownish orange (6C3). **Odor** mildly sweet or fungal. **Taste** not distinctive.

**Basidiospores** (Fig. 12 A) 19.5-25.6(-28) X 4-5.6(-6.3) µm [$\bar{\bar{x}}$ = 22.7 ± 0.7 X 4.6 ± 0.1 µm, E = 4-6, $\bar{Q}$ = 4.9 ± 0.2; TL90(90%): $\bar{x}$ = 21.4-24.0 X 4.4-4.8 µm, Q = 4.5-5.3; n = 10-25 spores per 10 specimens], subfusiform or clavate, sometimes curved in profile, hyaline, inamyloid, smooth, white, buff or rarely pale greyish red in deposit. **Basidia** (Fig. 12 B) 30-45 X 6.5-10 µm, 4-spored, cylindric or

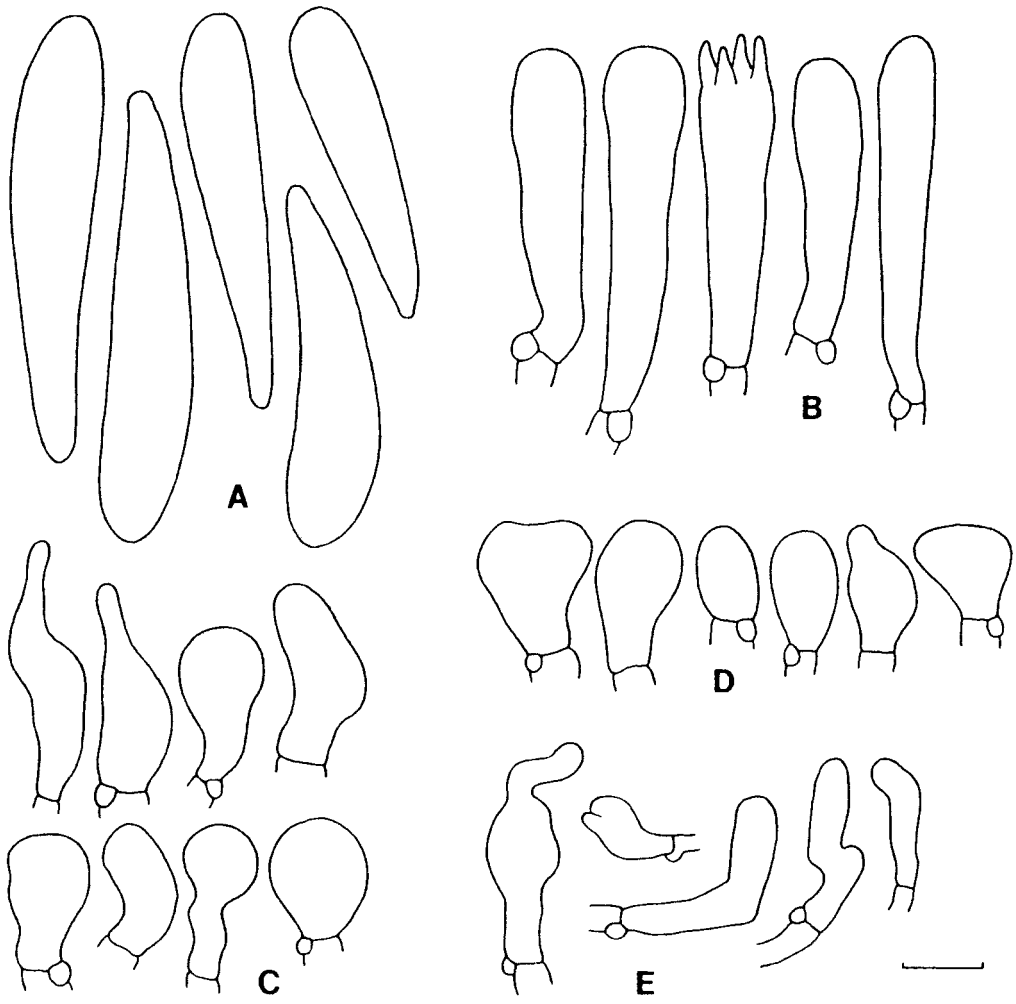



**Figure 12 A-E.** Features of *Marasmius decipiens* (Desjardin no. 4608). A. Basidiospores. B. Basidium and basidioles. C. Cheilocystidia. D. Pileipellis elements. E. Caulocystidia from stipe apex. Standard bar = 5 µm for A; 10 µm for B-E.

clavate. **Basidioles** (Fig. 12 B) cylindric or subclavate. **Pleurocystidia** absent. **Cheilocystidia** (Fig. 12 C) abundant, lamellar edge sterile, (7.2-)13.5-28(-32) X 5.5-15 µm, cylindric, clavate, ventricose, saccate or irregular in outline, rarely lobed, rarely rostrate, thin-walled, collapsing in age, hyaline, inamyloid or weakly dextrinoid. **Pileipellis** hymeniform, not mottled, composed of clavate,

turbinate, pyriform, subvesiculose or sphaeropedunculate cells (Fig. 12 D), 10-20 X 5-13 (-18) µm, non-diverticulate, rarely lobed, thin-walled or with walls up to 0.5 µm thick, hyaline or pale ochraceous, weakly dextrinoid. **Pileus trama** interwoven; **lamellar trama** interwoven; hyphae 3.5-10(-14) µm diam, frequently-branched, cylindric or slightly inflated, smooth, non-gelatinous, hyaline, dextrinoid, thin-walled. **Stipe tissue** monomitic; **cortical hyphae** 2.5-5.5 µm diam, parallel, cylindric, smooth, brownish orange, dextrinoid, with walls up to 1 µm thick; **medullary hyphae** 2.5-8 µm diam, similar but hyaline and thinner-walled. **Stipe vesture** at stipe apex absent, or of rare, scattered or clustered **caulocystidia** (Fig. 12 E) 9-28 X 4-9 µm, these cylindric, clavate or rarely ventricose-rostrate, erect or recurved, hyaline, weakly dextrinoid, thin-walled or with walls up to 0.5 µm thick; vesture at stipe base a loosely interwoven layer of hyphae 3-6 µm diam, cylindric or irregular in outline, often contorted, terminal cells erect or repent, hyaline or pale yellowish, dextrinoid, with walls up to 2 µm thick. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Solitary, scattered or subcespitose on leaf debris of *Rhododendron* or various deciduous hardwoods. May - September, most commonly collected in June. Uncommon in the southern Appalachians (Tennessee and North Carolina).

**Specimens Examined.** Refer to Appendix A.

**Commentary.** *Marasmius decipiens* is a distinct and easily recognized component of the North American *Globulari*. The species differs from all other North American representatives of the section in stature and spore size. *Marasmius decipiens* is characterized by a)

rugulose-plicate or radially ridged pilei colored greyish brown; b) distant, broad, non-marginate and non-collariate lamellae; c) non-insititious stipe with copious greyish orange basal tomentum; and d) clavate spores with mean spore size 22.7 X 4.6 µm ($\bar{Q}$ = 4.9). The species has the stature of a typical member of sect. *Sicci*, and might be confused with *M. paludigenus* Desjardin *in* Desjardin & Petersen. The latter species differs, however, in *Siccus*-type pileipellis elements and cheilocystidia, and shorter spores. Refer to Desjardin and Petersen (1989b) for a description and discussion of *M. paludigenus*.

*Marasmius decipiens* is apparently closely allied with *M. purpureostriatus* Hongo, a species described from Shiga Prefecture, Japan. Although I have not examined the type specimen of *M. purpureostriatus*, data provided by Hongo (1958) match quite closely those from *M. decipiens*. Micromorphological features of both species are nearly identical, although there are distinct differences in macromorphology. Basidiomata of *M. purpureostriatus* show pilei with brownish purple or dark purple disc and striations. In comparison, pilei of *M. decipiens* show a greyish brown disc and typically lack contrasting striations. In addition, both *M. decipiens* and *M. purpureostriatus* are quite similar to *M. bekolacongoli* Beeli, a species described from the Belgian Congo (Zaire). Until material of *M. purpureostriatus* and *M. bekolacongoli* is examined and compared with *M. decipiens*, all three taxa will be retained as distinct species. It would be interesting to obtain and cross monosporous isolates of these

three taxa to determine whether or not they belong to one biological species.

Smith and Hesler (1940) treated *M. decipiens* as *M. epodius* Bresadola, and reported two specimens from the Great Smoky Mountain National Park, Tennessee. I consider *M. epodius* to be a synonym of *M. anomalus* Lasch *in* Rabenhorst. The latter species differs from *M. decipiens* in forming pilei composed of *Siccus*-type broom cells, numerous pleurocystidia, and shorter spores. Refer to Chapter VIII for descriptions and discussions of *M. epodius* and *M. anomalus*.

Spore deposit color of basidiomata from the holotype specimen (Transylvania Co., NC) was recorded by Tish as reddish grey (Halling *et al.*, 1985). The spore print was obtained on thick, white, non-cotton paper and is now colored pinkish buff. In comparison, spore deposits obtained on glass slides from several specimens collected in Blount County, Tennessee, were initially white or buff, and have remained unchanged for several years. As another example, notes with a specimen collected by Hesler (TENN 35579) reported spores as white in deposit. A spore print taken on a white, 3" X 5" card and included with this specimen is now colored greyish orange (5B4). Apparently spore deposit color in *M. decipiens* may range from white or buff to greyish red when fresh, and when obtained on white paper of unknown quality, may change color through time in herbaria. A further investigation of the color of fresh spore deposits when obtained on glass slides is warranted.

**13. *MARASMIUS NIGRODISCUS*** (Pk.) Halling, Brittonia 35: 323. 1983.

≡ *Collybia nigrodisca* Peck, Annual Rep. New York State Mus. 50: 98. 1896 (1897).

≡ *Gymnopus nigrodiscus* (Pk.) Murrill, N. Amer. Fl. 9(5): 356. 1916.

= *Gymnopus glatfelteri* Murrill, N. Amer. Fl. 9(5): 358. 1916.

≡ *Collybia glatfelteri* (Murr.) Murrill, Mycologia 8: 219. 1916.

= *Gymnopus tenuifolius* Murrill, N. Amer. Fl. 9(5): 358. 1916.

≡ *Collybia tenuifolia* (Murr.) Murrill, Mycologia 8: 219. 1916.

≡ *Marasmius tenuifolius* (Murr.) Singer, Ann. Mycol. 4: 130. 1943.

= *Collybia delicata* Thiers, Mycologia 50: 519. 1958.

**HOLOTYPE:** United States, New York, Suffolk Co., Wading River, July, C. H. Peck (NYS!).

**Basidiomata** putrescent, seldom marcescent. **Pileus** 25-60(-100) mm diam, obtusely conic, convex and often umbonate when young, expanding in age to broadly campanulate, plano-convex or plane, with or without a broad, low umbo; surface dull, opaque, dry or moist and then subhygrophanous, sometimes lubricous, glabrous; disc smooth, rarely weakly rugulose; margin decurved, striatulate or pellucid-striate at first, often becoming uplifted, wavy, and radially-rugulose in age; coloration light brown (6D4-5), greyish brown (6E3-4) or brown (6E5-6) overall when young, disc remaining so in age, fading slightly, or darkening to dark greyish brown (7E3-5) or dark brown (7F3-4), margin fading in age to pale yellowish brown (5D4), cream (4A3), pale yellowish white (4A2), tan, or buff-colored, sometimes fading to tan or dingy buff overall. Context thick (up to 3 mm), buff or watery-concolorous with the surface. **Lamellae** adnate or adnexed, seceding in

age, close or subdistant (20-30 complete lamellae), broad or very broad (3-7.5 mm), typically not forked nor intervenose (rarely slightly intervenose near pileus margin), minutely pruinose; buff-colored when young, becoming cream (4A3), tan or dingy greyish orange (5B3) in age, non-marginate; **lamellulae** in 2-4 series. **Stipe** 45-100(-160) X 3.5-6(-7) mm, terete, equal above a slightly enlarged base, often twisted; base sometimes slightly curved, stuffed or hollow; apex often striate or longitudinally-ridged; surface dull, dry, pruinose or pubescent over upper portion, sometimes centrally glabrescent, base typically tomentose or covered with copious white or cream-colored mycelium, non-insititious; coloration white or buff overall, rarely lilac tinted at the apex. **Odor** mild or often strong, acidulous, with a faint raphanoid component. **Taste** mild or distinctly resinous or acidulous (similar to some non-acrid *Lactarius* spp.).

**Basidiospores** (Fig. 13 A) 6.4-8.8(-9.6) X 3.8-5.2(-5.6) µm [$\bar{\bar{x}}$ = 7.5 ± 0.3 X 4.4 ± 0.1 µm, E = 1.5-2, $\bar{Q}$ = 1.7 ± 0.05; TL90(90%): $\bar{x}$ = 6.9-8.1 X 4.2-4.6 µm, Q = 1.6-1.8; n = 20-25 spores per 10 specimens], ellipsoid or lacrymoid, rarely obovoid, hyaline, inamyloid, smooth, white, buff or sometimes cream-olivaceous or olivaceous-buff in fresh deposit, often becoming yellow or cream in time in the herbarium. **Basidia** (Fig. 13 B) 21-30(-34) X 5-8 µm, 4-spored, clavate. **Basidioles** (Fig. 13 B) cylindric, subclavate or clavate. **Pleurocystidia** (Fig. 13 C) abundant, 40-85(-170) X 8-15(-18) µm [$\bar{W}$ = 11.4 µm; n = 20-30 cystidia per 10 specimens], fusoid, fusoid-ventricose, or ventricose-rostrate, obtuse, refractive, arising from the lamellar trama (often from oleiferous hyphae) and projecting well beyond the basidioles,

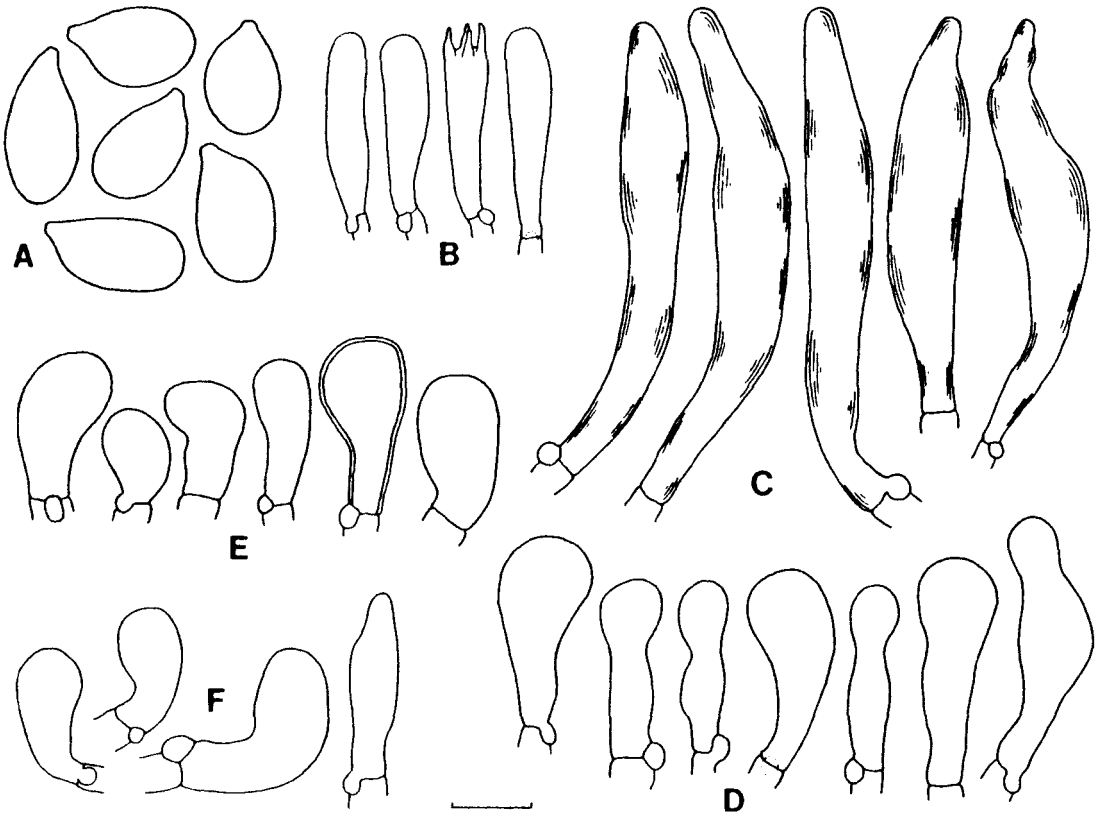



**Figure 13 A-F.** Features of *Marasmius nigrodiscus* (Desjardin no. 4301). A. Basidiospores. B. Basidium and basidioles. C. Pleurocystidia. D. Cheilocystidia. E. Pileipellis elements. F. Caulocystidia. Standard bar = 5 µm for A; 10 µm for B-F.

thin-walled, hyaline, inamyloid. **Cheilocystidia** (Fig. 13 D) numerous, 14.5-44(-60) X 5.5-16(-20) µm [$\bar{W}$ = 12 µm; n = 20-30 cystidia per 10 specimens], cylindric, clavate or sphaeropedunculate, suberect or erect, typically non-refractive, thin-walled, hyaline; pleurocystidioid elements scattered, refractive. **Pileipellis** hymeniform, not mottled, composed of cylindric, clavate, broadly clavate, subvesiculose or sphaeropedunculate elements (Fig. 13 E), 12-32 X 6.5-17.5(-21.5) µm, thin-walled or few with walls up to 1 µm thick, pale ochraceous or pale brown on pileus disc, hyaline or pale

yellow on pileus margin, inamyloid or weakly dextrinoid. **Pileus and lamellar trama** interwoven; hyphae 3-16(-28) µm diam, frequently-branched, cylindric or inflated, smooth, non-gelatinous, hyaline, strongly dextrinoid, thin-walled. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 2.5-12(-15) µm diam, subparallel, cylindric, smooth, hyaline or pale yellow, strongly dextrinoid, with walls up to 1.5 µm thick. **Stipe vesture** of scattered or clustered **caulocystidia** (Fig. 13 F) 12-48 X 5-10 µm, cylindric, clavate, vesiculose, ventricose or sphaeropedunculate, thin-walled, hyaline, inamyloid or weakly dextrinoid. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Solitary, scattered, gregarious or subcespitose on soil or leaf debris in deciduous woods or mixed forests, rarely on lawns. May - October, most commonly collected in July and August in the southern Appalachians. Common in eastern North America from New England southward to Florida and Texas.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** Basidiomata formed by *Marasmius nigrodiscus* are characteristically collybioid in stature, and larger than those formed by any other known North American *Marasmius*. In some specimens, pilei may be up to 100 mm broad, and stipes more than 100 mm long. Other salient features of *M. nigrodiscus* include: a) umbonate pilei with greyish brown disc and buff margin; b) close, broad, buff-colored lamellae; c) twisted, striate, pruinose or pubescent, buff-colored stipe with copious basal mycelium; d) conspicuous, refractive, fusoid hymenial cystidia; e) small spores; and f) numerous caulocystidia.

Another North American species that shares many features with *M. nigrodiscus* is *M. cystidiosus* (Smith & Hesler) Gilliam. Both species form large, collybioid basidiomata with hymeniform pileipelli, dextrinoid tramal tissues, and refractive hymenial cystidia. *Marasmius cystidiosus* differs in forming pilei colored ochraceous-tawny on the disc and pinkish buff on the margin (often distinctly rugose-pitted or reticulate in age), and in forming glabrous, smooth (not striate), polished and somewhat translucent stipes that are reddish brown when dried. In addition, *M. cystidiosus* lacks caulocystidia and forms longer and narrower spores ($\bar{\bar{x}}$ = 8.6 X 3.6 µm, $\bar{Q}$ = 2.4). Culture mat morphology is also helpful in differentiating *M. cystidiosus* from *M. nigrodiscus*. PDA-grown isolates of *M. cystidiosus* are characterized by: a) slow growth rate (12.5 mm radius at Week VI); b) thinly felty, brownish orange culture mat; c) brownish orange to dark brown reverse coloration; d) absence of crystals among aerial hyphae; and e) absence of dendrotrichomoid elements. In comparison, PDA-grown isolates of *M. nigrodiscus* have a faster mean growth rate (34 mm radius at Week VI), cream or greyish cream-colored aerial mycelium, yellowish-tinted reverse (not orange-tinted), and form deep yellow acicular crystals among the aerial hyphae as well as dextrinoid dendrotrichomoid elements. Refer to Chapter VI for further details on cultural features of these two species.

Hesler (1951) treated *M. nigrodiscus* as *Collybia glatfelteri* (Murr.) Murr., and reported numerous collections from the southern Appalachian Mountains. Re-examination of these specimens indicated that they were conspecific with the holotype specimen of *C.*

*glatfelteri*, considered here a synonym of *M. nigrodiscus*. A photograph illustrating typical material from the southern Appalachians (TENN 19190) was provided by Hesler (1951).

Halling (1983b) suggested that *M. nigrodiscus* and *M. lilacinus* (Coker & Beardslee) Singer were closely related, differing basically in basidiomata pigmentation and cheilocystidial morphology. I concur with Halling's observations, but consider *M. lilacinus* to represent a variety of *M. nigrodiscus*. For a discussion of evidence supporting the status change of *M. lilacinus*, and a comparison of *M. lilacinus* with *M. nigrodiscus*, refer to the type studies of each taxon in Chapter VIII.

**14. *MARASMIUS CYSTIDIOSUS*** (Smith & Hesler) Gilliam, Mycotaxon 4: 47. 1976.

≡ *Collybia cystidiosa* Smith & Hesler, J. Elisha Mitchell Sci. Soc. 56: 305. 1940.

= *Marasmius leighii* A. H. Smith, Mycotaxon 9: 344. 1979.

**HOLOTYPE:** United States, North Carolina, Swain Co., Great Smoky Mts. National Park, Indian Creek, 30 July 1939, L. R. Hesler no. 12195 (MICH!).

**Basidiomata** putrescent or marcescent. **Pileus** 30-60(-100) mm diam, hemispheric or obtusely conic when young, expanding to convex, campanulate or plano-convex, often with a low, broad umbo; surface somewhat lubricous when fresh and moist, subhygrophanous, glabrous, at first even but soon rugulose, in age often becoming rugose and pitted or nearly reticulate; margin at first incurved, pellucid-striatulate, spreading in age and becoming opaque; disc light brown (6D4-5), brown

(6E5), "sayal brown," or "ochraceous tawny;" margin "clay color," tan, "pinkish buff," or cream (4A3), fading slightly in age; context thick (up to 3 mm), white, somewhat waxy. **Lamellae** adnexed, seceding in age, close (28-42 complete lamellae), moderately broad (3-6 mm), not forked nor intervenose; white or buff at first, cream-buff in age, non-marginate; edges even or slightly pruinose; sides minutely pruinose; **lamellulae** in 3-5 series. **Stipe** 60-105(-180) X 3-8 mm, terete or compressed, equal or with a flared apex and/or an enlarged base, glabrous and often shiny, somewhat translucent when fresh, not striate, hollow, base covered with strigose or downy, white or buff-colored mycelium, non-insititious; stipes single or fasciculate; upper 1/2 to 2/3 white or buff, lower portion greyish orange (5B3), brownish orange (5C4) or light brown (6D4). **Odor** mild, fungoid, slightly alkaline or faintly raphanoid. **Taste** mild, acidulous or slightly bitter.

**Basidiospores** (Fig. 14 A) 6.8-11.2 X 3-4.2 µm [$\bar{\bar{x}}$ = 8.6 ± 0.4 X 3.6 ± 0.1 µm, E = 1.9-3.1, $\bar{Q}$ = 2.4 ± 0.1; TL90(90%): $\bar{x}$ = 7.9-9.3 X 3.4-3.8 µm, Q = 2.2-2.6; n = 20-30 spores per 10 specimens], narrowly ellipsoid, subfusoid or subcylindric, slightly inequilateral in profile, hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 14 B) 17.5-24 X 4.5-6.5 µm, 2- and 4-spored (some specimens predominantly 2-spored, others predominantly 4-spored, others with an equal distribution of 2- and 4-spored basidia), clavate. **Basidioles** (Fig. 14 B) cylindric, subclavate or clavate. **Pleurocystidia** (Fig. 14 C) abundant, (30-)40-70(-80) X (5-)6.5-10(-12) µm [$\bar{\bar{W}}$ = 8.3 ± 0.2 µm, n = 20 cystidia per 5 specimens], fusoid or ventricose, few cylindric or clavate, often apically strangulate, arising from the subhymenium or

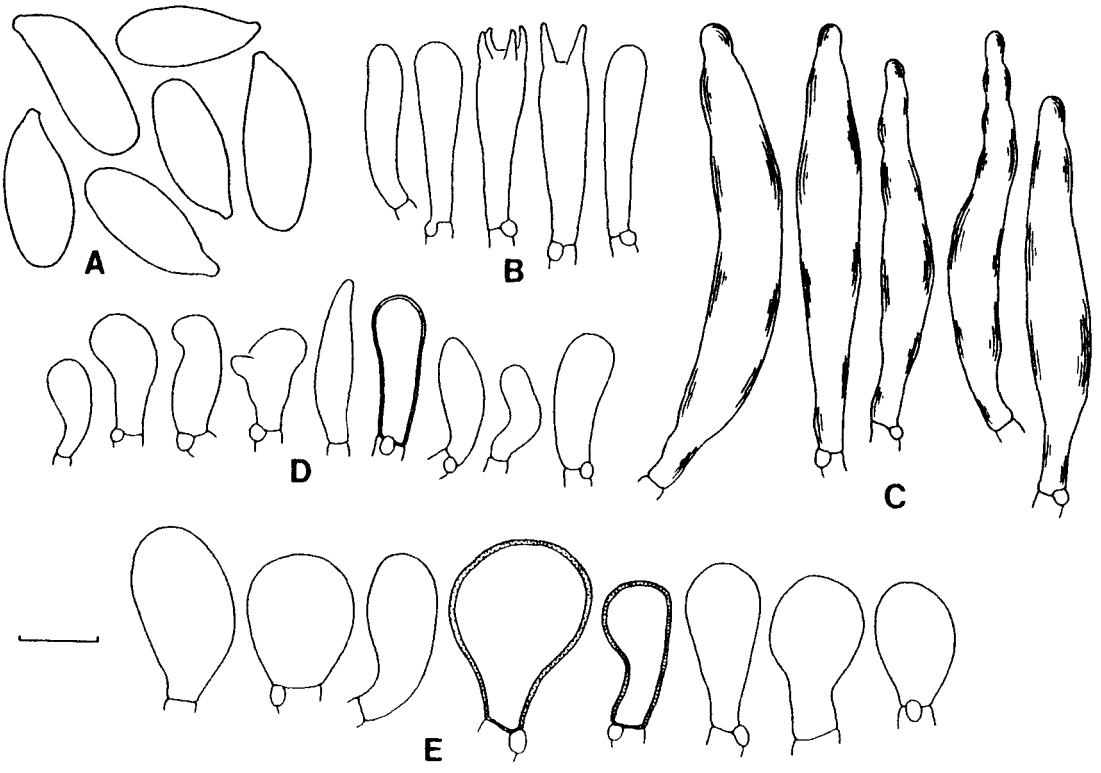



**Figure 14 A-E.** Features of *Marasmius cystidiosus* (Desjardin no. 4594). A. Basidiospores. B. Basidia and basidioles. C. Pleurocystidia. D. Cheilocystidia. E. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-E.

lamellar trama and projecting well beyond the basidioles, refractive, hyaline or very pale yellow, inamyloid, thin-walled. **Cheilocystidia** (Fig. 14 D) numerous, 12-24(-29) X 4-6.5(-10) µm, cylindric, clavate or broadly clavate, sometimes fusoid or ventricose-acuminate, erect or recurved from repent hyphae, non-refractive, hyaline, inamyloid, thin-walled or with walls up to 0.5 µm thick. **Pileipellis** hymeniform, not mottled, composed of cylindric, clavate, broadly clavate, vesiculose or sphaeropedunculate cells (Fig. 14 E), 12-36 X 7-18 µm, non-gelatinous; cells from disc region ochraceous or brownish orange with walls up to 1 µm thick; cells from marginal region hyaline, pale yellow or

ochraceous, thin-walled or with walls up to 0.5 µm thick; all cells smooth, inamyloid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 4-16(-20) µm diam, cylindric or inflated, non-gelatinous, thin-walled, hyaline, strongly dextrinoid. **Stipe tissue** monomitic; **cortical hyphae** 3-13 µm diam, parallel or subparallel, cylindric, smooth, hyaline (stipe apex), ochraceous or brownish orange (stipe base), strongly dextrinoid, thin-walled or with walls up to 1.5 µm thick; **medullary hyphae** inflated up to 23 µm diam, hyaline, otherwise similar to cortical hyphae; medulla with scattered refractive oleiferous hyphae. **Stipe vesture** absent. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Solitary, gregarious or cespitose, on leafy debris or much-decayed wood in mixed forest. June - September. Uncommon. Michigan, Minnesota, New York, North Carolina, Tennessee.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** Diagnostic features of *M. cystidiosus* include: a) large, collybioid basidiomata; b) rugose, pitted pilei colored light brown or ochraceous-tawny on the disc, and pinkish buff or cream on the margin; c) close, broad, pruinose lamellae; d) glabrous, subtranslucent, polished, non-striate stipe; e) hymeniform pileipellis of *Globulares*-type elements; f) strongly dextrinoid tramal hyphae; g) refractive hymenial cystidia; and h) absence of caulocystidia. Although the species has been collected numerous times at the type locality, it is known from Minnesota, Michigan and New York only by

single specimens. The specimen collected in New York was included as part of the holotype assemblage of *Collybia strictipes* Peck.

As mentioned above, *M. cystidiosus* is closely allied with *M. nigrodiscus* (Pk.) Halling. Refer to the commentary on the latter species for comparison.

Smith (1979) recently described *Marasmius leighii* Smith, which he considered close to yet distinct from *M. cystidiosus*. Smith separated the two taxa based on habit, habitat and taste. *Marasmius leighii* was described as forming mild tasting, fasciate basidiomata on decaying hardwood, whereas *M. cystidiosus* was described as forming bitter-tasting basidiomata that fruited solitarily on leafy humus. With the availability of additional topotypical material of *M. cystidiosus*, the criteria utilized by Smith (1979) to separate the two taxa are no longer tenable. One topotype specimen (TENN no. 14266) contains fasciate basidiomata arising from leafy humus, while another topotype specimen (TENN no. 16349) contains solitary basidiomata attached to woody debris. Likewise, several specimens with solitary and fasciate basidiomata (TENN nos. 20893, 21413) were reported by Hesler (personal notes) as tasting mild or acidulous. The latter specimens are illustrative of the wide range of habit, habitat and taste displayed by *M. cystidiosus* at the type locality and suggest that these features are not taxonomically significant. The holotype specimens of *M. cystidiosus* and *M. leighii* (both MICH!) are microscopically indistinguishable. Based on these observations, I consider *M. leighii* a synonym of *M. cystidiosus*.

The protologue of *M. nuptialis* Morgan (1905), a species described from material collected in the Miami Valley of Ohio, matches quite closely the protologue of *M. leighii*. Both taxa share the fasciate habit on rotten wood, subumbonate pileus with wrinkled or pitted surface, crowded or close lamellae, glabrous stipe with white basal mycelium, basidiomata coloration and spore size (*fide* Morgan, 1905). Unfortunately, no material determined by Morgan as *M. nuptialis* exists in the Morgan Herbarium at ISC, nor in any other major North American herbaria. It is quite possible that the material Morgan had in hand at the time he published *M. nuptialis* was conspecific with material currently determined as *M. cystidiosus*. Until specimens matching the protologue of *M. nuptialis* are collected in the Miami Valley of Ohio and designated neotype, the epithet will remain a *nomen incertae sedis*. If material conspecific with *M. cystidiosus* is selected, the epithet *M. nuptialis* would have priority.

Hymenial cystidia of *M. cystidiosus* have been described as thick-walled (Smith & Hesler, 1940; Smith, 1979) or thin-walled (Gilliam, 1976; Halling, 1983b). Halling (1983b) presented an excellent discussion of the various interpretations, and concluded that hymenial cystidia in the species are thin-walled. I fully concur with Halling's diagnosis.

An examination of the mating system functioning in *M. cystidiosus* indicates that the species is probably amphithallic, *i.e.*, bipolar heterothallic as well as secondarily homothallic. Several single spore isolates developed directly into hyphae with clamp connections. Providing no error was made in isolating these spores, it is probable

that the spores were discharged from bisporic basidia which are common in the basidiomata from which the spores were obtained. Crosses between monokaryotic (*i.e.*, non-clamped) single spore isolates indicated that the specimen examined (Desjardin no. 4594) was bipolar.

**15. *MARASMIUS OREADES*** (Bolt.: Fr.) Fries, Epicr. Syst. Mycol. 375. 1838.

≡ *Agaricus oreades* Bolton: Fries, Syst. Mycol. 1: 127. 1821.

[*Agaricus oreades* Bolton, Hist. Fung. Halifax 3: 151. 1789.]

≡ *Collybia oreades* (Bolt.: Fr.) Kummer, Führer Pilzk. 116. 1871.

≡ *Scorteus oreades* (Bolt.: Fr.) Earle, Bull. New York Bot. Gard. 5: 415. 1909.

= *Agaricus caryophylleus* Schaeffer, Fung. Bavar. Palat. Nasc. 4: 38. 1774.

≡ *Marasmius caryophylleus* (Schaeffer) Schröter *in* Cohn, Krypt. Fl. Schlesien 3A: 561. 1889.

**TYPE SPECIMEN:** None located.

**Basidiomata** pliant, marcescent or slightly putrescent. **Pileus** 15-45 mm diam, at first campanulate, obtusely conic or convex, expanding in age to broadly convex or plano-convex with a broad, low umbo; margin at first even and incurved, in age remaining even or becoming slightly short pellucid-striate, then crenulate or wavy and uplifted, rarely cleft; surface dull when dry, shiny when moist, subhygrophanous, even or slightly rugulose in age; coloration brown (6E5-7) overall when young, disc remaining so in age or fading to light brown (6D4-5), margin soon fading to light brown, pale greyish brown

(6C3), tan, pale orange white (5A2), pale yellowish white (4A2) or buff, very rarely becoming buff-colored overall; context soft, 2-4 mm thick, white or buff. **Lamellae** adnexed, seceding in age, close or subdistant (20-35 complete lamellae), broad (3-7 mm), rarely intervenose and/or forked; yellowish white (4A2) at first, remaining so or becoming orange white (5A2) in age, non-marginate; **lamellulae** in 1-3(-5) series. **Stipe** 15-70 X 2-5 mm, terete or slightly compressed, equal or ventricose, often with a short pseudorhiza, solid or stuffed; surface dull, dry, even or striate, sometimes twisted; apex pruinose or pubescent, colored buff or yellowish white (4A2); central portion downy, furfuraceous or felty, colored yellowish white or pale orange white (5A2); base tomentose, colored dingy greyish orange (5B3) or rarely pale ochraceous or light reddish brown, with white or buff tomentum. **Odor** of cyanic acid or chlorine, mild or strong. **Taste** mild or not distinctive.

**Basidiospores** (Fig. 15 A) (6.4-)7.2-9.6(-10.4) X 4-6 µm [$\bar{\bar{x}}$ = 8.3 ± 0.3 X 5.0 ± 0.2 µm, E = 1.2-2.1, $\bar{Q}$ = 1.7 ± 0.07; TL90(90%): $\bar{x}$ = 7.8-8.8 X 4.6-5.4 µm, Q = 1.6-1.8; n = 20-30 spores per 10 specimens], ellipsoid, ovoid or lacrymoid, sometimes with an abaxial bulge, hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 15 B) 28-35 X 4.5-8 µm, clavate, 4-spored. **Basidioles** (Fig. 15 B) cylindric or subclavate. **Pleurocystidia** absent. **Cheilocystidia** typically absent, lamellar edge rarely with a few contorted, flexuous, lobed subhymenial hyphae intercalated between basidiomorphous elements. **Pileipellis** hymeniform, not mottled, composed of cylindric, clavate, broadly clavate, sphaeropedunculate or irregular cells (Fig. 15 C), 12-20 X

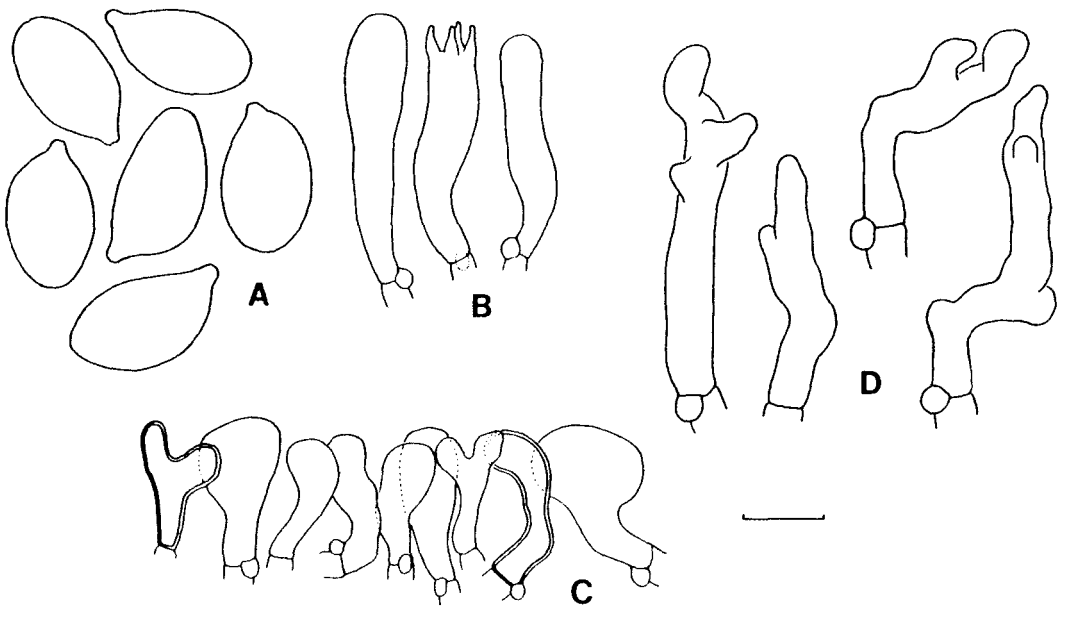



**Figure 15 A-D.** Features of *Marasmius oreades* (Massee, 1899). A. Basidiospores. B. Basidium and basidioles. C. Pileipellis elements. D. Caulocystidia. Standard bar = 5 µm for A; 10 µm for B-D.

4-12(-14.5) µm, sometimes lobed, non-diverticulate and non-setulose, non-gelatinous, thin-walled or rarely with walls up to 0.8 µm thick, hyaline or pale yellow, dextrinoid; elements becoming dispersed at maturity and pileipellis appearing subhymeniform. **Pileus trama** intricately interwoven; **lamellar trama** regular; hyphae 4-8(-16) µm diam, frequently-branched, cylindric or irregular in outline, smooth, non-gelatinous, thin-walled or firm-walled (up to 0.5 µm thick), hyaline, strongly dextrinoid. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** undifferentiated, 4-10 µm diam, subparallel, cylindric, smooth, hyaline, strongly dextrinoid, thin-walled or firm-walled. **Stipe vesture** a layer up to 200 µm thick composed of loosely interwoven hyphae, 4-8 µm diam, with suberect or erect terminal cells

(caulocystidia); **caulocystidia** (Fig. 15 D) 24-50 X 4-7(-10) µm, irregularly cylindric or strangulate, often lobed or with broad, obtuse outgrowths, hyaline, dextrinoid, thin-walled. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Scattered, gregarious or subcespitose, often growing in "fairy rings" in lawns, open meadows or grassy woods. May - October. Infrequently collected in the southern Appalachian Mts. Cosmopolitan.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** *Marasmius oreades*, commonly called the fairy ring mushroom, is one of the more widely distributed species in the genus, reported from every continent except Antarctica. It is primarily a temperate species, but it has been introduced into subtropical regions. The species usually grows associated with grasses in lawns or open meadows, although Gilliam (1976) reported several specimens collected in spruce forests. *Marasmius oreades* is easily recognized by the following features: a) broadly umbonate, even, glabrous, pale brown or tan pileus; b) subdistant, broad, yellowish white lamellae; c) non-insititious, pubescent or felty, buff-colored or yellowish white stipe; and d) odor of chlorine or cyanic acid. Furthermore, moderately long and broad spores ($\bar{Q}$ = 1.7), irregularly cylindric or strangulate caulocystidia, and absence of hymenial cystidia distinguish *M. oreades* from similar taxa. North American specimens of *M. oreades* are identical in all respects to specimens collected in Europe, and concordant with the Friesian concept of the species. Refer to Chapter VIII for a description of representative European material.

*Marasmius oreades* may be confused with another member of sect. *Globulares* that lacks hymenial cystidia, *viz., M. albogriseus* (Pk.) Singer. The latter species differs, however, in forming pellucid-striate, greyish brown pilei, greyish stipe, broadly clavate or sphaeropedunculate caulocystidia, smaller spores ($\bar{x}$ = 7.3 X 4.1 µm), and typically grows in soil or among wood chips in disturbed areas.

The mating system of *M. oreades* has been determined by several workers to be unifactorial (bipolar) (Burnett & Evans, 1966; Mallett & Harrison, 1988).

Photographs or watercolor illustrations of North American material of *M. oreades* have been published by numerous workers. Selected examples include: Murrill, 1910; Smith, 1938b, 1949, 1975; Miller, 1972; Lincoff, 1981; Arora, 1986.

**16. *MARASMIUS ALBOGRISEOIDES*** Desjardin nom. prov.

**Basidiomata** marcescent. **Pileus** 11-25 mm diam, convex when young, expanding in age to plano-convex, often with a broad, low umbo; surface dull, dry, opaque, glabrous; disc even at first, colored brownish grey (6C2), becoming rugulose in age and darkening to greyish brown (7D-E3) or slightly paler; margin even at first, colored greyish buff, becoming short-striate in age and remaining greyish buff or fading to buff; when dried *in situ* colored pale brownish grey overall (6C2) or with a slightly darker disc; context thick, white. **Lamellae** adnexed, subdistant, broad, not forked, not intervenose or rarely weakly intervenose nearest the margin in age; buff or pale yellowish white (4A2), drying dark greyish brown, non-marginate; **lamellulae** in

2-3 series. **Stipe** 20-45 X 2-5 mm, terete, equal or with a slightly enlarged base, fibrous-cartilaginous, hollow, sometimes twisted, often curved, non-insititious, arising from an extensive mat of white or yellowish white mycelium; upper 2/3 pruinose, buff or greyish buff (concolorous with the pileus margin), lower 1/3 pubescent or tomentose, greyish brown (7D3) or dark greyish brown (7E-F3), drying darker overall. **Odor** mild or faintly raphanoid. **Taste** mild.

**Basidiospores** (Fig. 16 A) 5.6-7.2 X 3.2-4 µm [$\bar{x}$ = 6.5 ± 0.5 X 3.6 ± 0.3 µm, E = 1.7-2.0, Q = 1.8 ± 0.1, n = 31], ellipsoid or lacrymoid, inequilateral in profile, hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 16 B) 20-32 X 5.5-7 µm, 4-spored, clavate. **Basidioles** (Fig. 16 B) cylindric or subclavate. **Pleurocystidia** absent. **Cheilocystidia** (Fig. 16 C) scattered, common on some lamellae, absent on others, 16-28 X 7-10 µm, clavate, broadly clavate or seldom sphaeropedunculate, sometimes irregular in outline, thin-walled, hyaline, inamyloid. **Pileipellis** hymeniform, not mottled, composed of cylindric, clavate, broadly clavate or subvesiculose cells (Fig. 16 D), 16-36 X (6.5-)8-16(-24) µm, non-gelatinous, smooth, thin-walled, hyaline or pale greyish yellow, dextrinoid. **Pileus** and **lamellar trama** interwoven; hyphae 3-12(-16) µm diam, frequently-branched, cylindric or inflated, smooth, thin-walled or firm-walled (up to 0.5 µm thick), hyaline, dextrinoid. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** undifferentiated, 3-12 µm diam, parallel or subparallel, cylindric or slightly inflated, hyaline or pale greyish yellow, dextrinoid, thin-walled or firm-walled. **Stipe vesture** of numerous, scattered or clustered **caulocystidia** (Fig. 16 E) 16-28 X 7-10 µm,

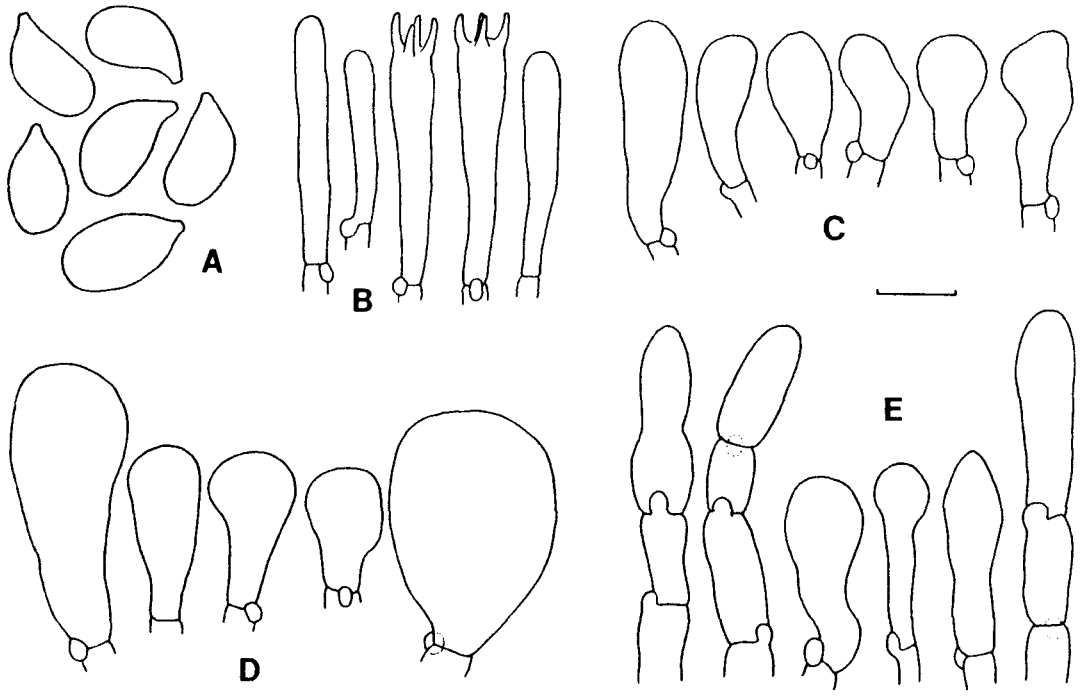



**Figure 16 A-E.** Features of *Marasmius albogriseoides* (Desjardin no. 4147). A. Basidiospores. B. Basidia and basidioles. C. Cheilocystidia. D. Pileipellis elements. E. Caulocystidia. Standard bar = 5 µm for A; 10 µm for B-E.

similar to the cheilocystidia but often in erect chains of 2-3 cells, cylindric, clavate, ventricose or irregular in outline, thin-walled, hyaline, weakly dextrinoid. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Gregarious or subcespitose on leaf mulch of oaks and various other hardwoods in mixed woods. September. Known from a single collection. Tennessee.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** *Marasmius albogriseoides* is a provisionally named taxon, known at present from a single specimen collected in Knox County, Tennessee. The epithet signifies the phenetic similarity of this taxon to *M. albogriseus* (Pk.) Singer. Both taxa form small

basidiomata with greyish brown, non-sulcate pilei, pallid, subdistant, non-intervenose lamellae, greyish brown stipes, small spores, and lack pleurocystidia. *Marasmius albogriseus* differs in forming convex pilei (not distinctly umbonate) with pellucid-striate margins, has an odor similar to *M. oreades* (*i.e.*, of cyanic acid), and lacks cheilocystidia. In comparison, *M. albogriseoides* forms umbonate pilei with opaque margins, has a slightly raphanoid odor, and forms distinct cheilocystidia.

*Marasmius albogriseoides* is also similar to *M. cohortalis* var. *alachuanus* (Murr.) Singer, described from Florida. The latter taxon differs in forming strongly reticulate-sulcate pilei with depressed disc, strongly intervenose lamellae, castaneous or tawny-russet stipe, and has an odor faintly of crabs or anise (*fide* Singer, 1976). The micromorphology of var. *alachuanus* is nearly indistinguishable from that of *M. albogriseoides*. Refer to Chapter VIII for a type study of *M. alachuanus* Murr. (basionym of *M. cohortalis* var. *alachuanus*).

*Marasmius albogriseoides* is similar in many respects to *M. wynnei* Berk. & Br. [= *M. globularis* Quél.], a species common in beech woods in Europe. The binomial *M. albogriseoides* will not be proposed formally until additional specimens are collected and compared with the holotype specimen of *M. wynnei*.

**17. *MARASMIUS STRICTIPES*** (Pk.) Singer, Ann. Mycol. 41: 130. 1943.

≡ *Collybia strictipes* Peck, Annual Rep. New York State Mus. 41: 62. 1887 (1888).

≡ *Gymnopus strictipes* (Pk.) Murrill, N. Amer. Fl. 9(5): 357. 1916.

**LECTOTYPE:** United States, New York, Catskill Mts., Sept., C. H. Peck (NYS!).

**Basidiomata** marcescent or slightly putrescent. **Pileus** 17-50 mm diam, convex when young, expanding to plano-convex in age, with or without a low umbo, seldom with uplifted margin, even or rarely radially-wrinkled, smooth or rarely subrugulose; surface dull or shiny, dry or moist, lubricous or waxy, subhygrophanous, glabrous; disc colored yellow (4A4), yellowish orange (4-5A5-6), orange (6B5-8) or brownish orange (6C6-8) when young, remaining so in age or often fading slightly and with scattered patches of brownish orange or orange; margin at first concolorous with or slightly paler than the disc, fading in age to greyish orange (5B5-6), light yellow (4A4), cream (4A3) or yellowish white (4A2), sometimes with scattered orange patches; context up to 3 mm thick, white or yellowish white. **Lamellae** adnexed, close or crowded, narrow (1-2 mm), thin, not forked nor intervenose; white or pale yellowish white (4A2), non-marginate; **lamellulae** in 4-5 series. **Stipe** 30-70 X 3.5-7 mm, terete, equal or with a slightly enlarged base, hollow, dull, pruinose overall, appearing somewhat canescent at first, glabrescent, non-insititious, arising from copious white or yellowish white basal mycelium; white overall when young, often becoming yellowish white in age. **Odor** mild or fragrant (somewhat like *Collybia dryophila*). **Taste** mild.

**Basidiospores** (Fig. 17 A) (6.8-)7.2-10(-10.6) X 3.2-4(-4.4) µm [$\bar{\bar{x}}$ = 8.3 ± 0.3 X 3.7 ± 0.1 µm, E = 1.8-2.7, $\bar{Q}$ = 2.2 ± 0.07; TL90(90%): $\bar{x}$ = 7.7-8.9 X 3.5-3.9 µm, Q = 2.1-2.3; n = 20-40 spores per 10 specimens], ellipsoid or elongate-lacrymoid, seldom ovoid,

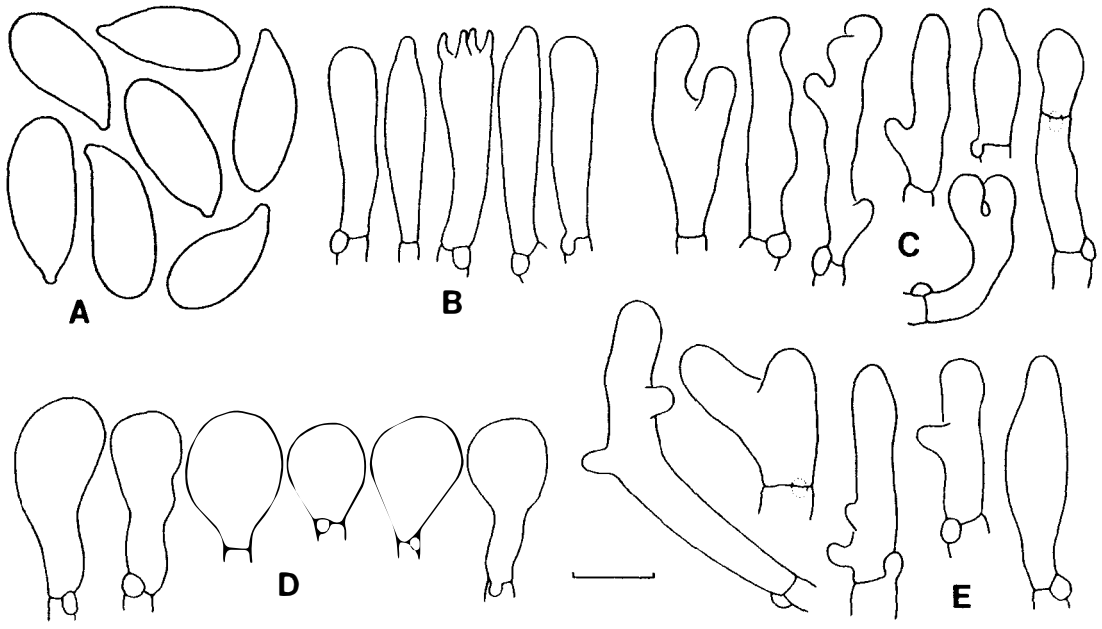



**Figure 17 A-E.** Features of *Marasmius strictipes* (Desjardin no. 4439). A. Basidiospores. B. Basidium and basidioles. C. Cheilocystidia. D. Pileipellis elements. E. Caulocystidia. Standard bar = 5 µm for A; 10 µm for B-E.

inequilateral in profile, hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 17 B) 20-28 X 5.5-8 µm, 4-spored, clavate. **Basidioles** (Fig. 17 B) subclavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** (Fig. 17 C) numerous, lamellar edge sterile; elements 14.5-34 X (3-)4.5-10 µm, versiform, cylindric, clavate, ventricose, often bifid or variously lobed, broadly obtuse, non-refractive, thin-walled, hyaline, inamyloid. **Pileipellis** hymeniform, not mottled, composed of cylindric, clavate, vesiculose or sphaeropedunculate elements (Fig. 17 D), 12-25 X 5-17.5 µm, non-gelatinous, smooth, hyaline or pale yellow, dextrinoid, thin-walled or with walls up to 1 µm thick. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-8(-12.5) µm diam, cylindric or inflated, smooth, non-gelatinous,

hyaline, strongly dextrinoid, thin-walled. **Stipe tissue** monomitic; **cortical hyphae** 4-8 µm diam, parallel, cylindric, smooth, hyaline or pale yellow, strongly dextrinoid, with walls up to 1 µm thick; **medullary hyphae** 3-12(-18) µm diam, thin-walled, otherwise similar to cortical hyphae; medulla with scattered, refractive oleiferous hyphae. **Stipe vesture** of numerous, often clustered, suberect or erect **caulocystidia** (Fig. 17 E) 20-50(-80) X 5-8(-10) µm, cylindric, clavate or irregular in outline, often lobed or with few knob-like or broad rod-like outgrowths, sometimes in short chains of 2 or 3 cells, thin-walled or slightly firm-walled (<0.5 µm thick), hyaline, inamyloid or dextrinoid. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Solitary, scattered or gregarious on leaf mulch of various hardwoods, often oak; in deciduous woods with scattered pines and/or hemlock. May - November; most commonly collected in August and September in the southern Appalachian Mts. Common throughout eastern North America; also reported from Mexico (Singer, 1958c).

**Specimens Examined.** Refer to Appendix A.

**Commentary.** As noted in Chapter VIII, the type specimen is a mixed collection. Five basidiomata match the protologue and are designated the lectotype; one basidiome is *M. cystidiosus*; six basidiomata represent an undetermined species belonging in *Collybia* sect. *Subfumosae*. *Marasmius strictipes* is characterized by: a) collybioid stature; b) convex, glabrous, even pilei colored yellowish or orange on the disc and pale yellow on the margin; c) crowded, narrow lamellae; d) pruinose, white or pale yellow, non-insititious

stipe with copious basal mycelium; and e) habit on leaf mulch of deciduous trees. In addition, cheilocystidial and caulocystidial morphologies are distinctive.

Coker and Beardslee (1921) reported numerous specimens from North Carolina as *Collybia nummularia* Fr. [correctly cited (Bull.) Gillet]. Re-examination of these specimens indicated that they were all conspecific with the lectotype specimen of *C. strictipes*. As noted by Coker and Beardslee, *M. strictipes* is a common species in North Carolina, as well as throughout the southern Appalachians.

In the southern Appalachians, *M. strictipes* is macromorphologically similar to *Collybia subsulphurea* Pk. The two species are easily separated in the laboratory by pileipellis morphology, tramal tissue chemistry and spore size. In *C. subsulphurea*, the pileipellis is a non-hymeniform layer of frequently-branched, interwoven hyphae (a *Dryophila*-type cuticle), tramal tissues are inamyloid, and spores measure 5.5-6.5 X 2.5-3.5 µm (*fide* Vilgalys & Miller, 1983).

Kauffman (1920) reported the development of basidiomata of *M. strictipes* in the laboratory from leaf mulch containing copious white mycelium. A mass of moldy, partially decayed leaves was placed in a glass dish 8.5" in diam by 4.5" deep, watered, partially covered, and kept in the dark at 15°-18° C. After three months, three basidiomata developed fully and shed spores. As far as I can discern, this experiment has not been replicated.

For additional contemporary descriptions of *M. strictipes* refer to Bigelow and Barr (1963), Singer (1958c, 1976), Gilliam (1976) and Lincoff (1981). A color photograph was published by Lincoff (1981).

***MARASMIUS*** sect. ***ALLIACEI*** Kühner, Botaniste 25: 87. 1933 [*ut Alliateae*].

= [subgen.] *Mycena* [sect.] *Longipedes* Morgan, J. Mycol. 11: 237. 1905.

= sect. *Chordales* Fries *sensu* Gilliam, Contr. Univ. Michigan Herb. 11: 26. 1975 [T: *Marasmius chordalis* Fr.]; *non Marasmius* sect. *Chordales sensu* Singer, Agaricales Mod. Tax. 323. 1949 (1951) [= *Xeromphalina* Kühner & Maire].

≡ [subgen.] *Chordales* (Fr.) Patouillard, Essai Tax. Hyménomyc. 145. 1900.

TYPE SPECIES [implied, Kühner (1933)]: *Agaricus alliaceus* Jacquin: Fries, Syst. Mycol. 1: 140. 1821.

Pileus small or medium-sized, convex, smooth or rugulose, even or striate, glabrous, variously colored; context thin, membranous. Lamellae well-developed, non-collariate, adnate or adnexed, distant to close, narrow or moderately broad, pallid, non-marginate. Stipe central, narrow, tough, hollow, glabrous to pubescent, non-insititious, usually darkly pigmented. Rhizomorphs absent. Odor and taste not distinctive or often alliaceous. Spores ellipsoid to clavate. Pleurocystidia present or absent. Cheilocystidia usually present. Pileipellis a hymeniform layer of non-diverticulate, non-setulose cells ranging from cylindric or clavate, to vesiculose or sphaeropedunculate (*i.e.*, *Globulares*-type elements). Tramal hyphae inamyloid. Stipe tissue monomitic, inamyloid. Stipe vesture present or absent. Clamp connections present.

**18. *MARASMIUS PYRRHOCEPHALUS*** Berkeley, London J. Bot. 6: 316. 1847.

= *Marasmius macrorrhizus* Montagne, Syll. Gen. Sp. Crypt. 142. 1856.

= *Marasmius longipes* Peck, Bull. Buffalo Soc. Nat. Sci. 1: 58. 1873; *non Marasmius longipes* Montagne, Ann. Nat. Sci. Bot. IV, 1: 114. 1854.

≡ *Marasmius elongatipes* Peck *nom. nov.*, Bull. Buffalo Soc. Nat. Sci. 4: 181. 1882.

= *Marasmius hirtipes* Clements, Bot. Surv. Nebraska 4: 21. 1896; *non Marasmius hirtipes* Spegazzini, Anales Mus. Nac. Hist. Nat. Buenos Aires 6: 112. 1898.

= *Marasmius morganianus* Sumstine, Mycologia 6: 35. 1914.

**HOLOTYPE:** United States, Ohio, Wayne Co., Waynesville, 23 Aug. 1844, T. G. Lea (K!).

**Basidiomata** marcescent. **Pileus** 5-20 mm diam, convex when young, expanding to plano-convex in age, sometimes with a shallow central depression; disc even or subrugulose; margin at first even, soon striate or rugulose-striate, in age sometimes crenulate, rarely uplifted; surface dull or subshiny, moist or dry, opaque, glabrous; when young colored cream (4A3), yellow (4A4-5) or brownish yellow (5B-C6-7) overall, disc region darkening in age to brownish orange (6C5-8), light brown (6D5-6) or with irregular patches of brown (7D-E5-7), margin remaining cream, yellow or brownish yellow, or becoming greyish orange (5B4-5) or light orange (5A4) in age; context thin, buff or yellowish white (4A2). **Lamellae** adnate or adnexed, close, narrow or moderately broad (1-2 mm), thin, not forked nor intervenose; white or buff when young, becoming yellowish white (4A2) or cream (4A3-4) in

age, sometimes spotted pale brown, non-marginate; **lamellulae** in 2-3 series. **Stipe** 20-170 X 1-2 mm, terete, equal above substrate, typically radicating below substrate level, straight or curved, tough, pliant, dull, apex densely pruinose, pubescent or subvelutinous, base and radicating portion tomentose; coloration white or buff overall at first, upper portion remaining so in age, base becoming yellowish brown (5D-E5-8), greyish brown (6E2-4), brown (6-7E5-8), dark yellowish brown (6F5-8) or dark brown (6-7F4-8), sometimes darkly pigmented overall in age, surface hairs concolorous with underlying tissue; basal mycelium buff, yellowish white or cream-colored. **Odor and taste** not distinctive.

**Basidiospores** (Fig. 18 A) 6.8-10.4 X 3.4-4.8 µm [$\bar{\bar{x}}$ = 8.3 ± 0.3 X 4.0 ± 0.1 µm, E = 1.6-2.9, $\bar{Q}$ = 2.1 ± 0.1; TL90(90%): $\bar{x}$ = 7.7-8.9 X 3.8-4.2 µm, Q = 1.9-2.3; n = 20-30 spores per 10 specimens], subcylindric, ellipsoid or elongate-ellipsoid, inequilateral in profile, hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 18 B) 15-29 X 5-7.5 µm, 4-spored, clavate. **Basidioles** (Fig. 18 B) cylindric or subclavate. **Hymenial cystidia** (Fig. 18 C) numerous on lamellar edges, numerous or uncommon on lamellar sides, 28-60 X 6.5-10 µm [$\bar{W}$ = 7-8 µm], capitulate, fusoid, ventricose or lageniform, typically capitate, rarely non-capitate, arising from the subhymenium and projecting well beyond the basidioles, often capped with a golden or yellow, refractive, resinous exudate or internal globule, sometimes with tawny contents, hyaline elsewhere, inamyloid, thin-walled or firm-walled (up to 0.5 µm thick). **Pileipellis** hymeniform, not mottled, composed of cylindric, clavate, turbinate, subvesiculose or

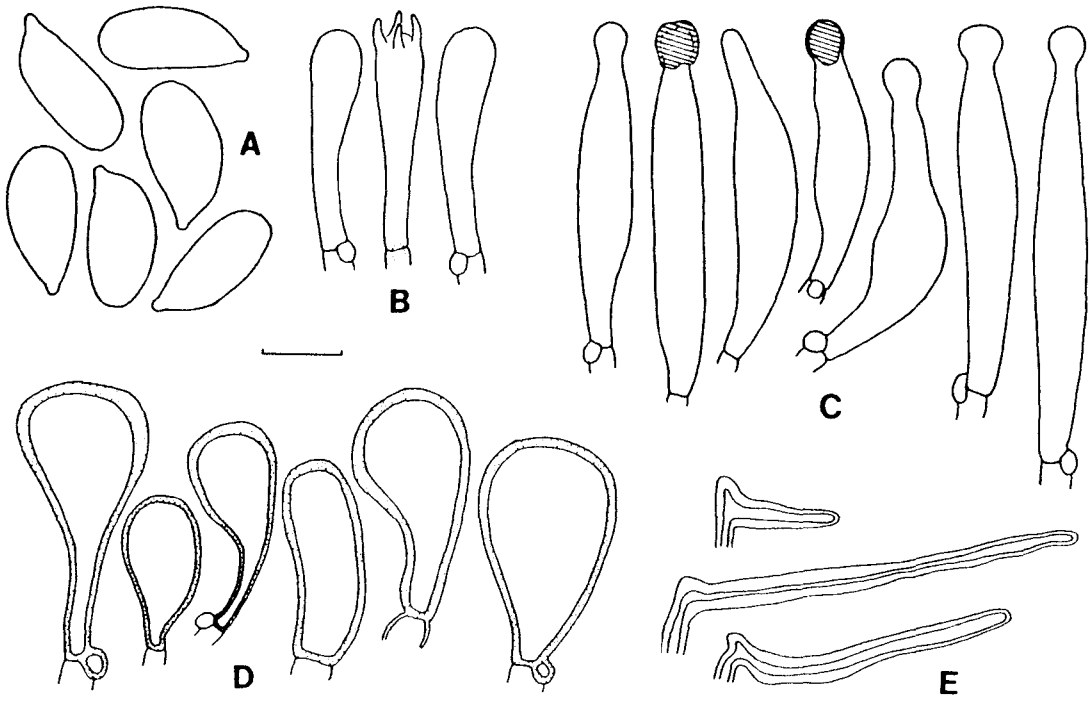



**Figure 18 A-E.** Features of *Marasmius pyrrhocephalus* (Desjardin no. 4467) A. Basidiospores. B. Basidium and basidioles. C. Hymenial cystidia. D. Pileipellis elements. E. Caulocystidia. Standard bar = 5 µm for A; 10 µm for B-D; 20 µm for E.

sphaeropedunculate cells (Fig. 18 D), 16-32 X 8-20(-24) µm, broadly obtuse, non-gelatinous, yellow or ochraceous, inamyloid; walls 0.5-2 µm thick, smooth. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-6(-9) µm diam, frequently-branched, non-gelatinous, cylindric, smooth, hyaline, inamyloid, thin-walled or firm-walled. **Stipe tissue** monomitic; **cortical hyphae** 2.5-6.5 µm diam, parallel, cylindric, smooth, yellow, ochraceous or brown, inamyloid, with walls up to 3 µm thick (some cells with lumen nearly occluded); **medullary hyphae** 2.5-8(-12) µm diam, subparallel, hyaline, inamyloid, with walls up to 1.5 µm thick. **Stipe vesture** of numerous suberect or erect

**caulocystidia** (Fig. 18 E) 40-200 X 6.5-12 µm, cylindric or acuminate, obtuse or subacute, rarely lobed, hyaline, yellow or ochraceous, inamyloid; walls up to 5 µm thick, thinning towards cell apex, some cells with lumen nearly occluded, few cells with tawny, globular, resinous contents. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Solitary, scattered or gregarious in hardwood leaf mulch, often on much decayed wood (often oak), in deciduous woods or mixed forests. May - November. Common throughout eastern North America.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** Basidiomata of *M. pyrrhocephalus* are characterized by: a) convex, rugulose-striate, yellowish or brownish orange pilei; b) close, pallid lamellae; c) pubescent, yellowish brown or greyish brown, radicating stipe; and d) habit on decayed, often buried hardwood logs. In addition, pileipellis morphology, inamyloid and clamped tramal tissues, capitate hymenial cystidia, spore size and very thick-walled caulocystidia are distinctive. Gilliam (1975b) indicated that the species was one of the first agarics to appear in the spring in oak-hickory woods around Ann Arbor, Michigan, and one of the last to cease fruiting in the fall. This same pattern holds true for *M. pyrrhocephalus* in the southern Appalachian Mountains.

*Marasmius pyrrhocephalus* is superficially similar to members of *Strobilurus* Sing., a genus characterized by basidiomata with pubescent, radicating stipes, hymeniform pileipelli, inamyloid tramal tissues and capitate hymenial cystidia. *Strobilurus* differs, however, in forming

pilocystidia, in lacking clamp connections in all tissues, and in forming spores typically less than 7 µm long.

Arnold (1935) reported that *M. pyrrhocephalus* (*ut Marasmius elongatipes* Pk.) was tetrapolar (bifactorial) heterothallic. These data were based on mating studies within and between three specimens collected in the vicinity of Ann Arbor, Michigan. It is interesting that crosses between tester strains of all three collections were "completely fertile" (Arnold, 1935), suggesting a multiple allele system.

**19. *MARASMIUS SCORODONIUS*** (Fr.) Fries, Epicr. Syst. Mycol. 379. 1838.

≡ *Agaricus scorodonius* Fries, Syst. Mycol. 1: 130. 1821.

[*Agaricus scorodonius* Fries, Observ. Mycol. 1: 29. 1815.]

= *Agaricus calopus* Persoon: Fries, Syst. Mycol. 1: 130. 1821.

[*Agaricus calopus* Persoon, Syn. Meth. Fung. 373. 1801 [*ut A. callopus*].

≡ *Marasmius calopus* (Pers.: Fr.) Fries, Epicr. Syst. Mycol. 379. 1838.

≡ *Marasmius scorodonius* var. *calopus* (Pers.: Fr.) Kauffman, Agar. Michigan 1: 72. 1918.

= *Marasmius alliatus* (Schaeff.) Schröter *in* Cohn, Krypt. Fl. Schlesien 3A: 559. 1889.

[*Agaricus alliatus* Schaeffer, Fung. Bavaria 4: 43. 1774.]

**TYPE SPECIMEN:** None located.

**Basidiomata** marcescent, reviving. **Pileus** 4-25 mm diam, convex at first, expanding to plano-convex or plane in age, sometimes with a shallow central depression, rarely with a low umbo; disc even; margin

at first incurved or decurved, even or striatulate, in age becoming reflexed or uplifted, wavy, short-striate or short-rugulose-striate; surface dull, dry, opaque, glabrous; coloration when young greyish orange (6B3), brownish orange (5C4-5), brownish grey (6C3-4), light brown (6-7D4-5), brown (7E4-8) or reddish brown (8E5-7) overall, in age disc often remaining darkly pigmented or fading slightly, margin fading in age to brownish grey (6C3-4), greyish orange (6B2-3), orange white (5A2), or buff, sometimes fading overall to cream or buff-colored; context thin (0.5-1.5 mm), buff or pale yellowish white. **Lamellae** adnate, sinuate or adnexed, seceding in age, close or subdistant, narrow (rarely up to 2 mm broad), sometimes forked, not or rarely slightly intervenose; buff, pale yellowish white (4A2) or pale orange white (5A2), sometimes becoming pale greyish orange (6B3) in age, rarely white, non-marginate; **lamellulae** in 2-3 series. **Stipe** 15-50(-60) X 0.5-1.5(-2.5) mm, terete or seldom compressed and cleft, equal or with a slightly flared apex, tough, hollow, dull or shiny, glabrous, subinsititious, stipe insertion with a few brownish orange fibrils; apex colored buff, greyish orange (6B3), brownish grey (6C3), brownish orange (6C4-5) or light brown (6D4); base colored brownish orange (6-7C6-8), brown (6-7E5-8), dark brown (7F5-7), reddish brown (8E5-8) or dark reddish brown (8F5-8). **Odor and taste** alliaceous.

**Basidiospores** (Fig. 19 A) 7.2-10.4 X 3.2-5(-5.6) µm [$\bar{\bar{x}}$ = 8.5 ± 0.3 X 4.1 ± 0.3 µm, E = 1.7-2.5, $\bar{Q}$ = 2.1 ± 0.1; TL90(90%): $\bar{x}$ = 7.9-9.1 X 3.5-4.7 µm, Q = 1.9-2.3; n = 20-25 spores per 10 specimens], ellipsoid or amygdaliform, slightly inequilateral in profile, hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 19 B) 22.5-30 X 5-7.5 µm,

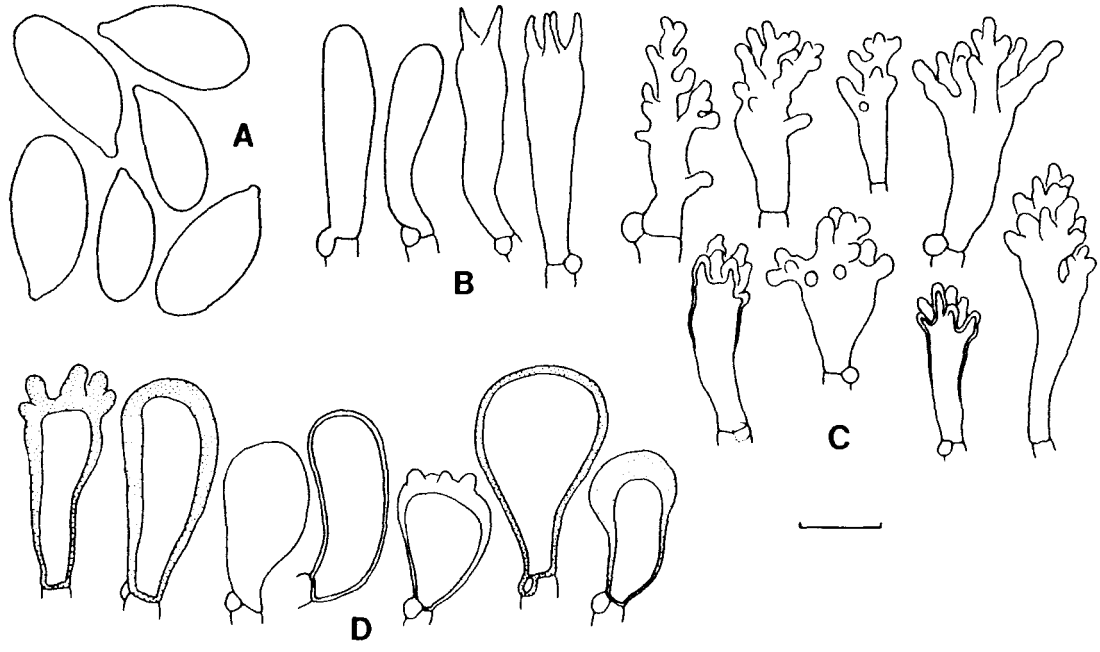



**Figure 19 A-D.** Features of *Marasmius scorodonius* (Desjardin no. 4339). A. Basidiospores. B. Basidia and basidioles. C. Cheilocystidia. D. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-D.

clavate, some basidiomata equally 2-spored and 4-spored, other basidiomata mainly 4-spored. **Basidioles** (Fig. 19 B) cylindric, fusoid or subclavate. **Pleurocystidia** absent. **Cheilocystidia** (Fig. 19 C) abundant, lamellar edge often sterile, elements apically diverticulate and irregularly lobed; main body 16-36 X 4-8.5 µm, cylindric, clavate or irregular in outline; lobes or diverticula 1.5-5.5(-7.5) X 1-3.5 µm, broadly cylindric, knob-like or irregular in outline, often nodulose, obtuse; elements hyaline, inamyloid, thin-walled or with walls up to 0.5 µm thick. **Pileipellis** hymeniform, evenly pigmented when young, mottled at maturity, composed of *Globulares*-type elements plus scattered broom-cell-type elements (Fig. 19 D); majority of cells

16-30 X 5.5-17.5(-21) µm, cylindric, broadly clavate or sphaero-pedunculate, smooth or weakly roughened, non-gelatinous, non-diverticulate or non-setulose, thin-walled or with walls up to 4 µm thick (thickest in apical portion of cell), ranging from hyaline or pale yellow, to ochraceous or brownish orange, inamyloid; *Siccus*-type elements interspersed, subhyaline, ochraceous or brownish orange, thick-walled, with few, apical setulae 2-8 X 1.5-3(-4) µm, these knob-like or irregular in outline, obtuse, sometimes nodulose, thick-walled or solid. **Pileus trama** loosely interwoven; hyphae 3-10 m diam, smooth or incrusted with granular or plaque-like, ochraceous or pale brownish orange pigment deposits, cylindric or weakly inflated, hyaline, inamyloid; **lamellar trama** regular, similar to the pileus trama but hyphae less incrusted, typically smooth. **Stipe tissue** monomitic; **cortical hyphae** 3-6.5 µm diam, parallel, cylindric, smooth, ochraceous, brownish orange or brown, inamyloid, with walls up to 2 µm thick; **medullary hyphae** 3.5-13 µm diam, similar but hyaline and thinner-walled. **Stipe vesture** absent. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Solitary, scattered or gregarious on conifer needles or twigs (*Pinus, Tsuga, Abies*), bark of dead or living hardwood trees or shrubs (*Quercus, Acer, Rhododendron, Leucothoe*), rarely leaves of deciduous trees, or rarely grass leaves; in deciduous woods, pine forests or mixed forests. May - September in the southern Appalachian Mts. Common throughout eastern North America and Europe; also reported from California (Desjardin, 1987b).

**Specimens Examined.** Refer to Appendix A.

**Commentary.** *Marasmius scorodonius* is easily recognized in the field by the following combination of features: a) convex, short-striate pileus colored brownish orange on the disc and yellowish brown or cream on the margin; b) close, non-collariate, narrow, pallid lamellae; c) glabrous, shiny, subinsititious, brownish stipe; and d) strong alliaceous odor. No other known North American taxon displays this suite of characters, and consequently, *M. scorodonius* is not likely to be confused with other species. Although no type specimen of *M. scorodonius* exists, North American material is identical to Swedish specimens determined as such by E. P. Fries (refer to Chapter VIII for a description of representative material). In addition, North American specimens match quite well the Friesian protologue (1821) and watercolor painting of *M. scorodonius* sanctioned by E. M. Fries (1862, Plate 32).

*Marasmius scorodonius* is one of the few temperate species in the genus capable of utilizing debris of both gymnospermous and angiospermous plants. In the southern Appalachian Mts., *M. scorodonius* is commonly collected on pine needles and twigs in pine forests, as well as on sticks and leaves of various hardwoods in deciduous woods. It is also one of the few species that fruits on both monocots and dicots. Although *M. scorodonius* is primarily saprophytic, basidiomata of the species have been observed occasionally growing from living plants. Indeed, Tehon (1924) reported *M. scorodonius* as parasitic on Red Wave wheat.

**20.** ***MARASMIUS COPELANDII*** var. ***OLIDUS*** (Gilliam) Desjardin, Mycologia 79: 129. 1987.

≡ *Marasmius olidus* Gilliam, Mycologia 67: 822. 1975.

**HOLOTYPE:** United States, Michigan, Oakland Co., Proud Lake, 1 Nov. 1970, leg. W. W. Patrick, Gilliam no. 997 (MICH!).

**Basidiomata** marcescent or slightly putrescent, reviving. **Pileus** 2-15(-20) mm diam, convex when young, expanding to plano-convex with a shallow central depression; disc at first even, becoming rugulose in age; margin striate or rugulose-striate, sometimes uplifted and wavy in age (*i.e.*, pileus concave); surface dull, dry, opaque, glabrous or minutely granulose; coloration light brown (6D4) overall when young, disc remaining light brown in age or fading slightly, margin becoming brownish grey (6C3), or greyish orange (5B4, 6B3), sometimes pale yellowish brown; context thin, pallid. **Lamellae** adnate, seldom slightly adnexed or subdecurrent, subdistant or distant, narrow or moderately broad (0.5-1.5 mm), thin, rarely weakly intervenose, rarely forked; pale greyish orange (<5B3), concolorous with the pileus margin at maturity; edges even or minutely crystalline-fimbriate; **lamellulae** in 1-2 series. **Stipe** 10-30(rarely -60) X 0.2-2 mm, terete, equal or with a slightly flared apex and/or subbulbous base, pliant, hollow, dull, dry, pruinose or pubescent above, tomentose-villose below, non-insititious or subinsititious; when young upper half concolorous with the lamellae, base light brown (7D4-5), in age upper few mm pallid, base greyish brown (7E3), brown (7E4-6), dark brown (7F4-6) or reddish brown 8E4-6). **Odor and taste** strongly alliaceous.

**Basidiospores** (Fig. 20 A) 10.4-17.2 X 2.8-4 µm [$\bar{\bar{x}}$ = 13.2 ± 1.3 X 3.4 ± 0.2 µm, E = 2.8-5.2, $\bar{Q}$ = 4.0 ± 0.5, n = 25-42 spores per 4 specimens], clavate, often curved in profile, hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 20 B) 20-35 X 5-8 µm, 4-spored, clavate. **Basidioles** (Fig. 20 B) subclavate or clavate. **Pleurocystidia** absent. **Cheilocystidia** (Fig. 20 C) numerous, lamellar edge typically sterile, 16-32 X 4-9 µm, cylindric, clavate or more often irregular in outline, often lobed or with 1-4 broad diverticulate outgrowths, hyaline, inamyloid, thin-walled. **Pileipellis** hymeniform, mottled, composed of *Globulares*-type elements (Fig. 20 D), 16-40 X 8-17.5(-28) µm, clavate, obovate, turbinate, vesiculose or sphaeropedunculate, broadly obtuse, seldom bifid or irregularly lobed, many cells subhyaline or pale yellow, thin-walled, others ochraceous or brownish orange, with walls 0.5-1.5 µm thick; all elements inamyloid, non-gelatinous. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-8(-10) µm diam, cylindric or inflated, smooth, non-gelatinous, hyaline, inamyloid, thin-walled. **Stipe tissue** monomitic; **cortical hyphae** 3-10 µm diam, parallel, cylindric, smooth, pale ochraceous or brown in water, olivaceous in 3% KOH, inamyloid, with walls up to 1.5 µm thick; **medullary hyphae** subparallel, hyaline, inamyloid, thin-walled. **Stipe vesture** a layer of tangled, suberect or erect **caulocystidia** (Fig. 20 E) 30-150 X 6.5-10 µm, cylindric, strangulate or irregular in outline, obtuse, seldom lobed, hyaline, pale yellow or ochraceous, inamyloid, with walls 1-2.5 µm thick. **Clamp connections** common in all tissues.

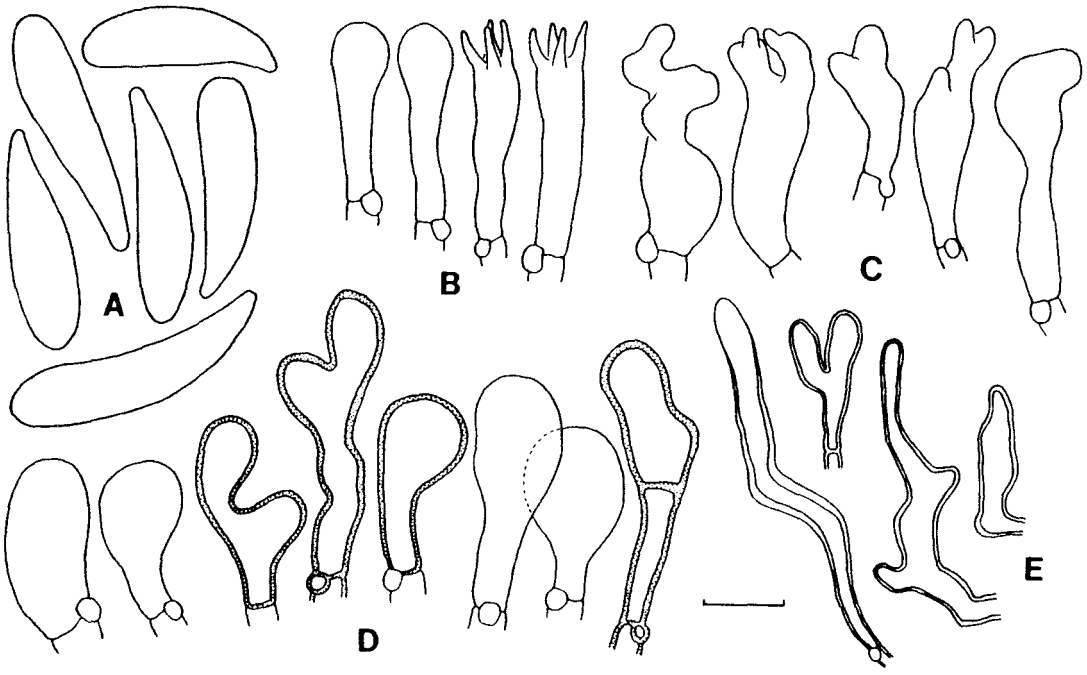



**Figure 20 A-E.** Features of *Marasmius copelandii* var. *olidus* (Hesler, TENN 14441). A. Basidiospores. B. Basidia and basidioles. C. Cheilocystidia. D. Pileipellis elements. E. Caulocystidia. Standard bar = 5 µm for A; 10 µm for B-D; 20 µm for E.

**Habit, habitat, and distribution.** Scattered or gregarious on senescent leaves of *Quercus* spp. in deciduous woods or mixed forests. August - December. Uncommon in eastern North America, from Michigan southward to Florida.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** Diagnostic features of basidiomata of *M. copelandii* var. *olidus* include: a) convex-depressed pileus colored pale brown or yellowish brown; b) adnate, subdistant, non-collariate lamellae concolorous with the pileus margin; c) pubescent to tomentose, brownish, non-insititious stipe; d) strongly alliaceous odor and

taste; and e) habit on oak leaves. Furthermore, cheilocystidial morphology and long clavate spores are distinctive.

*Marasmius copelandii* var. *olidus* was described from material collected in Michigan [*ut Marasmius olidus* Gilliam (1975a)]. Since the original report, only three specimens collected outside of Michigan have been discovered. Two of these were collected in North Carolina, and a third specimen was recently collected in Florida. The Florida material differs slightly from the holotype specimen in forming slightly shorter spores. In the holotype basidiomata, mean spore length was 14.9 µm, whereas in the Florida material mean spore length was 11.9 µm. In all other taxonomically important criteria, the Michigan specimens and Florida specimen are indistinguishable. It is interesting to note that the two specimens from North Carolina formed spores with intermediate mean spore lengths, *viz.*, 12.5 µm and 13.4 µm. Overlapping spore size ranges do not justify recognition of distinct forms of var. *olidus*. See Desjardin (1987a) for a discussion of the differences between var. *copelandii*, known at present only from western North America, and var. *olidus*.

In eastern North America, there occur three species of litter-decomposing marasmioid fungi with strong alliaceous odor; *viz.*, *Marasmius scorodonius* (Fr.) Fr., *M. copelandii* var. *olidus*, and *Marasmiellus praeacutus* (Ellis) Halling. *Marasmius scorodonius* differs from *M. copelandii* var. *olidus* in glabrous stipe, strongly diverticulate cheilocystidia, and smaller spores (refer to the description above for details). *Marasmiellus praeacutus* differs in paler pilei (white or buff-colored), fusiform-clavate stipe with

attenuated base, pileipelli composed of a poorly-developed *Rameales*-structure, and smaller spores (refer to the type study in Chapter VIII for details). See Halling (1987) for a contemporary description of *M. praeacutus*.

***MARASMIUS*** sect. ***HYGROMETRICI*** Kühner, Botaniste 25: 95. 1933 [*ut Hygrometriceae*].

TYPE SPECIES [implied, Kühner (1933)]: *Agaricus hygrometricus* Briganti, Hist. Fung. Neapol. 87. 1844.

Pileus small (1-5 mm diam), convex or plano-convex, margin even or striate, glabrous or minutely granulose, darkly pigmented. Lamellae non-collariate, adnate or adnexed, distant or remote, narrow or moderately broad. Stipe central, filiform, bristle-like, glabrous or pruinose, insititious, typically darkly pigmented. Rhizomorphs absent. Basidiospores medium-sized. Basidia 4-spored. Hymenial cystidia usually present and conspicuous, often capitate. Pileipellis hymeniform, of *Rotalis*-type broom cells, sometimes with scattered non-setulose cells or chains of setulose cells, often with pilocystidia similar to the hymenial cystidia. Tramal hyphae inamyloid. Stipe tissue monomitic, inamyloid. Stipe vesture present or absent. Clamp connections present.

**21.** ***MARASMIUS MINUTUS*** Peck, Annual Rep. New York State Mus. 27: 97. 1874 (1875).

= *Marasmius capillipes* Saccardo, Nuovo Giorn. Bot. Ital. 8: 162. 1876 [*sensu* Gilliam (1976)].

= *Marasmius pyrinus* Ellis, Bull. Torrey Bot. Club 8: 64. 1881.

= *Marasmius capillipes* var. *macrosporus* Kühner, Botaniste 25: 96. 1933.

**HOLOTYPE:** United States, New York, Catskill Mts. and Sandlake, July, 1873, C. H. Peck (NYS!).

**Basidiomata** marcescent, reviving. **Pileus** 0.1-2(-3) mm diam, obtusely conic or bullet-shaped at first, expanding to convex in age, sometimes with a shallow umbilicus, striate or sulcate; surface dull, dry, opaque, glabrous or minutely granulose; colored greyish brown (7E3-4), brown (7E5-7) or reddish brown (8D4-5) when young, fading slightly in age to pale greyish brown (6D3-4), light brown (6D5) or yellowish brown (5D4-5), drying dark brown (7F4-8); context very thin, pale brown. **Lamellae** non-collariate, adnate, distant or remote, narrow, thin, sometimes forked and/or weakly intervenose, pruinose; buff or pale yellowish white, non-marginate; **lamellulae** typically absent. **Stipe** 2-20 X <0.1 mm, terete, equal, filiform, wiry, solid, dry, shiny, glabrous, insititious; apex yellowish brown (5E5-6) or brown (6-7E5-6), base brown, reddish brown (8E5-7), dark brown (7-8F4-7) or black. **Rhizomorphs** absent. **Odor and taste** not distinctive.

**Basidiospores** (Fig. 21 A) (6.2-)7-10(-10.4) X (2.6-)3.0-3.8 µm [$\bar{\bar{x}}$ = 8.2 ± 1.0 X 3.2 ± 0.2 µm, E = 2-3.3, $\bar{Q}$ = 2.5 ± 0.2, n = 20-30 spores per 6 specimens], ellipsoid, elongate-ellipsoid or amygdaliform, hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 21 B) 15-24 X 5-7(-10) µm, 4-spored, clavate. **Basidioles** (Fig. 21 B) clavate or ventricose. **Hymenial cystidia** (Fig. 21 C) abundant on lamellar edges, abundant or uncommon on lamellar sides, 16-26 X 4-6.5 µm, lageniform, often subcapitate, arising from about the same level as the basidioles and projecting little or not at all, non-refractive, thin-walled, hyaline, inamyloid. **Pileipellis** hymeniform, composed of *Rotalis*-type broom cells, pilocystidia, and elements intermediate in morphology (Fig. 21 D); main body of broom cells 10-20 X 5-12 µm, clavate,

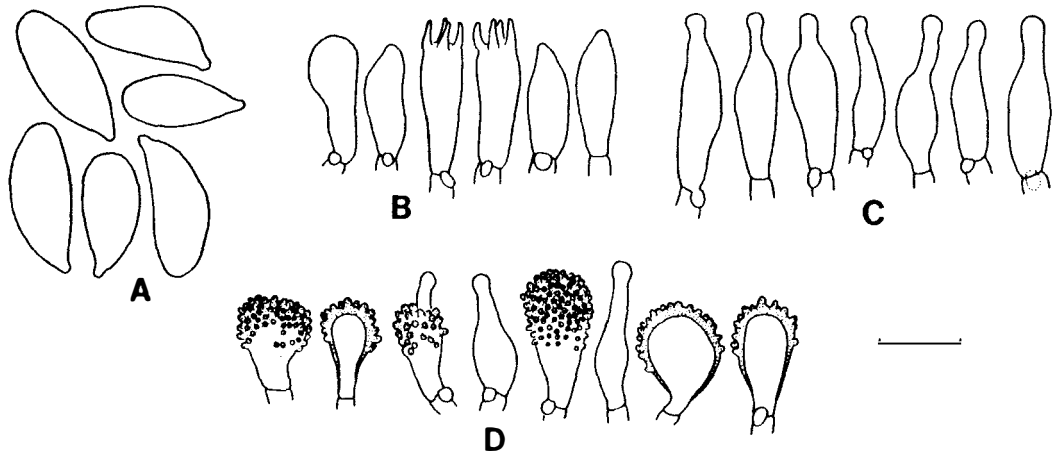



**Figure 21 A-D.** Features of *Marasmius minutus* (Peck, East Berne). A. Basidiospores. B. Basidia and basidioles. C. Hymenial cystidia. D. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-D.

pyriform, turbinate or vesiculose, typically with basal portion thin-walled and apical portion thick-walled, ranging from subhyaline or ochraceous, to reddish brown or brown; divergent setulae 0.5-1.5 X 0.5-1 µm, knob-like or rod-like, obtuse, densely crowded, solid, dark ochraceous, reddish brown or brown; **pilocystidia** uncommon, interspersed, 14-24 X 4-7.5 µm, fusoid-ventricose or lageniform, often subcapitate, hyaline, thin-walled; some elements intermediate between *Rotalis*-type broom cells and pilocystidia, *i.e.*, lageniform with the central inflated region covered with divergent setulae and apical neck smooth. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 1.5-5 µm diam, cylindric, smooth, non-gelatinous, thin-walled, hyaline, inamyloid. **Stipe tissue** monomitic; **cortical hyphae** 3-5 µm diam, parallel, cylindric, non-incrusted, hyaline or yellow (stipe apex) to reddish brown or dark brown (stipe base), inamyloid, with walls up to

1.2 µm thick; exteriormost surface of outermost hyphae strongly diverticulate; diverticula 0.5-1.5 X 0.5-1 µm, similar to divergent setulae of broom cells, rod-like, solid, concolorous with hyphal walls; **medullary hyphae** 1.5-6.5 µm diam, parallel, hyaline, inamyloid, thin-walled. **Caulocystidia** absent. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Scattered or gregarious on much decayed leaves of *Fraxinus, Ulmus, Pyrus*, *Populus*, rarely on *Lactuca* or *Ligustrum* (Charles, 1939), in elm-ash swamps (Gilliam, 1976) or deciduous woods. June - November. Uncommonly collected in eastern North America; also reported from Europe [as *M. capillipes*; Saccardo (1876); Kühner (1933)].

**Specimens Examined.** Refer to Appendix A.

**Commentary.** *Marasmius minutus* was described by Peck (1875) based on material collected from undetermined "fallen leaves in woods and swamps." Subsequently, Ellis (1881) published *M. pyrinus* Ellis, based on material collected from decayed pear leaves. Re-examination of the holotype specimens of these two species indicates that they are conspecific. These observations are in concordance with Gilliam's (1976) diagnosis. Gilliam (1976) reported that basidiomata of *M. minutus* were most commonly collected on curled, blackened leaves of *Fraxinus* in elm-ash swamps. *Marasmius minutus* is rare in the southern Appalachian Mts, know at present from a single specimen. I suspect that the species is more common in this region than herbarium records indicate, but due to the very small size of basidiomata, the species is easily overlooked in the field.

Key features of *M. minutus* include: a) brown, striate pilei typically less than 2 mm broad; b) non-collariate, distant, narrow lamellae; c) wiry, insititious stipe 2-20 X <0.1 mm; and d) fruiting usually on ash, elm, pear or poplar in swampy areas. Moreover, pileipellis, stipitipellis and hymenial cystidial morphologies are distinctive.

In North America, *M.minutus* is macromorphlogically similar to *M. magnoliae* Singer, a species forming minute, darkly pigmented basidiomata on leaves of *Magnolia grandiflora* L. The two species differ, however, in micromorphology, substrate and distribution. Basidiomata of *M. magnoliae* show pileipelli formed of erect chains of *Rotalis*-type elements, ventricose-rostrate, non-capitate cheilocystidia, absence of pleurocystidia, and broader spores ($\bar{W}$ = 4.3 µm). In addition, *M. magnoliae* fruits exclusively on evergreen magnolia leaves and is known at present only from Florida. Refer to Chapter VIII for a type study of *M. magnoliae*.

*Marasmius minutus* is also similar to several European taxa, *viz.*, *M. hudsonii* (Pers.: Fr.) Fr., and *M. buxi* Fr. *in* Quél. *Marasmius hudsonii* differs in forming pileipelli with lanceolate, reddish brown pilosetae, numerous thick-walled, acuminate caulocystidia, broader spores ($\bar{W}$ = 5.0 µm), absence of pleurocystidia, and fruiting on *Ilex* leaves. *Marasmius buxi* differs in forming much longer cheilocystidia (35-44 µm), broader spores ($\bar{W}$ = 4.7 µm), absence of pleurocystidia, and fruiting on *Buxus*. Refer to Chapter VIII for descriptions of representative specimens of *M. hudsonii* and *M. buxi*.

***MARASMIUS*** sect. ***SICCI*** Singer, Mycologia 50: 106. 1958.

≡ sect. *Globulares* subsect. *Siccini* Singer, Agar. Mod. Tax. 326. 1951.

TYPE SPECIES: *Agaricus siccus* Schweinitz, Schr. Naturf. Ges. Leipzig 1: 84. 1822 [≡ *Marasmius siccus* (Schw.) Fries, Epicr. Syst. Mycol. 382. 1838].

Pileus small to large (1-50 mm broad), campanulate, convex, or plano-convex, even, striate, sulcate or plicate, typically subvelutinous, variously colored. Lamellae well-developed, non-collariate, adnexed or nearly free, crowded to remote, narrow to broad, rarely weakly intervenose, pallid. Stipe central, terete, typically equal, solid or hollow, glabrous or pruinose to velutinous, non-insititious, variously colored. Rhizomorphs absent. Odor and taste usually not distinctive, rarely spermatic, fragrant or resinous. Basidiospores ellipsoid to clavate. Pleurocystidia present or absent. Cheilocystidia typically present and similar to the pileipellis elements. Hymenial setae present or absent. Pileipellis a hymeniform layer of *Siccus*-type broom cells, *i.e.*, clavate or irregular-shaped elements with apical setulae; setulae rod-like, conic or irregular in outline, seldom verrucose, obtuse to acute, thin-walled to thick-walled or solid, variously pigmented. Tramal hyphae hyaline, dextrinoid (sometimes weakly so). Stipe tissue monomitic. Stipe vesture present or absent. Clamp connections present.

***MARASMIUS*** sect. ***SICCI*** ser. ***SPINULOSI*** (Clémençon) Desjardin, *stat. nov.*

≡ subsect. *Spinulosi* Clémençon, Z. Mykol. 48: 15. 1982.

= ser. *Actinopodes* Singer *pro parte*, Fl. Neotrop. Monogr. 17: 236. 1976 [T: *Marasmius actinopus* Montagne].

TYPE SPECIES: *Agaricus cohaerens* Persoon: Fries, Syst. Mycol. 1: 253. 1821 [≡ *Marasmius cohaerens* (Pers.: Fr.) Cooke & Quélet].

Lanceolate, thick-walled setae present on the hymenophore; setae present or absent in the pileipellis and/or stipitipellis, hyaline or deeply pigmented, typically dextrinoid.

**22.** ***MARASMIUS DELECTANS*** Morgan, J. Mycol. 11: 206. 1905.

**LECTOTYPE:** United States, Ohio, Montgomery Co., Preston, 1895, A. P. & L. V. Morgan no. 21 (ISC!).

**Basidiomata** marcescent, reviving. **Pileus** 5-25(-40) mm diam, convex, campanulate or obtusely conic when young, expanding to plano-convex or plane in age, sometimes with a shallow central depression or umbilicus, sometimes subumbonate, seldom with uplifted, wavy margin; disc even or rugulose; margin even at first, soon striate or rugulose-striate; surface dull, dry, opaque or slightly translucent on the margin when moist, pruinose; coloration pale yellowish white (4A2), cream (4A3) or pale orange white (5A2-3) overall when young or with a slightly darker disc, often fading in age to buff or nearly white, usually retaining a slightly darker disc; context 1-2 mm thick, white. **Lamellae** adnate or adnexed, close or subdistant, narrow or moderately broad (1-2 mm), sometimes intervenose in age; concolorous with the pileus margin, non-marginate; **lamellulae** in 1-3 series. **Stipe** 15-65 X

1-2 mm, terete, equal or centrally slightly narrowed, typically shiny, dry, hollow, cartilaginous, glabrous above, lower portion pruinose, non-insititious, arising from a thick mat of downy, suede-like or fibrillose, buff-colored mycelium; upper half colored buff, pale yellowish white (4A2) or pale orange white when young, base brownish yellow (5C6-7), brownish orange (6C5-7), brown (6D-E5-6) or dark brown (6F5-6) when young, in age upper few mm concolorous with the lamellae, remainder of stipe dark brown (7F4-8). **Odor** mildly fungal, acidulous or like *M. oreades*. **Taste** mildly fungal or not distinctive.

**Basidiospores** (Fig. 22 A) (5.6-)6.0-8.0(-8.8) X 3.2-4.4 µm [$\bar{\bar{x}}$ = 7.1 ± 0.1 X 3.8 ± 0.1 µm, E = 1.6-2.3, $\bar{Q}$ = 1.9 ± 0.06; TL90(90%): $\bar{x}$ = 6.9-7.3 X 3.6-4.0 µm, Q = 1.8-2.0; n = 20-30 spores per 10 specimens], ellipsoid or ovoid, sometimes lacrymoid, inequilateral in profile, hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 22 B) 17.5-32 X 4-6.5 µm, 4-spored, clavate. **Basidioles** (Fig. 22 B) cylindric or subclavate. **Pleurosetae** (Fig. 22 C) 24-65 X 4-8 µm, abundant, lanceolate, fusoid, fusoid-ventricose, ventricose-rostrate, or irregular in outline, acute, sometimes branched near the apex, arising from the subhymenium and projecting up to 35 µm beyond the basidioles; walls refractive, hyaline or pale yellow, strongly dextrinoid, up to 3 µm thick. **Cheilocystidia** (Fig. 22 D) abundant, similar to the pileipellis elements; majority of cells **cheilosetae,** 35-55 X 4-6.5 µm, lanceolate or fusoid, often apically branched, acute, hyaline, dextrinoid, with walls up to 2.5 µm thick; *Siccus*-type broom cells few, interspersed; numerous elements transitional in morphology between *Siccus*-type broom cells and setoid elements; main body 16-24 X

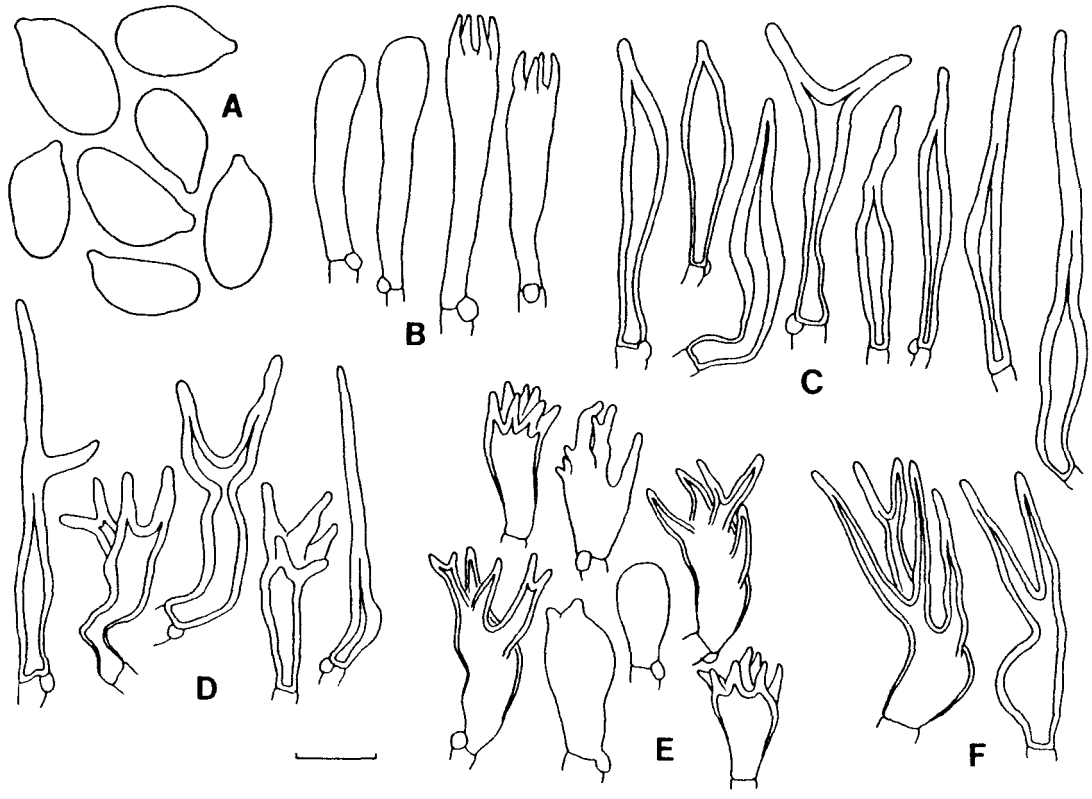



**Figure 22 A-F.** Features of *Marasmius delectans* (Desjardin no. 4518). A. Basidiospores. B. Basidia and basidioles. C. Pleurosetae. D. Cheilocystidia (cheilosetae, *Siccus*-type broom cells and elements intermediate in morphology). E. Pileipellis elements (*Siccus*-type broom cells and non-setulose elements). F. Transitional elements from pileipellis. Standard bar = 5 µm for A; 10 µm for B-F.

5.5-8 µm, irregularly cylindric or subclavate, thick-walled, hyaline, dextrinoid; apical setulae 3-16 X 1.5-3.5 µm, few (2-6), conic or irregular in outline, subacute or acute, solid, hyaline. **Pileipellis** hymeniform, not mottled; in primordia composed of irregularly-shaped (strangulate, contorted, wavy), obtuse, thick-walled, hyaline elements; at maturity composed of *Siccus*-type broom cells, pilosetae, and elements transitional in morphology: 1) ***Siccus*-type broom cells** (Fig. 22 E) with main body 12-20 X 5-10 µm, cylindric, clavate or turbinate,

typically thick-walled, hyaline, weakly dextrinoid; apical setulae 1.5-7 X 1.5-3 µm, ranging in number from 4-12 per cell, conic or rod-like, subacute or acute, thick-walled or solid, subhyaline or pale yellow; with few smooth (non-setulose), clavate or subvesiculose elements 10-20 X 6.5-10 µm interspersed; 2) **pilosetae** scattered, uncommon or numerous, similar to pleurosetae; 3) **transitional elements** (Fig. 22 F) similar to *Siccus*-type broom cells but with fewer and longer setulae; setulae up to 24 µm long, conic, acute, 2-5 per cell, yellow, dextrinoid, with walls up to 2 µm thick. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-12 µm diam, cylindric or inflated, smooth, non-gelatinous, hyaline, inamyloid or weakly dextrinoid, thin-walled. **Stipe tissue** monomitic; **cortical hyphae** 2.5-8 µm diam, parallel, cylindric, smooth, subhyaline or ochraceous (stipe apex), or brown (stipe base), strongly dextrinoid, with walls up to 2 µm thick; **medullary hyphae** 2.5-10 µm diam, subparallel, hyaline, dextrinoid, with walls up to 1 µm thick. **Stipe vesture** absent overall, or rarely present only on stipe base, consisting of scattered **caulosetae** similar to the pleurosetae. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Scattered or gregarious on decayed leaves of various hardwoods (*Quercus, Acer, Liriodendron, Carya*) in deciduous woods or mixed forests. June - October. Common throughout eastern North America.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** Distinctive features of *M. delectans* include pale yellowish white pileus, glabrous stipe colored yellowish white at the

apex and brown at the base, hyaline, dextrinoid hymenial setae and small spores. *Marasmius delectans* is the only known North America *Marasmius* with this combination of characters.

In primordia, pileipelli are composed of a palisade of irregularly-shaped, thick-walled elements lacking apical setulae. As basidiomata mature, numerous *Siccus*-type broom cells develop, interspersed among pilosetae and elements transitional in morphology between pilosetae and broom cells. The presence of setulose elements indicates that the species is best placed in sect. *Sicci*, as proposed by Gilliam (1976). Singer (1962a, 1975b) initially placed *M. delectans* in sect. *Globulares*, but later (Singer, 1986) included the species in sect. *Sicci* ser. *Haematocephali*. Because of the presence of hymenial setae and pilosetae in *M. delectans*, I consider the taxon closely allied with *M. cohaerens* (Pers.: Fr.) Cooke & Quél., and include *M. delectans* in ser. *Spinulosi*. I reserve ser. *Haematocephali* for species that form non-setoid pleurocystidia and lack pilosetae.

Three taxa with hymenial setae occur in eastern North America: *M. delectans, M. cohaerens* var. *cohaerens* (Pers.: Fr.) Cooke & Quél., and *M. cohaerens* var. *lachnophyllus* (Berk.) Gilliam. *Marasmius delectans* differs from *M. cohaerens* in pileus coloration and setae pigmentation. Both varieties of *M. cohaerens* form basidiomata with reddish brown, brownish orange or brown pilei, and brownish orange hymenial setae.

**23. *MARASMIUS COHAERENS*** var. ***COHAERENS*** (Pers.: Fr.) Cooke & Quélet, Clav. Syn. Hymenomyc. Eur. 153. 1878.

≡ *Agaricus cohaerens* Pers.: Fries, Syst. Mycol. 1: 253. 1821.

[*Agaricus cohaerens* Persoon, Syn. Meth. Fung. 306. 1801.]

≡ *Mycena cohaerens* (Pers.: Fr.) Kummer, Fürher Pilzk. 111. 1871.

= *Agaricus ceratopus* Persoon, Mycol. Eur. 3: 131. 1828.

≡ *Marasmius ceratopus* (Pers.) Quélet, Fl. Mycol. France 319. 1888.

**TYPE SPECIMEN:** None located.

**Basidiomata** marcescent, reviving. **Pileus** 10-30 mm diam, campanulate or obtusely conic when young, expanding to broadly campanulate, convex or plano-convex, often with a low, broad umbo, seldom centrally depressed; disc even or weakly rugulose; margin even or striatulate; surface dull, dry, rarely subhygrophanous, opaque, subvelutinous or velutinous; coloration dark brown (7F5-7) or dark reddish brown (8F5-7) overall when young, disc and extreme margin remaining so in age or fading slightly, median region becoming reddish brown (8E5-7), brown (7E4-6), light brown (7D4-6), light yellowish brown (5-6D5-6) or slightly paler in age; context 0.5-1.5 mm thick, pale ochraceous or dingy buff. **Lamellae** adnate or adnexed, subdistant or distant, moderately broad or broad (2-5 mm), pruinose, seldom intervenose, not forked; coloration buff, pale yellowish white (4A2) or cream-buff (4A3) when young, becoming pinkish buff or pale reddish brown in age (due to colored setae), non-marginate or with a slightly darker margin; **lamellulae** 2-4 series. **Stipe** 25-70 X 1-2.5 mm, terete, equal or with a slightly flared apex and/or slightly enlarged base, dull or shiny, dry, hollow, cartilaginous, glabrous or sometimes minutely pruinose at the apex, non-insititious, arising from pad of copious, buff or pale yellowish buff mycelium; upper half when young yellowish white (4A2) or pale yellowish pink, base pale yellowish brown

(5-6D5-6) or brown (6-7E4-7); in age apex darkening to pale yellowish brown, light brown (7D5-6) or ochraceous, base becoming dark brown (7F4-6) or nearly black. **Odor** not distinctive. **Taste** not distinctive or with a slightly bitter aftertaste.

**Basidiospores** (Fig. 23 A) (6.8-)7.2-10.4(-11.2) X 3.8-5.6 µm [$\bar{\bar{x}}$ = 8.3 ± 0.4 X 4.6 ± 0.3 µm, E = 1.4-2.2, $\bar{Q}$ = 1.8 ± 0.1; TL90(90%): $\bar{x}$ = 7.6-9.0 X 4.0-5.2 µm, Q = 1.6-2.0; n = 20-25 spores per 10 specimens], ellipsoid, broadly lacrymoid or pip-shaped, inequilateral in profile, hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 23 B) 22-30 X 5-9.5 µm, clavate, 4-spored. **Basidioles** (Fig. 23 B) cylindric or subclavate. **Hymenial setae** (Fig. 23 C) 44-80 X 6.5-14 µm [$\bar{W}$ = 10.0 ± 0.6 µm, n = 30 cystidia per 3 specimens], numerous on lamellar sides and edges, lanceolate, fusoid or ventricose-acuminate, sharply acute, rarely forked, arising from deep in the subhymenium and projecting well beyond the basidioles; walls pale yellowish brown, ochraceous or brownish orange, dextrinoid, 1-4 µm thick in upper portion of cell, thinner in basal portion. **Cheilocystidia** (Fig. 23 D) scattered, similar to *Siccus*-type pileipellis elements; main body 10-20 X 5-10 µm, cylindric or clavate, firm-walled or thick-walled, hyaline; apical setulae 3.5-13 X 1-2.5 µm, conic, acute, thick-walled or solid, hyaline or pale yellow. **Pileipellis** hymeniform, composed of *Siccus*-type broom cells, plus pilosetae; ***Siccus*-type broom cells** (Fig. 23 E) with main body 8-16(-20) X 5-8(-10) µm, cylindric, clavate or irregular in outline, typically hyaline and thin-walled, some elements pale brownish orange and firm-walled; apical setulae 2.5-10 X 1-2(-3) µm, conic, acute, thick-walled or solid, yellow, brownish orange or pale reddish

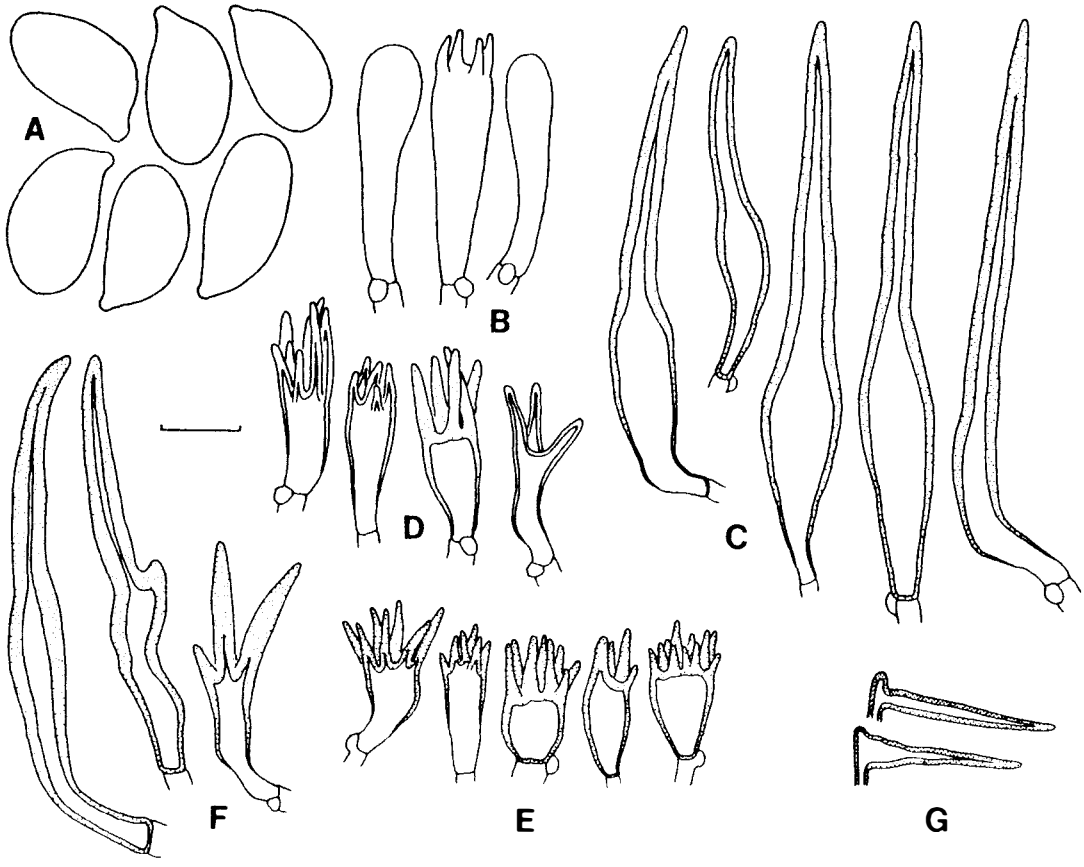



**Figure 23 A-G.** Features of *Marasmius cohaerens* var. *cohaerens* (Miller no. 9577). A. Basidiospores. B. Basidium and basidioles. C. Hymenial setae. D. Cheilocystidia. E. *Siccus*-type pileipellis elements. F. Pilosetae. G. Caulosetae. Standard bar = 5 µm for A; 10 µm for B-F; 20 µm for G.

brown, dextrinoid; **pilosetae** (Fig. 23 F) scattered, similar to hymenial setae but often thicker-walled, typically brownish orange, seldom apically forked; some elements intermediate in morphology between broom cells and setae, with 2-5 solid, apical setulae up to $20^{+}$ µm long. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-10(-13) µm diam, cylindric or inflated, frequently-branched, hyaline, dextrinoid, thin-walled. **Stipe tissue** monomitic; **cortical hyphae** 2.5-6(-9) µm diam, parallel, cylindric, smooth, ranging from

pale yellow to brownish orange or brown, dextrinoid, with walls up to 2 µm thick; **medullary hyphae** 3-8(-10) µm, parallel, hyaline or pale yellow, dextrinoid, thin-walled or with walls up to 1 µm thick. **Stipe vesture** poorly-developed, of few, scattered **caulosetae** (Fig. 23 G) similar to the hymenial setae. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Scattered, gregarious or subcespitose on decayed hardwood leaves or rotten logs in deciduous woods or mixed forests, seldom in coniferous forests with scattered hardwoods. September - October in the southern Appalachian Mts., July - October elsewhere. Common in northeastern North America and Europe; rare in southeastern North America.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** *Marasmius cohaerens* is easily distinguished from other members of sect. *Sicci* by presence of conspicuous, pigmented hymenial setae and pilosetae, in combination with a deeply pigmented pileus. Variety *cohaerens*, described from material collected in Europe, is characterized by the following features: a) reddish brown, brown or yellowish brown, subvelutinous, convex pileus; b) subdistant to distant, broad, pallid lamellae with reddish pruinosity; and c) nearly glabrous stipe. Although this variety is commonly collected in Europe, it is uncommonly encountered in North America. In North American, var. *cohaerens* is more common in the northeast, although it does occur in the southern Appalachian Mountains, and has been collected as far south as Florida.

The majority of North American specimens of *M. cohaerens* are correctly referred to var. *lachnophyllus* (Berk.) Gilliam, described from material collected in Ohio (*ut Agaricus lachnophyllus* Berk.). The latter variety differs in showing basidiomata with close to crowded, narrow lamellae, and strongly pruinose or hispid stipe. Refer to the commentary on var. *lachnophyllus* for further comparison with var. *cohaerens*.

**24. *MARASMIUS COHAERENS*** var. ***LACHNOPHYLLUS*** (Berk.) Gilliam, Mycotaxon 4(1): 64. 1976 (September).

≡ *Agaricus lachnophyllus* Berkeley, London J. Bot. 6: 312. 1847.

≡ *Collybia lachnophylla* (Berk.) Saccardo, Syll. Fung. 5: 203. 1887.

≡ *Marasmius lachnophyllus* (Berk.) Morgan, J. Mycol. 11: 239. 1906.

≡ *Gymnopus lachnophyllus* (Berk.) Murrill, N. Amer. Fl. 9(5): 360. 1916.

= *Agaricus spinulifer* Peck, Annual Rep. New York State Mus. 24: 62. 1871.

≡ *Collybia spinulifera* (Pk.) Peck, Annual Rep. New York State Mus. 49: 62. 1895 (1896).

≡ *Marasmius spinulifer* (Pk.) Morgan, J. Mycol. 11: 238. 1906.

= *Marasmius setulosus* Murrill, Bull. Torrey Bot. Club 67: 150. 1940 [*non Marasmius setulosus* (Murr.) Singer, Lilloa 22: 326. 1951.].

= *Marasmius cohaerens* var. *americanus* Singer, Fl. Neotrop. Monogr. 17: 247. 1976 (December).

**HOLOTYPE:** United States, Ohio, Wayne Co., Waynesville, 5 Sept. 1844, T. G. Lea (K!) [ISOTYPE: FH!].

**Basidiomata** marcescent, reviving. **Pileus** 10-45(-65) mm diam, campanulate, convex or obtusely conic, with an inrolled or incurved margin when young, expanding to broadly campanulate, convex-umbonate, plano-convex or plano-umbonate in age, rarely plane with uplifted margin; disc even or weakly rugulose in age; margin even when young, typically remaining even in age, seldom striatulate; surface dull, dry, opaque or extreme margin slightly translucent, subvelutinous or velutinous; coloration dark reddish brown (8-9F5-8), reddish brown (8E5-8) or brown (7E7-8) overall at first, disc (and often the extreme margin) usually remaining deeply pigmented or fading slightly in age, margin fading to brown (6-7E4-8), light brown (6-7D4-8), greyish red (7B4-5), brownish orange (6-7C4-5), greyish orange (6B2-3) or finally dingy orange white (5A2) or pinkish buff; context moderately thick (0.5-3 mm), dingy buff-colored. **Lamellae** adnate or more commonly adnexed, close or crowded (up to 5 per mm at pileus margin, including lamellulae), narrow or moderately broad (1-2 mm), typically not forked nor intervenose, strongly pruinose; coloration greyish orange (5-6B3) or pinkish grey (7B3) when young, darkening in age to greyish red (7-8C3-4) or slightly darker, due primarily to reddish brown pruinae (hymenial setae); lamellar edges often reddish brown or brown; **lamellulae** in 3-4 series. **Stipe** 20-85(-100) X 1.5-3.5 mm, terete, equal or seldom with a slightly enlarged base, dull or subshiny, dry, cartilaginous, hollow, pruinose or hispid overall, sometimes centrally glabrescent, non-insititious, arising from copious, downy or felty, white, cream or greyish orange (5-6B3) basal mycelium; coloration of upper 1/2 to 2/3 at first white, cream-buff or yellowish white (4A2)

with reddish pruinae, basal region brownish orange (6-7C5-8), brown (6-7D-E5-8) or dark brown (6-7F5-8); in age apex dingy buff, pale yellow, greyish red (7-8C3-4), brownish yellow (5C5) or brownish orange, base becoming dark brown (6-7F4-8) or dark reddish brown (8F4-8), with pruinae concolorous with the surface or slightly paler. **Odor** not distinctive or sometimes slightly spicy. **Taste** not distinctive or astringent.

**Basidiospores** (Fig. 24 A) 6.4-8.8(-9.6) X 3.2-4.8(-5) µm [$\bar{\bar{x}}$ = 7.6 ± 0.3 X 4.1 ± 0.2 µm, E = 1.6-2.3, $\bar{Q}$ = 1.9 ± 0.08; TL90(90%): $\bar{x}$ = 7.0-8.2 X 3.7-4.5 µm, Q = 1.7-2.1; n = 20-30 spores per 10 specimens], ellipsoid or amygdaliform, inequilateral in profile, hyaline, inamyloid, smooth, white in fresh deposit (pale yellow in old spore prints). **Basidia** (Fig. 24 B) 17.5-28 X 4.5-8 µm, clavate, 4-spored. **Basidioles** (Fig. 24 B) cylindric, subclavate or clavate. **Hymenial setae** (Fig. 24 C) densely crowded on lamellar edges, scattered but numerous on lamellar faces, (55-)80-120(-130) X (6.5-)9-20(-25.6) µm [$\bar{L}$ = 95.2 ± 7.0 µm; $\bar{W}$ = 15.0 ± 0.6 µm; n = 30 cystidia per 4 specimens], lanceolate or ventricose-acuminate, usually pedicellate, sharply acute, arising from deep in the subhymenium or lamellar trama and projecting well-beyond the basidioles, subhyaline, yellow, brownish orange or reddish brown, cell apex more deeply pigmented than cell base, dextrinoid, with walls 1-3.5 µm thick. **Cheilocystidia** (Fig. 24 D) similar to *Siccus*-type pileipellis elements and transitional elements, uncommon or common, interspersed among hymenial setae. **Pileipellis** hymeniform, not mottled or weakly mottled, composed of *Siccus*-type broom cells, pilosetae and elements transitional in morphology:

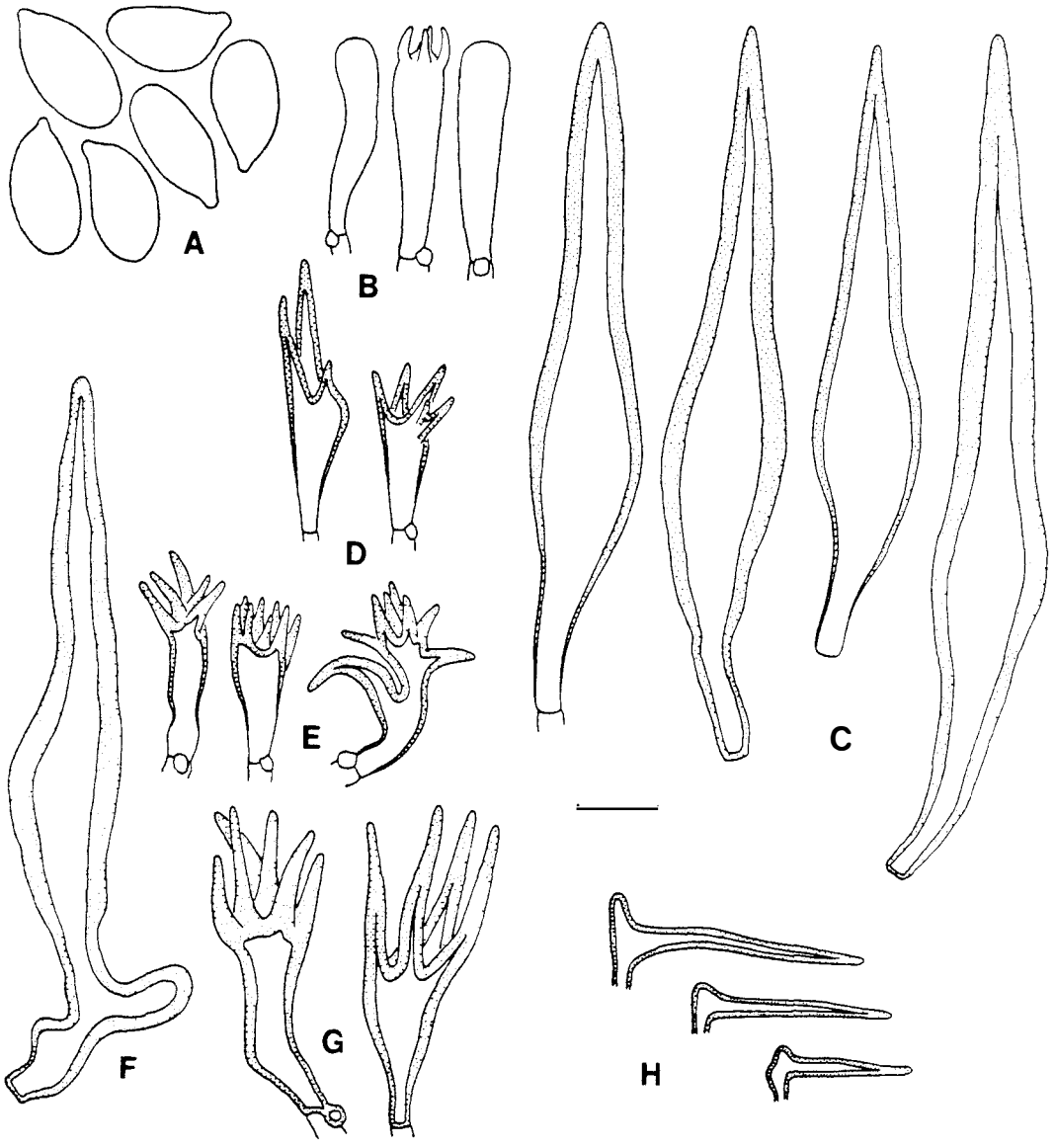



**Figure 24 A-H.** Features of *Marasmius cohaerens* var. *lachnophyllus* (Lea, 1844, holotype). A. Basidiospores. B. Basidium and basidioles. C. Hymenial setae. D. Cheilocystidia. E. *Siccus*-type pileipellis elements. F. Pilosetae. G. Transitional elements from pileipellis. H. Caulosetae. Standard bar = 5 µm for A; 10 µm for B-G; 20 µm for H.

1) ***Siccus*-type broom cells** (Fig. 24 E) with main body 9.5-20(-28) X 4-10(-11.5) µm, cylindric, clavate, turbinate or irregular in outline, seldom lobed, subhyaline, pale ochraceous, pale tawny or pale reddish brown, inamyloid or weakly dextrinoid, with walls 0.5-1.5 µm thick; apical setulae 2.5-10 X 0.5-2 µm, cylindric or conic, subacute or acute, thick-walled or solid, subhyaline, melleous, ochraceous or reddish brown; 2) **pilosetae** (Fig. 24 F) numerous, 40-120$^{+}$ X 5.5-15 µm, similar to the hymenial setae, arising from deep in the pileus trama, brownish orange, ferruginous, brown or reddish brown, dextrinoid, with walls up to 5 µm thick; 3) **transitional elements** (Fig. 24 G) similar to *Siccus*-type broom cells but typically larger and with fewer and longer apical setulae; setulae up to 30 X 2-4 µm, 3-6 per cell, conic, sharply acute, thick-walled or solid, brownish orange, ferruginous or reddish brown. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-10.5 µm diam, cylindric or inflated, smooth, non-gelatinous, hyaline, dextrinoid, thin-walled. **Stipe tissue** monomitic; **cortical hyphae** 2.5-6.5 µm diam, parallel, cylindric, smooth, pale yellow, ochraceous or tawny at stipe apex, brown at stipe base, dextrinoid, with walls up to 1.5 µm thick; **medullary hyphae** 2.5-12(-16) µm, hyaline or pale yellow, dextrinoid, thin-walled or firm-walled. **Stipe vesture** of numerous, erect caulosetae and rare *Siccus*-type broom cells and transitional elements; **caulosetae** (Fig. 24 H) 30-80$^{+}$ X 6-12 µm, conic, lanceolate or ventricose-acuminate, sharply acute, ochraceous or tawny, dextrinoid, with walls up to 3 µm thick. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Gregarious or subcespitose on leaf mulch or much-decayed wood in deciduous woods or mixed forests. May - October; most common from June to August in the southern Appalachians. Common throughout eastern North America from Nova Scotia and Ontario southward to Florida.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** As mentioned earlier, var. *lachnophyllus* is the most common variety of *M. cohaerens* occurring in North America. This taxon is characterized by: a) convex-umbonate, velutinous, reddish brown, brown or brownish orange pileus; b) close or crowded, narrow lamellae with greyish red pruinae; c) pruinose or hispid, brownish, non-insititious stipe; d) pigmented pilosetae and hymenial setae; e) abundant caulosetae; and f) small spores. Basidiomata commonly form subcespitose clusters on much-decayed hardwood logs, as well as fruiting gregariously on hardwood leaf mulch.

Gilliam (1976) provided an extensive comparison of var. *cohaerens* and var. *lachnophyllus*, reporting differences in lamellar breadth and spacing, spore size, hymenial setae size, frequency of cheilocystidia and caulosetae, and habitat. She also reported a number of specimens that did not fit the patterns she observed in the majority of specimens. My observations on southeastern specimens, as well as numerous specimens collected in northeastern North America, confirm most of Gilliam's observations. Characters most useful in separating the varieties include lamellar spacing and width, lamellar coloration and degree of pruinosity, hymenial setae size and stipe surface features (*i.e.*, abundance of caulosetae). Spore size is of limited

value, while frequency of cheilocystidia and habitat are unreliable features.

In general, basidiomata of var. *lachnophyllus* form close or crowded, narrow lamellae that are greyish red at maturity or reddish brown when dried, the coloration due to abundant, crowded, darkly pigmented hymenial setae. In comparison, basidiomata of var. *cohaerens* form subdistant or distant, broad lamellae colored cream-buff or pinkish buff, with fewer (*i.e.*, more widely spaced) or slightly paler hymenial setae. The stipe surface of var. *lachnophyllus* is typically densely pruinose or hispid (*i.e.*, with abundant, dense caulosetae), whereas that of var. *cohaerens* is usually glabrous or only weakly pruinose at the stipe apex (*i.e.*, with few, widely spaced caulosetae).

Hymenial setae of var. *lachnophyllus* average 95 X 15 µm (n = 30 cystidia per 4 specimens), while those of var. *cohaerens* average 60 X 10 µm (n = 30 cystidia per 3 specimens). On the average, spores of var. *lachnophyllus* are smaller than those of var. *cohaerens*. In basidiomata of var. *lachnophyllus*, mean spore length ranged from 7.1-8.1 µm, while mean spore width ranged from 3.7-4.3 µm (n = 10 specimens). The average mean spore size for this variety was 7.6 X 4.1 µm. In comparison, in basidiomata of var. *cohaerens* mean spore length ranged from 7.8-9.0 µm, while mean spore width ranged from 4.3-5.0 µm (n = 10 specimens). The average mean spore size was 8.3 X 4.6 µm. Although mean spore size ranges were overlapping in these varieties, spores of var. *lachnophyllus* tended to be slightly shorter and broader on the average than those of var. *cohaerens*.

Gilliam (1976) reported that cheilocystidia were typically present in var. *cohaerens* while usually absent in var. *lachnophyllus*. She also noted that basidiomata of var. *cohaerens* generally formed on leaf mulch, while in var. *lachnophyllus* basidiomata formed on hardwood logs. In material collected in southeastern North America, cheilocystidia were present or absent in both varieties, and basidiomata were collected commonly on both leaf mulch and rotten wood. These data suggest that cheilocystidia frequency and habitat are unreliable taxonomic characters.

***MARASMIUS*** sect. ***SICCI*** ser. ***ATRORUBENSES*** Desjardin, *ser. nov.*

= ser. *Actinopus* Singer, *pro parte*, Fl. Neotrop. Monogr. 17: 236. 1976.

*Pileipellis hymeniformis ex elementis M. sicco similibus; pilosetae nullae. Hymenii setae nullae. Stipes pruinosus vel pubescens, non insititius. Caulocystidia cylindrica, clavata vel acuminata, tenuitunicata vel crassitunicata; caulosetae nullae.*

TYPE SPECIES: *Agaricus atrorubens* Berkeley, London J. Bot. 1: 138. 1842 [≡ *Marasmius atrorubens* (Berk.) Berkeley, Hooker's J. Bot. Kew Gard. Misc. 8: 137. 1856].

Stipe non-insititious, pruinose, hispid or pubescent overall due to numerous, erect, cylindric, clavate or acuminate caulocystidia, these thin-walled or thick-walled, sometimes setoid; *Siccus*-type broom cells typically absent on stipe surface. Pileipellis hymeniform, composed of *Siccus*-type elements; pilosetae absent. Hymenophore lacking setae; pleurocystidia typically absent; cheilocystidia similar to the pileipellis elements or gloeocystidioid. Tramal hyphae dextrinoid (sometimes weakly so), clamped.

**25.** ***MARASMIUS CILIATOMARGINATUS*** Desjardin *in* Desjardin & Petersen, Mycotaxon 34: 76. 1989.

**HOLOTYPE:** United States, North Carolina, Macon Co., Highlands, Horse Cove Rd., 10 Aug. 1987, D. E. Desjardin no. 4414 (TENN 47626!).

**Basidiomata** marcescent, reviving. **Pileus** 5-20 mm broad, conic or campanulate when young, expanding in age to broadly campanulate or plano-convex, often with a low umbo and upturned margin; surface dull, dry, opaque, subvelutinous; disc rugulose, margin rugulose-striate;

coloration reddish brown (8D6-8), brown (7E7-8) or deep orange brown (7D8) overall when young, disc remaining so in age or fading to brownish orange (7C7-8), margin soon becoming brownish orange and fading in age to light brownish orange (6C5-7) or rarely when old and wet becoming light orange (5A3-4); context thin, buff-colored. **Lamellae** adnate, subdistant or nearly close (20-25 reach the stipe), narrow (<1.5 mm), yellowish white or cream (4A2-3), seldom forked near the margin, interlamellar spaces sometimes venose and assuming pileus tints at maturity; edges granular-crystalline, pale-concolorous with the pileus; **lamellulae** in 0-2 series. **Stipe** 18-45 X 0.5-1 mm, terete, equal or seldom with a small subbulbose base, solid or hollow in age, pruinose or pubescent overall, non-insititious, arising from a small ring of buff or cream-colored mycelium; upper half when young colored yellowish white (4A2) or dingy buff, lower half brown (6E5-6), hysterochroic; in age upper few mm pallid, base brown (6-7E4-6), reddish brown (8E5-6) or dark brown (7F5-6). **Odor** and **taste** not distinctive.

**Basidiospores** (Fig. 25 A) 13.5-18 X 3.2-4.7 µm [$\bar{\bar{x}}$ = 15.7 ± 1.0 X 4 ± 0.3 µm, E = 3-4.6, $\bar{Q}$ = 3.9 ± 0.3; n = 30 spores per 3 specimens], clavate or fusiform-elliptical, often curved in profile, hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 25 B) 22-30 X 6.5-8.5 µm, subcylindric or clavate, 4-spored. **Basidioles** (Fig. 25 B) clavate, ventricose or fusoid. **Pleurocystidia** not differentiated. **Cheilocystidia** of two types: 1) numerous gloeocystidioid elements (Fig. 25 C1), 38-56 X 3-5 µm, cylindric, flexuous or strangulate, obtuse, thin-walled, with or without tawny to reddish orange globular

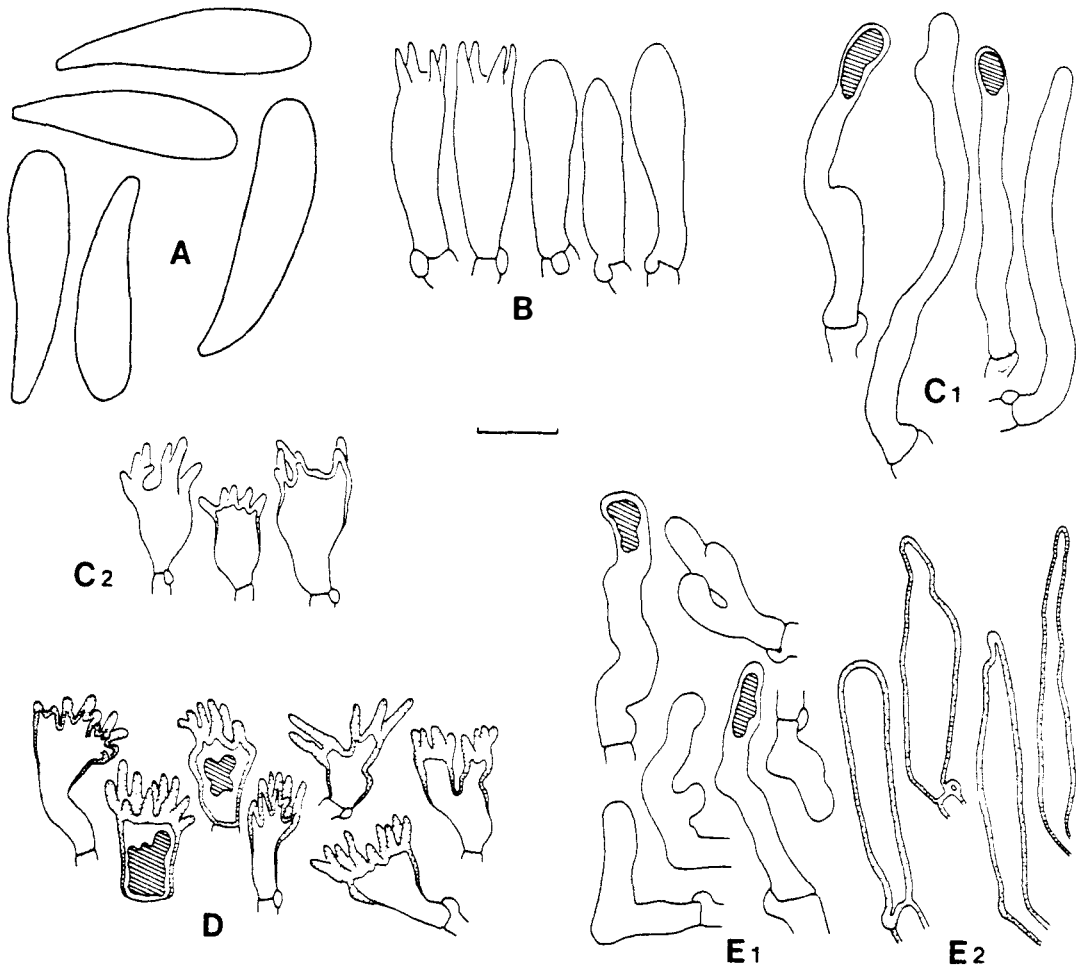



**Figure 25 A-E.** Features of *Marasmius ciliatomarginatus* (Desjardin no. 4414, holotype). A. Basidiospores. B. Basidia and basidioles. C1. Gloeocystidioid cheilocystidia. C2. *Siccus*-type cheilocystidia. D. Pileipellis elements. E1. Caulocystidia from stipe apex. E2. Caulocystidia from stipe base. Standard bar = 5 µm for A; 10 µm for B-E.

cytoplasmic contents typically congregated nearest the apices of the cells, or with reddish orange globular masses adherent to the external cellular surfaces, with inamyloid walls; 2) rare (or absent), scattered *Siccus*-type elements (Fig. 25 C2) similar to pileipellis elements, with hyaline or pale orange setulae. **Pileipellis** hymeniform,

weakly mottled, of *Siccus*-type broom cells (Fig. 25 D), with rare, inconspicuous, clavate, thin-walled, non-setulose cells interspersed; main body 8-16 X 3.2-8 µm, cylindric, clavate or irregular in outline, sometimes lobed, thin- or thick-walled, hyaline or tawny; apical setulae 1.5-8 X 0.8-2 µm, irregularly conic or cylindric, subnodulose or not, thick-walled or solid, ochraceous or reddish brown, pigmented portions weakly dextrinoid; some elements with tawny, globular contents; some elements thicker-walled and more deeply pigmented than average giving the pileipellis a mottled appearance under low magnification. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 1.5-9 µm diam, cylindric or inflated, frequently-branched, smooth, non-gelatinous, hyaline, inamyloid or weakly dextrinoid, thin-walled. **Stipe tissue** monomitic; **cortical hyphae** 2.5-6 µm diam, parallel, cylindric, smooth, hyaline or pale ochraceous and thin-walled apically, ochraceous or brown and thick-walled below, dextrinoid; **medullary hyphae** 2.5-11 µm diam, parallel or subparallel, hyaline or pale yellow, inamyloid or weakly dextrinoid; highly refractive oleiferous hyphae common. **Stipe vesture** of abundant **caulocystidia:** at stipe apex (Fig. 25 E1) 13-32 X 3-5 µm, irregularly cylindric or strangulate-contorted, rarely lobed, obtuse, hyaline, inamyloid, thin-walled, with or without reddish orange globular contents or adherent exudates; at stipe base (Fig. 25 E2) up to 40 X 4-8 µm, cylindric, ventricose or acuminate, pale ochraceous, inamyloid, with walls up to 1.5 µm thick. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Scattered or gregarious on senescent hardwood leaves or stems (rarely on *Rubus* stems or hickory

nuts) in mixed woods containing *Liriodendron, Quercus, Alnus, Cornus, Carya* and *Ilex* with scattered *Pinus* and *Tsuga*. August - September. Uncommon in southeastern North America. Known from North Carolina, Tennessee, Alabama and Florida.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** Features which in combination are diagnostic for *M. ciliatomarginatus* include: a) reddish brown or brownish orange, rugulose-striate pileus; b) subdistant, narrow, cream-colored, orange-marginate lamellae; c) pubescent, apically pallid and basally brownish, non-insititious stipe; d) clavate spores averaging 15.6 X 4 μm; e) absence of pleurocystidia; f) flexuous cheilocystidia with reddish orange contents or adherent exudates; and g) cylindric-contorted, non-diverticulate caulocystidia.

The most distinctive feature of this species is the abundant gloeocystidioid cheilocystidia and relative absence of *Siccus*-type cheilocystidia, resulting in a lamellar edge morphology unique in sect. *Sicci*. Consequently, *M. ciliatomarginatus* is not likely to be confused with any other members of the section. There are, however, several North American taxa that are phenetically similar in many other respects, *viz. M. sullivantii* Mont. (widespread in eastern North America), and *M. corrugatus* var. *aurantiacus* (Murr.) Sing. (known from Florida and the neotropics). *Marasmius sullivantii* (ser. *Haematocephali*) differs in having much smaller spores, abundant pleurocystidia and broom cell-type caulocystidia. *Marasmius corrugatus* var. *aurantiacus* (ser. *Leonini*) differs in having a glabrescent stipe with scattered broom cell-type caulocystidia, and smaller spores.

Refer to the description of *M. sullivantii* presented below and the type study of *M. aurantiacus* Murr. (Chapter VIII) for further details.

Singer (1965) misapplied the binomial *Marasmius actinopus* Mont. to a neotropical taxon with cystidiiform elements on the stipe surface, and subsequently established ser. *Actinopodes* Singer (1976) to accommodate species in sect. *Sicci* with setoid bodies or cystidiiform elements present on pileus, lamellae and/or stipe. Because the type specimen of *M. actinopus* lacks such elements (refer to the type study presented in Chapter VIII), and is therefore not conspecific with *M. actinopus sensu* Singer, another name is needed for the series comprising species with setoid bodies or cystidiiform elements on the stipe surface. [Species with setoid elements on the pileus and lamellae are referred to ser. *Spinulosi*.] Because Singer (1958) originally grouped *M. actinopus sensu* Singer with *M. atrorubens* (Berk.) Berk., *M. bahamensis* Murr., and *M. rubroflavus* (Theissen) Sing., in stirps *Atrorubens*, I have chosen the latter epithet as an acceptable name for the series in sect. *Sicci* comprising taxa with cystidiiform stipe elements.

*Marasmius ciliatomarginatus* is the only species in ser. *Atrorubenses* occurring in the southern Appalachians. *Marasmius testaceiceps* Murr., another member of the series known at present from several specimens collected in Florida (FLAS!), is similar to *M. ciliatomarginatus* but differs in forming smaller spores ($\bar{x}$ = 10.8 X 4.2 µm) and lacking gloeocystidioid cheilocystidia.

***MARASMIUS*** sect. ***SICCI*** ser. ***HAEMATOCEPHALI*** Singer, Fl. Neotrop. Monogr. 17: 201. 1976.

TYPE SPECIES: *Agaricus haematocephalus* Montagne, Ann. Sci. Nat. Bot. 2(7): 369. 1837 [≡ *Marasmius haematocephalus* (Mont.) Fries, Epicr. Syst. Mycol. 382. 1838].

Pleurocystidia present, well-differentiated, often refractive. Pilosetae, hymenial setae and caulosetae absent. Stipe surface glabrous or pruinose to pubescent. Caulocystidia present or absent, if present then of *Siccus*-type elements, never cylindric, clavate or acuminate. Other features as for the section.

**26. *MARASMIUS FALCATIPES*** Desjardin *in* Desjardin & Petersen, Mycotaxon 34: 85. 1989.

**HOLOTYPE:** United States, North Carolina, Macon Co., Highlands, Horse Cove Rd., 10 Aug. 1987, D. E. Desjardin no. 4415 (TENN 47629!).

**Basidiomata** marcescent, reviving. **Pileus** 1-7(-11) mm diam, campanulate or convex, expanding to plano-convex or plane, rarely umbonate, often undulate in age; disc even or rugulose; margin rugulose-striate; surface dull, dry, opaque, subvelutinous; color exceedingly variable, when young buff, greyish cream (4C2), grey (4E2), pale brownish grey (5E2-3), brownish orange (5C4), dark yellowish brown (5F4) or brown (6E4-6), the more deeply pigmented pilei fading in age to light yellowish brown (5D-E4-5), greyish yellow (5D3), pale brownish orange (5C3) or yellowish grey (4B3), but drying darker; context thin, white. **Lamellae** adnate, close or subdistant (7-14 reach the stipe), narrow or moderately broad (-1.5 mm), rarely forked or intervenose near

the margin; coloration white, buff or pale yellowish white (4A2) at first, remaining so in age or becoming pale yellowish grey (4B3) or orange white (5A2), non-marginate; **lamellulae** in 1-2 series. **Stipe** 1-2.5 X <0.2 mm, typically eccentric, but often central or rarely nearly lateral, terete, equal, curved or geniculate, pruinose overall, non-insititious, arising from a small, white mycelial pad; coloration white or buff overall when young, remaining so in age or the base darkening to cream (4A3), pale yellowish grey (4B3) or pale brownish orange (5C3). **Odor** and **taste** not distinctive.

**Basidiospores** (Fig. 26 A) (7.5-)8-10.5(-12) X 3.5-5.2 µm [$\bar{\bar{x}}$ = 9.4 ± 0.5 X 3.9 ± 0.2 µm, E = 1.9-2.9, $\bar{Q}$ = 2.4 ± 0.1; TL90(90%): $\bar{x}$ = 8.5-10.3 X 3.5-4.3 µm, Q = 2.2-2.7; n = 25 spores per 7 specimens], ellipsoid or amygdaliform, often with a slight suprahilar depression and abaxial bulge, with a prominent hilar appendix, hyaline, inamyloid, smooth white in deposit. **Basidia** (Fig. 26 B) 16-22.5 X 5-6.5(-7.5) µm, clavate, 4-spored. **Basidioles** (Fig. 26 B) broadly clavate or ventricose-fusoid. **Pleurocystidia** (Fig. 26 C) rare or numerous, 30-45 X 4.8-8 µm, irregularly cylindric, obtuse, arising from deep in the subhymenium and projecting up to 11 µm beyond basidioles, often basally curved, refractive, hyaline, inamyloid. **Cheilocystidia** (Fig. 26 D) numerous, 11-17(-20) X 4.8-8(-9) µm, setulose, similar to pileipellis elements but typically hyaline overall, only rarely with pale ferruginous setulae; lamellar edge entirely sterile or with scattered basidia, basidioles and rare pleurocystidia-type elements. **Pileipellis** hymeniform, not mottled or weakly mottled, composed of *Siccus*-type broom cells (Fig. 26 E); main body 8.5-16 X 4.5-8.5(-9.5) µm,

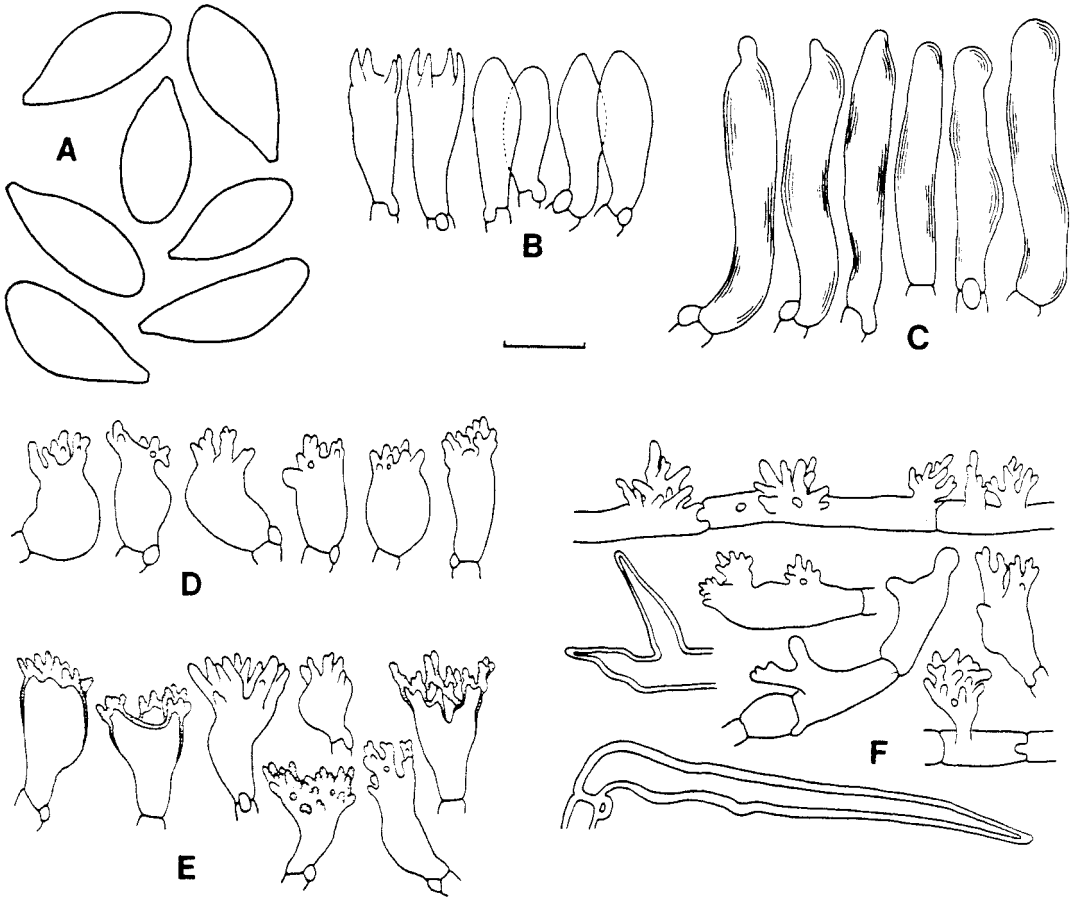



**Figure 26 A-F.** Features of *Marasmius falcatipes* (Desjardin no. 4415, holotype). A. Basidiospores. B. Basidia and basidioles. C. Pleurocystidia. D. Cheilocystidia. E. Pileipellis elements. F. Elements of stipe vesture (thick-walled elements from stipe base). Standard bar = 5 µm for A; 10 µm for B-F.

cylindric, clavate or irregular in outline, often lobed; basal portion of cells hyaline, thin-walled, inamyloid; apical setulae 1-7(-9) X 0.5-2 µm, irregularly cylindric or contorted, rarely branched, obtuse, hyaline to pale yellow and thin-walled, or ochraceous to ferruginous and thick-walled, pigmented areas weakly dextrinoid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-8(-10) µm diam, cylindric or inflated, smooth, non-gelatinous, hyaline, dextrinoid,

thin-walled. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 2.5-10 µm diam, parallel, cylindric, smooth, hyaline or pale yellow, strongly dextrinoid, with walls up to 2 µm thick; stipe base hyphae strongly sclerified. **Stipe vesture** (Fig. 26 F) of numerous diverticulate or setulose inflations projecting from the outermost layer of cortical hyphae, and with scattered elements similar to those of the pileipellis. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Scattered or gregarious on senescent leaves or stems of various hardwoods, herbaceous vines or grasses in mixed deciduous woodlands. July - September. Uncommon in southeastern North America. Known from Virginia, North Carolina, South Carolina and Tennessee.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** *Marasmius falcatipes* exhibits substantial morphological and substrate variability. The stipe-pileus insertion ranges from central to nearly lateral, with the full range of variation exhibited within or between collections. Pileus coloration varies from buff, greyish yellow or brownish yellow to brownish orange, brown or grey. Basidiomata have been found growing on senescent leaves or stems of various deciduous hardwoods or herbaceous vines (*e.g., Rubus, Lonicera*), as well as grass leaves. Moreover, there appears to be no correlation between degree of stipe eccentricity, pileus coloration and substrate preference.

*Marasmius falcatipes* is accepted here in sect. *Sicci* ser. *Haematocephali* based on the presence of conspicuous, refractive pleurocystidia. Although basidiomata of *M. falcatipes* show distinctive

pleurocystidia, the species appears to be most phenetically similar to several taxa lacking pleurocystidia (*i.e.*, belonging to ser. *Leonini*), *viz.*, *M. armeniacus* Gilliam and *M. pusio* Berk. & Curt. The holotype specimens of *Marasmius armeniacus* (MICH!) and *M. pusio* var. *pusio* (FH!) differ from *M. falcatipes* in longer stipes (at least two times longer than the width of the pileus) and having more polymorphic caulocystidia. In comparison, the stipe of *M. falcatipes* is usually shorter than the width of the pileus. Refer to the type studies of *M. armeniacus* and *M. pusio* (Chapter VIII) for further details. *Marasmius pusio* var. *guatopoensis* (Dennis) Sing. essentially differs only in lacking pleurocystidia (*fide* Dennis, 1961).

If greater taxonomic emphasis is placed on the presence of a short, eccentric stipe, it could be argued that *M. falcatipes* belongs in sect. *Neosessiles* Singer (1958). This section was established to unify all taxa combining the following characters: 1) pleurotoid habit (*i.e.*, stipe eccentric, lateral or absent); 2) non-collariate lamellae; 3) dextrinoid tramal tissue; and 4) hymeniform pileipellis of diverticulate elements. Subsequently, Singer (1965) emended the section to include both dextrinoid ("pseudoamyloid") tramal hyphae (subsect. *Neosessilini*) and inamyloid tramal hyphae (subsect. *Spaniophyllini*). If taxa currently placed in sect. *Neosessiles* are re-evaluated utilizing characters in common usage at sectional or subsectional levels, it appears that sect. *Neosessiles* is somewhat heterogeneous. It contains taxa with *Siccus*- or *Rotalis*-type pileipellis elements, insititious or non-insititious stipes, dextrinoid or inamyloid tramal tissue, and with or without pleurocystidia [see

Singer (1976) for a thorough treatment of the neotropical species]. Examination of the holotype specimens of a number of species currently placed in sect. *Neosessiles* indicated that this section includes discordant elements. For example, *M. polycystis* Singer (1976), described from a specimen collected in Bolivia, exhibits all characters diagnostic of sect. *Sicci* except for the presence of a short, eccentric stipe. Indeed, when compared with *M. falcatipes, M. polycystis* differs only in pleurocystidial morphology. In the latter, pleurocystidia are broadly ventricose and average 13.6 μm in width (n = 45 cystidia; known from a single, holotype specimen), while in *M. falcatipes*, pleurocystidia are cylindrical with a mean width of 5.8 μm [$\bar{W}$ = 5.1-6.5 μm, n = 20 cystidia per 10 specimens). The extensive variability in stipe-pileus insertion exhibited by *M. falcatipes* indicates that stipe eccentricity may be of limited taxonomic value. These data suggest that *M. polycystis* is better placed in sect. *Sicci*, presumably closely allied with *M. falcatipes*. Since many species in sect. *Neosessiles* are known only from their type specimens, which in some cases consist of a single basidiome, it would be premature to dismantle or redefine the section until further material is available for comparative studies. Nonetheless, the taxonomic disposition of species currently placed in sect. *Neosessiles* warrants further evaluation.

**27. *MARASMIUS SPISSUS*** Gilliam, Mycologia 67: 834. 1975.

**HOLOTYPE:** United States, Michigan, Washtenaw Co., Sharon Hollow, NW of Manchester, 2 July 1960, A. H. Smith no. 62486 (MICH!).

**Basidiomata** marcescent or slightly putrescent. **Pileus** 10-35(-40) mm diam, campanulate or broadly convex with an incurved margin when young, expanding to plano-convex, plano-umbonate or plane, sometimes with an uplifted margin in age, even overall throughout development (*i.e.*, non-striate); surface dull, dry or moist and subhygrophanous, opaque, subvelutinous; coloration brown (7D7-8) or reddish brown (8E5-6) overall when young; disc soon fading to light brown (6-7D5-8), pinkish brown, brownish orange (6C5-7) or becoming slightly paler in age; margin fading in age to brownish grey (6C3-4), greyish orange (5-6B3-4), pale orange white (5-6A3), cream (4A3, cream-buff, pale yellowish white (4A2), or pinkish buff, sometimes weakly zonate or mottled with various combinations of these colors; context watery-concolorous with pileus surface, up to 2.5 mm thick. **Lamellae** adnexed, seceding in age, very crowded, narrow (up to 1.5 mm), thin, not intervenose, sometimes forked near the margin and/or anastomosing elsewhere; coloration white, buff or pale yellowish white (4A2) at first, becoming cream (4A3) or pale orange white (5A2) in age, non-marginate; **lamellulae** in 4-5 series. **Stipe** 20-75 X 2-4 mm, terete or compressed, equal or with a flared apex and/or slightly enlarged base, tough, hollow; upper 1/2 - 3/4 glabrous or minutely pruinose (14 X mag.), glabrescent, basal region pruinose above copious basal mycelium, non-insititious, arising from a thick mat of downy or felty, white, yellowish white, orange white or buff-colored mycelium; apex colored white, buff or yellowish white (4A2), grading near the middle to yellowish orange (4-5A4) or greyish orange (5B5), base colored brownish orange (6C5-8), light brown (6-7D6-8) or brown (6-7E6-8), or sometimes

dark brown (7F5-8). **Odor** sweet, slightly fruity or fungal, sometimes like *Collybia dryophila*. **Taste** mild, seldom slightly astringent.

**Basidiospores** (Fig. 27 A) 5.6-8.0 X 2.8-3.8 µm [$\bar{\bar{x}}$ = 6.6 ± 0.2 X 3.2 ± 0.1 µm, E = 1.7-2.4, $Q^-$ = 2.0 ± 0.07, n = 20-30 spores per 6 specimens], ellipsoid or amygdaliform, inequilateral in profile, hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 27 B) 17.5-24 X 4.5-6.5 µm, clavate, 4-spored. **Basidioles** (Fig. 27 B) cylindric, fusoid or clavate. **Pleurocystidia** (Fig. 27 C) common on some basidiomata, uncommon or seemingly absent on others, 24-36 X 3.5-5.5 µm, narrowly cylindric, flexuous or ventricose with a long, narrow rostrum, obtuse or subacute, arising from about the same level as the basidioles and projecting little or up to 12 µm beyond, non-refractive, thin-walled, readily collapsing, sometimes inconspicuous, hyaline, inamyloid. **Cheilocystidia** of two types: 1) ***Siccus*-type broom cells** (Fig. 27 D1), uncommon, with main body 10-16 X 5-10 µm, cylindric, clavate or turbinate, thin-walled or with walls up to 1 µm thick, hyaline, pale yellow or pale tawny; apical setulae 2.5-7.5 X 1-2 µm, conic, obtuse, subacute or acute, thick-walled, hyaline, yellow or tawny; 2) **versiform, non-setulose elements** (Fig. 27 D2), abundant, 19.5-36 X 5-11.5 µm, clavate, strangulate-clavate or irregular in outline, often bifid or irregularly lobed, refractive, thin-walled, hyaline, inamyloid. **Pileipellis** hymeniform, weakly mottled, composed of *Siccus*-type broom cells (Fig. 27 E); main body 8-32 X 5-12 µm, cylindric, clavate, turbinate or irregular in outline, sometimes lobed; majority of cells hyaline or pale yellow and thin-walled; scattered cells orange or pale brownish orange and thick-walled; apical setulae

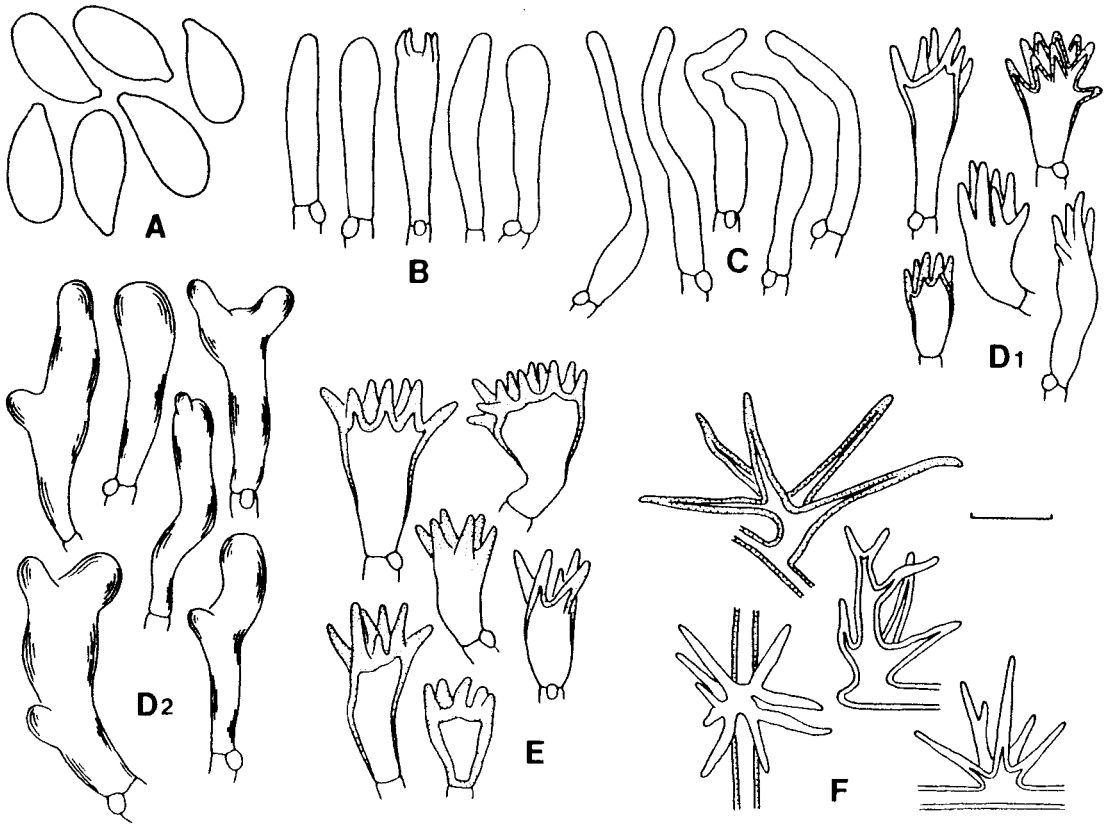



**Figure 27 A-F.** Features of *Marasmius spissus* (Smith no. 62486, holotype). A. Basidiospores. B. Basidium and basidioles. C. Pleurocystidia. D1. *Siccus*-type cheilocystidia. D2. Refractive, non-setulose cheilocystidia. E. Pileipellis elements. F. Dendrotrichomoid elements from stipe base. Standard bar = 5 µm for A; 10 µm for B-F.

2-8 X 0.5-2.5 µm, cylindric or conic, obtuse, subacute or acute, thick-walled or solid, ranging from subhyaline to yellow, orange or brownish orange; pigmented areas weakly dextrinoid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3.5-12 µm, cylindric or inflated, smooth, non-gelatinous but with oily cells contents, hyaline, strongly dextrinoid, thin-walled. **Stipe tissue** monomitic; **cortical hyphae** 2.5-8 µm diam, parallel, cylindric, smooth, hyaline (stipe apex), ochraceous or brownish orange (stipe base), strongly dextrinoid, with

walls up to 1.5 µm thick; **medullary hyphae** 3-10(-12) µm diam, similar to cortical hyphae but hyaline and thinner-walled. **Stipe vesture** absent at stipe apex, composed of numerous dendrotrichomoid elements or rare *Siccus*-type broom cells at stipe base; **dendrotrichomoid elements** (Fig. 27 F) with poorly-developed basal regions giving rise to 4-8 divergent setulae; setulae up to $24^{+}$ X 1.5-3 µm, cylindric-acuminate or conic, sometimes branched, subacute or acute, thick-walled or solid, hyaline or ochraceous, dextrinoid. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Solitary, scattered or gregarious, rarely subcespitose, on decaying hardwood leaves in deciduous woods or mixed forests. June - September. Uncommon in eastern North America from New York southward to North Carolina and Tennessee.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** Diagnostic field characters of *M. spissus* include: a) non-striate, plano-umbonate, pileus colored pinkish brown on the disc and greyish orange or pinkish buff on the margin; b) crowded, narrow, yellowish white lamellae; c) apically glabrous, basally pruinose stipe colored yellowish white above and brownish orange below; and d) habit on hardwood leaves. Micromorphologically, the species is distinct because of the following combination of characters: e) small spores; f) inconspicuous, flexuous, non-refractive pleurocystidia; g) two types of cheilocystidia; and h) numerous dendrotrichomoid elements on the stipe base.

In the field, basidiomata of *M. spissus* might be misdiagnosed as *Collybia dryophila* (Bull.: Fr.) Kummer. The latter species differs, however, in forming non-hymeniform pileipelli composed of interwoven, non-setulose hyphae, inamyloid tramal tissues, and lacks dendrotrichomoid elements on the stipe surface.

*Marasmius spissus* is included here in ser. *Haematocephali* because of the presence of pleurocystidia. It should be noted, however, that the pleurocystidia of *M. spissus* are often inconspicuous or seemingly absent in some basidiomata, and never strongly refractive as in the majority of species comprising this series. A comparison of *M. spissus* to species of *Marasmius* worldwide might indicate closer affinity to taxa in ser. *Leonini*. The species is keyed out in both series for diagnostic convenience.

I encountered in herbarium material what appears to be a darkly pigmented form of *M. spissus*. Several collections housed at NYS show a deep reddish brown pileus and pale greyish brown lamellae as dried [*viz.*, New York, Selkirk, Aug., Peck; New York, Round Lake, Aug., Peck; Ohio, Morgan]. Whether these colors were present in fresh material is unknown. The pigmentation of these herbarium specimens may represent an artifact of drying or herbarium storage. All micromorphological features of these specimens match those of the holotype specimen of *M. spissus*.

**28. *MARASMIUS SULLIVANTII*** Montagne, Syll. Crypt. 143. 1856.

**HOLOTYPE:** United States, Ohio, Sullivant no. 174 (PC!).

**Basidiomata** marcescent, reviving. **Pileus** 8-25 mm diam, hemispheric, convex, campanulate or obtusely conic when young, expanding to broadly convex or plano-convex, with or without a broad, low umbo, in age margin rarely uplifted, even overall throughout maturation (*i.e.*, non-striate) or with margin becoming short-striatulate or pellucid-striate in age; surface dull, dry or moist and subhygrophanous, opaque, subvelutinous, often with scattered, buff-colored soredioid (powdery) spots when dried; coloration deep reddish brown (8-9E-F6-8) or reddish brown (8-9D7-8) overall when young; disc remaining reddish brown in age, or sometimes fading slightly or becoming brownish orange (7C-D6-8); margin becoming brownish red (8C-D6-8), brownish orange (6-7C6-8), reddish orange (7B7-8) or orange (6B5-7) in age; context thin, white. **Lamellae** adnexed, close (20-26 complete lamellae), moderately broad (up to 3 mm), not forked nor intervenose; white when young, becoming buff, dingy buff, pale yellowish white (4A2) or pale orange white (5A2) in age; edges concolorous with the faces, or orange, pale brownish orange, pink, red or pale reddish brown in age, often with scattered, pallid, soredioid spots when dried; **lamellulae** in 2-3 series. **Stipe** 10-35(-50) X 1-2 mm, terete, equal or with a flared apex and/or slightly enlarged base, tough, cartilaginous, hollow, dull, dry, pruinose or pubescent above the base, non-insititious; base covered with long, strigose, white or pale yellowish white mycelial hairs; when young, upper half colored white or buff, base brownish orange (6-7C6-8) or brown (7E6-8); in age upper few mm concolorous with the lamellae, base grading from brownish

orange to brown or reddish brown (8D-E6-8). **Odor** not distinctive or slightly fungal. **Taste** mild or subastringent.

**Basidiospores** (Fig. 28 A) 6.4-8.8(-9.6) X 3.2-4 µm [$\bar{\bar{x}}$ = 7.6 ± 0.3 X 3.6 ± 0.1 µm, E = 1.8-2.6, $\bar{Q}$ = 2.1 ± 0.1; TL90(90%): $\bar{x}$ = 7.1-8.1 X 3.4-3.9 µm, Q = 2.0-2.2; n = 30 spores per 8 specimens], ellipsoid or subamygdaliform, rarely ovoid, inequilateral in profile, hyaline, inamyloid, smooth, white or pale yellowish white in fresh deposit. **Basidia** (Fig. 28 B) 17.5-28 X 5-6.5 µm, clavate, 4-spored. **Basidioles** (Fig. 28 B) cylindric, clavate or seldom ventricose. **Pleurocystidia** (Fig. 28 C) uncommon or common, 25-50 X 4.5-8 µm, fusoid or irregularly cylindric, sometimes apically attenuated or wavy in outline, sometimes appendiculate, arising from deep in the subhymenium or from the lamellar trama and projecting little or well-beyond the basidioles, refractive (sometimes only weakly so), sometimes inconspicuous, thin-walled, hyaline, inamyloid. **Cheilocystidia** (Fig. 28 D) common, similar to the *Siccus*-type pileipellis elements; main body 9.5-16(-24) X 4-7.5 µm, cylindric, clavate or turbinate, seldom lobed, thin-walled or firm walled, hyaline or pale yellow; apical setulae 2.5-7 X 0.5-1.5 µm, cylindric or conic, obtuse or subacute, thick-walled, hyaline, pale yellow or pale orange. **Pileipellis** hymeniform, not mottled, composed of *Siccus*-type broom cells (Fig. 28 E); main body 8-16 X 4.5-8 µm, cylindric, clavate, turbinate or irregular in outline, thin-walled or firm-walled, hyaline or pale orange; apical setulae 2.5-8 X 0.5-1.5 µm, cylindric or conic, somewhat wavy, obtuse, subacute or acute, thick-walled or solid, subhyaline, orange or tawny, dextrinoid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-10 µm diam,

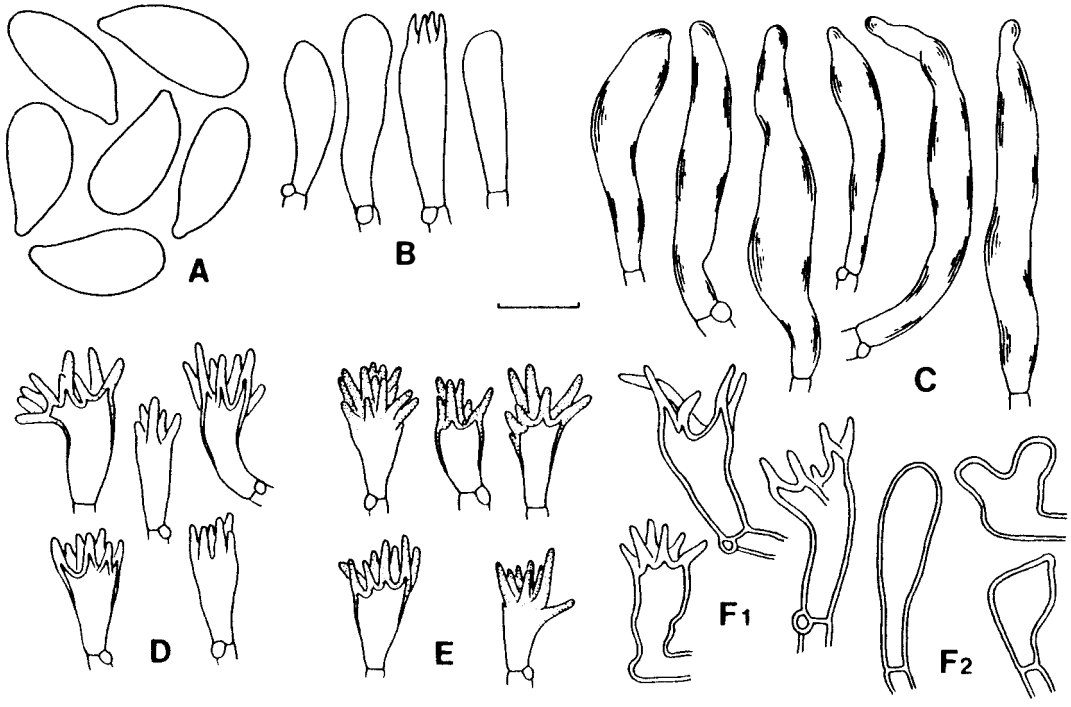



**Figure 28 A-F.** Features of *Marasmius sullivantii* (Sullivant no. 174, holotype). A. Basidiospores. B. Basidium and basidioles. C. Pleurocystidia. D. Cheilocystidia. E. Pileipellis elements. F1. *Siccus*-type caulocystidia. F2. Non-setulose caulocystidia. Standard bar = 5 µm for A; 10 µm for B-F.

cylindric or slightly inflated, smooth, non-gelatinous, hyaline, dextrinoid, thin-walled. **Stipe tissue** monomitic; **cortical hyphae** 4-12 µm diam, parallel, cylindric, smooth, hyaline or pale yellow (stipe apex), dark ochraceous or brown (stipe base) [olivaceous brown in 3% KOH], dextrinoid, with walls up to 2 µm thick; **medullary hyphae** similar to cortical hyphae but hyaline and thinner-walled. **Stipe vesture** of numerous *Siccus*-type broom cells plus non-setulose elements; ***Siccus*-type broom cells** (Fig. 28 F1) similar to the pileipellis elements, present as recurved terminal cells of cortical hyphae with apical setulae, or as repent cells with lateral, erect setulae; **non-**

**setulose elements** (Fig. 28 F2) 8-40 X 5-10 µm, fusoid, ventricose, clavate or irregular in outline, sometimes lobed or with knob-like outgrowths, thick-walled, hyaline. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Scattered or gregarious on decaying leaves of various hardwoods (*Quercus, Acer, Carya, Liriodendron*) in deciduous woods or mixed forests with *Tsuga*. June - September. Common throughout eastern North America, from Massachusetts to Minnesota and southward to Texas and Alabama.

**Specimens Examined**. Refer to Appendix A.

**Commentary.** *Marasmius sullivantii* is one of the more commonly collected members of sect. *Sicci* in the Great Smoky Mountains. Populations often number 50 or more basidiomata, fruiting gregariously in deep hardwood leaf mulch in deciduous woods. The species is characterized by the following combination of features: a) convex, non-striate, subvelutinous, reddish brown or brownish orange pileus; b) close, moderately broad lamellae that are often slightly pigmented on the margins; c) pruinose or pubescent stipe with long, white, strigose basal mycelial hairs; d) small spores; and e) dimorphic caulocystidia. One feature useful in diagnosing dried herbarium specimens is the presence of buff-colored or pale yellowish spots on the pileus and lamellae. At low magnification, the spots are similar in appearance to soredia in lichens (*i.e.*, powdery or granulose), and I have termed them "soredioid spots." This feature has not been observed on material of any other North America species of *Marasmius*.

Gilliam (1976) provided an extensive comparison of *M. sullivantii* and *M. glabellus* Pk. The two species are superficially similar at immature stages of development, but there should be no problem identifying mature basidiomata. *Marasmius glabellus* differs in forming basidiomata with distinctly striate or sulcate pilei colored more toward orange or yellow, distant, broad lamellae, glabrous stipe, larger spores, and lacks caulocystidia. *Marasmius sullivantii* is also superficially similar to *M. ciliatomarginatus*. For a comparison of the latter two species refer to the commentary on *M. ciliatomarginatus*.

A photograph of southern Appalachian material of *M. sullivantii* was presented by Hesler (1957) identified as *M. floridanus* Murr. Although *M. floridanus* does occur in the southern Appalachians, unfortunately the specimen shown in the photograph (TENN 21390) was misdetermined. Both *M. sullivantii* and *M. floridanus* form non-striate, darkly pigmented pilei composed of *Siccus*-type broom cells, and fruit on hardwood leaf litter. *Marasmius floridanus* differs, however, in forming a glabrous stipe that lacks caulocystidia, and in forming more conspicuous pleurocystidia and longer spores. Refer to the description of *M. floridanus* provided below for further details.

**29. *MARASMIUS GLABELLUS*** Peck, Bull. buffalo Soc. Nat. Sci. 1: 58. 1873 (1874).

**HOLOTYPE:** United States, New York, Worchester and Croghan, C. H. Peck (NYS!).

**Basidiomata** marcescent, reviving. **Pileus** 5-20 mm diam, campanulate or convex when young, expanding to broadly campanulate,

broadly convex or plano-convex, with or without a small central umbo or papilla, sometimes depressed in age; disc even at first, becoming rugulose; margin even at first, soon striate, sometimes crenate in age; surface dull, dry, opaque, subvelutinous; coloration light brown (6D5-7), brownish orange (6C5-7) or brownish yellow (5C6-8) overall when young, disc typically remaining so in age or fading slightly, margin fading slightly in age, often with paler striae, in age pileus usually pale brownish orange or yellowish brown with paler radiating striae; context thin, buff or pale yellowish white. **Lamellae** adnexed, seceding in age, distant or remote (12-15 complete lamellae), broad (up to 5 mm), not forked, not intervenose or weakly intervenose in age; colored white or pale yellowish white, seldom pale brown-marginate; **lamellulae** in 1-2 series. **Stipe** 15-50 X 1-1.5 mm, terete, equal or with a flared apex, tough, hollow, shiny, glabrous overall, non-insititious, arising from a mat of fibrillose, white or orange mycelium; apex yellowish white (4A2) or cream (4A3), darkening slightly in age; central portion greyish orange (5B5); base yellowish brown (5C5-7), brown (7E5-6) or reddish brown (8E5-6), darkening in age. **Odor and taste** not distinctive or slightly spermatic.

**Basidiospores** (Fig. 29 A) 7.2-11.2 X 4-5.6 µm [$\bar{\bar{x}}$ = 9.1 ± 0.5 X 4.6 ± 0.1 µm, E = 1.6-2.5, $\bar{Q}$ = 2.0 ± 0.1; TL90(90%): $\bar{x}$ = 8.1-10.1 X 4.4-4.8 µm, Q = 1.8-2.2; n = 20-25 spores per 8 specimens], ovate, pip-shaped or ellipsoid, hyaline, inamyloid, smooth, white indeposit. **Basidia** (Fig. 29 B) 25-34 X 5.5-8 µm, clavate, 4-spored. **Basidioles** (Fig. 29 B) cylindric or clavate. **Pleurocystidia** (Fig. 29 C) uncommon or common, (32-)40-68 X 5-10 µm, irregularly cylindric or fusoid, often

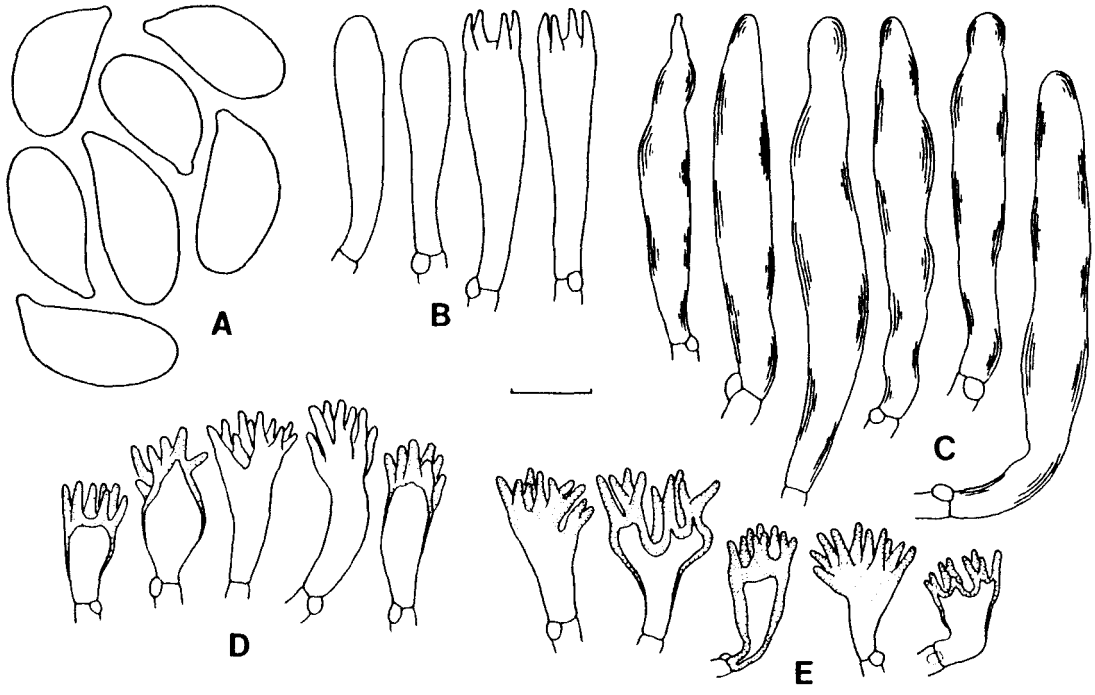



**Figure 29 A-E.** Features of *Marasmius glabellus* (Desjardin no. 4125). A. Basidiospores. B. Basidia and basidioles. C. Pleurocystidia. D. Cheilocystidia. E. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-E.

wavy in outline, often apically constricted and appendiculate, seldom apically lobed, arising from deep in the subhymenium and projecting up to 16 µm beyond the basidioles, refractive or sometimes non-refractive, thin-walled, hyaline, inamyloid. **Cheilocystidia** (Fig. 29 D) common, similar to the *Siccus*-type pileipellis elements; main body 10-21 X 5-8 µm, cylindric, clavate, subvesiculose or irregular in outline, sometimes lobed, typically thin-walled and hyaline, some elements thick-walled and pale orange; apical setulae 2-6.5 X 1-2 µm, cylindric or conic, obtuse or subacute, thick-walled or solid, ranging from hyaline to pale yellow or orange. **Pileipellis** hymeniform, mottled or weakly mottled, composed of *Siccus*-type broom cells (Fig. 29 E); main

body 10-16(-24) X 6.5-13 µm, cylindric, clavate, subvesiculose, turbinate or irregular in outline, sometimes lobed; many elements thin-walled and hyaline or pale orange; many other elements thick-walled and ochraceous or orange; apical setulae 1.5-6.5 X 0.5-2 µm, cylindric, conic or irregular in outline, rarely branched, obtuse or subacute, thick-walled or solid, ranging from pale ochraceous to orange or brownish orange, dextrinoid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-10 µm, cylindric or inflated, smooth, non-gelatinous, thin-walled, hyaline, dextrinoid (sometimes weakly so). **Stipe tissue** monomitic; **cortical hyphae** 2.5-8 µm diam, parallel, cylindric, smooth, hyaline to pale yellow (stipe apex) or ochraceous to brownish orange (stipe base), strongly dextrinoid, with walls up to 1.5 µm thick; **medullary hyphae** 3.5-16 µm diam, cylindric or inflated, hyaline, with walls <1 µm thick. **Stipe vesture** absent. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Solitary, gregarious or subcespitose on decaying hardwood leaves in deciduous woods or mixed forests. July - September. Uncommon or rare in the southern Appalachian Mts.; uncommonly collected throughout northeastern North America.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** *Marasmius glabellus* is rare in the southern Appalachian region, known at present from four specimens. The following combination of features are diagnostic for the species: a) campanulate, striate pilei colored brownish orange or brownish yellow with paler striae; b) distant or remote, broad lamellae; c) glabrous,

non-insititious stipe colored yellowish white above and brownish yellow below; d) broad spores ($\bar{W}$ = 4.6 µm); e) irregularly cylindric, refractive pleurocystidia; and f) absence of caulocystidia.

Immature basidiomata of *M. glabellus* are superficially similar to brownish orange forms of *M. sullivantii*. The latter species differs, however, in forming pilei that only rarely become striate at maturity, in showing closer and narrower lamellae, pruinose or pubescent stipe with dimorphic caulocystidia, and in forming smaller spores. In the field, *M. glabellus* may be misdiagnosed as *M. pulcherripes* Pk. or *M. siccus* (Schw.) Fr. Both of the latter species differ from *M. glabellus* in forming closer, narrower lamellae and much longer spores.

Another taxon very similar to *M. glabellus* occurs in North America, differing only in absence of pleurocystidia. This taxon, provisionally named *M. submarginatus* (Singer, *ined.*) was collected on decayed oak leaves in White Pines Forest State Park, Ogle Co., Illinois (FH!).

The binomial *M. glabellus* has been misapplied to several exsiccati numbers distributed by J. B. Ellis. Ellis' North American Fungi Exsiccati Ser. I, Cent. 10, no. 910, determined as *M. glabellus* is really *M. paludigenus* Desjardin *in* Desjardin & Petersen. Refer to Desjardin and Petersen (1989b) for a description of *M. paludigenus* and a comparison with *M. glabellus*. Ellis and Everhart's Fungi Columbiani Exsiccati, Cent. 6, no. 501, determined as *M. glabellus* is conspecific with *M. rotula*.

**30.** ***MARASMIUS FLORIDANUS*** var. ***FLORIDANUS*** Murrill, Bull. Torrey Bot. Club 67: 149. 1940.

= *Marasmius spadiceus* Gilliam, Mycologia 67: 840. 1975.

**HOLOTYPE:** United States, Florida, Alachua Co., Planera Hammock, near Gainesville, 16 July 1938, West, Arnold & Murrill no. F17347 (FLAS!).

**Basidiomata** marcescent, reviving. **Pileus** 10-50 mm diam, hemispheric or convex when young, expanding to broadly convex, plano-convex or nearly plane in age, sometimes subumbonate; disc even or weakly rugulose in age; margin even, sometimes short-striatulate in age; surface dull, dry, opaque, subvelutinous; coloration "auburn" or "amber brown" overall when young, fading slightly in age to "Kaiser brown," "hazel," fulvous or brownish orange (near "Cinnamon-rufous"); context 1-1.5 mm thick, buff. **Lamellae** adnexed, close or subdistant, moderately broad (1-3 mm), thin, not forked nor intervenose; white at first, becoming pale yellowish white (4A2) or cream (4A3) in age, non-marginate; **lamellulae** in 1-3 series. **Stipe** 20-50(-70) X 1.5-3 mm, terete, equal, sometimes twisted, tough, cartilaginous, hollow, dry, shiny, glabrous, non-insititious, arising from a pad of buff-colored, strigose mycelium; apex colored white, yellowish white or orange white; base colored brown or reddish brown. **Odor and taste** not distinctive.

**Basidiospores** (Fig. 30 A) 7.2-11.2 X 2.8-4 µm [$\bar{\bar{x}}$ = 9.0 ± 0.5 X 3.3 ± 0.1 µm, E = 2.2-3.7, $\bar{Q}$ = 2.7 ± 0.2; TL90(90%): $\bar{x}$ = 8.0-10.0 X 3.1-3.5 µm, Q = 2.3-3.1; n = 20-30 spores per 9 specimens], ellipsoid, elongate-ellipsoid or subamygdaliform, inequilateral in profile,

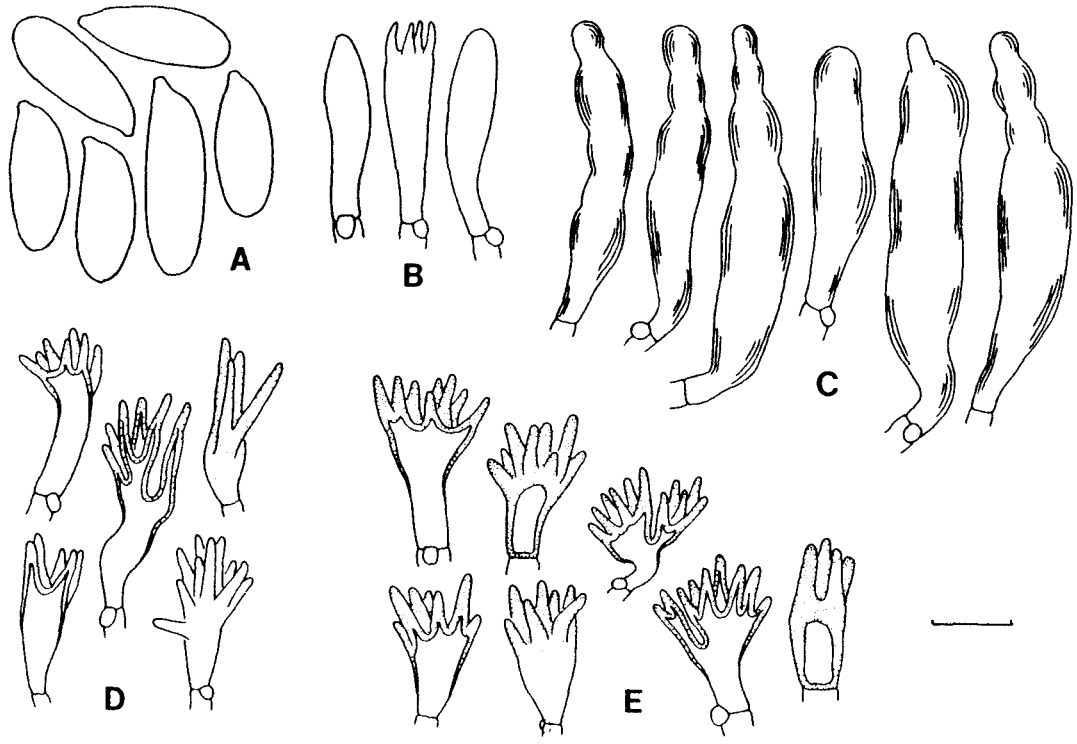



**Figure 30 A-E.** Features of *Marasmius floridanus* var. *floridanus* (TENN 10219). A. Basidiospores. B. Basidium and basidioles. C. Pleurocystidia. D. Cheilocystidia. E. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-E.

hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 30 B) 21.5-28 X 5.5-6.5 µm, clavate, 4-spored. **Basidioles** (Fig. 30 B) fusoid or clavate. **Pleurocystidia** (Fig. 30 C) numerous, 32-50(-58) X 6-10(-12) µm, irregularly cylindric, fusoid, subclavate, ventricose or lageniform, often strangulate, apically constricted or with a mucronate projection, arising from deep in the subhymenium or from the lamellar trama and projecting well-beyond the basidioles, refractive, thin-walled, hyaline, rarely pale yellow, inamyloid. **Cheilocystidia** (Fig. 30 D) numerous, similar to the *Siccus*-type pileipellis elements; main body 8-17.5 X 5-9.5 µm, cylindric, clavate, turbinate or irregular in

outline, sometimes lobed, thin-walled or firm-walled, hyaline or pale yellow; apical setulae 3-12(-17.5) X 0.5-2.5 µm, cylindric, cylindric-acuminate or conic, obtuse, subacute or acute, thick-walled or solid, hyaline, yellow or pale ochraceous. **Pileipellis** hymeniform, evenly mottled, composed of *Siccus*-type broom cells (Fig. 30 E); main body 8-18 X 5.5-10.5 µm, cylindric, clavate, turbinate, pyriform or irregular in outline, often lobed; many elements thin-walled or firm-walled, subhyaline, pale yellow, pale orange, or pale brownish orange; many elements thick-walled, brownish orange or pale brown; apical setulae 2.5-12 X 1-2.5 µm, cylindric-acuminate or conic, subacute or acute, thick-walled or solid, ranging from yellow to orange, brownish orange or tawny, dextrinoid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-15 µm diam, cylindric, sometimes inflated up to 22 µm diam, smooth, non-gelatinous, thin-walled, hyaline, dextrinoid. **Stipe tissue** monomitic; **cortical hyphae** 2.5-8(-12.5) µm diam, parallel, cylindric, smooth, yellow, ochraceous or brownish orange, strongly dextrinoid, with walls up to 1.5 µm thick; **medullary hyphae** 3-12 µm diam, hyaline, dextrinoid, thin-walled. **Stipe vesture** absent, or rarely with few *Siccus*-type broom cells at extreme apex or extreme base. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Scattered or gregarious on decaying hardwood leaves or much-decayed hardwood logs in deciduous woods. Uncommon in eastern North America; known from Michigan, Ohio, Illinois, Tennessee, North Carolina, Alabama and Florida.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** There has been confusion in the past over the correct binomial to apply to the organism described above. Herbarium material has been determined as *M. floridanus*, *M. cladophyllus* Berk., *M. glabellus* Pk., *M. bellipes* Morg. and *M. spadiceus* Gilliam. Material from eastern North America conspecific with the holotype specimen of *M. floridanus* is characterized by the following combination of features: a) convex, non-striate pileus colored brown, fulvous or brownish orange; b) close or subdistant, moderately broad lamellae; c) glabrous, non-insititious stipe colored yellowish white above and reddish brown below; d) mean spore size of 9.0 X 3.3 µm; e) fusoid-strangulate, refractive pleurocystidia; and f) absence of caulocystidia.

*Marasmius cladophyllus* differs from *M. floridanus* in forming basidiomata with strongly intervenose or meruloid hymenophore, pubescent stipe and absence of pleurocystidia. *Marasmius glabellus* differs in forming distinctly striate pilei, distant or remote lamellae, and broader spores (W = 4-5.6 µm, $\bar{W}$ = 4.6 µm). *Marasmius bellipes* differs in forming much smaller basidiomata (pilei 4-15 mm diam; stipe <1 mm diam) with distinctly striate pilei, distant lamellae, shorter setulae on pileipellis elements, and lacks pleurocystidia.

The protologue of *Marasmius spadiceus* differs subtly from that of *M. floridanus* in pileus and stipe coloration and substrate. *Marasmius spadiceus* was described as forming basidiomata with moderate brown or brownish orange pilei, stipes colored pale orange-yellow at the apex and deep brown at the base, and habit on decayed leaves in oak woods

(Gilliam, 1975a). In comparison, *M. floridanus* was described as forming fulvous pilei, stipes colored white at the apex and fulvous at the base, and habit on decayed hardwood logs (Murrill, 1940). Micromorphologically, the holotype specimens of these two taxa are indistinguishable. After studying numerous specimens ranging in distribution from Florida to Michigan, I conclude that pileus and stipe pigmentation, and substrate are variable in this taxon. Material collected by L. R. Hesler from Tennessee (deposited at TENN) showed the full range of pileus and stipe pigmentation outlined above. Furthermore, material collected by W. C. Coker from Chapel Hill, North Carolina (deposited at NCU) fruited on both hardwood leaves and woody debris. Based on these observations, I consider *M. spadiceus* a synonym of *M. floridanus*.

Singer (1976) considered *M. floridanus* a synonym of *M. spegazzinii* Sacc. & Sydow [*nom. nov.* for *M. balansae* Spegazzini (1891) *non* Patouillard (1890)], a species described from Paraguay. The holotype specimen of *M. balansae* could not be located (*i.e.*, no longer housed at LPS; H. Spinedi, Curator, pers. comm.) and I cannot, therefore, comment on the conspecificity of *M. balansae* (≡ *M. spegazzinii*) and *M. floridanus*. Several specimens collected from Mexico (F!) and determined by Singer as *M. spegazzinii* are not conspecific with *M. floridanus*. Until additional material matching the protologue of *M. balansae* is collected from Paraguay and compared with the holotype specimen of *M. floridanus*, the North American taxon is best regarded as *M. floridanus*.

Singer (1958a) described a taxon very similar to *M. floridanus* based on material collected from Richmond, Virginia, and cited the binomial as "*M. virginianus* Singer *spec. nov. ad. int.*" (without Latin diagnosis). I accept the latter epithet to represent a distinct variety of *M. floridanus* and present a formal proposal below.

**31. *MARASMIUS FLORIDANUS*** var. ***VIRGINIANUS*** Singer *ex* Desjardin, *var. nov.*

= *Marasmius virginianus* Singer, *nom. inval.*, Sydowia 12: 112. 1958.

*A varietate typica lamellis intervenosus, sporis brevis*, 6.4-8.4 X 2.8-3.4 µm *differt.*

HOLOTYPE: Virginia, Richmond, 10 Sept. 1934, D. H. Linder (FH!).

Fresh material not seen. The description of macromorphological features is taken verbatim from Singer (1958a).

"**Pileus** tawny, the umbo slightly darker, in dried condition "rust sorolla" (M & P) at margin and on disc, with a lighter colored zone between them (pl. 12 G 11, M & P), with short furrowed but not sulcate or striate margin, slightly crenate or entire, glabrous, campanulate, becoming more applanate, 38 mm broad. **Lamellae** white, between narrowly adnexed and free, narrow, somewhat intervenose, distinctly intervenose in marginal half of pileus, close. **Stipe** concolorous with the pileus in the upper portion, "Mars brown" (R.) toward the base, equal, glabrous, more or less shining, 63 X 2 mm; basal strigosity present, mycelium whitish, at stipe coarse and somewhat fulvescent. **Context** very thin, white."

**Basidiospores** (Fig. 31 A) 6.4-8.4 X 2.8-3.4 µm [$\bar{x}$ = 7.4 ± 0.5 X 3.1 ± 0.2 µm, E = 2.1-2.7, Q = 2.4, n = 30 spores per 1 specimen], ellipsoid or subamygdaliform, hyaline, inamyloid, smooth. **Basidia** (Fig. 31 B) 16-21 X 5-6.5 µm, clavate, 4-spored. **Basidioles** (Fig. 31 B) cylindric or subclavate. **Pleurocystidia** (Fig. 31 C) numerous, 32-44 X 6-10 µm, irregularly cylindric, fusoid, subclavate or ventricose, typically wavy in outline or strangulate, sometimes apically constricted and appendiculate, arising from deep in the subhymenium and projecting little or up to 8 µm beyond the basidioles, refractive, thin-walled, hyaline, inamyloid. **Cheilocystidia** (Fig. 31 D) scattered, common, similar to the *Siccus*-type pileipellis elements; main body 12-17.5 X 4-6.5 µm, cylindric or clavate, sometimes lobed, thin-walled or firm-walled, hyaline; apical setulae 2.5-10 X 0.5-2.5 µm, cylindric-acuminate or conic, subacute or acute, thick-walled or solid, hyaline or pale yellow. **Pileipellis** hymeniform, weakly mottled, composed of *Siccus*-type broom cells (Fig. 31 E); main body 9.5-16 X 5-8(-10) µm, cylindric, clavate, subvesiculose, turbinate or irregular in outline, often lobed; many elements thin-walled or firm-walled and hyaline or pale orange; many elements thick-walled and orange or brownish orange; apical setulae 3-12 X 0.5-2.5 µm, cylindric-acuminate or conic, subacute or acute, typically solid, ranging from yellow to orange or brownish orange, dextrinoid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-12 µm diam, cylindric or sometimes inflated up to 16 µm diam, smooth, non-gelatinous, thin-walled, hyaline, dextrinoid. **Stipe tissue** monomitic; **cortical hyphae** 4-8 µm diam, parallel, cylindric, smooth, yellow (stipe apex) or brownish orange (stipe base),

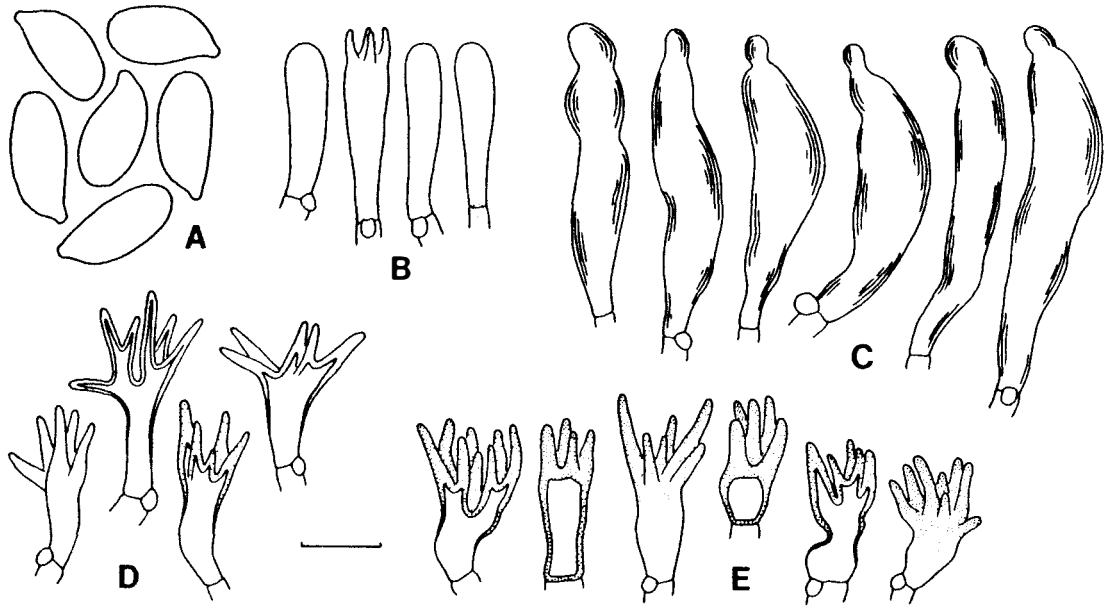



**Figure 31 A-E.** Features of *Marasmius floridanus* var. *virginianus* (Linder, 1934, holotype). A. Basidiospores. B. Basidium and basidioles. C. Pleurocystidia. D. Cheilocystidia. E. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-E.

dextrinoid, with walls up to 1.5 µm thick; **medullary hyphae** 3-18 µm diam, cylindric or inflated, hyaline, dextrinoid, with walls <1 µm thick. **Stipe vesture** absent. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** "On leaf mold and petioles of frondose trees" (Singer, 1958a). Known from a single specimen.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** *Marasmius floridanus* var. *virginianus* differs from the type variety only in lamellar features and spore size. In var. *virginianus*, basidiomata show distinctly intervenose lamellae, at least in the marginal half of the hymenophore, and mean spore size 7.4 X 3.1 µm. In comparison, basidiomata of var. *floridanus* show non-intervenose lamellae and mean spore size 9.0 X 3.3 µm.

Although var. *virginianus* is known from only a single specimen collected outside of the southern Appalachian region, it might occur in deciduous woodlands in the eastern foothills of the Appalachian chain. The variety is described here to clarify its taxonomic disposition and validate the epithet.

**32. *MARASMIUS PSEUDOBAMBUSINUS*** Desjardin, *sp. nov.*

*Pileus 1.5-4.5 mm latus, convexus, aequus (non striatus), ferrugineus vel cinnabarinus. Lamellae adnexae, remotae, angustae, pallidae, ferrugineus-marginatae. Stipes 5-20 X 0.1-0.2 mm, filiformus, glaber, non insititius, apice bubalinus, base brunneus. Basidiosporae 13.6-19.2 X 3.6-5.2 µm, clavatae, laeves, hyalinae, inamyloideae. Pleurocystidia abunda, refractiva, cylindrica, clavata, ventricosa vel strangulata, saepe constricta. Cheilocystidia elementis pileipellis similia. Pileipellis hymeniformis ex elementis M. sicco similibus; diverticuli ferruginei, saepe verrucosae. Trama ex hyphis dextrinoideis, fibulatis. Caulocystidia nulla.*

HOLOTYPE: United States, Tennessee, Knox Co., Knoxville, 12 July 1987, D. E. Desjardin no. 4353 (TENN!).

**Basidiomata** marcescent, reviving. **Pileus** 1.5-4.5(-6) mm diam, convex or broadly convex, even overall when young, expanding in age to plano-convex, usually remaining even overall or with the margin becoming short-striate or short-sulcate, rarely crenate; surface dull, dry, opaque, subvelutinous; coloration reddish brown (8D7-7), brownish red (8C6-8), brownish orange (6-7C6-8) or reddish orange (7B7-8) overall when young, remaining brownish orange or reddish orange overall

in age, or with margin fading to orange (6B5-8) or greyish orange (6B3-4), typically with orange or reddish orange tones at maturity. Context thin, white. **Lamellae** adnate or adnexed, very rarely with a thin, adherent (never free), collar of tissue at stipe apex (not a true collarium), distant or remote (6-10 complete lamellae), narrow (<1 mm broad), thin, seldom forked near pileus margin, rarely weakly intervenose; colored white when young, becoming buff or pale yellowish white (4A2) in age, non-marginate or more often orange-marginate; **lamellulae** usually absent, or rarely with a few interspersed. **Stipe** 5-20 X 0.1-0.2 mm, terete, equal, filiform, wiry, shiny, glabrous, non-insititious, arising from a small ring of white or pale orange buff, strigose mycelium; apex colored white when young with base brownish orange (6C5-6); in age, upper few mm concolorous with lamellar faces, base brown (6-7E5-8) or dark brown (6F5-8). **Odor and taste** not distinctive.

**Basidiospores** (Fig. 32 A) 13.6-19.2 X 3.6-5.2 µm [$\bar{\bar{x}}$ = 16.4 ± 0.6 X 4.3 ± 0.1, E = 3.1-4.8, $\bar{Q}$ = 3.8 ± 0.1, n = 10-30 spores per 6 specimens], clavate, often curved in profile, hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 32 B) 17.5-23 X 6.5-8.5 µm, clavate, 4-spored. **Basidioles** (Fig. 32 B) broadly cylindric, clavate or ventricose. **Pleurocystidia** (Fig. 32 C) numerous, 25.5-50 X 5.5-12 µm, cylindric, fusoid, ventricose or irregular in outline, typically strangulate or apically constricted 1-3 times, often appendiculate, arising from the subhymenium and projecting little or well beyond the basidioles, refractive, thin-walled, hyaline, inamyloid. **Cheilocystidia** (Fig. 32 D) numerous, similar to *Siccus*-type

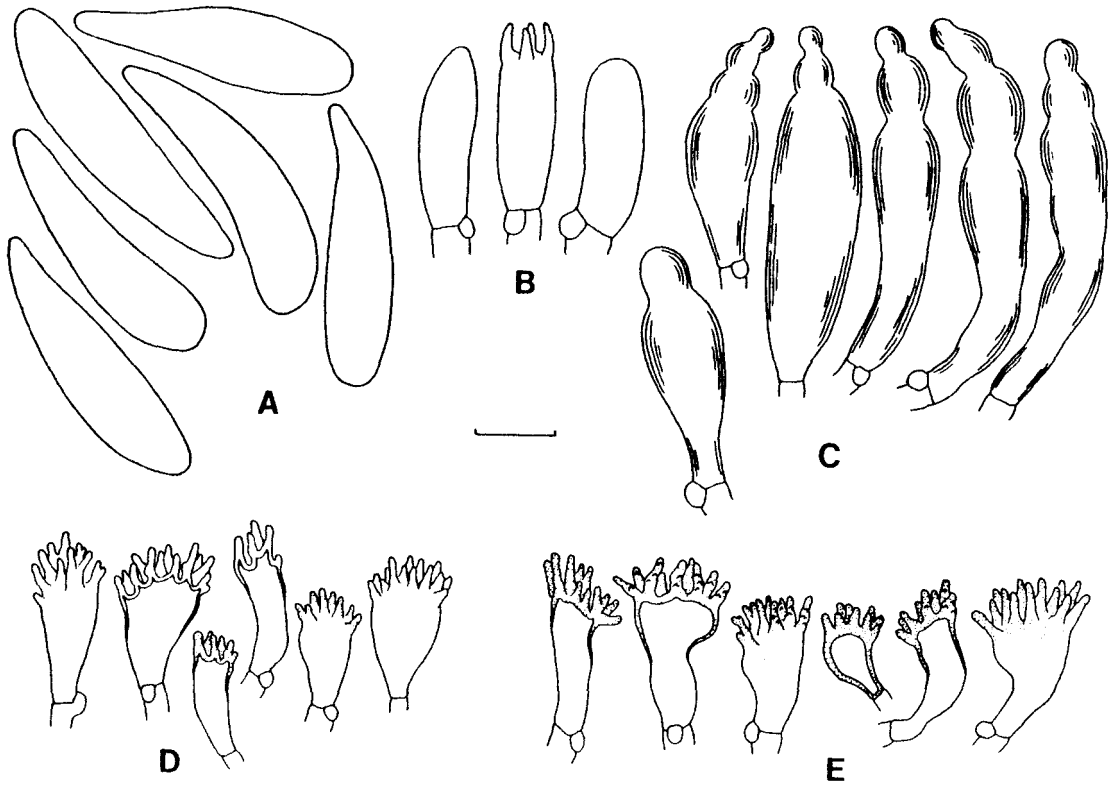



**Figure 32 A-E.** Features of *Marasmius pseudobambusinus* (Desjardin no. 4353, holotype). A. Basidiospores. B. Basidium and basidioles. C. Pleurocystidia. D. Cheilocystidia. E. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-E.

pileipellis elements; main body 8-17.5 X 4.5-11.5 µm, cylindric, clavate, subvesiculose or turbinate, thin-walled, hyaline; apical setulae 1.5-5 X 0.5-1 µm, irregularly cylindric, wavy in outline, sometimes verrucose, obtuse, subacute or acute, thin-walled or thick-walled, ranging from hyaline to orange. **Pileipellis** hymeniform, weakly mottled, composed of *Siccus*-type elements (Fig. 32 E); main body 8-20 X 5-14.5 µm, cylindric, broadly clavate, subvesiculose, turbinate or irregular in outline, sometimes lobed; majority of elements thin-walled, hyaline or pale orange; few elements thick-walled, deeper

pigmented, and often with fewer, shorter, and broader apical setulae; apical setulae 1.5-6.5 X 0.5-1.5 µm, crowded, very fine, irregularly cylindric or conic, often wavy in outline, often verrucose, obtuse, subacute or acute, thick-walled or solid, ochraceous, orange, tawny or brownish orange. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-6.5(-8) µm diam, cylindric or seldom slightly inflated, smooth, non-gelatinous, thin-walled, hyaline, dextrinoid. **Stipe tissue** monomitic; **cortical hyphae** 3-6 µm diam, parallel, cylindric, smooth, hyaline (stipe apex) or brown (stipe base), dextrinoid, with walls up to 1 µm thick; **medullary hyphae** 4-12 µm diam, parallel, hyaline, dextrinoid, thin-walled. **Stipe vesture** absent. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Densely gregarious on secescent leaves of various grasses in open lawns. May - August. Uncommon; known from Pennsylvania, Illinois, Tennessee and Louisiana.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** *Marasmius pseudobambusinus* is characterized by the following combination of features: a) small, convex pileus colored reddish orange or orange, usually remaining non-striate throughout maturation; b) remote, narrow, orange-marginate, non-collariate lamellae; c) filiform, glabrous, non-insititious stipe; d) habit on grasses; e) long, clavate spores; f) conspicuous, refractive, broad, strangulate or apically-constricted pleurocystidia; g) pileipellis elements with crowded, very fine, often verrucose apical setulae; and h) absence of caulocystidia. This species has been misdiagnosed as *M. graminum* (Lib.) Berk. & Br., but the latter differs in showing

basidiomata with umbilicate, striate pilei, collariate lamellae, insititious stipe, smaller spores ($\bar{\bar{x}}$ = 8.8 X 4.6 µm), and absence of pleurocystidia.

The epithet *pseudobambusinus* reflects the affinity of this organism to *M. bambusinus* (Fr.) Fr., a phenetically similar species described from material collected on bamboo in Brazil. Because type material of *M. bambusinus* could not be located, I am accepting Singer's (1976) concept of the species (representative material has been selected and described in Chapter VIII). *Marasmius bambusinus* and *M. pseudobambusinus* are macromorphologically nearly indistinguishable. *Marasmius bambusinus* differs, however, in pileipellis and pleurocystidial morphologies. *Siccus*-type broom cells comprising pileipelli of basidiomata of *M. bambusinus* show stout apical setulae that are typically conic, even in outline, non-verrucose and 1.5-2.5 µm diam. In addition, pleurocystidia are irregularly cylindric, broadly obtuse, and neither appendiculate nor constricted. In comparison, setulae of pileipellis elements in *M. pseudobambusinus* are very fine (0.5-1.5 µm diam), crowded, typically wavy in outline and verrucose, while pleurocystidia are usually strangulate or apically constricted and often appendiculate.

*Marasmius pseudobambusinus* is also similar to *M. bambusiniformis* Singer, described from Ecuador, and *M. puniceus* Thiers, described from Texas. *Marasmius bambusiniformis* differs in forming distinctly sulcate pilei, slightly longer spores ($\bar{L}$ = 18.6 µm), and in lacking pleurocystidia. *Marasmius puniceus* differs in forming basidiomata with bright red ["eugenia red;" Thiers (1958)], sulcate pilei, pinkish and

non-marginate lamellae, clavate, non-appendiculate and non-constricted pleurocystidia, and habit on cow dung.

33. ***MARASMIUS HAEMATOCEPHALUS*** var. ***HAEMATOCEPHALUS*** (Mont.) Fries, Epicr. Syst. Mycol. 382. 1838.

≡ *Agaricus haematocephalus* Montagne, Ann. Sci. Nat. Bot. 2(7): 369. 1837.

**TYPE SPECIMEN:** None located.

**Basidiomata** marcescent, reviving. **Pileus** 3-12 mm diam, campanulate or obtusely conic when young, expanding to broadly campanulate or nearly plane with a small umbo; disc smooth at first, remaining so in age or becoming minutely rugulose; margin at first even and decurved, soon becoming striate, finally sulcate and often uplifted, crenulate; surface dull, dry, opaque, subvelutinous; coloration when young dark purplish red (12F7-8), "Hydrangea red," "deep Corinthian red," dark violet brown (10-11F6-8) or violet brown (11E7-8) overall or only on the disc, with the margin colored greyish purplish red (11C5-6) or brownish red (10D-E7-8); in age disc remaining dark purplish red, deep red or violet brown, or fading slightly; margin in age fading to greyish purplish red (11C-D5-6) or greyish red (9-10C5-6); context thin, buff or concolorous with the pileipellis. **Lamellae** adnexed or free, non-collariate, remote (10-15 complete lamellae), broad (up to 2.5 mm in the largest basidiomata), not forked, typically non-intervenose, rarely weakly intervenose near the margin in age; lamellar faces white or pale pink; interlamellar spaces pale-concolorous with the pileus (*i.e.*, pink or pale purplish

red); lamellar edges pinkish red, deep reddish or violet red, sometimes non-marginate; **lamellulae** usually absent, rarely with a few short lamellulae present. **Stipe** 15-35 X 0.2-0.5 mm, terete, equal, filiform, wiry, dull or shiny, hollow, glabrous, subinsititious or non-insititious, arising from a small ring of white, strigose mycelium; colored greyish red or greyish purplish red (11-12C-D5-6) overall when young; apex in age remaining greyish red or purplish red, or becoming violet brown (11E6-8), base becoming dark brown (7F4-8) or dark reddish brown (8F4-8). **Odor and taste** not distinctive or mildly fungal.

**Basidiospores** (Fig. 33 A) 16-22 X (3.6-)4-5.6 µm [$\bar{\bar{x}}$ = 18.6 ± 0.7 X 4.5 ± 0.2 µm, E = 3.3-5.1, $\bar{Q}$ = 4.2 ± 0.3, n = 15-20 spores per 6 specimens], clavate or subfusiform, often curved in profile, hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 33 B) 22.5-30 X 5.5-8 µm, clavate, 4-spored. **Basidioles** (Fig. 33 B) clavate or ventricose. **Pleurocystidia** (Fig. 33 C) numerous on some basidiomata, uncommon on others, 34-56(-67) X 5.5-10(-12) µm [$\bar{W} \approx$ 8-9 µm], cylindric, subclavate or fusoid, often apically constricted in oldest basidiomata (usually non-constricted in young basidiomata), broadly obtuse, arising from deep in the subhymenium and projecting well beyond the basidioles, refractive, thin-walled, hyaline, inamyloid. **Cheilocystidia** (Fig. 33 D) numerous, similar to *Siccus*-type pileipellis elements; main body 9-20 X 4-8 µm, cylindric, clavate, turbinate or irregular in outline, sometimes lobed, thin-walled, hyaline; apical setulae 1-6 X 0.5-1.2 µm, cylindric, subconic or more commonly irregular in outline, often wavy, obtuse or subacute, thick-walled or solid, hyaline, yellowish orange or pale red in $H_2O$. **Pileipellis**

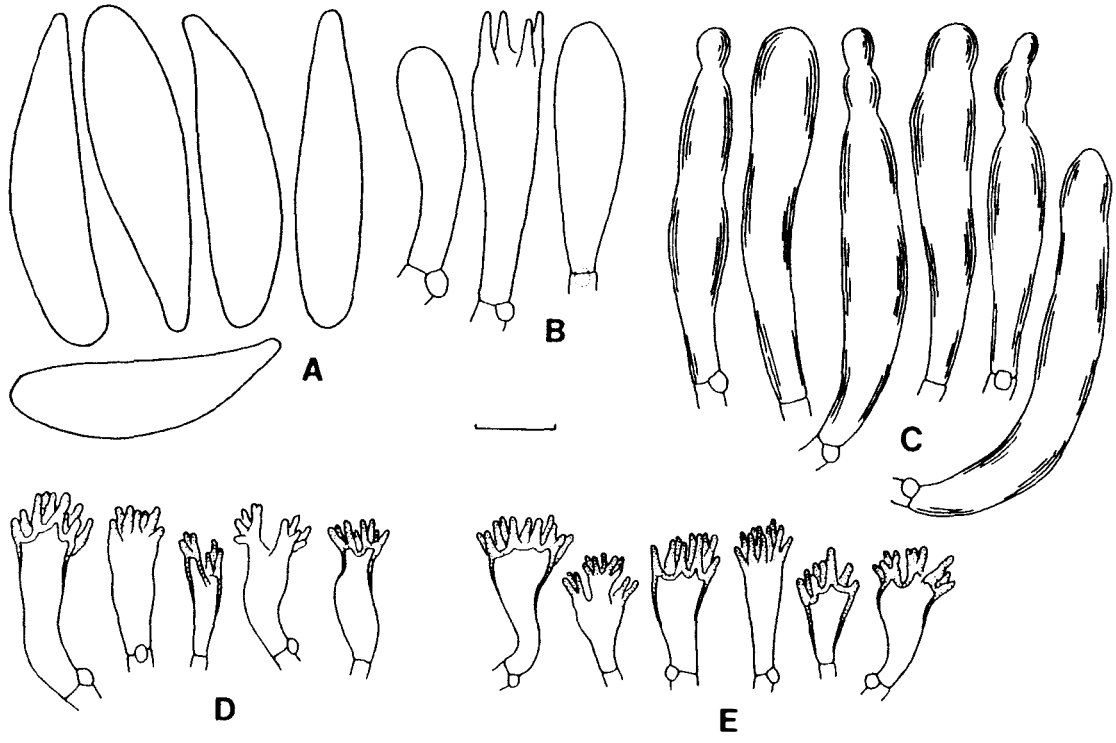



**Figure 33 A-E.** Features of *Marasmius haematocephalus* var. *haematocephalus* (Desjardin no. 4321). A. Basidiospores. B. Basidium and basidioles. C. Pleurocystidia. D. Cheilocystidia. E. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-E.

hymeniform, not mottled or weakly mottled, composed of *Siccus*-type broom cells (Fig. 33 E); main body 8-18.5(-22) X (4-)5-10 µm, cylindric, clavate, turbinate or irregular in outline, often lobed, typically thin-walled and hyaline, few apically thick-walled and pale red; apical setulae 1.5-5.5(-8.5) X 0.5-1.5 µm, cylindric, conic or irregular in outline, often wavy, seldom branched, obtuse or subacute, thick-walled or solid, ranging from red to maroon or reddish brown in $H_2O$, with pigment soluble in 3% KOH and elements becoming pale grey or olivaceous grey. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-6.5(-9) µm diam, cylindric or rarely slightly inflated,

smooth, non-gelatinous, hyaline, dextrinoid, thin-walled or firm-walled. **Stipe tissue** monomitic; **cortical hyphae** 2.5-6 µm diam, parallel, cylindric, smooth, ochraceous or brown, dextrinoid, with walls up to 1.5 µm thick; **medullary hyphae** 2.5-8 µm diam, similar but hyaline and thinner-walled. **Stipe vesture** absent. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Scattered or gregarious on small twigs or other woody debris of hardwoods (*Quercus*). Uncommon in southeastern United States; more common in the American neotropics southward to Argentina.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** *Agaricus haematocephalus* was originally described by Montagne (*ibid.*) from a specimen collected by A. de Saint Hilaire from Rio de Janeiro, Brazil. The species has been collected commonly throughout South America, Central America and the Caribbean region. Singer (1976) was the first to report the species (supported with voucher material) from continental United States, citing several specimens from Florida. My field work indicates that *M. haematocephalus* occurs as far north as Tennessee. The species is easily recognized by the following combination of characters: a) small, campanulate, sulcate pilei colored deep purplish red or deep reddish; b) remote, non-collariate lamellae with pinkish faces and reddish edges; c) glabrous, wiry, non-insititious stipe; d) habit on woody debris of hardwoods; e) long, clavate spores; f) conspicuous, refractive pleurocystidia; and g) absence of caulocystidia.

Many herbarium specimens of North American material have been incorrectly diagnosed as *M. haematocephalus*, including specimens better regarded as *M. siccus* (Schw.) Fr., *M. fulvoferrugineus* Gilliam, and *M. ferrugineus* Berk. & Curtis. *Marasmius haematocephalus* differs from all of these species in pileus pigmentation, *i.e.*, showing purplish red tones. In addition, *M. siccus* and *M. fulvoferrugineus* differ in forming larger basidiomata with closer and narrower lamellae and habit on decayed leaves.

Singer (1976) included the following binomials as synonyms of *M. haematocephalus*: *M. rhodocephalus* Fries; *M. semipellucidus* Berk. & Br.; *M. sanguineus* Cooke & Massee; *M. atropurpureus* Murr.; and *M. vinosus* Beeli. I have not examined the type specimens of any of these taxa and cannot, therefore, comment on their conspecificity with *M. haematocephalus*.

Several specimens of what appeared to be a color-variant form of *M. haematocephalus* were discovered in an area where the typical purplish red form of *M. haematocephalus* had been collected frequently. These specimens showed pilei colored brownish orange on the disc and pale orange white or buff on the margin, lacking any purplish red tones. In most other macro- and micromorphological features, these specimens were indistinguishable from *M. haematocephalus*. In addition, culture mat morphologies of the two taxa were nearly indistinguishable (refer to Chapter VI for descriptions of cultural morphology). The pallid taxon is described below as a new variety.

**34. *MARASMIUS HAEMATOCEPHALUS*** var. ***ANOMALOIDES*** Desjardin, *var. nov.*

*A varietate pileo disco cinnamomeus, margin griseolo-aurantius vel bubalinus, pleurocystidiis apice attenuo-strangulatis, sporis 14.4-19.2 X 3.4-4.6* µm *differt.*

HOLOTYPE: United States, Tennessee, Knox Co., Knoxville, 6 July 1987, D. E. Desjardin no. 4322 (TENN!).

**Basidiomata** marcescent, reviving. **Pileus** 3-8 mm diam, campanulate or obtusely conic when young, expanding in age to broadly campanulate or plano-umbonate; disc at first even, becoming rugulose in age; margin at first striatulate, soon becoming sulcate, often scalloped in age; surface dull, dry, opaque, subvelutinous; coloration brownish orange (5C4-5) overall at first; disc remaining brownish orange in age or fading to brownish grey (6C3) or greyish orange (5B5); margin fading in age to greyish orange (5B4-5), orange-white (5A2-3), orange-buff or buff; context thin, buff or pale-concolorous with the pileipellis. **Lamellae** adnexed or free, remote (7-10 complete lamellae), broad (up to 2 mm), not forked nor intervenose; white, buff or pale orange-buff (<5A2), non-marginate; **lamellulae** usually absent, rarely a few lamellulae present. **Stipe** 15-35 X 0.2-0.5 mm, terete, equal, filiform, wiry, dull or shiny, hollow, glabrous, non-insititious, arising from a thin pad or white or buff-colored, downy mycelium; apex white or buff at first, darkening slightly in age; base brown (6-7E4-6) or dark brown (7F4-7). **Odor and taste** not distinctive or mildly fungal.

**Basidiospores** (Fig. 34 A) 14.4-19.2 X 3.4-4.6 µm [$\bar{\bar{x}}$ = 16.8 ± 0.7 X 3.9 ± 0.1 µm, E = 3.8-4.8, $\bar{Q}$ = 4.3 ± 0.1, n = 20 spores per 3 specimens], clavate or subfusiform, typically curved in profile,

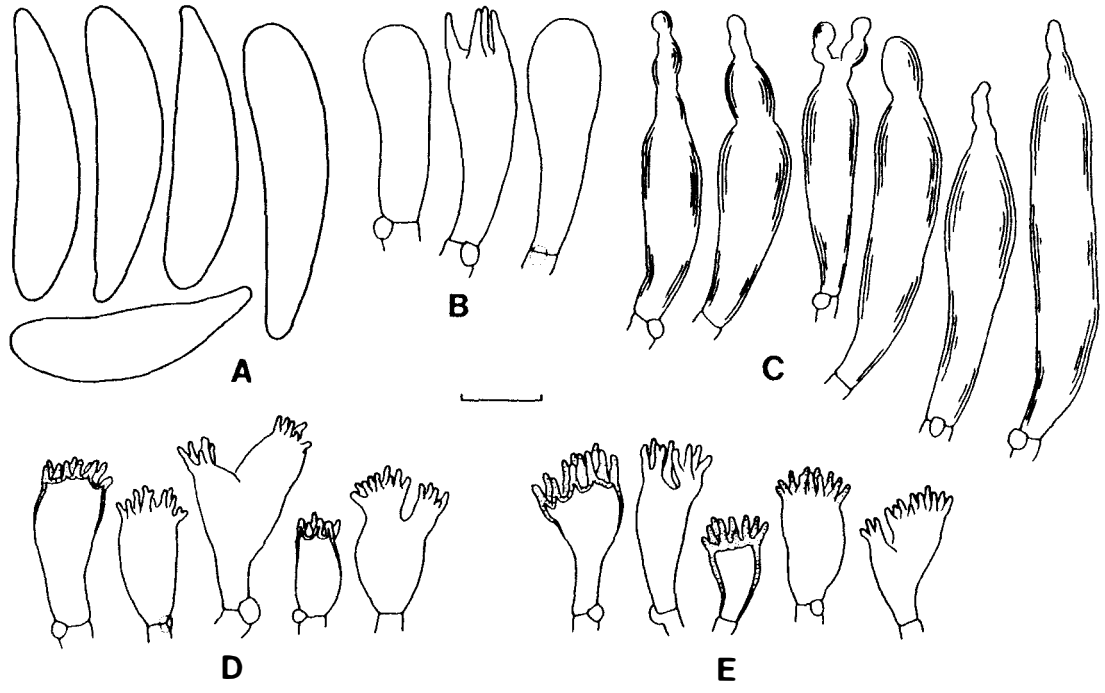



**Figure 34 A-E.** Features of *Marasmius haematocephalus* var. *anomaloides* (Desjardin no. 4322, holotype). A. Basidiospores. B. Basidium and basidioles. C. Pleurocystidia. D. Cheilocystidia. E. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-E.

hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 34 B) 21.5-33.5 X 7-9.5 µm, clavate, 4-spored. **Basidioles** (Fig. 34 B) cylindric or broadly clavate. **Pleurocystidia** (Fig. 34 C) numerous, 36-54 X 7-10 µm, fusoid or clavate, usually attenuated and strangulate at the apex, often with 2-4 successive apical constrictions, rarely apically lobed, sometimes not constricted, arising from deep in the subhymenium and projecting little or well-beyond the basidioles, refractive, thin-walled, hyaline, inamyloid. **Cheilocystidia** (Fig. 34 D) numerous, similar to *Siccus*-type pileipellis elements; main body 8-22 X 5-10(-12) µm, cylindric, clavate or irregular in outline, often

lobed, thin-walled, hyaline; apical setulae 0.5-5 X 0.5-1.2 µm, crowded, irregularly cylindric, wavy in outline, sometimes branched, obtuse or subacute, thin-walled or firm-walled, hyaline or pale yellow. **Pileipellis** hymeniform, weakly mottled, composed of *Siccus*-type broom cells (Fig. 34 E); main body 8-20 X 5-9 µm, cylindric, clavate, turbinate or irregular in outline, sometimes lobed; majority of elements thin-walled, hyaline; few elements firm-walled or thick-walled, stramineous; apical setulae 1.5-6 X 0.5-1.5 µm, crowded, irregularly cylindric or subconic, usually wavy in outline, obtuse or subacute, thin-walled or thick-walled, sometimes solid, ranging from hyaline to pale yellow, stramineous or pale brownish orange. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-9(-12) µm diam, cylindric or inflated, smooth, non-gelatinous, thin-walled, hyaline, dextrinoid. **Stipe tissue** monomitic; **cortical hyphae** 3-6.5 µm diam, parallel, cylindric, smooth, hyaline (stipe apex) or brownish (stipe base), strongly dextrinoid, with walls up to 1 µm thick; **medullary hyphae** 3-8(-10) µm diam, similar but hyaline and thinner-walled. **Stipe vesture** absent. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Scattered, gregarious or densely gregarious on small twigs or other woody debris of hardwoods (*Quercus*), or rarely on grass leaves. Rare. Known from Tennessee.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** Variety *anomaloides* is known from three specimens, one of which comprises nearly 100 basidiomata collected in an area of approximately 10 sq. meters. On several occasions, var. *haematocephalus* was collected at the same site on the same day, but no

intermediate color-forms were observed. Variety *anomaloides* differs from most other varieties of *M. haematocephalus* in pileus pigmentation, *viz.*, lacking purple or deep reddish tones. In addition, var. *anomaloides* differs from the type variety in forming pleurocystidia typically apically attenuated and strangulate, and in forming slightly smaller spores. Cultural morphology of varieties *haematocephalus* and *anomaloides* are similar, but differ in several subtle characters. Refer to the descriptions and commentaries on these varieties in Chapter VI for further details.

Variety *anomaloides* comes closest to var. *leucophyllus* Sing., another variety of *M. haematocephalus* lacking purple or reddish tones. Variety *leucophyllus* differs, however, in forming darker pilei that lack cinnamon or orange tones. The latter variety was described as showing pilei with dull brownish disc region and "hazel" marginal zone, lacking orange tones and not fading to buff in age (*fide* Singer, 1976). In comparison, mature pilei of var. *anomaloides* show a greyish orange disc and orange white or buff-colored margin.

The varietal epithet was chosen to signify macroscopic similarity to *M. anomalus* Lasch *in* Rabenhorst. *Marasmius anomalus* differs, however, in forming basidiomata with closer lamallae, thicker stipes (0.5-1 mm), habit almost exclusively on grass leaves or roots, and in forming pileipelli with numerous thick-walled, nearly smooth elements interspersed among *Siccus*-type broom cells. Refer to the type study of *M. anomalus* for a description and discussion of the various taxonomic concepts of the latter binomial.

*Marasmius haematocephalus* var. *anomaloides* may be confused in the field with *M. subrotula* Murr. and *M. similis* Berk & Curt. *Marasmius subrotula* differs in lacking conspicuous, refractive pleurocystidia, and in developing basidiomata on dung-covered twigs of dicotyledonous trees or directly on dung (*fide* Singer, 1976). *Marasmius similis* differs in lacking pleurocystidia and in forming shorter spores ($\bar{L}$ = 12.3 µm). Refer to the type study of *M. similis* (Chapter VIII) for comparison.

**35. *MARASMIUS SICCUS*** (Schw.) Fries, Epicr. Syst. Mycol. 382. 1838.

≡ *Agaricus siccus* Schweinitz, Schr. Naturf. Ges. Leipzig 1: 84. 1822.

= *Marasmius campanulatus* Peck, Annual Rep. New York State Mus. 23: 126. 1873.

= *Marasmius fulviceps* Clements, Bot. Surv. Nebraska 4: 20. 1896 [*non Marasmius fulviceps* Berkeley, London J. Bot. 6: 490. 1847.].

≡ *Marasmius clementsianus* Saccardo & Sydow, *nom. nov.*, Syll. Fung. 14: 101. 1899.

**HOLOTYPE**: United States, North Carolina (Salem) or Pennsylvania (Bethlehem), "Salem - Beth.," Schweinitz, no date (PH!).

**Basidiomata** marcescent, reviving. **Pileus** 5-25 mm diam, convex, campanulate or obtusely conic when young, expanding to broadly convex, broadly campanulate, plano-convex or plano-umbonate in age, sometimes papillate, rarely with a shallow central depression; disc even at first, becoming rugulose at maturity; margin decurved, striate at first, becoming sulcate or plicate, crenate in age; surface dull, dry, opaque, subvelutinous; coloration deep brownish orange (7C6-8), light

brown (7D6-8) or reddish orange (7B7-8) overall when young; disc remaining deep brownish orange in age or becoming reddish brown (8D6-8) or fading slightly to brownish orange (6C5-8); margin becoming brownish orange (6C6-8), orange (6B6-8), yellowish orange (5B7-8) or finally light orange (5A5-6) in age; context thin, buff or pale orange white (5A2). **Lamellae** adnexed or free, often not reaching the stipe and with an narrow region of contextual tissue surrounding the point of stipe attachment, distant or sometimes remote, narrow (1-2 mm), thin, not forked nor intervenose; colored white at first, becoming buff or pale yellowish white (4A2) in age; edges concolorous with the faces or orange-marginate; non-lamellate region surrounding stipe apex often concolorous with the pileus; **lamellulae** absent or in 1-2 series. **Stipe** (17-)25-60(-85) X 0.5-1.25 mm, terete, equal or sometimes with a slightly swollen base, tough, cartilaginous, hollow, dull or shiny, glabrous, non-insititious, arising from a floccose pad of white or buff-colored mycelium; apex buff or pale yellowish white (4A2); base light brown (6D5-6), brown (6-7E5-7) or dark brown (6-7F4-8). **Odor and taste** not distinctive.

**Basidiospores** (Fig. 35 A) 15.2-20.8 X 3.2-4.6 µm [$\bar{\bar{x}}$ = 18.0 ± 0.8 X 3.9 ± 0.1 µm, E = 3.7-5.9, $\bar{Q}$ = 4.7 ± 0.2; TL90(90%): 16.5-19.5 X 3.7-4.1 µm, Q = 4.3-5.1; n = 10-25 spores per 11 specimens], narrowly clavate, clavate or subfusiform, often curved in profile, hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 35 B) 20-42 X 6-7.5 µm, clavate or subclavate, 4-spored. **Basidioles** (Fig. 35 B) cylindric, subclavate or fusoid. **Pleurocystidia** (Fig. 35 C) numerous, 32-60 X 5-9 µm [$\bar{W}$ ≈ 6-7 µm], cylindric, subclavate or fusoid, broadly obtuse or

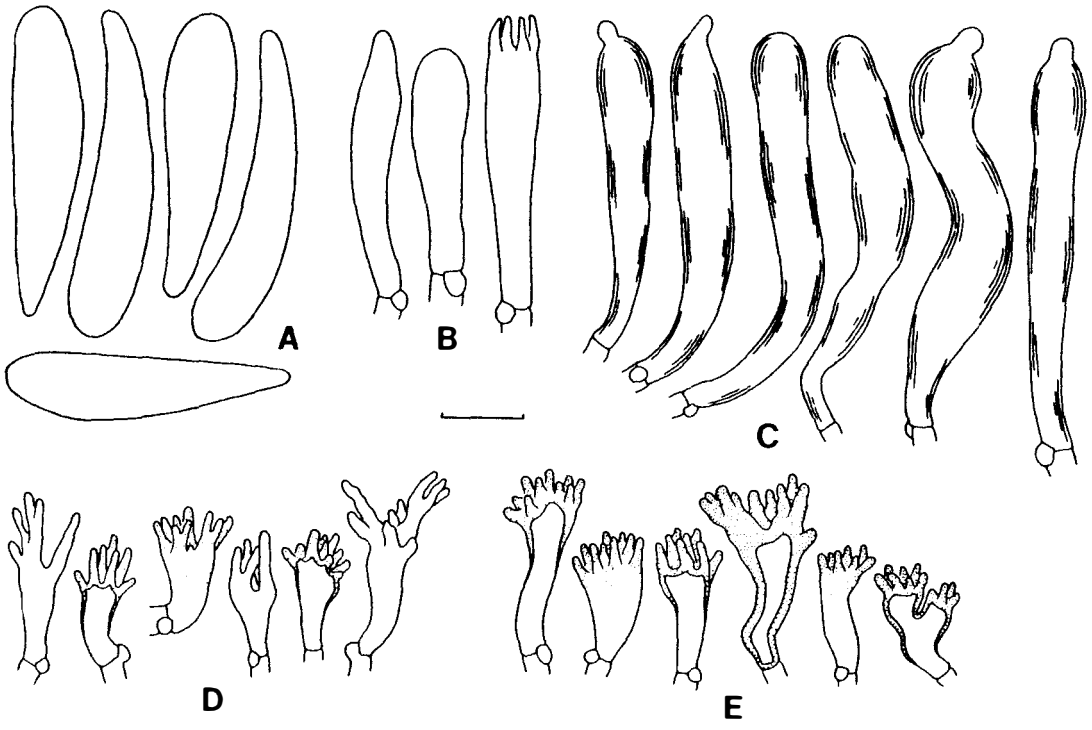



**Figure 35 A-E.** Features of *Marasmius siccus* (Schweinitz, holotype). A. Basidiospores. B. Basidium and basidioles. C. Pleurocystidia. D. Cheilocystidia. E. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-E.

more often once-constricted at the apex with a knob-like outgrowth, sometimes capitate, appendiculate or mucronate, arising from deep in the subhymenium or lamellar trama and projecting well beyond the basidioles, often basally curved, refractive, thin-walled, hyaline or pale yellow, inamyloid. **Cheilocystidia** (Fig. 35 D) numerous, similar to pileipellis elements; main body 10-20 X 4-8 µm, cylindric, clavate, turbinate or irregular in outline, sometimes lobed, thin-walled, hyaline; apical setulae 1.5-8 X 0.5-1.5 µm, irregularly cylindric or conic, sometimes branched, obtuse, subacute or acute; thin-walled to firm-walled and hyaline, or thick-walled and yellow. **Pileipellis**

hymeniform, not mottled or mottled, composed of broom cells (Fig. 35 E); main body 8-22.5(-25) X 4-8(-12) µm, cylindric, clavate, turbinate or irregular in outline, often lobed; majority of elements thin-walled or firm-walled, hyaline or pale yellow; many elements thick-walled, orange or pale brownish orange, seldom tawny; apical setulae 1-6 X 0.5-2 µm, cylindric, conic or irregular in outline, rarely branched, obtuse or subacute, thick-walled or solid, ranging from yellow to orange or brownish orange, weakly dextrinoid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-8(-11.5) µm diam, frequently-branched, cylindric or inflated, smooth, thin-walled, hyaline, strongly dextrinoid. **Stipe tissue** monomitic; **cortical hyphae** 3-8(-10) µm diam, parallel, cylindric, smooth, ochraceous, brownish orange, brown or reddish brown, dextrinoid, with walls up to 2.5 µm thick; **medullary hyphae** 3-12 µm diam, similar but hyaline and thinner-walled. **Stipe vesture** absent. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Scattered or gregarious on decayed hardwood leaf mulch or rarely on woody debris in deciduous woods or mixed forests. July - September. Common throughout northeastern North America, westward to Idaho, southward to Macon Co., North Carolina; uncommon in the southern Appalachian Mts. Reported from Europe (Noordeloos, 1987) and Japan (BPI!).

**Specimens Examined.** Refer to Appendix A.

**Commentary.** The binomial *M. siccus* is one of the oldest and most commonly misapplied names in literature on North American marasmioid agarics. No less than seven species occurring in North America have been misdiagnosed as *M. siccus*. The binomial is correctly applied to

basidiomata with the following combination of features: a) convex or campanulate, sulcate pilei colored brownish orange on the disc and orange on the margin (*i.e.*, alway with orange tones, rarely with red tones); b) distant, narrow lamellae; c) glabrous, non-insititious stipe with yellowish white apex and brown base; d) habit usually on hardwood leaves, only rarely on woody debris; e) long spores ($\bar{L}$ = 18.0 µm); f) refractive, narrow ($\bar{W}$ ≈ 6-7 µm) pleurocystidia often apically once-constricted; and g) absence of caulocystidia. In northeastern North America, *M. siccus* is commonly confused with *M. pulcherripes* Pk., *M. robinianus* Gilliam, *M. borealis* Morg., *M. bellipes* Gilliam, and *M. glabellus* Pk. In southeastern North America, *M. siccus* is often confused with *M. fulvoferrugineus* Gilliam, and *M. ferrugineus* Berk. & Curt.

*Marasmius pulcherripes* differs from *M. siccus* in forming basidiomata with closer lamellae, shorter spores ($\bar{L}$ = 13.3 µm) and less conspicuous, non-refractive pleurocystidia. *Marasmius robinianus* differs in forming paler pilei, shorter spores ($\bar{L}$ = 12.9 µm), and habit on leaves of *Robinia*. *Marasmius borealis* differs in forming stipes that are deep red at the apex, shorter spores ($\bar{L}$ ≈ 15 µm), and lacks pleurocystidia. *Marasmius bellipes* differs in forming pilei more reddish brown or yellowish brown with paler striae, purplish red stipe apices, shorter spores ($\bar{L}$ ≈ 10.2 µm), and lacks pleurocystidia. *Marasmius glabellus* differs in forming brownish orange pilei with much paler striae, and shorter and broader spores ($\bar{\bar{x}}$ = 9.1 X 4.6 µm). *Marasmius fulvoferrugineus* differs in forming usually larger basidiomata with reddish brown pilei, and lacks pleurocystidia, while

*M. ferrugineus* differs in forming smaller pilei (3-10 mm diam), broader pleurocystidia ($\bar{W} \approx$ 10-12 µm), and with habit on hardwood sticks or logs.

*Marasmius siccus* is uncommonly collected in the southern Appalachian Mountains, where the majority of specimens labelled as *M. siccus* are correctly referred to *M. fulvoferrugineus*. Hesler (1960) misapplied the epithet in the description and photograph of material from the Great Smoky Mountains. Although described from the vicinity of Salem, North Carolina, *M. siccus* is more commonly encountered north of this area. It is interesting that the species has been collected throughout northeastern North America, in Europe (Finland, Sweden; *fide* Noordeloos, 1987) and Japan, but is absent from western coastal North America.

An examination of the mating system functioning in *M. siccus* [determined from one specimen (Desjardin no. 4714)] indicates that the species is unifactorial (bipolar) heterothallic.

**36. *MARASMIUS PULCHERRIPES*** Peck, Annual Rep. New York State Mus. 24: 77. 1871 (1872).

**HOLOTYPE:** United States, New York, Garrisons, June, C. H. Peck (NYS!).

**Basidiomata** marcescent, reviving. **Pileus** (2.5-)5-15 (-20) mm diam, at first conic, obtusely-conic, convex or campanulate, often papillate, expanding in age to broadly convex or broadly campanulate, usually with a small central umbo or papilla; disc at first even, becoming rugulose in age; margin striate or sulcate, sometimes wavy or

crenate in age; surface dull, dry, opaque, subvelutinous; coloration variable, often occuring as two distinct color-forms: 1) ("pinkish-red form") disc region dark reddish brown (9-10E6-8) or reddish brown (9D6-8; 8E6-8) when young, remaining so or fading slightly in age; margin dark reddish brown, reddish brown, red (9C6-7), brownish red (8C6-8) or greyish red (7-8B-C4) when young, fading in age to greyish red, pink (9A3-4), pinkish buff (9A2), greyish orange (5-6B3-4), orange white (6A2) or pale orange white (5A2); and 2) ("brownish orange form") disc region brown (7D-E6-8) or brownish orange (6-7C5-8) when young, remaining so or fading slightly in age; margin brownish orange (6C5-8) at first, fading in age to greyish orange (5-6B3-4), light orange (5A3-4), orange white (6A2) or pale orange white (5A2); sometimes intermediate color-forms develop, with red tones on the pileus disc and orange tones on the margin; context thin, buff. **Lamellae** adnexed or free, subdistant or seldom distant (15-23 complete lamellae), narrow or moderately broad (up to 2 mm), thin, not forked, usually not intervenose or rarely weakly intervenose in older basidiomata; coloration white, buff, pale yellowish white (4A2), pale orange-white (5A2), or pale pinkish white (7A2), non-marginate; **lamellulae** usually absent, or with a few interspersed lamellulae. **Stipe** 25-50(-70) X 0.5-1 mm, terete, equal, tough, cartilaginous, hollow, dull or shiny, glabrous, non-insititious, arising from a small pad of strigose mycelium colored white, buff, pale yellow, ochraceous or pale tawny; apex colored buff, pinkish white (7-8A2), pink (8-9A4), greyish red (8B4) or reddish grey (11B4-6) in "pinkish-red form", **or** buff, yellowish white (4A2), orange-white (5-6A2) or greyish

orange (6B3) in "brownish orange form," sometimes stipe apex with pink tones in "brownish orange form;" base colored yellowish brown (6E6-8), reddish brown (8-9E5-8) or dark brown (6-7F4-8) in both forms. **Odor and taste** not distinctive.

**Basidiospores** (Fig. 36 A) (10.4-)12-16 X 3.2-4.6 µm [$\bar{\bar{x}}$ = 13.3 ± 0.6 X 3.9 ± 0.2 µm, E = 2.8-4.5, $\bar{Q}$ = 3.4 ± 0.2; TL90(90%): $\bar{x}$ = 12.2-14.4 X 3.5-4.3 µm, Q = 3.0-3.8; n = 10-30 spores per 10 specimens], clavate or subfusiform, slightly inequilateral or curved in profile, hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 36 B) 24-33 X 5.5-8 µm, subclavate or clavate, 4-spored. **Basidioles** (Fig. 36 B) cylindric, subclavate or fusoid. **Pleurocystidia** (Fig. 36 C) usually uncommon, often inconspicuous, 30.5-45 X 5-8 µm, cylindric, fusoid, subclavate or flexuous, often apically once-constricted, often mucronate, arising from deep in the subhymenium or from about the same level as the basidioles, and projecting little or up to $14^{+}$ µm beyond the basidioles, non-refractive, thin-walled, hyaline, inamyloid. **Cheilocystidia** (Fig. 36 D) numerous, similar to *Siccus*-type pileipellis elements; main body 6-22.5 X 4-8 µm, cylindric, clavate, turbinate or irregular in outline, sometimes lobed, thin-walled, hyaline; apical setulae 0.5-6 X 0.5-1.5 µm, cylindric, conic or irregular in outline, obtuse or subacute, thin-walled or thick-walled, hyaline, pale yellow or pale orange. **Pileipellis** hymeniform, mottled, composed of *Siccus*-type broom cells (Fig. 36 E); main body 6.5-17(-20) X 4-8(-10) µm, cylindric, clavate, turbinate or irregular in outline, often lobed; majority of elements thin-walled or firm-walled, hyaline, pale yellow or pale tawny; many elements thick-walled (up to 1.5 µm), orange,

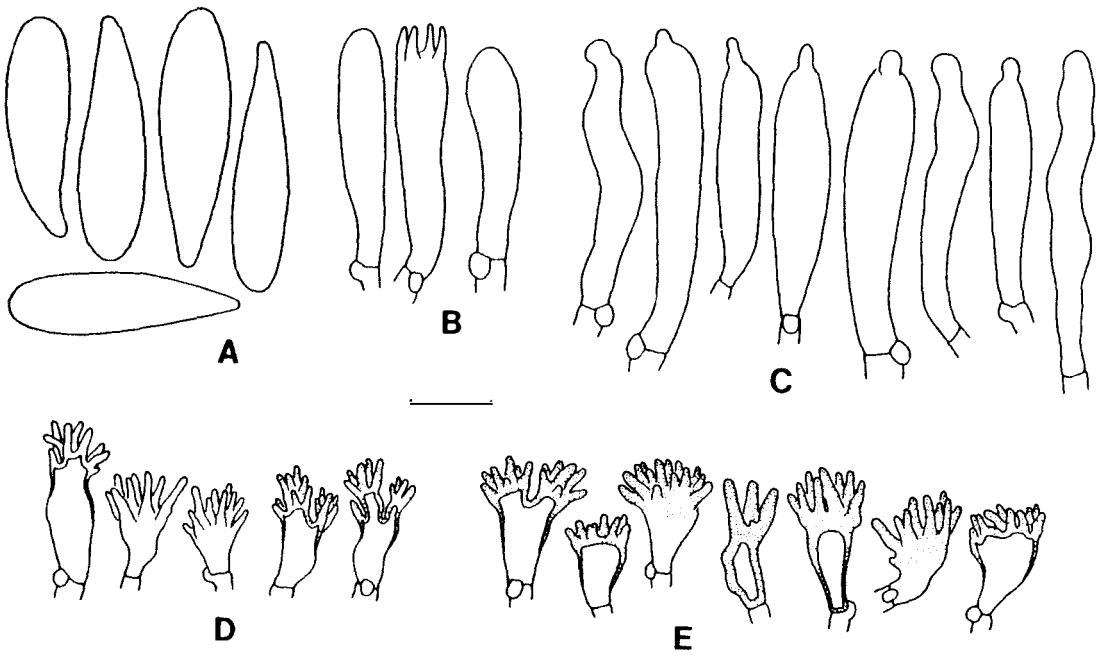



**Figure 36 A-E.** Features of *Marasmius pulcherripes* (Desjardin no. 4343). A. Basidiospores. B. Basidium and basidioles. C. Pleurocystidia. D. Cheilocystidia. E. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-E.

ochraceous or brownish orange, these interspersed among the thin-walled elements; apical setulae 1.5-6(-9.5) X 0.5-2 µm, cylindric, conic or irregular in outline, obtuse or subacute, thick-walled or solid, ranging from subhyaline or pale yellow, to orange, ochraceous or brownish orange. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-6.5(-12) µm diam, frequently-branched, cylindric or slightly inflated, smooth, non-gelatinous, thin-walled, hyaline, weakly dextrinoid. **Stipe tissue** monomitic; **cortical hyphae** 1.5-7 µm diam, parallel, cylindric, smooth, hyaline or pale yellow (stipe apex), to brownish orange, olivaceous brown or brown (stipe base), dextrinoid, with walls up to 2 µm thick; **medullary hyphae** similar but hyaline or pale yellow and thinner-walled throughout. **Stipe vesture** absent, or

with scattered *Siccus*-type broom cells on stipe apex. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Scattered or gregarious on decayed hardwood leaf mulch, rarely on pine needles, in deciduous woods, pine forests or mixed forests. June - October; most common in July - August. Common throughout eastern North America; reported from California (Desjardin, 1987b) and Japan (Imazeki & Hongo, 1987).

**Specimens Examined.** Refer to Appendix A.

**Commentary.** *Marasmius pulcherripes* is one of the more commonly collected members of sect. *Sicci* in the southern Appalachian Mts. Basidiomata are characterized by the following combination of features: a) campanulate, sulcate pilei colored either reddish brown on the disc and greyish red or pink on the margin, **or** brownish orange on the disc and pale orange on the margin; sometimes with red tones on the disc and orange tones on the margin; b) subdistant, narrow, non-marginate lamellae; c) glabrous, non-insititious stipe colored pink, red or yellowish white on the apex and brown on the base; d) mean spore size 13.3 X 3.9 µm; and e) inconspicuous, non-refractive pleurocystidia that are often mucronate. As indicated above, two color-forms are often encountered in eastern North America, *viz.*, a pinkish-red form, and a brownish orange form. Occasionally, basidiomata were observed that showed intermediate colors, *i.e.*, with red tones on pileus disc and orange tones on pileus margin. Micromorphology and cultural morphologies of all color-forms are indistinguishable, and consequently I do not propose formal recognition of separate varieties based on pileus pigmentation. The holotype

specimen of *M. pulcherripes* represents the "pinkish-red form" of the species (pileus and stipe with red tones).

The "pinkish-red form" of *M. pulcherripes* may be confused with *M. bellipes* Morg. or immature basidiomata of *M. fulvoferrugineus* Gilliam. *Marasmius bellipes* differs in forming distant lamellae, and smaller spores. In addition, dried mature pilei are usually reddish brown with much paler striae, giving the pileus a streaked appearance. *Marasmius fulvoferrugineus* differs in forming much larger basidiomata with darker pilei and larger spores. Refer to descriptions of the latter two species for further details.

The "brownish orange form" of *M. pulcherripes* may be confused with *M. siccus* and *M. borealis*. *Marasmius siccus* differs in forming more widely-spaced lamellae, conspicuous, refractive pleurocystidia, and longer spores ($\bar{L}$ = 18.0 µm). *Marasmius borealis* differs in forming pilei more deeply orange-yellow, stipe apices colored maroon or greyish red, slightly longer spores ($\bar{L} \approx 14.8$ µm), and lacks pleurocystidia.

Pleurocystidia are often difficult to observe in *M. pulcherripes*, and care must be taken when determining their presence or absence. In most basidiomata examined, pleurocystidia were uncommon but definitely present. The binomial is included in keys to both ser. *Haematocephali* and ser. *Leonini* to aid in diagnosis.

***MARASMIUS*** sect. ***SICCI*** ser. ***LEONINI*** Singer, Fl. Neotrop. Monogr. 17: 160. 1976.

TYPE SPECIES: *Marasmius leoninus* Berkeley, Hooker's J. Bot. Kew Gard. Misc. 8: 135. 1856.

Pleurocystidia absent. Pilosetae, hymenial setae and caulosetae absent. Stipe surface typically glabrous, rarely pruinose. Caulocystidia typically absent, rarely present and then of *Siccus*-type broom cells. Other features the same as those for the section.

**37. *MARASMIUS BELLIPES*** Morgan, J. Mycol. 11: 207. 1905.

= *Marasmius glabellus* var. *bellipes* (Morg.) Kauffman, Agar. Michigan 1: 66. 1918.

**LECTOTYPE:** United States, 11 Sept. 1905, Morgan (ISC!) [no locale given, but probably Preston, Ohio].

**Basidiomata** marcescent, reviving. **Pileus** 4-15 mm diam, campanulate when young, expanding in age to broadly campanulate, convex or plano-convex with a shallow central depression, often papillate; disc even; margin even at first, becoming striate or sulcate to the disc in age; surface dull, dry, opaque, subvelutinous; coloration deep purplish red (12D-E6-8) overall when young, remaining so on the disc in age or fading to brownish violet (11E5-6) or "russet-vinaceous;" margin fading in age to "russet-vinaceous," reddish brown (8-9D5-6) or slightly paler; colored light brown (7D6-8) with much paler striae when dried; context thin. **Lamellae** adnexed or free, distant, broad or moderately broad, thin, not forked nor intervenose; white or buff-colored, non-marginate; **lamellulae** usually absent.

**Stipe** 20-40 X 0.5-1 mm, terete, equal, tough, hollow, dull or shiny, glabrous, non-insititious, arising from a pad of buff-colored, strigose or downy mycelium; apex purplish red (12D-E5-6) or "purplish vinaceous;" base "dark livid brown" or dark greyish brown (10-11E3-4). **Odor and taste** not distinctive.

**Basidiospores** (Fig. 37 A) 8-12(-13.6) X 3-4.2 µm [$\bar{\bar{x}}$ = 10.2 ± 0.8 X 3.5 ± 0.2 µm, E = 2.4-3.7, $\bar{Q}$ = 2.9 ± 0.2, n = 15-40 spores per 5 specimens], subclavate, ellipsoid or elongate-amygdaliform, hyaline, inamyloid, smooth. **Basidia** (Fig. 37 B) 21-32 X 4.5-7 µm, subclavate or clavate, 4-spored. **Basidioles** (Fig. 37 B) subclavate or fusoid. **Pleurocystidia** absent; many non-refractive, hyaline, fusoid basidioles with collapsed apices present which appear pleurocystidioid in morphology, but these all arise from the same level as the basidia and do not project beyond the other hymenial elements. **Cheilocystidia** (Fig. 37 C) numerous, similar to *Siccus*-type pileipellis elements; main body 9-18 X 4.5-7 µm, cylindric or subclavate, sometimes lobed, thin-walled, hyaline; apical setulae 1.5-8 X 0.5-2 µm, cylindric, conic or irregular in outline, seldom branched or nodulose, obtuse or subacute, thin-walled or thick-walled, hyaline or pale yellow. **Pileipellis** hymeniform, not mottled or weakly mottled, composed of *Siccus*-type broom cells (Fig. 37 D); main body 8-18 X 4-10 µm, cylindric, clavate, turbinate or irregular in outline, sometimes lobed; majority of elements thin-walled, hyaline; some elements thick-walled, pale brownish orange or pale tawny, these interspersed among thin-walled cells; apical setulae 1.5-7 X 1-2.5 µm, cylindric, conic or irregular in outline, sometimes nodulose, obtuse or subacute, thick-

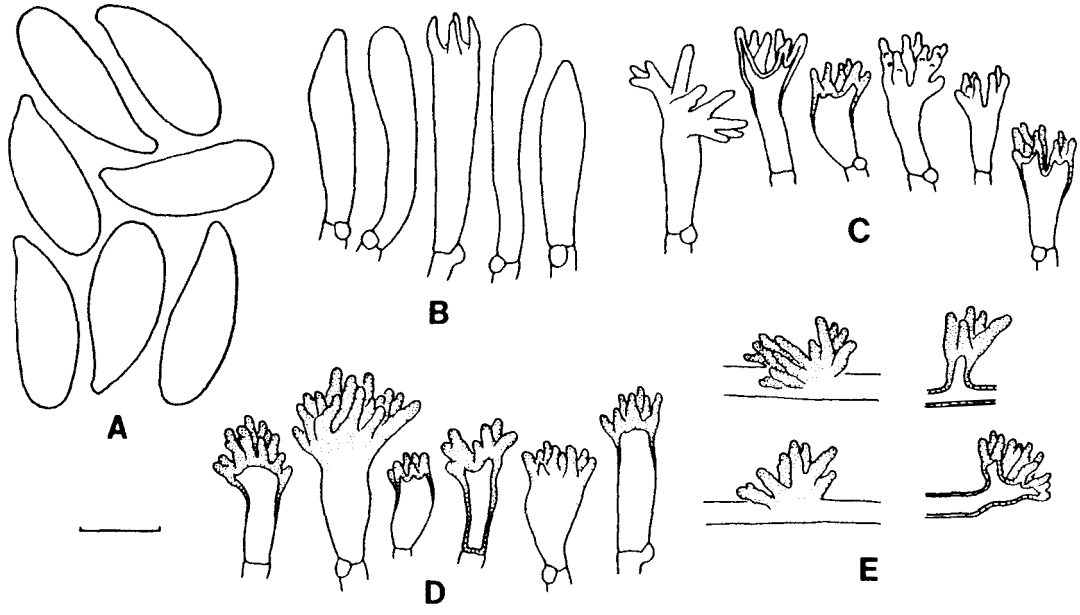



**Figure 37 A-E.** Features of *Marasmius bellipes* (Morgan, 1905, lectotype). A. Basidiospores. B. Basidium and basidioles. C. Cheilocystidia. D. Pileipellis elements. E. Stipe vesture. Standard bar = 5 µm for A; 10 µm for B-E.

walled or solid, ochraceous, brownish orange, tawny or reddish brown, weakly dextrinoid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-7(-10) µm, cylindric, smooth, non-gelatinous, thin-walled, hyaline, dextrinoid. **Stipe tissue** monomitic; **cortical hyphae** 2.5-6 µm diam, parallel, cylindric, smooth, yellow, ochraceous or brown, strongly dextrinoid, with walls up to 1.5 µm thick; **medullary hyphae** 2.5-11.5 µm diam, subparallel, cylindric or slightly inflated, hyaline, dextrinoid, thin-walled at stipe apex, with walls up to 1 µm thick at stipe base. **Stipe vesture** present at apex only, composed of scattered clusters of setulae (Fig. 37 E) arising intercalarily from repent cortical hyphae, or arising terminally from poorly-developed main bodies (and then similar to *Siccus*-type broom cells); setulae 2.5-12 X

1-2.5 µm, irregularly cylindric, often wavy in outline, subacute, thick-walled or solid, ochraceous, brownish orange or tawny. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Scattered or gregarious on decayed hardwood leaves in deciduous woods. June - September. Uncommon in eastern North America; rare in the southern Appalachian Mts. Known from Wisconsin, Ohio, Virginia, North Carolina and Tennessee.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** *Marasmius bellipes* is a rarely collected species, known at present from ten specimens, five of which represent authentic material from Ohio (ISC!). Diagnostic features of the species include: a) campanulate, striate pileus colored purplish red or russet-vinaceous; b) distant, moderately broad, non-marginate lamellae; c) glabrous, non-insititious stipe with purplish red apex; d) mean spore size 10.2 X 3.5 µm; e) absence of pleurocystidia; and f) scattered clusters of setulae on stipe apex.

Gilliam (1976) reported the presence of "clavate to cylindric, capitellate or appendiculate, hyaline" pleurocystidia in *M. bellipes*. I was unable to demonstrate the presence of clearly differentiated pleurocystidia in the lectotype specimen or in any of the authentic specimens. Many basidioles revived poorly and matched exactly the "pleurocystidial" morphology described by Gilliam. All of these elements, however, were non-refractive, arose from the same level as other hymenial elements and did not project significantly beyond other

hymenial elements. I consider pleurocystidia absent in *M. bellipes*, a condition that dictates placement in ser. *Leonini*.

In the southern Appalachian Mountains, immature basidiomata of *M. bellipes* may be confused with *M. haematocephalus* var. *haematocephalus*, but the latter differs in forming basidiomata with fewer and broader lamellae, much larger spores ($\bar{\bar{x}}$ = 18.6 X 4.5 µm), and conspicuous, refractive pleurocystidia. *Marasmius bellipes* may be confused also with *M. pulcherripes*, but the latter differs in forming basidiomata with closer lamellae, longer spores (12-16 µm; $\bar{L} \approx 13.3$ µm), and paler pilei lacking pallid striae.

Numerous specimens collected in the vicinity of Chapel Hill, North Carolina and determined by W. C. Coker as *M. bellipes* (NCU!) represent *M. sullivantii* and *M. floridanus*. Both of the latter species differ from *M. bellipes* in forming dark reddish brown, non-striate pilei, closer lamellae and shorter spores ($\bar{L} \approx 7.6$-9 µm). Refer to the descriptions of these species presented above for further details.

**38. *MARASMIUS FULVOFERRUGINEUS*** Gilliam, Mycotaxon 4(1): 82. 1976.

**HOLOTYPE:** United States, North Carolina, Henderson Co., Elks, Green Cove, near Tuxedo, 14 Sept. 1974, Gilliam no. 1557 (MICH!).

**Basidiomata** marcescent, reviving. **Pileus** (8-)15-35(-45) mm diam, campanulate or obtusely conic when young, expanding to broadly campanulate or convex, finally plano-campanulate or broadly convex, sometimes with a shallow central depression, sometimes subumbonate or papillate; disc even at first, soon rugulose; margin striate when young, soon becoming sulcate, finally plicate and undulate in age,

often crenate; mature pilei often rugulose-plicate or irregularly ridged; surface dull, dry, opaque, subvelutinous; coloration dark reddish brown (8F5-6), reddish brown (8-9E6-8) or brown (7E7-8) overall when young; disc remaining so or fading slightly in age; margin remaining so or fading to reddish brown (8D5-8), light brown (7D6-8) or brownish orange (7C5-8); context thin, buff. **Lamellae** adnexed, becoming free in age, distant or seldom remote (20-26 complete lamellae), broad (up to 6 mm in largest basidiomata), not forked, lamellar sides sometimes venose in age; buff or pale yellowish white (4A2); edges concolorous with the sides or sometimes orange-marginate; **lamellulae** typically absent, rarely with a few interspersed lamellulae. **Stipe** 40-85(-100) X 1-1.5 mm, terete, equal or with a slightly enlarged base, tough, hollow, dull or shiny, glabrous, non-insititious, arising from a pad of downy mycelium colored white, buff, pale yellowish white (4A2), cream (4A3) or pale orange-white (5A2); apex colored pale yellowish white (4A2) or pinkish buff (7A2) when young, becoming brownish orange or reddish brown in age; base colored brown (7E6-8), reddish brown (8E6-8), dark brown (6-7F6-8) or dark reddish brown (8F6-8). **Odor and taste** not distinctive.

**Basidiospores** (Fig. 38 A) 14.8-19.2(-20.8) X 3.8-5.4 µm [$\bar{\bar{x}}$ = 17.2 ± 0.5 X 4.2 ± 0.2 µm, E = 3-4.8, $\bar{Q}$ = 4.1 ± 0.3, n = 15-30 spores per 5 specimens], clavate or subfusiform, curved in profile, hyaline, inamyloid, smooth, white in deposit. **Basidia** (Fig. 38 B) 25-42 X 6.5-9 µm, clavate, 4-spored. **Basidioles** (Fig. 38 B) cylindric, subclavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** (Fig. 38 C) numerous, similar to *Siccus*-type pileipellis elements; main body 8-20 X 5-8

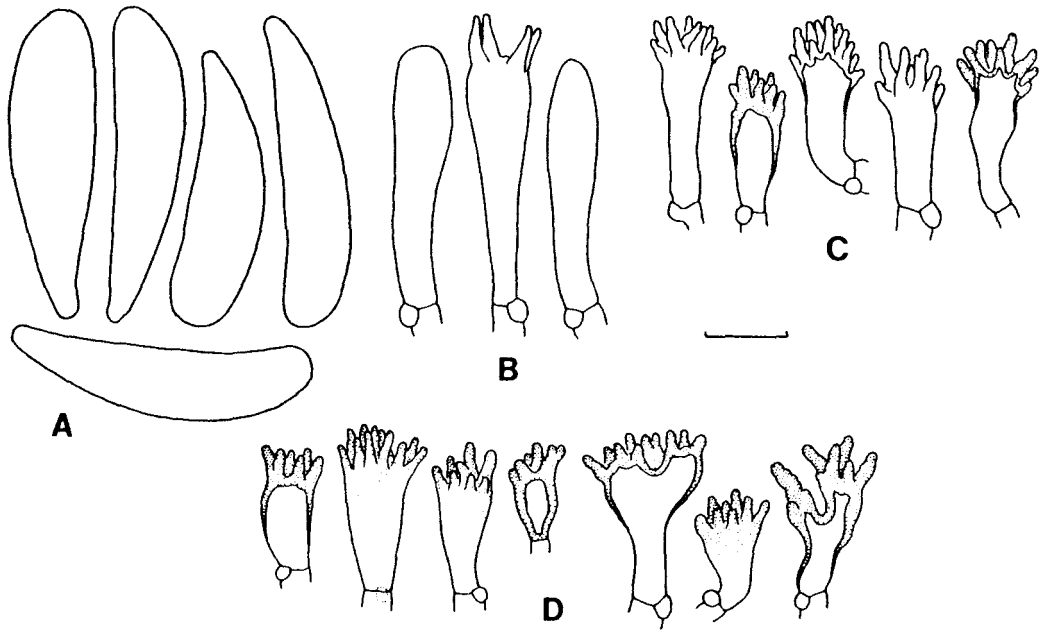



**Figure 38 A-D.** Features of *Marasmius fulvoferrugineus* (Gilliam no. 1557, holotype). A. Basidiospores. B. Basidium and basidioles. C. Cheilocystidia. D. Pileipellis elements. Standard bar = 5 µm for A; 10 µm for B-D.

(-9) µm, cylindric, subclavate or irregular in outline, seldom lobed, thin-walled or firm-walled, hyaline; apical setulae 1-8 X 0.5-1.5 µm, cylindric, conic or irregular in outline, often wavy, sometimes verrucose, sometimes branched, obtuse or subacute, thick-walled or solid, hyaline or seldom pale yellow or orange. **Pileipellis** hymeniform, mottled, composed of *Siccus*-type broom cells (Fig. 38 D); main body 8-20 X 5-13 µm, cylindric, clavate, turbinate or irregular in outline, often lobed; many elements thin- or firm-walled, hyaline or pale yellow; many elements thick-walled, ochraceous or brownish orange; apical setulae 1.5-8 X 0.5-2.5 µm, cylindric, conic or irregular in outline, often wavy, often verrucose, sometimes branched, obtuse or subacute, thick-walled or solid, ranging from ochraceous to

orange, brownish orange or tawny, weakly dextrinoid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-12 µm diam, cylindric or inflated, smooth, non-gelatinous, thin-walled, hyaline, strongly dextrinoid. **Stipe tissue** monomitic; **cortical hyphae** 2.5-6(-8) µm diam, parallel, cylindric, smooth, yellow or ochraceous (stipe apex), or brown (stipe base), dextrinoid, with walls up to 1.5 µm thick; **medullary hyphae** 3-12 µm diam, parallel, hyaline or pale yellow, dextrinoid, thin-walled. **Stipe vesture** absent, or composed of rare, isolated *Siccus*-type broom cells located on stipe apex. **Clamp connections** common in all tissues.

**Habit, habitat, and distribution.** Scattered or gregarious on decayed hardwood leaf mulch in deciduous woods or mixed forests. July - September in the southern Appalachian Mts; May - November along the Gulf Coast. Common throughout southeastern North America.

**Specimens Examined.** Refer to Appendix A.

**Commentary.** *Marasmius fulvoferrugineus* forms the largest basidiomata of any member of sect. *Sicci* occurring in the southern Appalachian Mountains. On occasion, basidiomata have been observed with pilei up to 45 mm diam and stipes up to 100 mm long. The following combination of features are diagnostic for *M. fulvoferrugineus*: a) large, campanulate, plicate pileus colored reddish brown; b) distant, broad lamellae; c) glabrous, non-insititious stipe with apex colored yellowish white or pale pink; d) mean spore size 17.2 X 4.2 µm; and e) absence of pleurocystidia. This species has been commonly misdiagnosed as *M. siccus* in the southeast. *Marasmius siccus* differs in forming typically smaller basidiomata with

pilei colored brownish orange or orange (usually lacking reddish brown or ferruginous tones), narrower lamellae, slightly longer spores ($\bar{L} \approx$ 18 µm), and conspicuous, refractive pleurocystidia. In addition, cultural morphologies of the two species are distinct. Refer to Chapter VI for comparison. *Marasmius siccus* is more commonly encountered north of the southern Appalachians, while *M. fulvoferrugineus* occurs more often from the southern Appalachians southward.

Pileus coloration of *M. fulvoferrugineus* is similar to that of *M. floridanus*, but the latter differs in forming nearly even pilei (*i.e.*, not plicate), closer lamellae, smaller spores ($\bar{\bar{x}}$ = 9.0 X 3.3 µm), and conspicuous pleurocystidia.

*Marasmius fulvoferrugineus* is similar to *M. plicatulus* Pk, a species known at present only from coastal western North America, in basidiome size, pileus coloration, lamellar features and absence of pleurocystidia. *Marasmius plicatulus* differs in forming nearly even pilei (plicate only when dried!), and shorter and broader spores ($\bar{x} \approx$ 13.8 X 5.5 µm). Refer to Desjardin (1987a) for a description and discussion of *M. plicatulus*.

# CHAPTER V

## PRELIMINARY KEY TO *MARASMIUS* FROM NORTH AMERICA

### Sect. *RHIZOMORPHIGENA*

1. Stipe glabrous; pileus 2-6 mm broad; clamp connections present; spores 6.4-10 µm long ($\bar{L}$ ≈ 8.3 µm); stipe medullary tissue heterogeneous [southeastern US] ..... *M. brevipes*
1. Stipe pubescent; pileus 1-3 mm broad; clamp connections absent; spores 10-12 µm long ($\bar{L}$ ≈ 11µm); stipe medullary tissue homogeneous [sect. *Androsacei*] ..... *M. tomentellus*

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### Sect. *ANDROSACEI*

1. Stipe glabrous overall ..... 2
1. Stipe pruinose or silky (use hand lens) ..... 6

2 (1). Stipe stramineous, golden-melleous ..... 3
2. Stipe reddish brown, brown or black ..... 4

3 (2). Clamp connections absent; basidiomata formed on coniferous needles (generally pines) [eastern NA] ..... ..... *M. straminipes* var.*straminipes*
3. Clamp connections present; basidiomata formed on oak leaves [southeastern US] ..... *M. straminipes* var. *fibulatus*

4 (2). Clamp connections and cheilocystidia absent [temperate NA] ..... *M. pallidocephalus*

4. Clamp connections and cheilocystidia present ..... 5

5 (4). Pileus brown or dark brown; stipe and rhizomorphs dark brown or black; pileipellis and hypodermal hyphae brown, pigment-incrusted [Cosmopolitan] ..... *M. androsaceus*

5. Pileus reddish brown; stipe and rhizomorphs reddish brown, translucent; pileipellis and hypodermal hyphae pallid, weakly incrusted [southeastern US, neotropics] ..... *M. cyrillidis*

6 (1). Clamp connections absent ..... 7

6. Clamp connections present (at least on stipe medullary hyphae) ..... 9

7 (6). Basidiomata typically arising directly from rhizomorphs; stipe length/pileus width ratio ≈ 1:1; spores 10-12 µm long [Gulf coastal] ..... *M. tomentellus*

7. Basidiomata not arising directly from rhizomorphs; stipe length/pileus width ratio >2:1; spores <8.5 µm long ..... 8

8 (7). Stipe nearly glabrous, weakly pruinose; pileipellis elements and cheilocystidia strongly diverticulate; diverticula narrow and elongate; clamp connections present on stipe medullary hyphae but absent (or at

least exceedingly rare) elsewhere [North Carolina, Mexico] ..... *M. chiapasensis*

8. Stipe conspicuously pruinose or pubescent overall; ornamentation white over brown cortical hyphae; pileipellis elements and cheilocystidia weakly diverticulate; diverticula broad and short; clamp connections absent throughout [Florida] ..... *M. atlanticus*

9 (6). Cheilocystidia absent ..... 10

9. Cheilocystidia present, conspicuous ..... 11

10 (9). Odor and taste weakly alliaceous; pileus dark reddish brown or dark brown; lamellae brownish grey; stipe subvelutinous, dark brown or black overall; spores 8-9 µm long; caulocystidia monomorphic [California] ..... *M. thiersii*

10. Odor and taste not alliaceous; pileus disc rosy-isabelline, margin pallid; lamellae pallid; stipe pruinose, apex pallid, base brown; spores 6.4-8.8 µm long; caulocystidia dimorphic [Florida] ..... *M. subalbiceps*

11 (9). Spores 6-7.2 µm long; caulocystidia abundant; clamp connections absent on hymenial elements but present on stipe medullary hyphae [North Carolina, Mexico] ..... *M. chiapasensis*

11. Spores 8.4-10.2 µm long; caulocystidia uncommon; clamp connections present in all tissues [California, Europe] ..... *M. quercophilus*

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Sect. ***MARASMIUS***

## Key to Subsections

1. Pileipellis composed of *Rotalis*-type elements ..... ..... subsect. *Marasmius*
1. Pileipellis composed of *Siccus*-type elements ..... ..... subsect. *Penicillati*

Sect. ***MARASMIUS*** subsect. ***MARASMIUS***

1. Basidiomata formed on monocotyledonous leaves in marshy environments; basidia bisporic [Circumboreal] ..... *M. limosus*
1. Basidiomata formed on coniferous or dicotyledonous leaves or wood; basidia tetrasporic ..... 2

2 (1). Basidiomata formed on coniferous needles (*Abies*); spores 4-5.6 µm diam ($\bar{W} \approx 4.8$ µm) [New York, Europe] ..... *M. wettsteinii*

2. Basidiomata formed on dicotyledonous leaves or wood; spores typically narrower ..... 3

3 (2). Basidiomata formed on *Ilex* leaves; pileus brown overall, lacking a pallid central zone; lamellae distant (9-11 reach the stipe) [Mississippi] ..... *M. ilicicola*

3. Substratum different than *Ilex* leaves; pileus differently colored; lamellae more numerous (13-25 reach the stipe) ..... 4

4 (3). Pileus ferruginous overall [Pennsylvania] ..... ..... *M. "ferrugineocapillaris"*

4. Pileus white, buff or pale brown, never ferruginous ..... 5

5 (4). Basidiomata formed on hardwood leaves, typically oak; pileus margin cream-colored, ochraceous or pale brown; pileus disc with a pallid zone surrounding a dark central spot; stipe <0.4 mm thick [eastern NA] ..... *M. capillaris*

5. Basidiomata formed on hardwood logs and sticks; pileus dingy white overall except for dark central spot (*i.e.*, margin not tending toward brownish); stipe typically >0.4 mm thick [eastern NA, Europe] ..... *M. rotula*

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Sect. ***MARASMIUS*** subsect. ***PENICILLATI***

1. Basidiomata formed on monocotyledonous leaves; lamellar edges non-marginate; spore $\bar{W}$ >4.5 µm ..... 2

1. Basidiomata formed on dicotyledonous leaves or wood; lamellar edges marginate; spore $\bar{W}$ <4.5 µm ..... 3

2 (1). Pileus "bay," campanulate with a prominent conic, dark brown papilla [Florida] ..... *M. octifolius*

2. Pileus reddish brown or brownish orange, often fading marginally to orange-white, umbilicate; papilla small or more commonly absent [cosmopolitan] ..... *M. graminum*

3 (1). Basidiomata formed on dicotyledonous wood [Florida] ..... ..... *M. ruforotula*

3 . Basidiomata formed on dicotyledonous leaves [Florida] ..... ..... *M. rufomarginatus*

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Sect. *EPIPHYLLI*

1. Clamp connections absent ..... 2

1. Clamp connections present ..... 3

2 (1). Basidia bisporic; spores 11-14 µm long; pileus at maturity 3-8 mm broad; pilocystidia <40 µm long, lageniform; basidiomata formed on *Populus* debris [British Columbia, Europe] ..... *M. tremulae*

2. Basidia tetrasporic; spores 9.6-11.2 µm long; pileus at maturity <1 mm broad; pilocystidia up to 65 µm long, ventricose-mucronate; basidiomata formed on *Alnus* leaves [northeastern maritime] ..... *M. minutissimus*

3 (1). Spores >12.5 µm long; basidiomata formed on monocotyledonous leaves [circumboreal] ..... *M. caricis*

3. Spores < 12.5 µm long; basidiomata formed on dicotyledonous leaves ..... 4

4 (3). Pileipellis elements mainly lobed, *i.e.*, with 1-4 subconic, obtuse projections; pileus <2 mm broad, pale yellow or pale orange when young; basidiomata formed on *Fagus* leaves [northeastern US] ..... *M. epifagus*

4. Pileipellis elements entire, lacking projections; pileus generally >2 mm broad, differently colored; substratum different than above ..... 5

5 (4). Pileus white or yellowish white; pileipellis elements hyaline; basidiomata formed on leaf blades or petioles of Betulaceae, *Fraxinus, Populus* or *Cornus* [temperate NA, Europe] ..... *M. epiphyllus*

5. Pileus pinkish white or orange-white; pileipellis elements hyaline, yellow and pale brown; basidiomata formed on petioles of *Platanus* or *Liquidambar* [eastern US] ..... *M. felix*

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Sect. ***GLOBULARES***

1. Spores clavate, 19.5-28 µm long ($\bar{L} \approx 23$ µm); pileus sulcate, disc greyish brown, margin cream-buff; lamellae distant,

broad, not strongly intervenose; upper half of stipe glabrous [southern Appalachian Mts.] ..... *M. decipiens*

1. Spores 5.6-12 µm long ($\bar{L} \approx$ 6.5-10 µm); basidiomata not with the above combination of characters ..... 2

2 (1). Pleurocystidia conspicuous, lageniform, clavate, fusoid or ventricose-rostrate, projecting well beyond the basidioles ..... 3

2. Pleurocystidia absent ..... 6

3 (2). Basidiomata omphalinoid; lamellae subdecurrent; clamp connections absent; hymenial cystidia capitate, lageniform [California] ..... *M. calhouniae*

3. Basidiomata collybioid; lamellae adnexed, sinuate or adnate, but not distinctly subdecurrent; clamp connections present; hymenial cystidia clavate, fusoid or ventricose-rostrate, typically not capitate ..... 4

4 (3). Stipe glabrous overall, polished and translucent, not striate, white above, brown below, drying reddish brown; pileus disc ochraceous-tawny, margin pinkish buff; cheilocystidia cylindric or clavate, much smaller than the pleurocystidia and non-refractive; caulocystidia absent [eastern US] ..... *M. cystidiosus*

4. Stipe apex pruinose or pulverulent, opaque, striate, white or buff-colored overall and drying pallid; pileus

colored differently than above; cheilocystidia and pleurocystidia similar; caulocystidia abundant ..... 5

5 (4). Basidiomata with lilac pigmentation in pileus, lamellae and stipe apex; cheilocystidia abundant, $\bar{W} \approx 17.5$ µm [North Carolina] ..... *M. nigrodiscus* var. *lilacinus*

5. Basidiomata lacking lilac pigmentation; cheilocystidia infrequent, $\bar{W} \approx 12.0$ µm [eastern NA] ..... ..... *M. nigrodiscus* var. *nigrodiscus*

6 (2). Cheilocystidia absent ..... 7

6. Cheilocystidia present ..... 8

7 (6). Pileus pale greyish brown; stipe apex glabrous or minutely pruinose, base pubescent, vesture thin; pileipellis elements entire, very rarely lobed; spores 6.4-8.4 µm long ($\bar{L} \approx 7.3$ µm); basidiomata formed on soil or among wood chips in disturbed soil [California, temperate South America] ..... *M. albogriseus*

7. Pileus pale brown, yellowish brown or cream; stipe pulverulent or pubescent overall, vesture thick; pileipellis elements often lobed; spores 7-10 µm long ($\bar{L} \approx 8.5$ µm); basidiomata formed in lawns or open grassy areas [cosmopolitan] ..... *M. oreades*

8 (6). Pileus smooth, entire, neither sulcate nor pellucid-reticulate; context ≈ $2^+$ mm thick ..... 9

8. Pileus rugulose-sulcate or pellucid-reticulate; context <1 mm thick ..... 10

9 (8). Pileus 11-25 mm broad, disc greyish brown, margin buff-colored; spores 5.6-7.2 µm long ($\bar{L}$ ≈ 6.5 µm); cheilocystidia broadly clavate [Tennessee] ..... *M. "albogriseiodes"*

9. Pileus 17-50 mm broad, disc yellow, often with rusty brown splotches, margin yellow; spores 7.2-10 µm long ($\bar{L}$ ≈ 8.3 µm); cheilocystidia cylindric, often lobed [eastern NA] ..... ..... *M. strictipes*

10 (8). Pileus dark brown or brownish grey, rugulose-sulcate, not pellucid-reticulate; lamellae distant or remote, broad, not intervenose; spores 8.8-12 µm long ($\bar{L}$ ≈ 10 µm) [Florida] ..... *M. heliomyces*

10. Pileus cream-buff or milky white, pellucid-reticulate; lamellae subdistant or distant, moderately broad, strongly intervenose; spores 5.6-7.6 µm long ($\bar{L}$ ≈ 6.7 µm) [Gulf coastal] ..... *M. cohortalis* var. *alachuanus*

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Sect. ***ALLIACEI***

1. Spores >12.5 µm long ($\bar{L}$ ≈ 15 µm) ..... 2

1. Spores <12.5 µm long ($\bar{L}$ ≈ 8-10 µm) ..... 5

2 (1). Basidiomata formed on monocotyledonous leaves in marshy areas; basidiomata white overall; pileus 2-7.5 mm broad; odor mild; pilocystidia present (sect. *Epiphylli*) .....*M. caricis*

2. Basidiomata formed on dicotyledonous leaves in wooded areas; basidiomata pigmented; pileus typically >7.5 mm broad; odor alliaceous; pilocystidia absent ..... 3

3 (2). Basidiomata formed on *Gaultheria* or *Berberis* leaves; spores 15-19.2 µm long; pileipellis elements with few or numerous projections or lobes [Pacific Northwest] ..... *M. salalis*

3. Basidiomata formed on leaves of Fagaceae; spores 10.4-17.2 µm long; pileipellis elements entire or rarely with one lobe ..... 4

4 (3). Stipe 25-65 X 1-4 mm; pileus convex or plano-convex at maturity [California] ..... *M. copelandii* var. *copelandii*

4. Stipe 10-30 X 0.2-2 mm; pileus concave with a wavy margin at maturity [eastern US] ... *M. copelandii* var. *olidus*

5 (1). Odor and taste alliaceous ..... 6

5. Odor and taste not alliaceous ..... 7

6 (5). Stipe glabrous; pileus brown, yellowish brown, greyish orange or orange-white; basidiomata formed on hardwood debris [eastern NA, Europe, rarely California] ..... *M. scorodonius*

6. Stipe pubescent or velutinous; pileus dark reddish brown, fading slightly in age; basidiomata formed on montane coniferous debris [California] ..... *M. applanatipes*

7 (5). Pleurocystidia absent ..... 8

7. Pleurocystidia present, conspicuous, capitate ..... 9

8 (7). Hymenophore merulioid; clamp connections absent; pileus stramineous; basidiomata formed on *Scirpus* leaves in marshy areas [Quebec] ..... *M. flavomerulinus*

8. Hymenophore lamellate; clamp connections present; pileus reddish brown; basidiomata formed on *Dryas* leaves in arctic and alpine tundras [Canada, Greenland, northern Europe] ..... *M. epidryas*

9 (7). Basidiomata formed on *Dryas* leaves in arctic and alpine tundras ..... *M. epidryas*

9. Substratum and habitat different than above ..... 10

10 (9). Basidiomata omphalinoid, putrescent; pileus disc pale grey, margin white or buff; lamellae subdecurrent; stipe not rooting; clamp connections absent (sect. *Globulares*) ..... *M. calhouniae*

10. Basidiomata marasmioid/collybioid, marcescent; pileus more deeply pigmented; lamellae adnate; stipe often rooting; clamp connections present ..... 11

11 (10). Pileus olivaceous brown, fading to yellowish brown, pruinose due to numerous ventricose-rostrate pilocystidia; spores 4.2-7.3 μm wide; typically in coniferous woods [circumboreal] ..... *M. chordalis*

11. Pileus yellow or brownish orange, glabrous; pilocystidia absent; spores 3.4-4.8 μm broad; typically in deciduous woods [eastern NA] ..... *M. pyrrhocephalus*

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Sect. ***HYGROMETRICI***

1. Pileipellis with chains of *Rotalis*-type elements interspersed among a hymeniform layer of *Rotalis*-type cells; spores 3.8-5 μm wide ($\bar{W} \approx 4.3$ μm); lamellar edge with both fusoid-ventricose non-setulose elements and *Rotalis*-type cells; basidiomata formed on leaves of *Magnolia grandiflora* [Florida] ..... *M. magnoliae*

1. Pileipellis a hymeniform layer of *Rotalis*-type elements lacking chains of similar cells; spores 2.6-3.8 μm wide ($\bar{W} \approx 3.2$ μm); lamellar edge lacking *Rotalis*-type cells; basidiomata formed typically on *Fraxinus* leaves [north-eastern US] ..... *M. minutus*

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## Sect. *SICCI*

### Sect. *SICCI* ser. *SPINULOSI*

1. Pileus dingy white or cream-colored overall; hymenial setae hyaline or rarely pale yellow [eastern NA] ..... *M. delectans*
1. Pileus brown, reddish brown or yellowish brown, darkest over disc; hymenial setae yellow, ochraceous or pale brown ..... 2

2 (1). Lamellae subdistant or distant, broad; stipe glabrous or weakly pruinose at apex [eastern NA, Europe] ..... *M. cohaerens* var. *cohaerens*

2. Lamellae close or crowded, narrow; stipe pruinose or subvelutinous overall [eastern NA] ..... ..... *M. cohaerens* var. *lachnophyllus*

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### Sect. *SICCI* ser. *ATRORUBENSES*

1. Stipe vesture composed of numerous setulose elements, with or without interspersed non-setulose elements ..... 2
1 . Stipe vesture composed only of non-setulose elements, these typically irregularly cylindric, clavate or lanceolate, thin- or thick-walled ..... 5

2 (1). Pleurocystidia present, refractive ..... 3

2. Pleurocystidia absent ..... 4

3 (2). Stipe <3 mm long, often eccentric, curved, white overall; pileus 1-7 mm broad, brownish orange, brownish grey or yellowish brown (ser. *Haematocephali*) ..... *M. falcatipes*

3. Stipe >10 mm long, central, straight, base brown or reddish brown; pileus 5-25 mm broad, reddish brown (ser. *Haematocephali*) ..... *M. sullivantii*

4 (2). Pileus pale purplish brown, brown or dark brownish orange; basidiomata formed on tree bark (ser. *Leonini*) ..... *M. pusio* var. *pusio*

4. Pileus orange, brownish orange or brownish yellow; basidiomata formed on grass leaves or *Rubus* stems and roots (ser. *Leonini*) ..... *M. pusio* var. *armeniacus*

5 (1). Cheilocystidia dimorphic, mostly gloeocystidioid, flexuous with orange globular contents, with few *Siccus*-type broom cells interspersed; spores 13.5-18 µm long ($\bar{L} \approx 15.7$ µm) [southeastern US] ..... *M. ciliatomarginatus*

5. Cheilocystidia monomorphic, all *Siccus*-type broom cells; gloeocystidioid elements absent; spore $\bar{L} < 14$ µm ..... 6

6 (5). Spores 12-16 µm long ($\bar{L} \approx 13.9$ µm); pileus "isabelline" or brownish ochraceous [Florida, Bahama Islands] ..... *M. bahamensis*

6. Spores 9.6-12 µm long ($\bar{L} \approx 10.8$ µm); pileus "testaceous" [Florida] ..... *M. testaceiceps*

Sect. ***SICCI*** ser. ***HAEMATOCEPHALI***

1. Spores >12 µm long, $\bar{L}$ ≈ 13-19 µm ..... 2

1. Spores <12 m long, $\bar{L}$ ≈ 6.5-9.5 µm ..... 10

2 (1). Basidiomata formed on grass leaves or cow dung; pileus typically <4 mm broad ..... 3

2. Basidiomata formed on wood or leaves of various hardwoods; pileus typically >4 mm broad ..... 4

3 (2). Pileus deep red, sulcate; lamellae non-marginate; pleurocystidia clavate with broadly rounded apices, only rarely strangulate or appendiculate; basidiomata on cow dung [Texas] ..... *M. puniceus*

3. Pileus reddish orange or orange, smooth (non-sulcate); lamellae often orange-marginate; pleurocystidia strangulate or appendiculate; basidiomata on grass leaves [southeastern US] ..... *M. pseudobambusinus*

4 (2). Pileus disc pale brownish orange, greyish orange or orange, margin at maturity orange-white or paler ..... 5

4. Pileus disc purplish red, reddish brown, greyish red, ferruginous or brownish orange, margin slightly paler at maturity ..... 7

5 (4). Lamellae remote, broad; spores 14.4-19.2 µm long ($\bar{L}$ ≈ 16.8 µm), $\bar{Q}$ ≈ 4.3; caulocystidia absent, *i.e.*, no *Siccus*-type broom cells on stipe apex [Tennessee] ..... ..... *M. haematocephalus* var. *anomaloides*

5. Lamellae subdistant or distant, narrow; spores 11.6-16 µm long ($\bar{L}$ ≈ 13-14 µm), $\bar{Q}$ ≈ 3.6; *Siccus*-type broom cells present on stipe apex ..... 6

6 (5). Lamellae distant (11-16 reach the stipe); pleurocystidia weakly refractive; basidiomata on *Robinia* leaves [Michigan] ..... *M. robinianus*

6. Lamellae subdistant (15-23 reach the stipe); pleurocystidia non-refractive; basidiomata on leaves of various hardwoods [eastern NA] ..... *M. pulcherripes* (brownish orange form)

7 (4). Pileus disc dark purplish red or violet brown, margin greyish purple or reddish brown; lamellae remote, broad; stipe apex pinkish red or purplish red; spores 16-22 µm long ($\bar{L}$ ≈ 18.6 µm) [southeastern US, pantropical] ..... *M. haematocephalus* var. *haematocephalus*

7. Basidiomata not with the above combination of characters; lamellae typically closer and narrower ..... 8

8 (7). Spores 12-16 µm long ($\bar{L}$ ≈ 13.3 µm), $\bar{Q}$ ≈ 3.4; pleurocystidia non-refractive, hyaline, often inconspicuous; pileus reddish brown, greyish red or

pink, seldom brownish orange or greyish orange; stipe apex often red or pink [eastern NA, rarely California] ..... *M. pulcherripes*

8. Spores 15-20.5 µm long ($\bar{L}$ ≈ 17-19 µm), $\bar{Q}$ ≈ 3.9-4.7; pleurocystidia refractive, hyaline or pale yellow, conspicuous; pileus ferruginous, deep brownish orange or reddish orange; stipe apex pallid or orange-white, not red or pink ..... 9

9 (8). Basidiomata formed on hardwood leaves; pileus 5-25 mm broad; stipe 25-50 mm long; pleurocystidia $\bar{W}$ ≈ 6-7 µm [eastern NA, rarely Japan and Europe] ..... *M. siccus*

9. Basidiomata formed on hardwood sticks or logs; pileus 3-10 mm broad; stipe 10-30 mm long; pleurocystidia $\bar{W}$ ≈ 10-12 µ [Florida, South America] ..... *M. ferrugineus*

10 (1). Stipe <3 mm long, often eccentric, curved, pruinose and white overall; pileus 1-7 mm broad, brownish orange, brownish grey or yellowish brown [southeastern US] ..... *M. falcatipes*

10. Stipe >10 mm long, central, straight, glabrous or pruinose, more deeply pigmented than above; pileus typically >7 mm broad, variously colored ..... 11

11 (10). Stipe pruinose overall or only on region above basal tomentum (use hand lens); caulocystidia *Siccus*-type broom cells or dendrotrichomoid elements ..... 12

11. Stipe glabrous from apex to basal tomentum; caulocystidia absent ..... 13

12 (11). Pileus deep reddish brown or brownish orange overall; lamellae close or subdistant, moderately broad, often with soredioid spots when dried; stipe pruinose overall; spores 6.4-9.6 µm long ($\bar{L} \approx 7.6$ µm); cheilocystidia monomorphic, all *Siccus*-type broom cells; caulocystidia dimorphic, of cylindric or clavate, non-setulose cells plus *Siccus*-type broom cells [eastern US] ..... *M. sullivantii*

12. Pileus disc brown, brownish orange or pinkish brown, margin pinkish orange or pinkish buff; lamellae crowded, narrow, lacking soredioid spots; stipe glabrous at apex but pruinose above basal tomentum; spores 5.8-8.0 µm long ($\bar{L} \approx 6.6$ µm); cheilocystidia dimorphic, of irregularly cylindric, lobed, refractive elements plus *Siccus*-type broom cells; caulocystidia monomorphic, dendrotrichomoid [eastern US] ..... *M. spissus*

13 (11). Pileus striate or plicate; lamellae distant or remote, broad; spores 4-5.6 µm wide ($\bar{W} \approx 4.6$ µm) [eastern US] ..... *M. glabellus*

13. Pileus smooth or striatulate; lamellae close or subdistant, narrow or moderately broad; spores 2.8-3.6 µm wide ($\bar{W} \approx 3.1$ µm) ..... 14

14 (13). Lamellae distinctly intervenose near pileus margin; spores 6.4-8.4 µm long ($\bar{L} \approx 7.4$ µm) [Virginia] ..... ..... *M. floridanus* var. *virginianus*

14. Lamellae not intervenose; spores 7.2-11.2 µm long ($\bar{L} \approx 9$ µm) [eastern US] ..... *M. floridanus* var. *floridanus*

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Sect. ***SICCI*** ser. ***LEONINI***

1. Spores 12-24 µm long, $\bar{L}$ range 13.8-19.4 µm ..... 2

1. Spores 6.4-14 µm long, $\bar{L}$ <12.9 µm, $\bar{L}$ range 7.2-11 µm .... 6

2 (1). Lamellae narrow, subdistant or distant ..... 3

2. Lamellae broad, distant or remote ..... 4

3 (2). Pileus smooth almost until maturity, then shallowly sulcate, deep orange, brownish orange or orange-yellow; pleurocystidia absent; spore $\bar{L} \approx 14.8$ µm [northeastern NA] ..... *M. borealis*

3. Pileus striate or sulcate throughout development, reddish brown, greyish red or pink, seldom brownish orange or orange-white; pleurocystidia present but inconspicuous,

non-refractive; spores $\bar{L}$ ≈ 13.3 µm (ser. *Haematocephali*) ..... *M. pulcherripes*

4 (2). Pileus disc yellowish brown, margin greyish orange or cream-colored; spores 16-24 µm long ($\bar{L}$ ≈ 19.4 µm); pileipellis composed of both smooth cells and *Siccus*-type broom cells; basidiomata formed on hardwood debris in marshy environments [northeastern coastal US] ..... *M. paludigenus*

4. Pileus dark reddish brown, dark brown, brown, fulvous or ferruginous overall; spore $\bar{L}$ ≈ 14-17 µm; pileipellis composed entirely of *Siccus*-type broom cells; habitat different from above ..... 5

5 (4). Pileus dark reddish brown, dark brown or brown, smooth almost until maturity, then short-striate; spores 12.3-16.2 µm long, $\bar{x}$ ≈ 14 X 5.5 µm, $\bar{Q}$ ≈ 2.5; stipe apex greyish red [Pacific coastal NA] ..... *M. plicatulus*

5. Pileus reddish brown, fulvous or ferruginous, deeply plicate; spores 14.8-19.2 µm long, $\bar{x}$ ≈ 17.2 X 4.2 µm, $\bar{Q}$ ≈ 4.1; stipe apex white, yellowish white or pinkish white [Eastern US] ..... *M. fulvoferrugineus*

6 (1). Stipe white, pruinose or pubescent overall ..... 7

6. Stipe more deeply pigmented, glabrous above basal tomentum or with rare, scattered pruinae ..... 8

7 (6). Pileus pale purplish brown, brown or dark brownish orange; basidiomata formed on tree bark [South Carolina, South America] ..... *M. pusio* var. *pusio*

7. Pileus orange, brownish orange or brownish yellow; basidiomata formed on grass leaves or *Rubus* stems or roots [Indiana, California] ..... *M. pusio* var. *armeniacus*

8 (6). Pileus with olivaceous pigmentation, fuliginous-olive, olive fuscous or olive-ochraceous ..... 9

8. Pileus without olivaceous pigmentation ..... 10

9 (8). Lamellar edge olivaceous-marginate; lamellae subdistant or distant, moderately broad; basidiomata formed on dicotyledonous debris [Florida] ..... *M. olivascenticeps*

9. Lamellar edge non-marginate; lamellae close, narrow or moderately broad; basidiomata formed on monocotyledonous or dicotyledonous debris [Florida, neotropics] ..... *M. trinitatis*

10 (9). Setulae on pileipellis elements and cheilocystidia irregular in outline, strangulate-contorted and densely verrucose; spore $\bar{L} \approx 12.3\text{-}12.9$ µm ..... 11

10. Setulae on pileipellis elements and cheilocystidia cylindric or conic, not verrucose; spore $\bar{L} < 11$ µm ..... 12

11 (10). Pileus white; lamellae remote, broad; basidiomata formed on hardwood twigs [South Carolina] ..... *M. similis*

11. Pileus brown or cinnamon brown; lamellae distant, narrow; basidiomata formed on grasses [New England, South Carolina] ..... *M. pruinatus*

12 (10). Lamellae distant, broad; basidiomata formed on dicotyledonous leaves ..... 13

12. Lamellae close or subdistant, rarely distant, narrow or moderately broad; basidiomata formed on woody debris .... 14

13 (12). Pileus deep reddish purple, reddish brown or brown; lamellae non-marginate; stipe apex purplish red; spores 3-4.2 µm wide ($\bar{W} \approx 3.5$ µm, $\bar{Q} \approx 3$) [eastern US] ..... ..... *M. bellipes*

13. Pileus brownish orange; lamellae often ferruginous-marginate; stipe apex white; spores 4-5 µm wide ($\bar{W} \approx 4.5$ µm, $\bar{Q} \approx 2.2$) [Illinois] ..... *M. submarginatus*

14 (12). Pileipellis composed of nearly equal numbers of smooth cells and *Siccus*-type broom cells; stipe lacking broom cells and dendrotrichomoid elements; spores 6.4-8 µm long ($\bar{L} \approx 7.2$ µm) [Florida, South America] ..... *M. corrugatus* var. *portonovensis*

14. Pileipellis composed entirely of *Siccus*-type broom

cells (very rarely with few smooth cells interspersed); stipe with scattered broom cells or dendrotrichomoid elements; spore $\bar{L} \approx 8.2\text{-}9.9$ µm ..... 15

15 (14). Spores 7.2-9 µm long ($\bar{L} \approx 8.2$ µm); pileus 8-22 mm broad; stipe base with scattered irregularly cylindric caulocystidia and rare dendrotrichomoid elements [Florida, South America] ..... *M. corrugatus* var. *aurantiacus*

15. Spores 8.8-10.4 µm long ($\bar{L} \approx 9.9$ µm); pileus 15-42 mm broad; stipe base with scattered dendrotrichomoid elements, lacking irregularly cylindric caulocystidia [Florida, South America] ..... *M. leoninus*

# CHAPTER VI

## CULTURAL STUDIES

The importance of cultural characters in taxonomy of wood-rotting Aphyllophorales has long been established (Davidson *et al.*, 1942; Nobles, 1948, 1958, 1965; Stalpers, 1978). The potential value of the use of cultural characters in taxonomy of Agaricales has been indicated by Miller (1971) and Watling (1984), but to date, such studies are rare (Semerdzieva, 1965; Campbell & Petersen, 1975; Mueller, 1982, 1984, 1985; Mueller & Fries, 1985; Vilgalys & Miller, 1983; Thorn & Barron, 1986). Of these latter studies, only Mueller (1982, 1984) and Mueller and Fries (1985) used cultural characters taxonomically, to separate closely allied species. The following studies on cultural morphology of southern Appalachian *Marasmii* were undertaken to determine the value of cultural characters in the taxonomy of *Marasmius*.

A preliminary experiment was performed to determine the degree of morphological variability resulting from the growth of isolates on various culture media. Isolates of fifteen species (Table 1) representing six sections of *Marasmius* were grown under controlled conditions on five different media (three replicates of each isolate): Malt Extract Agar (MEA), Potato Dextrose Agar (PDA), Cornmeal Dextrose Yeast Agar (CMDY), Malt Yeast Soytone Agar (MYS), and Modified Melin-Norkrans Medium (MNM) [see Appendix B for formulae]. Isolates of all species examined, except *Marasmius delectans, M. cohaerens* var. *lachnophyllus* and *M. strictipes*, grew well on all five media, often

**Table 1.** Isolates of Selected *Marasmius* Species Utilized in Preliminary Study of Cultural Morphology.

| Specific Epithet | Section | Collection # |
|---|---|---|
| *androsaceus* | *Androsacei* | 4491 |
| *straminipes* var. *fibulatus* | *Androsacei* | 4474 |
| *capillaris* | *Marasmius* | 4239 |
| *graminum* | *Marasmius* | 4386 |
| *rotula* | *Marasmius* | 4466 |
| *felix* | *Epiphylli* | 4471 |
| *strictipes* | *Globulares* | 4453 |
| *pyrrhocephalus* | *Alliacei* | 4467 |
| *scorodonius* | *Alliacei* | 3875 |
| *cohaerens* var. *lachnophyllus* | *Sicci* | 4438 |
| *delectans* | *Sicci* | 4518 |
| *falcatipes* | *Sicci* | 4415 |
| *pseudobambusinus* | *Sicci* | 4353 |
| *pulcherripes* | *Sicci* | 4075 |
| *siccus* | *Sicci* | 4314 |

covering a 90 mm Petri plate in two weeks. The three exceptions grew poorly on all five media, covering less than half the Petri plate in five weeks. In the majority of species examined in this preliminary experiment, somatic hyphae showed very little differentiation when grown on MEA. In general, aerial mycelium was not formed or consisted of a few silky, radially arranged, hyaline or white hyphal strands. Isolates of *M. scorodonius, M. pyrrhocephalus* (both sect. *Alliacei*), *M. capillaris* and *M. rotula* (both sect. *Marasmius*) grown on MEA formed cottony or woolly, white aerial mycelium with scattered brownish or avellaneous crustose regions.

In contrast, isolates of all taxa grown on PDA, CMDY, MYS and MNM typically formed well-developed, often highly pigmented aerial mycelium. Isolates of some species (*e.g., M. androsaceus, M. pulcherripes*) grew faster and formed thicker mats on one or more of these media, while isolates of a few species (*e.g., M. graminum, M. falcatipes*) showed nearly identical culture mat morphology on all media tested. Only one species, *viz., M. straminipes* var. *fibulatus*, showed significant variation on all five media. When grown on PDA, CMDY, and MYS, somatic hyphae of the latter species formed numerous erect rhizomorphs by Week V, but variation was observed on each medium in mat coloration and zonation, and reverse color. Culture mat morphology on MNM was similar to that on CMDY but rhizomorphs were not formed, and when grown on MEA, the isolate formed pigmentless aerial mycelium and lacked rhizomorphs.

A comparison of somatic hyphal growth and differentiation of all taxa examined in this preliminary study revealed that the greatest

interspecies variability in culture mat morphology was between isolates grown on PDA. It was surmised that this variation may be of taxonomic significance and warranted further examination. For this reason, the macro- and micromorphologies of somatic hyphae in culture were determined and evaluated for each species, from isolates grown on PDA as well as on MEA, the traditional medium used by Nobles (1948, 1965) and Stalpers (1978).

## CULTURAL CHARACTERS.

Ninety isolates representing 29 taxa were utilized in the following studies on cultural characters in southern Appalachian *Marasmius* (Table 2). Three replicates of each isolate were grown on MEA and PDA. In 28 of the taxa examined, there was very little variation between different isolates of a given species (*i.e.*, infraspecific variation). Only one species, *viz.*, *M. androsaceus*, showed significant infraspecific variation, with isolates sorting into three distinct culture mat morphologies. The latter observation warrants further investigation; specifically, comparison of isolates from the southern Appalachians with isolates obtained elsewhere in the geographical range of the species. Clearly, more confidence can be placed in my characterization of cultural morphology of a species when numerous isolates were available for study, than when only a single isolate was available. However, results obtained from taxa represented in this study by four or more isolates indicate that cultural morphology is fairly consistent within species.

**TABLE 2.** Isolates of *Marasmius* Species Utilized in Cultural Studies.

| Specific Epithet | Section | Collection # |
|---|---|---|
| *brevipes* | *Rhizomorphigena* | 4586 |
| *straminipes* var. *straminipes* | *Androsacei* | 4325 |
| *straminipes* var. *fibulatus* | *Androsacei* | 4447, 4474 |
| *pallidocephalus* | *Androsacei* | 4615 |
| *androsaceus* | *Androsacei* | 3579, 3806, 3917, 3937, 4328, 4450, 4475, 4481, 4491 |
| *graminum* | *Marasmius* | 3838, 4386, 4442 |
| *capillaris* | *Marasmius* | 3855, 4239, 4345, 4465, 4493 |
| *rotula* | *Marasmius* | 3546, 3547, 3818, 4241, 4461, 4466, 4555 |
| *felix* | *Epiphylli* | 4471, 4486 |
| *decipiens* | *Globulares* | 4272, 4480, 4608 |
| *nigrodiscus* | *Globulares* | 4301, 4392 |
| *cystidiosus* | *Globulares* | 4594 |
| *oreades* | *Globulares* | 4019, Halling 5958 |
| *strictipes* | *Globulares* | 4073, 4411, 4439, 4453 |
| *pyrrhocephalus* | *Alliacei* | 4218, 4273, 4437, 4467, 4503, 4573, 870813/01 |
| *scorodonius* | *Alliacei* | 3875, 3952, 3975, 4500, 4554 |
| *delectans* | *Sicci* | 4518 |
| *cohaerens* var. *cohaerens* | *Sicci* | 4522 |
| *cohaerens* var. *lachnophyllus* | *Sicci* | 4071, 4387, 4438, 4589 |
| *ciliatomarginatus* | *Sicci* | 4414 |
| *falcatipes* | *Sicci* | 4415, 4456, 4490 |
| *spissus* | *Sicci* | 4598 |
| *sullivantii* | *Sicci* | 4072, 4342, 4434, 4452, 4595 |
| *pseudobambusinus* | *Sicci* | 4353 |
| *haematocephalus* var. *haematocephalus* | *Sicci* | 4321, 4640 |
| *haematocephalus* var. *anomaloides* | *Sicci* | 4322, 4711 |
| *siccus* | *Sicci* | 4314, 4464 |
| *pulcherripes* | *Sicci* | 4017, 4057, 4075, 4326, 4343, 4390, 4487, 4596 |
| *fulvoferrugineus* | *Sicci* | 4324, 4420, 4501, 4656 |

**Macromorphological Characters.**

**MEA-Grown Isolates.** As indicated above, very little useful taxonomic information was obtained from isolates grown on MEA. The 29 taxa utilized in this study can be grouped in three categories based on culture mat morphology on MEA: 1) isolates of 21 taxa formed no aerial mycelium or only poorly-developed aerial mycelium consisting of a few appressed radiating hyphal strands; 2) isolates of 4 taxa formed white, cottony or woolly aerial mycelium; and 3) isolates of 4 taxa formed pallid, woolly aerial mycelium plus irregularly-shaped, brownish or avellaneous crustose patches. Within each of these categories, the majority of isolates could not be separated based on morphology. Moreover, each category contained taxa belonging to a number of different sections of the genus. The Nobles Species Codes (Nobles, 1965) for the majority of MEA-grown taxa were nearly identical. These results suggest that macromorphological cultural characters of isolates grown on MEA are of limited taxonomic value.

**PDA-Grown Isolates.** In contrast, culture mat analyses of isolates grown on PDA revealed distinct morphologies for nearly all species examined. The following discussion of diagnostic features pertains exclusively to growth on PDA. Diagnostic macromorphological characters include: a) mean growth rate; b) color of the culture mat; c) texture of the culture mat; and d) reverse color.

**Mean Growth Rate.** Growth (expressed as the radius of the culture mat) of each replicate of each isolate was measured at one week intervals for a period of six weeks or until the plates were covered. Mean growth rate ranged from 7 mm at Week VI (*M. strictipes*) to 60 mm

at Week I (*M. graminum*). Members of sect. *Globulares* grew slowly on PDA [7-34(-55) mm at Week VI], while members of sect. *Marasmius* exhibited very rapid growth rates, covering 90 mm plates in 2-3 weeks. Mean growth rate (MGR) may, on occasion, be used to separate closely allied taxa. For example, the MGR for *M. nigrodiscus* at Week VI was 34 mm (n = 6), compared to 12.5 mm (n = 3) for *M. cystidiosus*; MGR for *M. siccus* at Week VI was 70+ mm (n = 6), compared to 44.6 mm (n = 24) for *M. pulcherripes*; MGR for *M. rotula* at Week II was 70+ mm (n = 21), compared to 50 mm (n = 15) for *M. capillaris*. Mean growth rate alone, however, is insufficient to separate taxa, but when used in correlation with other cultural characters growth rate may be of taxonomic value.

**Culture Mat Coloration.** Culture mats ranged in coloration from white, cream, tan or beige, to various shades of yellow, green, orange or red, to brown, dark brown or charcoal. In some taxa, color of the culture mat changed as cultures aged, often initially white overall but developing deeper pigments in older regions (*i.e.*, adjacent to the inoculum plug) and retaining a white advancing zone. Some taxa formed white mats throughout 6 weeks of growth, while other taxa formed pigmented mats from the onset of growth on PDA. In a few species (*e.g., M. rotula, M. capillaris*), some isolates were initially white overall and did not develop pigments until the fifth or sixth week of growth, while other isolates of the same species formed pigmented aerial hyphae by Week II. If these cultures were observed only at Week IV, it would appear as if several distinct morphologies were formed; however, by Week VI, once fully pigmented, all isolates of the species showed identical culture mat morphology. Such ontogenic sequences

signify the importance of recording culture mat development at weekly intervals. Culture mats of some taxa were zonate, with the zones representing areas of different coloration and/or texture.

Culture mat coloration is one of the more important taxonomic cultural characters, useful in separating closely allied taxa. For example, cultures of *M. rotula* developed azonate crustose mats of "avellaneous," "fawn brown," or "wood brown" hyphae (*i.e.*, with pink or dull violaceous tints, lacking orange tints) by Week VI, whereas equally aged cultures of *M. capillaris* developed zonate crustose mats of "clay color," "cinnamon," or "cinnamon buff" hyphae (*i.e.*, with orange tints, lacking pink tints) [color terms in quotation marks from Ridgway (1912)]. Isolates of *M. siccus* developed subfelty mats of cream-buff or pale ochraceous mycelium, whereas isolates of *M. pulcherripes* formed felty mats of deep olivaceous mycelium. Bright yellow spots composed of globular clusters of deep yellow acicular crystals developed on culture mats of *M. nigrodiscus*, while such pigmented crystal deposits were lacking in isolates of *M. cystidiosus*. Further comparisons will be provided below in the commentaries following the descriptions of cultural morphology.

**Culture Mat Texture.** Terms used to describe culture mat texture are those of Stalpers (1978). Isolates of *Marasmius* species developed culture mats ranging in texture from downy, farinaceous (granulose), floccose, silky, cottony, woolly or plumose, to subfelty, felty or crustose. Often, the aerial mycelium was initially downy, silky or cottony, and later developed mats with woolly, subfelty, felty or crustose texture. Hence, within a single culture, a full range of

textures may be observed, grading from downy or silky in the advancing zone to felty or crustose near the inoculum plug. In most taxa examined, the advancing zone hyphae were submerged or only poorly developed on the surface of the agar, while the aerial mycelia in older regions of cultures were well-developed and often raised. In a few species (*e.g., M. cohaerens* var. *lachnophyllus, M. strictipes*) at Week VI the culture mats were radially ridged, grooved or folded. Additionally, rhizomorphs developed in one species (*viz.,* both varieties of *M. straminipes*) by Week VI. The use of culture mat texture data alone is insufficient to separate closely allied taxa. If one does not know what species of *Marasmius* an isolate belongs to, however, culture mat texture data will be useful in narrowing the possibilities. For example, isolates of *M. graminum* and *M. falcatipes* consistently developed thick, woolly aerial mycelium, whereas isolates of *M. delectans* and *M. scorodonius* formed thin, felty mats, compared to crustose mats formed by isolates of *M. rotula* and *M. capillaris*. In the descriptions that follow, culture mat texture is described throughout the ontogenic sequence until Week VI. Nobles (1965) and Stalpers (1978) Species Code numbers are given for the texture at Week VI.

**Reverse Color.** Reverse color is defined as the color of the agar resulting from presence or absence of diffused pigments formed by the hyphae. In the majority of species examined, the agar was pigmented by Week VI, especially under or adjacent to the inoculum plug. In a number of taxa, pigments diffused well beyond the margin of the culture mat. Isolates of most species showed cream, yellowish, ochraceous or

pale brownish pigments in the agar. Two rather striking exceptions were cultures of *M. spissus* and *M. pulcherripes*. The reverse of isolates of *M. spissus* was at first yellow, but soon became golden and developed into a deep brilliant red by Week II. At Week VI, the culture mat had developed to a radius of 9 mm, but the deep red pigments diffused throughout the entire Petri plate. Reverse of isolates of *M. pulcherripes* showed tawny olivaceous or dark olivaceous pigments, matching the culture mat coloration. In certain cases, reverse color was useful in separating closely allied taxa. For example, reverse of cultures of *M. siccus* was ochraceous, that of isolates of *M. fulvoferrugineus* was reddish brown, while that of cultures of *M. pulcherripes* was dark olivaceous.

It was difficult to select an appropriate Species Code symbol for reverse color from those offered by Nobles (1965) and Stalpers (1978). Nobles' code symbols for reverse color are as follows: "38. Reverse unchanged. 39. Reverse brown, at least in part. 40. Reverse bleached, at least in part." In the descriptions below, if the reverse was pallid, *i.e.*, white, cream or pale yellow, the species was coded 38. If the reverse was more deeply pigmented, the species was coded 39. Stalpers' code symbols for reverse color are as follows: "37. Reverse bleached. 38. Reverse darkened." These choices were wholly inadequate for recording taxonomically important cultural features of *Marasmius* species. Stalpers Species Code was appended, therefore, to account for observed variation. The following Code symbols are proposed and used accordingly in the descriptions below: 37. Reverse bleached. 37a. Reverse unchanged. [no 38 used.] 38a. Reverse cream-colored.

38b. Reverse orange or brownish orange. 38c. Reverse red or brownish red. 38d. Reverse yellow or ochraceous. 38e. Reverse brown, dark brown or charcoal. 38f. Reverse olivaceous.

**Odor of Cultures.** Odors of cultures of the majority of taxa examined were not distinctive. In a few species, the odor was musty (*M. delectans, nigrodiscus, siccus, pulcherripes, fulvoferrugineus*), while in several others the odor was reminiscent of fresh coconut (*M. cystidiosus, strictipes*, several isolates of *M. androsaceus*). In one species (*M. ciliatomarginatus*) cultures were raphanoid, in another (*M. haematocephalus* var. *anomaloides*) cultures were rancid, somewhat like cat urine, while in a third species (*M. pallidocephalus*), cultures were fruity, faintly suggestive of ripe mango. It was surprising that the odor of cultures of *M. scorodonius* was not distinctive, *i.e.*, not alliaceous. In the field, mycelium and basidiomata of this species are strongly alliaceous. A second alliaceous species, *M. perlongispermus* Sing., recently cultured from fresh material collected in Colombia, also produced inodorous mycelium *in vitro*. Presumably the volatile compounds produced by mycelium *in situ* are formed either through the degradation or synthesis of compounds not available in MEA or PDA.

**Basidiomata Production in Culture.** Of the 29 taxa examined, only one replicate of one species, *viz., M. felix* (DED 4471), produced basidiomata in culture. After approximately nine weeks growth in the dark at 20-23° C, basidiomata with pinhead-sized pilei formed. The replicate was removed from the dark and placed in a room with natural sunlight (approx. 14 hrs light, 10 hrs dark) and after about one week the pilei expanded and spores were formed and shed. All

micromorphological features of the basidiomata formed in culture matched those of the basidioma from which the original isolate was obtained. Arnold (1935) reported the formation of basidiomata of *M. pyrrhocephalus* (as *M. elongatipes*) on six different media, plus basidiomata formation *in vitro* in cultures of *M. epiphyllus* and *M. capillaris*.

**Micromorphological Characters.**

Before proceeding with a discussion of diagnostic micromorphological characters in cultures of *Marasmius*, a few terms used in the descriptions must be defined. Hyphae with short, cylindric, aseptate side-branches or projections are called "diverticulate" (Fig. 39 A) [Nobles Code Symbol 11a; Stalpers Code Symbol 65]. The diverticula may be scattered and sparse, termed "sparsely diverticulate," or numerous and densely packed, termed "densely diverticulate." If terminal cells or side-branches are subcoralloid, coralloid or brush-like, the hyphae are termed "staghorn-like" (Fig. 39 B) [Nobles 11a; Stalpers 61]. Clamp connections that give rise directly to hyphae are said to be "sprouting clamps."

Terminology used in this study to define differentiated culture mat tissues was originally proposed by Starbäck (1895) and amended by Korf (1951, 1958) to describe ascomata excipular tissues. Later, Miller (1971) indicated that the same terms were appropriate for describing culture mat morphology of agarics. Terms used in descriptions below are as follows: ***textura globulosa*** - tissue composed of loosely interwoven, globose, subglobose or irregularly-shaped (but

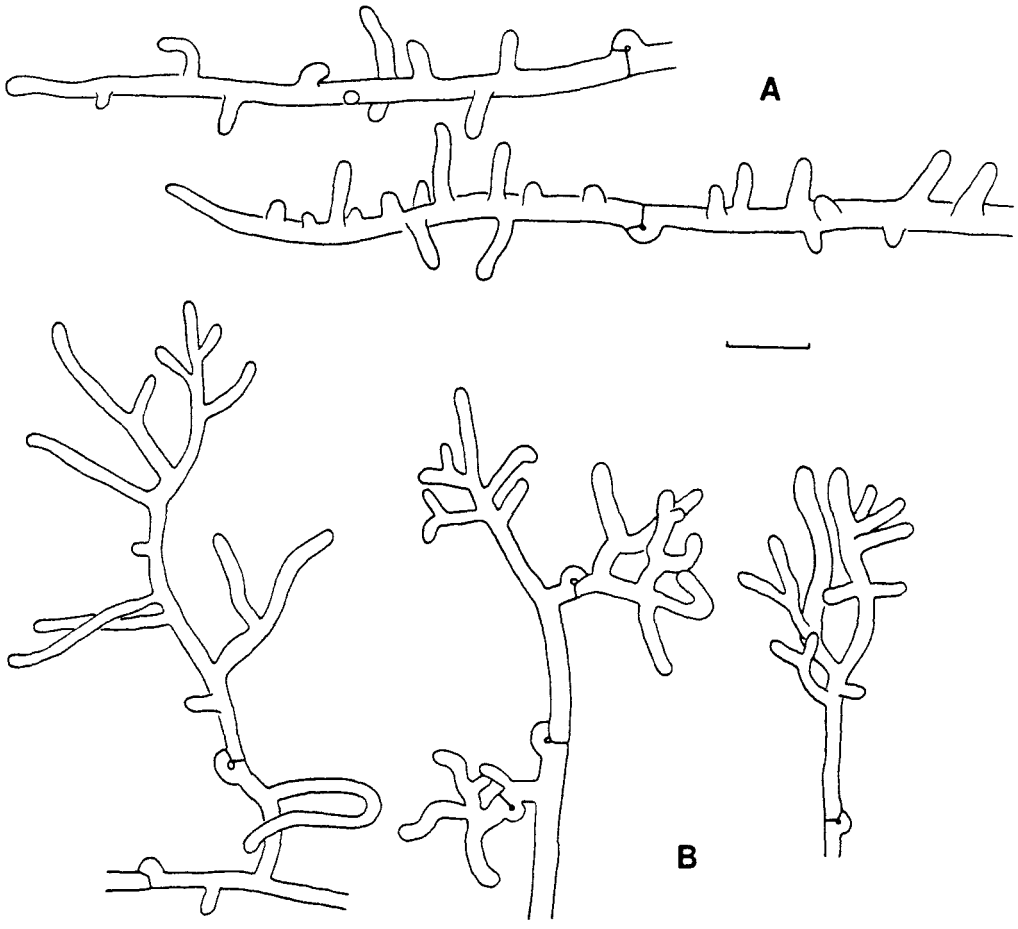



**Figure 39 A-B.** Micromorphological Features of Axenic Cultures of *Marasmius*. A. Diverticulate hyphae. B. Staghorn-like hyphae. Standard bar = 10 µm.

short-celled), thin-walled hyphae with interhyphal spaces (Fig. 40 A); ***textura angularis*** - tissue composed of tightly adherent, irregularly-shaped (short-celled) or polyhedral (by mutual pressure) hyphal cells, thin- or thick-walled, often pigmented, lacking interhyphal spaces (Fig. 40 B); ***textura intricata*** - tissue composed of interwoven, long-celled hyphae, thin- or moderately thick-walled, typically hyaline, with interhyphal spaces (Fig. 40 C); ***textura epidermoidea*** - tissue composed of tightly adherent, long-celled hyphae, these often irregular

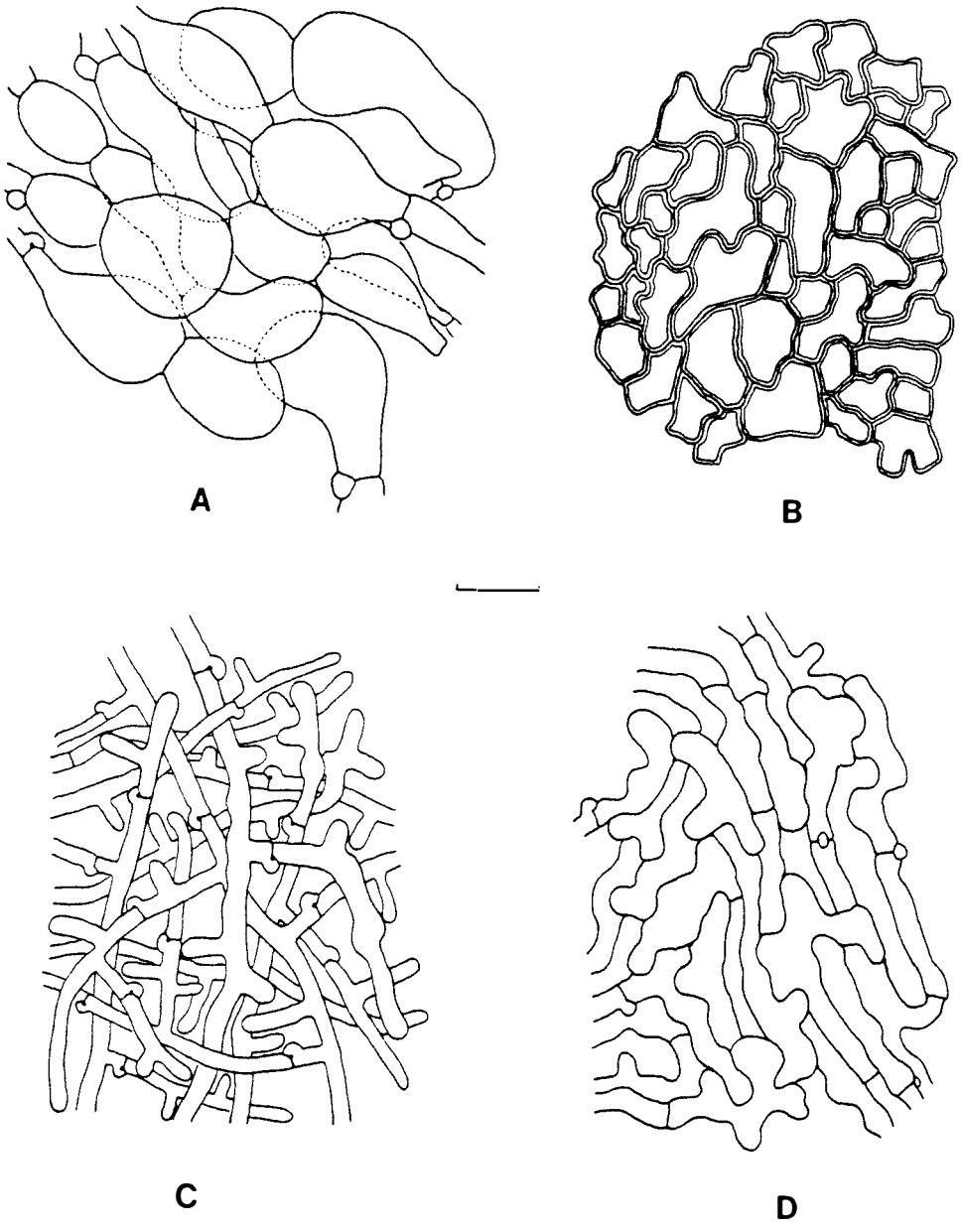



**Figure 40 A-D.** Culture Mat Tissues of *Marasmius*. A. *Textura globulosa*. B. *Textura angularis*. C. *Textura intricata*. D. *Textura epidermoidea*. Standard bar = 10 µm.

in outline and frequently-branched, thin- or thick-walled, often pigmented, lacking interhyphal spaces (Fig. 40 D). These terms may have modifiers such as: "poorly-developed," describing a tissue not fully formed, *i.e.,* one not meeting all criteria in the definitions above but suggesting the morphology of a particular tissue type; "well-developed," a fully formed, easily definable tissue type; "incomplete," a well-developed tissue type with discrete regions of undeveloped tissue, *e.g.,* a *textura angularis* with pockets of loosely interwoven, long-celled elements. The four tissue types discussed above were coded for Nobles and Stalpers Species Codes as follows: *textura globulosa* - Nobles 10, Stalpers 63; *textura angularis* and *textura epidermoidea* - Nobles 11, Stalpers 64; *textura intricata* - Nobles 11i, Stalpers 64.

Many isolates of species belonging to sect. *Sicci* formed specialized aerial side-branches herein termed "dendrotrichomoid elements" (Fig. 41). These elements are hyaline, moderately thick-walled, typically dextrinoid, short, broad-based side-branches which give rise apically and subapically to a cluster of unbranched, long, aseptate, filiform "arms." The structures are reminescent of leaf trichomes of various Fagaceous trees. They are also suggestive of the dichophyses of *Lachnocladium* and *Vararia* species, but in these, the apical branches are successively dichotomously branched. Dendrotrichomoid elements were uncoded in the Nobles Code and given the symbol "68a" in the Stalpers Code.

Several general statements can be offered concerning micromorphological features of cultures of the 29 *Marasmius* taxa

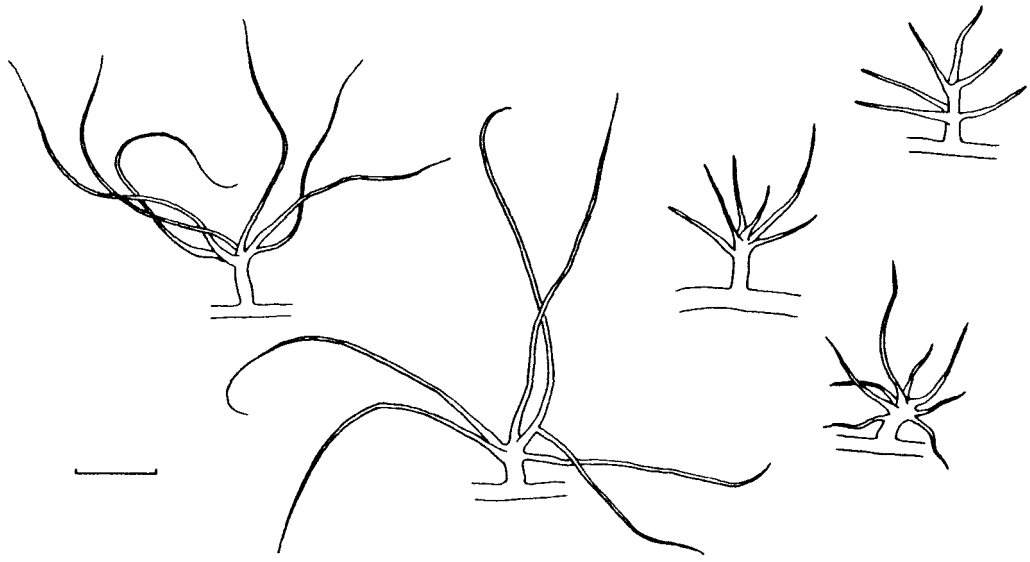


**Figure 41.** Dendrotrichomoid Elements from Culture Mats of *Marasmius*. Standard bar = 5 μm.

studied. No broom cells of the *Siccus*-type or *Rotalis*-type were formed in culture. No clearly differentiated leptocystidia or gloeocystidia were formed. No basidia were formed on somatic hyphae, and no asexual spores were observed, *i.e.*, no conidia, chlamydospores, nor oidia. No pigment-incrusted hyphae were observed. Species forming basidiomata with clamp connections formed clamped somatic hyphae in culture. Likewise, species forming basidiomata lacking clamp connections formed clampless hyphae in culture. Additionally, species forming basidiomata with dextrinoid or inamyloid tissues formed dextrinoid or inamyloid tissues in culture respectively.

**MEA-Grown Isolates**. Micromorphological features of MEA-grown isolates provided limited taxonomically valuable data. Because the majority of taxa examined formed no or little aerial mycelium on MEA,

only a few species developed differentiated tissues (*e.g., M. androsaceus, capillaris, rotula*). In isolates of the latter species, well-developed, brownish-pigmented *texturae angulari* developed by Week VI. In most isolates, hyphae were loosely interwoven, narrow (1.5-4 µm diam), hyaline, thin-walled, inamyloid, and ranged within an isolate from non-diverticulate and infrequently-branched, to diverticulate and frequently-branched, often staghorn-like. Very little interspecific variation was observed and consequently, species determinations could not be made based exclusively on micromorphology.

**PDA-Grown Isolates.** PDA-grown isolates yielded more taxonomically valuable micromorphological data than isolates grown on MEA, but here too, many taxa developed similar micromorphologies. Diagnostic micromorphological characters include: a) culture mat tissue-type; b) other differentiated elements, such as dendrotrichomoid elements, irregularly swollen intercalary cells, etc.; c) clamp connection formation; and d) crystal formation.

**Culture Mat Tissue-types.** In some taxa (*M. pallidocephalus, graminum, felix, oreades, falcatipes, pseudobambusinus*, etc.), no definable tissue was formed by aerial hyphae. Isolates of these species formed downy, cottony or woolly aerial mycelium composed merely of loosely interwoven hyphae. Other taxa, however, formed easily definable tissues described as *textura globulosa, textura angularis, textura intricata*, or *textura epidermoidea*. Species considered closely allied (based on morphology and ecology of basidiomata) tended to form similar culture mat tissues. For example, *M. rotula* and *M. capillaris* both developed *textura angularis* tissue in culture, *M. nigrodiscus* and

*M. cystidiosus* formed *textura intricata*, while isolates of *M. siccus*, *M. fulvoferrugineus* and *M. pulcherripes* did not form distinct tissues in culture. In isolates of some taxa, there was an ontogenetic sequence progressing from loosely interwoven hyphae through a *textura intricata*, to either a *textura angularis* from the inflation and subsequent adherence of adjacent cells, or to a *textura epidermoidea* where long-celled elements did not become inflated but branched repeatedly with adjacent branches becoming tightly adherent. Results of these studies indicate that under controlled conditions, isolates of a given species grown on PDA formed consistent culture mat micromorphologies, *i.e.*, little or no infraspecific variation in tissue-type was observed. Tissue-type data may be useful in determining unknown isolates, when used in conjunction with other cultural characters.

**Other Differentiated Elements.** As mentioned previously, many species formed dendrotrichomoid elements in the aerial mycelium (mainly on PDA, rarely on MEA), especially members of sect. *Sicci*. Dendrotrichomoid elements were observed in isolates of eleven of thirteen examined taxa in sect. *Sicci*, absent only in *M. spissus* and *M. pulcherripes*. In addition, these structures were formed by isolates of all members of sect. *Globulares* except *M. cystidiosus*. No isolates of members of sections *Rhizomorphigena, Androsacei, Marasmius, Epiphylli* or *Alliacei* formed dendrotrichomoid elements. In many of the taxa that formed such structures, repent, thick-walled, dextrinoid hyphae with scattered, unbranched, aseptate, filiform side-branches were observed interwoven in the aerial mycelium. These latter skeletalized hyphae

suggested dendrotrichomoid elements in which internodes between the apical "arms" had become greatly elongated.

Presence or absence of irregularly swollen (up to 10+ μm diam) intercalary cells on PDA-grown submerged hyphae may be diagnostic. Isolates of approximately one third of the taxa examined formed submerged hyphae with swollen intercalary cells. For example, in sect. *Androsacei*, swollen intercalary cells were observed on *M. straminipes* (both varieties), but were lacking in isolates of *M. androsaceus* and *M. pallidocephalus*. In sect. *Globulares*, swollen cells were seen only in *M. nigrodiscus*, whereas all three species of sect. *Marasmius* examined in this study developed such cells. In sect. *Sicci*, nine of the thirteen taxa examined lacked swollen cells in submerged hyphae.

The degree of hyphal diverticulation may be diagnostic only when extremes are considered, *i.e.*, consistently non-diverticulate or with rare scattered diverticula versus densely diverticulate. For example, isolates of the majority of taxa examined formed conspicuously diverticulate or staghorn-like hyphae throughout the cultures, while hyphae of isolates of *M. pallidocephalus* and *M. decipiens* typically lacked diverticula.

**Clamp Connection Formation.** Presence or absence of clamp connections in cultures of *Marasmius* paralleled their occurrence in basidiomata of the same taxa. Of the 29 taxa examined, two species are clampless, *viz.*, *M. straminipes* var. *straminipes* and *M. pallidocephalus*, and likewise, cultures of these taxa were clampless. Isolates of *M. straminipes* var. *fibulatus* and *M. androsaceus* formed

clamp connections, but not at every septum, *i.e.*, inconstant clamps. All other clamped taxa exhibited constant clamp formation in culture.

**Crystal Formation.** Various types of crystals were formed in isolates of specific taxa (as observed when mounted in KOH or water), and their shape, pigmentation and distribution may be diagnostic. Aerial hyphae of four taxa (*M. graminum, pseudobambusinus, haematocephalus* var. *haematocephalus, haematocephalus* var. *anomaloides*) were often incrusted with hyaline, granular crystals when grown on MEA and/or PDA. In MEA-grown isolates of three other species (*M. strictipes, spissus, sullivantii*), aerial hyphae were often incrusted with glassy, hyaline, amorphous or plaque-like crystals which entirely encased the hyphae. PDA-grown isolates of *M. nigrodiscus* formed long, deep yellow acicular crystals grouped in clusters among aerial hyphae, while MEA-grown isolates of *M. pulcherripes* formed aerial hyphae encased in short, hyaline acicular crystals. Hyaline octahedral crystals were observed in agar or among aerial hyphae of MEA-grown isolates of *M. decipiens* and *M. nigrodiscus*. Additionally, glassy, hyaline, amorphous crystals developed in PDA-grown isolates of *M. falcatipes, M. siccus, M. pseudobambusinus* and *M. fulvoferrugineus*. In PDA-grown isolates of *M. pulcherripes*, deep grass green, globular crystals were observed in KOH-mounts of aerial hyphae. When correlated with other cultural characters, crystal morphology and distribution may prove taxonomically valuable.

In summary, very little variation in cultural morphology was observed in isolates grown on MEA, whereas culture mat analyses of

isolates grown on PDA revealed distinct morphologies for nearly all species examined. On the latter medium, infraspecific variability in cultural morphology was low, while interspecific variability was high. No single cultural character can be used to clearly separate taxa, however, a combination of selected macro- and micromorphological features are suitable for species or species complex determination. Diagnostic features of greatest value include: a) mean growth rate; b) culture mat coloration and texture; c) reverse color; d) culture mat tissue-type; e) occurrence of differentiated elements such as dendrotrichomoid elements or swollen intercalary cells; and f) formation and distribution of crystals. Diagnostic features of limited taxonomic value include: a) culture odor; b) rhizomorph formation; c) occurrence of clamp connections; and d) degree of hyphal diverticulation.

## DESCRIPTIONS OF CULTURAL MORPHOLOGY

The following descriptions of cultural morphology are organized in the order in which the species are treated in the taxonomic portion of this manuscript. Separate descriptions are provided for morphologies formed on MEA and PDA. Mean growth rates were determined weekly from all replicates of all isolates of each species. Spot tests for the presence of specific phenoloxidases were performed at Week II and Week VI, and the results are recorded accordingly below. A discussion of these results is provided elsewhere in this manuscript. The Nobles Species Code (Nobles, 1965) and Stalpers Species Code (Stalpers, 1978)

were determined for each species, with separate codes recorded for each growth medium. Additions or clarifications to these codes, proposed by Boidin and Lanquetin (1983) and proposed here, are summarized in Table 3. Color terms in quotation marks are from Ridgway (1912), all other color terms are from Kornerup and Wanscher (1978). Where appropriate, commentaries on taxonomically important cultural features follow the descriptions.

**TABLE 3.** Additions or Clarifications to Nobles' and Stalpers' Species Codes Utilized in Descriptions of Cultural Morphology.
α indicates symbols proposed by Boidin & Lanquetin (1983).
β indicates symbols proposed by Nobles (1965) [clarified]
τ indicates symbols proposed by Stalpers (1978) [clarified]
δ indicates symbols proposed here.

NOBLES CODE

2. Laccase and tyrosinase present. α
2a. Laccase only present. α
2b. Tyrosinase only present. α
3c. Clamps constant. α
3i. Clamps inconstant. α
3r. Clamps rare. α
8d. Skeletalized hyphae dextrinoid. α
11. Hyphae differentiated through formation of short branches, diverticula or staghorn-like elements, tightly adherent, interlocking to form a plectenchyma tissue (*textura angularis, textura epidermoidea*). β
11a. Hyphae differentiated through formation of short branches, diverticula or staghorn-like elements, but not tightly adherent and not forming a distinct tissue. δ
11i. Hyphae forming a *textura intricata*. δ
54. Substrate: Angiosperm wood. β
54a. Substrate: Angiosperm leaves (excluding grasses). δ
55. Substrate: Gymnosperm wood. β
55a. Substrate: Gymnosperm leaves. δ
56. Other substrates, including soil and grasses. β

STALPERS CODE

37. Reverse bleached. τ
37a. Reverse unchanged. δ
38a. Reverse cream-colored. δ
38b. Reverse orange or brownish orange. δ
38c. Reverse red or brownish red. δ
38d. Reverse yellow or ochraceous. δ
38e. Reverse brown, dark brown or charcoal. δ
38f. Reverse olivaceous. δ
39. Clamps present. τ
39a. Clamps absent. δ
68a. Dendrotrichomoid elements present. δ
89. Substrate: Angiosperm wood. τ
89a. Substrate: Angiosperm leaves (excluding grasses). δ
90. Substrate: Gymnosperm wood. τ
90a. Substrate: Gymnosperm leaves. δ
91. Other substrates, including soil and grasses. τ

***MARASMIUS BREVIPES***

**Medium: MEA. Mean Growth Rate:** (n = 3) 1 wk, 13 mm; 2 wks, 32 mm; 3 wks, 50 mm; 4 wks, plates covered. **Macromorphology:** Advancing zone submerged, silky, hyphae hyaline. Aerial mycelium poorly developed, appressed, silky, hyaline or with a few white radiating strands. Reverse unchanged. Odor not distinctive or faintly like ethanol. **Micromorphology:** Advancing zone hyphae 1.5-3 µm diam, infrequently-branched, non-diverticulate, hyaline, inamyloid, thin-walled, clamped, clamps rarely sprouting. Aerial hyphae rare, similar to advancing zone hyphae. Submerged hyphae 1.5-3 µm diam, loosely interwoven, infrequently-branched, non-diverticulate, hyaline, inamyloid, clamped. **Phenoloxidase Reactions:** Week II: Laccase (-), Tyrosinase (-), Peroxidase (-). Week VI: Laccase (-), Tyrosinase (-), Peroxidase (weakly +). **Nobles Code:** 1.3c.7.36.38.44.52.54. **Stalpers Code:** 8.13.20.30.37a.39.45.52.89.

**Medium: PDA. Mean Growth Rate:** (n = 3) 1 wk, 10 mm; 2 wks, 28 mm; 3 wks, 46 mm; 4 wks, plates covered. **Macromorphology:** Advancing zone submerged, silky; hyphae hyaline. Aerial mycelium at first cottony or woolly, slightly raised, white overall; remaining white and woolly at Week VI with scattered velutinous or crustose patches of brown or dark brown mycelium. Reverse unchanged or pale cream-colored. Odor faintly of ethanol. **Micromorphology:** Advancing zone hyphae same as on MEA. Aerial mycelium of younger woolly regions forming a thick layer of densely interwoven hyphae; hyphae 2-3 µm diam, typically infrequently-branched, non-diverticulate, hyaline, inamyloid, clamped, with walls up to 0.6 µm thick, few hyphae with walls up to 1+ µm thick.

Aerial hyphae of older regions forming a poorly-developed to well-developed *textura epidermoidea* composed of brown, dextrinoid hyphae irregular in outline, with walls up to 1 µm thick, loosely interwoven or tightly adherent and lacking interhyphal spaces; some areas of *textura epidermoidea* overlaid by loosely interwoven hyphae which arise as side branches or erect terminal cells of the repent adherent hyphae. Submerged hyphae 2-4.5 µm diam, hyaline, inamyloid, thin- or moderately thick-walled, clamped. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (-), Peroxidase (+). Week VI: Laccase (+), Tyrosinase (-), Peroxidase (+). **Nobles Code:** 2a.3c.11.26.36.37.38.44.52.54. **Stalpers Code:** 1.3.8.13.21.22.(26).28.30.34.36.38a.39.45.48.52.64.67. 80.89. **Isolates Examined:** DED 4586.

**Commentary**. PDA-grown isolates of *M. brevipes* were characterized by white, woolly culture mats with isolated brown crustose regions, and *textura epidermoidea* tissue. Recently, Desjardin and Petersen (1989d) re-evaluated the taxonomic placement of *M. brevipes*, accepting the species in *Marasmius* as originally described, rather than in *Micromphale* where it was placed by other authors (*cf.* Dennis, 1953; Pegler, 1983). One compelling reason for this decision was the presence of dextrinoid tissue in the stipe cortical layer, a common feature in *Marasmius*. Dextrinoid tissues are absent in all *Micromphale* species studied by me. It is significant that hyphae comprising the *textura epidermoidea* of cultures of *M. brevipes* were dextrinoid.

***MARASMIUS STRAMINIPES*** var. ***STRAMINIPES***

**Medium: MEA. Mean Growth Rate:** (n = 3) 1 wk, 13 mm; 2 wks, 28.5 mm; 5 wks, 64 mm; 6 wks, plates covered. **Macromorphology:** Advancing zone submerged, silky or rarely downy; hyphae hyaline. Aerial mycelium at Week I cottony, white, by Week VI becoming floccose or subfelty, white. Reverse pale cream-colored. Odor not distinctive. Rhizomorphs not formed by Week VI. **Micromorphology:** Advancing zone hyphae 1.5-3 µm diam, cylindric, infrequently-branched, sparsely diverticulate, sometimes coiled or contorted, hyaline, inamyloid, thin-walled, unclamped. Aerial hyphae 2-4 µm diam, loosely interwoven, frequently-branched, non-diverticulate or sparse diverticulate, otherwise similar to advancing zone hyphae. Submerged hyphae similar to advancing zone hyphae. **Phenoloxidase Reactions:** Week II: Laccase (-), Tyrosinase (-), Peroxidase (weakly +). Week VI: Laccase (+), Tyrosinase (-), Peroxidase (weakly +). **Nobles Code:** 2a.6.(7).11a. 36.46.55a. **Stalpers Code:** 1.3.8.13.19.21.24.30.38a.39a.45.52.53. 65.90a.

**Medium: PDA. Mean Growth Rate:** (n = 3) 1 wk, 3 mm; 2 wks, 7 mm; 5 wks, 38.5 mm; 6 wks, 52.5 mm. **Macromorphology:** Advancing zone at Week II submerged, silky or plumose; hyphae hyaline or white; by Week VI becoming cottony, pale yellow. Aerial mycelium at Week II white and woolly on the margin, pale brownish orange and felty in older regions; by Week VI becoming zonate, zones white or cream and felty, yellow or orange and felty, brownish orange and felty, and brown, velutinous or crustose. Numerous erect, brownish orange, glabrous rhizomorphs developed by Week IV. Reverse grading from yellow in younger regions

to ochraceous, brownish orange or brown near the inoculum plug. Odor not distinctive. **Micromorphology:** Advancing zone hyphae 1.5-3 µm diam, infrequently-branched, sparsely diverticulate, hyaline, inamyloid, thin-walled. Aerial hyphae of felty regions forming a *textura intricata*; hyphae 2-4 µm diam, loosely interwoven, frequently-branched, non-diverticulate or diverticulate, hyaline or pale yellow, inamyloid, thin-walled; in older, more deeply pigmented crustose regions hyphae forming an incomplete *textura epidermoidea* composed of long-celled, ochraceous or brown hyphae irregular in outline. Submerged hyphae typically frequently-branched, non-diverticulate or diverticulate, hyaline or pale ochraceous, inamyloid, thin-walled; in areas near rhizomorph initiation hyphae become inflated up to 9 µm diam with walls up to 2+ µm thick, with terminal cells often lobed. Rhizomorphs composed of parallel hyphae 3.5-9 µm diam; cortical hyphae ochraceous, dextrinoid, thick-walled; medullary hyphae hyaline, inamyloid, thin-walled. All hyphae unclamped. **Phenoloxidase Reactions:** Week II: Laccase (-), Tyrosinase (-), Peroxidase (-). Week VI: Laccase (+), Tyrosinase (-), Peroxidase (+). **Nobles code:** 2a.6.11.11i.16.26.(36).37.39.47.55a. **Stalpers Code:** 1.3.10.13.22.25. 28.29.30.32.34.38b.38d.38e.39a.44.45.48.52-55.64.65.67.80.81.90a. **Isolates Examined.** DED 4325.

**Commentary.** Of the 29 taxa examined in this study, only *M. straminipes* var. *straminipes* and *M. pallidocephalus* lacked clamp connections on somatic hyphae. This feature coupled with formation of a zonate, deeply pigmented *textura epidermoidea* on PDA is diagnostic for *M. straminipes* var. *straminipes*. Isolates of the latter were

easily distinguished from the other clampless species, *M. pallidocephalus*. A distinct culture mat tissue was not formed by isolates of *M. pallidocephalus*; rather, the aerial mycelium was loosely interwoven and remained white throughout six weeks growth. Cultures of var. *straminipes* differed from those of var. *fibulatus* in occurrence of clamp connections and mean growth rate. Clamp connections were present in var. *fibulatus*, albeit inconstant, and PDA-grown isolates filled 90 mm Petri plates by Week IV. Other cultural features of var. *fibulatus* are similar to those of var. *straminipes*, including culture mat morphology and rhizomorph formation.

***MARASMIUS STRAMINIPES*** var. ***FIBULATUS***

**Medium: MEA. Mean Growth Rate:** (n = 6) 1 wk, 18 mm; 2 wks, 41.3 mm; 4 wks, plates covered. **Macromorphology:** Advancing zone submerged, silky or rarely downy; hyphae hyaline. Aerial mycelium cottony or floccose, white. Reverse unchanged. Odor not distinctive. Rhizomorphs not formed by week VI. **Micromorphology:** Advancing zone hyphae 2-4 µm diam, frequently-branched, diverticulate, staghorn-like, hyaline, inamyloid, thin-walled; clamps inconstant, few sprouting clamps. Aerial mycelium in marginal region loosely interwoven, in older regions forming a poorly-developed *textura intricata*; hyphae 2-4.5 µm diam, frequently-branched, non-diverticulate or diverticulate, hyaline, inamyloid, thin-walled, with the majority of septa clamped. Submerged hyphae similar to aerial hyphae but mainly unclamped. **Phenoloxidase Reactions:** Week II: Laccase (-), Tyrosinase (-), Peroxidase (weakly +). Week VI: Laccase (+), Tyrosinase (-),

Peroxidase (weakly +). **Nobles Code:** 2a.3i.11i.36.38.44.54a. **Stalpers Code:** 1.3.7.8.13.19.21.30.37a.40.(42).45.52.53.61.64.65.89a.

**Medium: PDA. Mean Growth Rate:** (n = 6) 1 wk, 18 mm; 2 wks, 40.5 mm; 4 wks, plates covered. **Macromorphology:** Advancing zone submerged, silky; hyphae hyaline. Aerial mycelium zonate; zones moderately broad, white and woolly, orange and felty, brown and felty or velutinous, and dark brown and crustose, seldom radially ridged; older regions with numerous brownish orange or dark brown watery droplets. Few erect, ochraceous or brownish orange, glabrous rhizomorphs developed by Week VI. Reverse grading from hyaline or yellow in the younger areas to brownish orange or dark brown near the inoculum plug. Odor not distinctive. **Micromorphology:** Advancing zone hyphae 2-4 µm diam, frequently-branched, diverticulate, staghorn-like, hyaline, inamyloid, thin-walled; clamps inconstant, few sprouting clamps. Aerial hyphae of felty zones interwoven, 1.5-3 µm diam, diverticulate, staghorn-like; crustose regions formed of a *textura epidermoidea*; hyphae moderately short-celled or long-celled, 3-6 µm diam, irregular in outline, tightly adherent, dark ochraceous or brown, inamyloid, thick-walled. Submerged hyphae in younger regions 1.5-4.5 µm diam, non-inflated, hyaline, inamyloid, thin-walled, mainly unclamped; in older regions, especially near areas of rhizomorph initiation, hyphae inflated to 9 µm diam, moderately thick-walled, with terminal cells often lobed. Rhizomorphs composed of parallel hyphae 3-8(10) µm diam; cortical hyphae ochraceous, dextrinoid, thick-walled; medullary hyphae hyaline, inamyloid, thin-walled; clamps inconstant. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (-),

Peroxidase (+). Week VI: Laccase (+), Tyrosinase (-), Peroxidase (+). **Nobles Code:** 2a.3i.11.16.26.(36).37.39.44.54a. **Stalpers Code:** 1.3.7.8.13.22.25.28.29.30.32.34.38b.38d.38e.40.(42).44.45.48.52-55.61.64.65.67.80.81.89a. **Isolates Examined.** DED 4447, 4474.

**Commentary.** For a comparison with var. *straminipes*, see the commentary on that variety. In the original description of this variety (Desjardin & Petersen, 1989a), we noted that clamp connections were common only on basidia, basidioles and stipe medullary hyphae, and absent or exceedingly rare elsewhere. The inconstancy of clamp formation was also apparent in cultures of var. *fibulatus*. When grown on either MEA or PDA, clamp connections formed typically on aerial hyphae but rarely formed on submerged hyphae.

***MARASMIUS PALLIDOCEPHALUS***

**Medium: MEA. Mean Growth Rate:** (n = 3) 1 wk, 12.5 mm; 2 wks, 30 mm; 3 wks, 48 mm; 4 wks, plates covered. **Macromorphology.** Advancing zone submerged, silky; hyphae hyaline. Aerial mycelium poorly developed, radiating-silky with a few woolly tufts around colony margin at Week VI, white. Reverse unchanged. Odor mildly sweet. **Micromorphology:** Advancing zone hyphae 1.5-4 µm diam, infrequently-branched and non-diverticulate or frequently-branched and sparsely diverticulate, often staghorn-like, hyaline, inamyloid, thin-walled, unclamped. Aerial hyphae rare, frequently-branched and diverticulate, similar to advancing zone hyphae. Submerged hyphae 2-4.5 µm diam, similar to advancing zone hyphae, some with false clamps. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (-),

Peroxidase (-). Week VI: Laccase (weakly +), Tyrosinase (-), Peroxidase (+). **Nobles Code:** 2a.6.11a.36.38.44.50.55a. **Stalpers Code:** 1.3.8.13.(16).20.30.37a.39a.45.52.53.60.61.90a.

**Medium: PDA. Mean Growth Rate:** (n = 3) 1 wk, 12.5 mm; 2 wks, 30 mm; 3 wks, 48 mm; 4 wks, plates covered. **Macromorphology:** Advancing zone silky or rarely cottony; hyphae hyaline. Aerial hyphae white throughout 6 weeks growth; initially slightly raised, cottony or woolly, by Week VI with weakly-developed growth rings composed of alternating appressed-woolly and raised-woolly regions. Reverse pale yellow or pale cream. Odor fruity, faintly of ripe mango. **Micromorphology:** Advancing zone hyphae similar in morphology to those on MEA. Aerial hyphae 1.5-2.5 µm diam, loosely interwoven, infrequently-branched, sparsely diverticulate, hyaline, inamyloid, thin-walled, unclamped. Submerged hyphae similar to aerial hyphae but 1.5-5 µm diam. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (-), Peroxidase (+). Week VI: Laccase (+), Tyrosinase (-), Peroxidase (+). **Nobles Code:** 2a.6.11a.36.38.44.50.55a. **Stalpers Code:** 1.3.8.13.21.22.29.30.38a.39a.45.52.61.65.90a. **Isolates Examined.** DED 4615.

***MARASMIUS ANDROSACEUS***

**Medium: MEA. Mean Growth Rate:** (n = 27) 1 wk, 11.2 mm; 2 wks, 25.6 mm,; 5 wks, 58.5 mm; 6 wks, plates covered. **Macromorphology:** Advancing zone at Week I silky, hyaline; by Week II becoming plumose or cottony, white. Aerial mycelium cottony or floccose, white, rarely with small white, felty regions or pale brown crustose patches.

Reverse white or pale yellow. Odor not distinctive in some isolates, musty in some isolates, or sweet and faintly like coconut in other isolates. Rhizomorphs not formed by Week VI. **Micromorphology**: Advancing zone hyphae 1.5-4 μm diam, infrequently-branched and non-diverticulate, or frequently-branched and diverticulate, often staghorn-like, hyaline, inamyloid, thin-walled, clamped. Aerial hyphae of cottony or floccose regions similar to those of the advancing zone; hyphae of crustose regions forming tissues grading from a hyaline *textura intricata* into a brown *textura angularis* with thick-walled, brown, inamyloid cells. Submerged hyphae similar to advancing zone hyphae, but some isolates with swollen intercalarly cells; hyphae hyaline, inamyloid, thin-walled, clamps inconstant. **Phenoloxidase Reactions**: Week II: Laccase (+), Tyrosinase (-), Peroxidase (+). Week VI: Laccase (weakly +), Tyrosinase (-), Peroxidase (+). **Nobles Code**: 2a.3c.(3i).11.11a.11i.(26).36.38.(45).46.(50).54a.(55a). **Stalpers Code**: 1.3.(8).9.19.21.(25).(28).30.(34).(36).37a.39.45.52. 61.64.65.(67).(80).89a.(90a).

**Medium: PDA**. Three distinct morphologies were formed by different isolates of *M. androsaceus*. The distinct morphologies, labeled A, B, or C are described separately below.

**Morphology A. Mean Growth Rate**: (n = 9) 1 wk, 8.8 mm; 2 wks, 18.2 mm; 5 wks, 39.5 mm; 6 wks, 47 mm. **Macromorphology**: Advancing zone silky and white at Week I, becoming cottony and pale yellow by Week VI. Aerial mycelium initially cottony or farinose, white; becoming zonate by Week II; zones white or pale yellow and woolly, cream or pale brownish orange and felty, and dark brownish orange and

crustose. Reverse grading from pale yellow to brownish orange. Odor not distinctive. **Micromorphology:** Advancing zone hyphae similar to those on MEA. Aerial hyphae of non-crustose regions, 2-4.5 µm diam, loosely interwoven, frequently-branched, diverticulate, hyaline or pale yellow, inamyloid, clamped; crustose regions formed of a *textura intricata*; hyphae hyaline or pale tawny, with irregularly inflated or strangulate terminal cells. Submerged hyphae cylindric and non-diverticulate, or irregular in outline and diverticulate, hyaline, inamyloid, clamped. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (+), Peroxidase (+). Week VI: Laccase (+), Tyrosinase (+), Peroxidase (+). **Nobles Code:** 2.3c.11a.11i.(26).(36).37.39.47.54a. **Stalpers Code:** 1.2.3.9.13.21.22.25.28.29.30.31.32.34.38b.38d.39.45. 52.53.61.64.65.(67).(80).89a. **Isolates Examined:** DED 3806, 3937, 4475.

**Morphology B. Mean Growth Rate:** (n = 12) 1 wk, 16.6 mm; 2 wks, 36.4 mm; 5 wks, 62 mm; 6 wks, plates covered. **Macromorphology:** Advancing zone similar to that of Morphology A. Aerial mycelium zonate by Week II, zones white and woolly, white and felty, and brown and crustose; by Week VI culture mats irregularly zonate or maculate, with white, thickly woolly regions and irregular dark brown crustose and lacunose regions; no orange pigments observed. Reverse grading from yellow to ochraceous or dark brown. Odor not distinctive. **Micromorphology:** Advancing zone hyphae similar to those on MEA. Aerial mycelium developing through a four-step sequence: 1) hyphae 2-4 µm diam, loosely interwoven, sparsely diverticulate, hyaline; 2) hyphae more tightly interwoven, forming a *textura intricata*, with

elements hyaline or pale yellow, rarely swollen; 3) hyphae forming a tissue intermediate between *textura epidermoidea* and *textura angularis*, with many elements long and contorted, others short and prismatic, ranging in pigmentation from yellow to ochraceous or pale brown; 4) hyphae forming a well-developed *textura angularis*, with elements deep brown and puzzle-like in outline, formed from intercalary or terminal swellings and from gnarled lateral branches. Submerged hyphae similar to those of Morphology A, but inconstantly clamped. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (-), Peroxidase (+). Week VI: Laccase (+), Tyrosinase (-), Peroxidase (+). **Nobles Code:** 2a.3i.11.11i.26.36.37.39.46.54a. **Stalpers Code:** 1.3.8. 13.22.25.28.29.30.34.38d.38e.40.45.52.53.61.64.65.67.80.89a. **Isolates Examined:** DED 3579, 4328, 4450, 4481.

**Morphology C. Mean Growth Rate:** (n = 6) 1 wk, 3 mm; 2 wks, 8.5 mm; 5 wks, 34.5 mm; 6 wks, 41.8 mm. **Macromorphology:** Advancing zone similar to that of Morphology A. Aerial mycelium white throughout six weeks growth, raised and thickly-felty overall, sometimes with a waxy crust. Reverse white or cream. Odor faintly sweet. **Micromorphology:** Advancing zone hyphae similar to those on MEA. Aerial hyphae 1.5-2.5 µm diam, densely interwoven but not forming a distinct tissue, non-diverticulate or diverticulate, hyaline, inamyloid, thin-walled, clamped. Submerged hyphae similar to the aerial hyphae but up to 5 µm diam. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (-), Peroxidase (+). Week VI: Laccase (+), Tyrosinase (-), Peroxidase (+). **Nobles Code:** 2a.3c.11a.36.38.47.50.54a.55a. **Stalpers Code:** 1.3.10.

13.25.30.36.37a.(38a).39.45.52.53.61.65.89a.90a. **Isolates Examined:** DED 3917, 4491.

**Commentary**. *Marasmius androsaceus* was the only taxon investigated that exhibited substantial infraspecific variation in cultural morphology. The three distinct morphologies described above were observed from isolates grown on PDA. Indeed, the morphologies were as distinct from each other as they were from other taxa. The morphology types differed in mean growth rate, culture mat coloration and texture, reverse coloration, culture mat tissue type, and constancy of clamp formation. These data are summarized as follows: Morphology A: moderately slow-growing (plates not covered by week VI); zonate culture mats with yellow or brownish orange tints; pale yellow to brownish orange reverse coloration; crustose regions formed of *textura intricata*; and constant clamp formation. Morphology B: moderately fast growing (plates covered by week VI); irregularly zonate or maculate culture mats with white woolly and dark brown crustose regions, lacking yellow or orange tints; yellow to dark brown reverse coloration; crustose regions formed of *textura angularis*; and inconstant clamp formation. Morphology C: moderately slow growing (plates not covered by week VI); azonate, white felty culture mats; white or cream reverse coloration; no distinct culture mat tissue formed; and constant clamp formation.

The distinct morphological differences between isolates of *M. androsaceus* are somewhat anomalous and perplexing, when compared with the consistent infraspecific morphologies exhibited by all other taxa examined in this study. Basidiomata from which these isolates were

obtained belong to the same morphological species. It is probable, however, that the three cultural morphology-types represent distinct physiological strains, or possibly sibling species. The latter hypotheses warrant further investigation utilizing mating studies and electrophoretic analyses.

Replicates of isolate #4491, grown on MEA, PDA, CMDY, MYS and MNM formed numerous rhizomorphs after six months growth in the dark at 10° C. The other isolates used in this study did not form rhizomorphs by three months growth, and were not examined beyond that time period.

***MARASMIUS GRAMINUM***

**Medium: MEA. Mean Growth Rate:** (n = 9) 1 wk, 60 mm; 2 wks, plates covered. **Macromorphology:** Advancing zone submerged, silky, hyphae hyaline. Aerial mycelium poorly-developed, appressed, silky or thinly cottony; hyphae hyaline or white throughout. Reverse unchanged. Odor not distinctive. **Micromorphology:** Advancing zone composed of fascicles of hyphae; hyphae 1.5-4 µm diam, frequently-branched and staghorn-like behind undifferentiated terminal cells, hyaline, inamyloid, thin-walled, clamped. Aerial hyphae rare, similar to advancing zone hyphae. Submerged hyphae 2-6.5 µm diam, irregular in outline, frequently-branched, often inflated at branch inceptions, hyaline, inamyloid, thin-walled, clamped. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (-), Peroxidase (+). Week VI: Laccase (+), Tyrosinase (-), Peroxidase (+). **Nobles Code:** 2a.3c.11a. 26.36.38.42.56. **Stalpers Code:** 1.3.6.13.(16).20.30.37a.39.44.45. 52-54.61.65.80.91.

**Medium: PDA. Mean Growth Rate:** (n = 9) 1 wk, 59 mm; 2 wks, plates covered. **Macromorphology:** Advancing zone cottony or plumose; hyphae white. Aerial mycelium initially plumose or woolly and distinctly radiating, white overall; by Week VI becoming thickly woolly, colored white, buff or cream over majority of mat but marginal regions which adher to the plate become pale brown or brownish orange; no crustose tissue formed. Reverse unchanged, cream or pale orange-cream. Odor not distinctive. **Micromorphology:** Advancing zone hyphae similar to those on MEA but with less developed staghorn-like branches. Aerial hyphae 1.5-3.5 µm diam, densely interwoven, frequently-branched but not staghorn-like, hyaline, inamyloid, thin-walled, clamped; often coated with hyaline, granular crystal incrustations; interwoven among the aerial hyphae are rare, thick-walled, dextrinoid, filiform hyphae <1.8 µm diam, similar in morphology to "arms" of dendrotrichomoid elements. Submerged hyphae infrequently- or frequently-branched, often swollen up to 10 µm diam, hyaline, inamyloid, thin-walled, clamped. **Phenoloxidase Reactions:** Same as on MEA. **Nobles Code:** 2a.3c.7.12. 26.36.(38).42.56. **Stalpers Code:** 1.3.6.12.22.23.30.31.38a.38b.39. 44.45.52.(55).57.80.82.91. **Isolates Examined:** DED 3838, 4386, 4442.

**Commentary.** PDA-grown isolates of *M. graminum* grew faster than any other taxon examined, developing culture mat radii of ≈60 mm in one week. Culture mats were typically pallid and woolly overall, similar in morphology to those of *M. pallidocephalus, M. falcatipes* and *M. pseudobambusinus*. Isolates of *M. pallidocephalus* differed in slower growth rate (plates covered in 4 wks), fruity odor, and in the absence of clamp connections, incrusting crystals and swollen intercalary

cells. It was more difficult to separate cultures of *M. graminum* from those of *M. falcatipes* and *M. pseudobambusinus*. All three taxa grew rapidly on PDA (plates covered by week II), lacked distinctive culture mat tissues, formed dextrinoid filiform skeletalized hyphae, and had similar reverse coloration. Isolates of *M. falcatipes* differed from those of *M. graminum* in that the former produced amorphous non-incrusting crystals, well-developed dendrotrichomoid elements, lacked intercalary swellings on submerged hyphae, and reacted positively to spots tests for tyrosinase. Isolates of *M. pseudobambusinus* differed in slower growth rate (30 mm in one week, compared to 59 mm for *M. graminum*), formation of culture mats with cinnamon tints by Week VI, and absence of incrusting crystals when grown on PDA (although amorphous, non-incrusting crystals were present). It is coincidental that these three taxa, which share so many similar cultural features, all fruit on grasses.

***MARASMIUS CAPILLARIS***

**Medium: MEA**. **Mean Growth Rate:** (n = 15) 1 wk, 23.4 mm; 2 wks, 49.1 mm; 3 wks, plates covered. **Macromorphology:** Advancing zone submerged, silky; hyphae hyaline. Aerial mycelium of some isolates cottony with scattered floccose regions, white or buff overall; aerial mycelium of other isolates poorly-developed, appressed, radiating, silky, colored white, cream-buff or pale orange white; by week VI small crustose, "cinnamon buff" regions develop near the inoculum plug in most isolates. Reverse unchanged. Odor not distinctive or mildly antiseptic. **Micromorphology:** Advancing zone hyphae 1.5-3 µm diam,

frequently-branched, diverticulate, staghorn-like, hyaline, inamyloid, thin-walled, clamped. Aerial hyphae of cottony or floccose regions 1.5-3 µm diam, loosely interwoven, infrequently-branched, sparsely diverticulate, not strongly staghorn-like; aerial hyphae of crustose regions forming a well-developed *textura angularis* composed of jigsaw puzzle-like elements up to 10 µm diam, with hyaline or pale ochraceous walls up to 0.8 µm thick; cell contents appearing weakly dextrinoid. Submerged hyphae similar to advancing zone hyphae, or highly irregular in outline with numerous cells swollen up to 8 µm diam, hyaline, inamyloid, thin-walled, clamped. **Phenoloxidase Reactions**: Week II: Laccase (+), Tyrosinase (-), Peroxidase (+). Week VI: Laccase (+/-), Tyrosinase (-), Peroxidase (+). **Nobles Code**: 2a.3c.11.11a.26.36.38. 43.(52).54a. **Stalpers Code**: 1.3.7.13.(19).21.28.30.32.37a.39.44.45. 51-55.61.64.65.(67).80.89a.

**Medium: PDA**. **Mean Growth Rate**: (n = 15) 1 wk, 26.1 mm; 2 wks, 51.7 mm; 3 wks, plates covered. **Macromorphology**: Advancing zone silky or cottony; hyphae hyaline or white. Aerial mycelium forming two distinct morphologies by Week II, depending on the isolate: 1) some isolates forming thickly woolly, white mats; 2) others forming zonate mats, zones white and silky, white or buff and felty, orange or brownish orange and crustose. Aerial mycelium of all isolates at Week VI forming a crustose layer of "clay color," "cinnamon" or "cinnamon buff" hyphae; some isolates with raised regions of buff or cream-colored woolly or felty mycelium scattered among the crustose regions; some isolates exuding numerous watery droplets. Reverse cream, "cinnamon" or brownish orange. Odor not distinctive. **Micromorphology**:

Advancing zone hyphae similar to those on MEA. Aerial hyphae of woolly regions 1.5-4 µm diam, interwoven, infrequently-branched, sparsely diverticulate, hyaline, weakly dextrinoid in mass, thin-walled, clamped; aerial hyphae of crustose regions forming a well-developed *textura angularis* composed of jigsaw puzzle-like elements up to 16 µm diam, tissue mottled at 125X; hyphal walls ochraceous or brown, dextrinoid, up to 1 µm thick. Submerged hyphae highly irregular in outline, mean width 3.5-4 µm, many cells swollen up to 10 µm diam, often enlarged at branch inceptions, hyaline, inamyloid or weakly dextrinoid in mass, thin-walled or a few with walls up to 1 µm thick, clamped. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (weakly +/-), Peroxidase (+). Week VI: Laccase (+), Tyrosinase (weakly +/-), Peroxidase (+). **Nobles Code:** 2.3c.11.26.37.38.43.54a. **Stalpers Code:** 1.2.3.7.13.22.28.(29).32.38a.38b.39.44.45. 51-55.61. 64.(65).67.80.89a. **Isolates Examined:** DED 3855, 4239, 4345, 4465, 4493.

**Commentary**. *Marasmius capillaris* is considered closely allied with *M. rotula*, and it is often difficult to separate specimens of the two species based on basidiomata morphology. In general, basidiomata of *M. capillaris* have tan or beige colored pilei, very narrow wiry stipes and grow on leaves of hardwoods. In comparison, basidiomata of *M. rotula* have white, slightly broader pilei, slightly thicker stipes and grow on wood of hardwoods. Basidiomata of the two species are indistinguishable micromorphologically. On occasion, specimens may be encountered that show features of both taxa. Cultural morphology may help to separate problematical specimens if cultures are available.

PDA-grown isolates of *M. capillaris* formed crustose, often zonate culture mats colored "clay" or "cinnamon," (*i.e.*, with orange tones), whereas isolates of *M. rotula* formed azonate crustose mats colored "avellaneous," "fawn color" or "wood brown" (*i.e.*, with pink to drab tones, lacking orange tones). Reverse color also differed between the species. In isolates of *M. capillaris*, the agar became cinnamon or brownish orange, while in isolates of *M. rotula* the agar remained unchanged. Very little infraspecific variation in pigmention was observed.

***MARASMIUS ROTULA***

**Medium: MEA**. **Mean Growth Rate:** (n = 21) 1 wk, 26.4 mm; 2 wks, 68 mm; 3 wks, plates covered. **Macromorphology:** Advancing zone submerged, silky or plumose; hyphae hyaline. Aerial mycelium initially cottony or woolly with scattered tufts, white or buff-colored; by Week VI developing scattered felty or crustose patches colored white, cream-buff, avellaneous or pale brown. Reverse unchanged. Odor not distinctive. **Micromorphology:** Advancing zone hyphae 1.5-3 µm diam, typically frequently-branched, diverticulate, staghorn-like, seldom infrequently-branched and sparsely diverticulate; hyaline, inamyloid, thin-walled, clamped. Aerial hyphae of cottony or woolly regions loosely interwoven, similar to advancing zone hyphae but not strongly staghorn-like; hyphae of crustose regions forming a poorly-developed or well-developed *textura angularis* composed of jigsaw puzzle-like elements up to 12 µm diam; hyphal walls ranging from hyaline to pale brown, up to 1 µm thick; cell contents weakly

dextrinoid. Submerged hyphae similar to advancing zone hyphae, or highly irregular in outline, with many intercalary cells swollen up to 6.5 µm diam, hyaline, inamyloid, thin-walled, clamped. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (-), Peroxidase (+). Week VI: Laccase (+), Tyrosinase (-), Peroxidase (+). **Nobles Code:** (2).2a.3c.11.11a.26.36.38.43.54. **Stalpers Code:** 1.(2).3.7.13.21.22. 28.30.(34).37a.39.44.45.51-55.61.64.65.(67).80.89.

**Medium: PDA. Mean Growth Rate:** (n = 21) 1 wk, 31.7 mm; 2 wks, plates covered. **Macromorphology:** Advancing zone submerged, or with few aerial hyphae, silky; hyphae hyaline or white. Aerial mycelium initially thickly woolly and white with scattered irregularly shaped crustose patches colored "avellaneous," "fawn color" or "wood brown;" by Week VI becoming crustose overall, margin colored white, elsewhere colored "avellaneous," "fawn color" or "wood brown;" sometimes the crustose mat is overlaid with subfelty cream-colored mycelium; some isolates exuding numerous watery droplets. Reverse unchanged or becoming pale cream-colored. Odor not distinctive. **Micromorphology:** Advancing zone hyphae 1.5-4.5 µm diam, approx. 50% infrequently-branched and non-diverticulate, approx. 50% frequently-branched, diverticulate and staghorn-like; hyaline, inamyloid, thin-walled, clamped. Aerial hyphae forming a well-developed *textura angularis* composed of jigsaw puzzle-like elements up to $10^{+}$ µm diam; walls brown, up to 1 µm thick, weakly dextrinoid; some isolates with tissue overlaid by hyphae similar in morphology to advancing zone hyphae. Submerged hyphae similar to advancing zone hyphae, but some intercalary cells swollen up to 7 µm diam. **Phenoloxidase Reactions:**

Week II: Laccase (+), Tyrosinase (weakly +), Peroxidase (+). Week VI: Laccase (+/-), Tyrosinase (-), Peroxidase (+). **Nobles Code:** 2.3c. 11.26.37.38.42.54. **Stalpers Code:** 1.2.3.6.13.(24).28.34.37a.(38a). 39.44.45.51-54.61.64.65.67.80.89. **Isolates Examined:** DED 3546, 3547, 3818, 4241, 4461, 4466, 4555.

**Commentary**. Culture mats of isolates of *M. rotula* were initially white and thickly woolly overall, but soon discrete avellaneous or pinkish brown crustose patches developed. As the culture mats aged, the crustose regions enlarged until the entire mat was overlayed by a thin crustose layer. This same pattern of development was observed in many isolates of *M. capillaris*. For a comparison of the differences between cultures of *M. rotula* and *M. capillaris*, see the commentary on the latter species.

***MARASMIUS FELIX***

**Medium: MEA**. **Mean Growth Rate:** (n = 6) 1 wk, 15.8 mm; 2 wks, 34.3 mm; 3 wks, 54.5 mm; 4 wks, plates covered. **Macromorphology:** Advancing zone submerged, silky; hyphae hyaline. Aerial mycelium poorly-developed, thinly cottony or floccose, hyaline or white. Reverse unchanged. Odor not distinctive. **Micromorphology:** Advancing zone hyphae 1.5-3 µm diam, frequently-branched, staghorn-like, hyaline, inamyloid, thin-walled, clamped. Aerial hyphae often adherent, forming thin strands of 2-10 hyphae; hyphae infrequently-branched, non-diverticulate, with scattered staghorn-like elements, otherwise similar to advancing zone hyphae. Submerged hyphae 2-6 µm diam, loosely interwoven, infrequently-branched and irregular in outline, or

frequently-branched and diverticulate, hyaline, inamyloid, thin-walled, clamped. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (-), Peroxidase (+). Week VI: Laccase (+/-), Tyrosinase (-), Peroxidase (+). **Nobles Code:** 2a.3c.11a.36.38.44.54a. **Stalpers Code:** 1.3.8.13.19.21.30.37a.39.44.45.52-54.61.65.89a.

**Medium: PDA**. **Mean Growth Rate:** (n = 6) 1 wk, 13.3 mm; 2 wks, 32 mm; 3 wks, 49.5 mm; 4 wks, plates covered. **Macromorphology:** Advancing zone submerged, silky or plumose; hyphae hyaline. Aerial mycelium cottony or woolly-tufted, white or buff. Submerged mycelium yellow or pale ochraceous near the margin, brown near the plug. Reverse grading from cream to golden or brownish orange. Odor not distinctive. **Micromorphology:** Advancing zone hyphae 1.5-5 µm diam, frequently-branched, staghorn-like, irregular in outline, with many intercalary cells swollen, hyaline, inamyloid, thin-walled, clamped. Aerial hyphae similar to advancing zone hyphae, interwoven. Submerged hyphae often adhered together, infrequently-branched or frequently-branched, with walls up to 1 µm thick, hyaline or pale yellow, inamyloid, clamped. **Phenoloxidase Reactions:** Same as those on MEA. **Nobles Code:** 2a.3c.11a.36.39.44.54a. **Stalpers Code:** 1.3.8.13.21. 22.30.38a.38b.39.44.45.52.53.61.65.80.89a. **Isolates Examined:** DED 4471, 4486.

**Commentary**. Culture mat morphology of PDA-grown isolates of *M. felix* varied little from that of MEA-grown isolates, an unusual phenomenon. In all other species studied, there were distinct differences in culture mat coloration and texture between PDA-grown and MEA-grown isolates. Conversely, on both media, aerial mycelia of

isolates of *M. felix* were cottony or floccose/tufted and white. In addition, micromorphological features were similar for hyphae grown on both media. Differences were observed in degree of culture mat development and reverse coloration. On MEA, isolates formed very little aerial mycelium, and the reverse remained unchanged by Week VI. On PDA, isolates formed well-developed aerial mycelium, and the reverse became orange or brownish orange by Week VI.

Isolates of *M. felix* were somewhat similar in morphology to those of *M. graminum*, but the latter differed in faster growth rate, thicker culture mats, formation of weakly-skeletalized dextrinoid hyphae with dendrotrichomoid-like side branches, and presence of granular crystal-incrusted hyphae.

***MARASMIUS DECIPIENS***

**Medium: MEA. Mean Growth Rate:** (n = 9) 1 wk, 6 mm; 2 wks, 11.5 mm; 3 wks, 15 mm; 4 wks, 20.7 mm; 5 wks, 26.7 mm; 6 wks, 33.5 mm. **Macromorphology:** Advancing zone submerged, silky or with plumose outgrowths by Week VI; hyphae cream-buff. Aerial mycelium absent or consisting of a few radiating, silky hyphal strands colored white, cream or pale ochraceous. Submerged mycelium cream-colored, ochraceous or pale brownish orange. Reverse yellow or pale ochraceous. Odor not distinctive or faintly like ethanol. **Micromorphology:** Advancing zone hyphae 2-4 μm diam, infrequently-branched, non-diverticulate or with rare diverticula, not staghorn-like, hyaline, inamyloid or weakly dextrinoid in mass, thin-walled, clamped. Aerial hyphae rare, similar to advancing zone hyphae, with or without dextrinoid dendrotrichomoid

elements; with small, hyaline, octahedral crystals scattered among aerial hyphae. Submerged hyphae 2-7 µm diam, irregularly swollen, infrequently-branched, non-diverticulate, hyaline, dextrinoid in mass, thin-walled, clamped. **Phenoloxidase Reactions:** Week II: Laccase (-), Tyrosinase (weakly +/-), Peroxidase (-). Week VI: Laccase (-), Tyrosinase (-), Peroxidase (-). **Nobles Code:** (1).(2b).3c.7.26.36. 39.47.(52).54a. **Stalpers Code:** (2).9.13.16.35.(36).38d.39.44.45. 52-54.(68a).80.82.89a.

**Medium: PDA. Mean Growth Rate:** (n = 9) 1 wk, 2.8 mm; 2 wks, 17.7 mm; 3 wks, 34.8 mm; 4 wks, 46 mm; 5 wks, 55.5 mm; 6 wks, 61.4 mm. **Macromorphology:** Advancing zone submerged in some isolates, raised and thinly felty in others; hyphae ochraceous or pale brownish orange. Aerial mycelium initially woolly or subfelty, colored white or pale yellow; by Week VI becoming felty or farinose overall, grading from pale ochraceous on the margin, to cream or mustard yellow near the margin, to deep yellow or golden surrounding the inoculum plug. Submerged hyphae brownish orange or brown. Reverse yellowish orange or brownish orange. Odor mildly mealy or musty. **Micromorphology:** Advancing zone hyphae similar to those on MEA, but many also 1.5-2 µm diam; with scattered dextrinoid dendrotrichomoid elements in raised regions. Aerial hyphae 1.5-3 µm diam, densely interwoven, with numerous suberect terminal cells, infrequently-branched, non-diverticulate, cylindric or wavy in outline, some hyphae irregularly swollen up to 6 µm diam; hyphae hyaline, dextrinoid in mass, thin-walled, clamped; with numerous dextrinoid dendrotrichomoid elements scattered among aerial hyphae. Submerged hyphae 2-3.5 µm diam,

infrequently-branched, mostly cylindric, hyaline or pale ochraceous, dextrinoid in mass, thin-walled, clamped. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (weakly +), Peroxidase (+). Week VI: Laccase (weakly +), Tyrosinase (weakly +/-), Peroxidase (+). **Nobles Code:** 2.3c.7.26.36.37.39.47.51.54a. **Stalpers Code:** 1.2.3.9.12.13. 18.22.25.(30).31.35.36.38b.39.44.45.52-54.(67).68a.80.89a. **Isolates Examined:** DED 4272, 4480, 4608.

**Commentary**. MEA-grown isolates were easily distinguished because of the near absence of aerial mycelium and development of ochraceous or brownish orange submerged mycelium. PDA-grown isolates were somewhat similar to those of *M. fulvoferrugineus* and *M. siccus*. Isolates of *M. fulvoferrugineus* differed in slower mean growth rate (38.9 mm by Week VI), reddish brown reverse coloration, crystal formation, and lack of dendrotrichomoid elements. Isolates of *M. siccus* differed in faster growth rate (plates covered by Week IV), ochraceous reverse coloration, crystal formation, and formation of numerous unbranched, dextrinoid skeletalized hyphae. In addition, isolates of both of the latter species differed from those of *M. decipiens* by forming pigmentless hyphae when grown on MEA, as well as by reacting positively to spot tests for phenoloxidases. Although PDA-grown isolates of *M. decipiens* reacted positively to spot tests for laccase, tyrosinase and peroxidase, MEA-grown isolates reacted negatively to all three tests.

***MARASMIUS NIGRODISCUS***

**Medium: MEA**. **Mean Growth Rate:** (n = 6) 1 wk, 3 mm; 2 wks, 9 mm; 3 wks, 14.5 mm; 4 wks, 21.5 mm; 5 wks, 28 mm; 6 wks, 34 mm.

**Macromorphology:** Advancing zone submerged, silky; hyphae hyaline. Aerial mycelium absent or consisting of a few silky, hyaline, radiating strands. Reverse unchanged. Odor not distinctive. **Micromorphology:** Advancing zone hyphae 1.5-3 µm diam, infrequently-branched, non-diverticulate or with rare nodulose diverticula, hyaline, inamyloid or weakly dextrinoid in mass, thin-walled, clamped. Aerial hyphae rare, similar to advancing zone hyphae but with more well-developed diverticula; no tissue formed. Submerged hyphae 2-6.5(10) µm diam, irregular in outline, frequently-branched, diverticulate, hyaline, inamyloid or weakly dextrinoid in mass, thin-walled, clamped; with numerous hyaline octahedral crystals in agar. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (weakly +), Peroxidase (+). Week VI: Laccase (+), Tyrosinase (-), Peroxidase (+). **Nobles Code:** 2.3c.11a. 36.38.47.54a. **Stalpers Code:** 1.2.3.10.13.16.30.37a.39.44.45.52-54. 65.83.89a.

**Medium: PDA. Mean Growth Rate:** (n = 6) 1 wk, 3 mm; 2 wks, 9 mm; 3 wks, 16 mm; 4 wks, 22.5 mm; 5 wks, 28 mm; 6 wks, 34 mm. **Macromorphology:** Advancing zone appressed, silky; hyphae buff or greyish cream. Aerial mycelium initially thinly cottony, colored buff or pale cream; by Week VI becoming thinly felty overall and grading in coloration from margin inward, buff, cream, greyish cream and pale greyish brown; radially ridged and folded; with deep yellowish green or yellow spots composed of clusters of crystals (numerous in #4392, uncommon in #4301). Reverse zonate, zones cream, yellow, ochraceous, greyish brown and brown. Odor mildly musty. **Micromorphology:** Advancing zone hyphae 2-3 µm diam, cylindric, non-diverticulate,

hyaline, weakly dextrinoid in mass, thin-walled, clamped. Aerial hyphae forming a poorly-developed or well-developed *textura intricata*; hyphae undifferentiated or highly irregular in outline, 3-5(8) µm diam, infrequently-branched, mostly non-diverticulate or with scattered nodulose diverticula, hyaline, dextrinoid in mass, thin-walled, clamped; tissue overlaid in areas with thick-walled, strongly dextrinoid hyphae giving rise to aseptate, filiform side-branches 200+ X 0.8-2 µm, these similar in morphology to "arms" of dendrotrichomoid elements; with cluster of deep yellow or golden acicular crystals 5-20 X <0.5 µm scattered among aerial mycelium. Submerged hyphae similar to aerial hyphae but none skeletalized, many intercalary cells swollen. **Phenoloxidase Reactions:** Same as on MEA. **Nobles Code:** 2.3c.(8d). 11i.26.37.39.47.51.54a. **Stalpers Code:** 1.2.3.10.13.(21).25.31.34. 36.38a.38d.38e.39.44.45.(48).52-54.64.65.(68a).80.82.89a. **Isolates Examined:** DED 4301, 4392.

**Commentary**. Diagnostic macromorphological features of PDA-grown isolates of *M. nigrodiscus* include: a) thinly felty, cream or greyish cream colored aerial mycelium; b) cream, yellow and ochraceous reverse coloration; and c) deep yellow spots composed of clusters of crystals. No other taxa examined in this study formed deep yellow acicular crystals of the sort observed in PDA-grown isolates of *M. nigrodiscus*. Micromorphologically, the *textura intricata* of broad, irregularly-shaped hyphae is distinctive. For a comparison with *M. cystidiosus* see the commentary on the latter species.

***MARASMIUS CYSTIDIOSUS***

**Medium: MEA. Mean Growth Rate:** (n = 3) 1 wk, 8 mm; 2 wks, 20.5 mm; 3 wks, 32.5 mm; 4 wks, 46.5 mm; 5 wks, 56.5 mm; 6 wks, plates covered. **Macromorphology:** Advancing zone submerged, silky; hyphae hyaline. Aerial mycelium absent or consisting of a few silky or downy, hyaline hyphal strands. Reverse unchanged. Odor not distinctive or slightly sour. **Micromorphology:** Advancing zone hyphae 1.5-4 µm diam, infrequently-branched, non-diverticulate, hyaline, inamyloid, thin-walled, clamped. Aerial hyphae rare, 2.5-4 µm diam, repent but giving rise to numerous suberect side-branches 1.5-2.5 µm diam, these frequently-branched and diverticulate, hyaline, inamyloid, thin-walled, clamped. Submerged hyphae 1.5-5 µm diam, frequently-branched, sparsely diverticulate, otherwise similar to advancing zone hyphae. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (+), Peroxidase (+). Week VI: Laccase (-), Tyrosinase (-), Peroxidase (weakly +). **Nobles Code:** 2.3c.(7).11a.36.38.46.54a. **Stalpers Code:** 1.2.3.9.13.16.30.37a.39.45.52.53.65.89a.

**Medium: PDA. Mean Growth Rate:** (n = 3) 1 wk, 1 mm; 2 wks, 1.5 mm; 3 wks, 3 mm; 4 wks, 6 mm; 5 wks, 9 mm; 6 wks, 12.5 mm. **Macromorphology:** Advancing zone very narrow, submerged, silky, hyphae hyaline at first, by Week VI becoming tan or pale orange buff. Aerial mycelium appressed, thinly felty overall; at first colored white overlaying greyish brown submerged mycelium, soon becoming buff-colored overlaying pale brownish orange submerged mycelium, by Week VI becoming orange buff on the margin and brownish orange near the inoculum plug overlaying more deeply pigmented submerged hyphae; inoculum plug dark

brown overlaid by subfelty brownish orange mycelium. Reverse grading from margin inward, orange buff, golden orange, brownish orange and dark brown; with a golden orange pigment diffused in the agar beyond the colony margin. Odor musty or mildly of coconut. **Micromorphology:** Advancing zone hyphae similar to those on MEA. Aerial mycelium in younger regions composed of loosely interwoven hyphae 2-2.5 µm diam, infrequently-branched, hyaline, weakly dextrinoid in mass, thin-walled, clamped; aerial hyphae in older regions forming a well-developed *textura intricata*; hyphae 2-10 µm diam, highly irregular in outline, with many intercalary cells swollen, frequently-branched, hyaline or pale ochraceous, dextrinoid in mass, clamped, with walls up to 1 µm thick; some terminal elements suberect or erect, cystidioid. Submerged hyphae 2-3 µm diam, not swollen, hyaline or pale yellow, inamyloid, thin-walled, clamped. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (+), Peroxidase (+). Week VI: Laccase (+), Tyrosinase (weakly +), Peroxidase (+). **Nobles Code:** 2.3c.11i.26.37. 39.47.51.54a. **Stalpers Code:** 1.2.3.10.13.25.32.34.36.38b.38e.39.44. 45.48.52-55.64.(67).80.89a. **Isolates Examined:** DED 4594.

**Commentary**. This species has been collected once by me, hence, only a single isolate was available for study. Of all taxa studied, the isolate of *M. cystidiosus* was one of the slowest growers on PDA, reaching a radius of 12.5 mm at Week VI. Diagnostic features of the PDA-grown isolate include: a) slow growth rate; b) thinly felty, brownish orange culture mat; c) brownish orange to dark brown reverse coloration; and d) aerial hyphae forming a *textura intricata* of highly irregularly-shaped elements. Basidiomata of *M. cystidiosus* are nearly

indistinguishable from those of *M. nigrodiscus*, the two taxa differing significantly only in characteristics of the stipe surface (see discussions following the descriptions of these species in the taxonomic portion of this manuscript). Cultural features may provide an additional aid in separating the two species. PDA-grown isolates of *M. nigrodiscus* differed from that of *M. cystidiosus* in faster growth rate (34 mm radius at Week VI), cream or greyish cream-colored aerial mycelium, yellow-tinted reverse coloration (not orange-tinted), formation of deep yellow acicular crystals, and presence of dextrinoid skeletalized aerial hyphae with aseptate filiform side-branches.

***MARASMIUS OREADES***

**Medium: MEA**. **Mean Growth Rate:** (n = 6) 1 wk, 2.3 mm; 2 wks, 7.5 mm; 3 wks, 9.8 mm; 4 wks, 16 mm; 5 wks, 18 mm; 6 wks, 22.8 mm (ranging from 15-35 mm). **Macromorphology:** Advancing zone submerged, silky; hyphae hyaline. Aerial mycelium absent or consisting of a few silky, white, radiating hyphal strands, rarely cottony near inoculum plug. Reverse unchanged. Odor not distinctive. **Micromorphology:** Advancing zone hyphae 1.5-4 µm diam, infrequently-branched, non-diverticulate or diverticulate, hyaline, inamyloid, thin-walled, clamped. Aerial hyphae rare, similar to advancing zone hyphae. Submerged hyphae similar to advancing zone hyphae but some coiled or contorted. **Phenoloxidase Reactions:** Week II: Laccase (+/-), Tyrosinase (-), Peroxidase (+). Week VI: Laccase (-), Tyrosinase (weakly +/-), Peroxidase (weakly +). **Nobles Code:** 2.3c.7.(11a).

36.38.47.56. **Stalpers Code:** (1).(2).3.10.13.16.(21).30.37a.39.45. 52.53.65.91.

**Medium: PDA. Mean Growth Rate:** (n = 6) 1 wk, 1.8 mm; 2 wks, 7.5 mm; 3 wks, 12.5 mm; 4 wks, 21.3 mm; 5 wks, 25.3 mm; 6 wks, 31.8 mm (ranging from 16-55 mm). **Macromorphology:** Advancing zone silky or cottony, white or buff-colored. Aerial mycelium woolly overall, thick over the inoculum plug, thin and often tufted elsewhere, colored white or buff overall, rarely with pale "cinnamon buff" areas. Submerged mycelium pale ochraceous near plug. Reverse unchanged or cream to brownish orange. Odor not distinctive. **Micromorphology:** Advancing zone hyphae 2-5 µm diam, infrequently-branched, non-diverticulate or with broad, knob-like diverticula, hyaline, inamyloid, thin-walled, clamped. Aerial mycelium of densely interwoven hyphae; uppermost layer of hyphae 1.5-2.5 µm diam, infrequently-branched, non-diverticulate, with numerous erect or suberect terminal cells, these tangled, cylindric or wavy in outline; subtending layer composed of hyphae 3-6 µm diam, irregular in outline, often strangulate, infrequently-branched, hyaline or pale yellow, inamyloid, thin-walled, clamped; interwoven among aerial hyphae are scattered dextrinoid skeletalized hyphae giving rise to aseptate, filiform side-branches similar in morphology to "arms" of dendrotrichomoid elements. Submerged hyphae similar to advancing zone hyphae. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (-), Peroxidase (+). Week VI: Laccase (+), Tyrosinase (+), Peroxidase (+). **Nobles Code:** 2.3c.(7).11a.(8d).36.38.47.56. **Stalpers Code:** 1.2.3.10.13.22.30.

37a.39.44.45.47.52-54.65.91. **Isolates Examined:** DED 4019, Halling 5958.

**Commentary**. PDA-grown isolates of *M. oreades* were characterized by formation of thin, woolly or tufted white culture mats, unchanged reverse coloration, and aerial mycelium composed of filiform hyphae arising from a layer of broad, irregularly-shaped hyphae. Cultures of this species were somewhat similar to those of *M. pallidocephalus*, but the latter differed in growth rate, odor, and the absence of clamp connections and dextrinoid skeletalized aerial hyphae.

***MARASMIUS STRICTIPES***

**Medium: MEA**. **Mean Growth Rate:** (n = 12) 1wk, 3.1 mm; 2 wks, 9.4 mm; 3 wks, 15.1 mm; 4 wks, 30.4 mm; 6 wks, 34.4 mm. **Macromorphology:** Advancing zone submerged or consisting of a few aerial hyphae, silky or thinly plumose; hyphae hyaline or white. Aerial mycelium poorly-developed, appressed, thinly cottony or plumose, rarely farinose in areas, colored white. Reverse unchanged. Odor faintly sweet. **Micromorphology:** Advancing zone hyphae 1.5-3 µm diam, non-diverticulate or diverticulate, not staghorn-like, seldom twisted or coiled, hyaline inamyloid, thin-walled, clamped. Aerial hyphae 1.5-3 µm diam, loosely interwoven, frequently-branched, diverticulate, hyaline, inamyloid or weakly dextrinoid in mass, thin-walled, clamped; many hyphae coated with thick, glassy, hyaline, amorphous or plaque-like crystals; with occasional dextrinoid dendrotrichomoid elements in isolate #4073, absent in other isolates. Submerged hyphae similar to aerial hyphae but lacking crystal incrustations. **Phenoloxidase**

**Reactions:** Week II: Laccase (+), Tyrosinase (weakly +), Peroxidase (+). Week VI: Laccase (+), Tyrosinase (weakly +/-), Peroxidase (+). **Nobles Code:** 2.3c.11a.36.38.47.50.54a. **Stalpers Code:** 1.2.3.10. 13.21.(23).30.(36).37a.39.45.52.57.65.(68a).82.89a.

**Medium: PDA. Mean Growth Rate:** (n = 12) 1 wk, 1.5 mm; 2 wks, 2.9 mm; 3 wks, 3.5 mm; 4 wks, 4.5 mm; 6 wks, 6.9 mm.

**Macromorphology:** Advancing zone very narrow, silky or cottony, hyaline or white at first, becoming pale yellow, cream buff, or pale orange buff by Week VI. Aerial mycelium initially woolly or subfelty overall, colored white or buff near the margin and pale brown near the inoculum plug; by Week VI forming a brownish orange, brown or dark reddish brown crustose mat overlayed by a thin layer of velutinous or felty mycelium colored orange buff, brownish orange or pale brown; often radially grooved and folded. Reverse grading in color from the margin inward, cream, yellow, orange cream, brownish orange, brown and dark brown; with a yellow or golden pigment diffused in the agar well beyond the colony margin. Odor faintly musty or of coconut.

**Micromorphology:** Advancing zone hyphae 2-3.5 µm diam, infrequently-branched, non-diverticulate, hyaline, inamyloid or weakly dextrinoid in mass, thin-walled, clamped. Aerial hyphae forming a *textura intricata* or *textura epidermoidea*; hyphae long-celled, 3-8 µm diam, irregular in outline, loosely interwoven with numerous interhyphal spaces in some areas, tightly adherent in other regions, hyphal walls up to 0.8 µm thick, ochraceous, dextrinoid; this tissue overlayed in areas with loosely interwoven, often clustered and suberect hyphae 2-3 µm diam, strangulate and nodulose, hyaline, inamyloid or weakly dextrinoid,

thin-walled. Submerged hyphae 2-4 µm diam, irregular in outline, many nodulose, hyaline, weakly dextrinoid, thin-walled, clamped. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (weakly +/-), Peroxidase (+). Week VI: Laccase (+/-), Tyrosinase (weakly +), Peroxidase (+). **Nobles Code:** 2.3c.11.11i.26.37.39.47.51.54a. **Stalpers Code:** 1.2.3.10.12.22.24.25.26.28.32.36.38a.38b.38e.39.44. 45.53-55.64.65.(67).89a. **Isolates Examined:** DED 4073, 4411, 4439, 4453.

**Commentary**. Diagnostic features of PDA-grown isolates of *M. strictipes* include: a) extremely slow growth rate; b) darkly pigmented, crustose, radially grooved and folded culture mat overlaid by slightly paler velutinous or felty mycelium; c) reverse coloration matching culture mat pigmentation; d) typically non-diverticulate hyphae, although submerged hyphae may be slightly nodulose; and e) *textura intricata* and *textura epidermoidea* tissues often overlaid by a velutinous layer composed of suberect, strangulate and nodulose hyphal end cells. These features, in combination with formation of glassy plaque-like incrusting crystals on aerial hyphae of MEA-grown isolates, are distinctive for *M. strictipes*.

The isolate of *M. cystidiosus* utilized in this study developed a similar culture mat morphology on PDA, but differed from isolates of *M. strictipes* in not forming crustose tissue, instead developing merely a felty culture mat. In addition, MEA-grown cultures of the former lacked glassy plaque-like incrusting crystals.

***MARASMIUS PYRRHOCEPHALUS***

**Medium: MEA. Mean Growth Rate:** (n = 21) 1 wk, 14.9 mm; 2 wks, 42.4 mm; 3 wks, 61.9 mm; 4 wks, plates covered. **Macromorphology:** Advancing zone submerged, silky; hyphae hyaline. Aerial mycelium at Week II silky or downy, colored hyaline or buff, with a thinly felty zone of pale brownish orange mycelium around the inoculum plug; at Week VI, thinly crustose overall, colored "cinnamon" with small "Mikado brown" patches, also with scattered areas of floccose, buff or "cinnamon" mycelium, or rarely overlayed with cottony white mycelium. Reverse unchanged or pale brown. Odor not distinctive. **Micromorphology:** Advancing zone hyphae 1.5-4 µm diam, frequently-branched, diverticulate, many staghorn-like, hyaline, inamyloid, thin-walled, clamped. Aerial hyphae similar to advancing zone hyphae but often with infrequently-branched elements agglutinated into bundles of 2-6 hyphae, the bundles branching to form a reticulum over the surface of the agar; crustose areas formed of a poorly-developed *textura intricata*; hyphae hyaline, brownish orange or pale brown, inamyloid, with walls up to 0.8 µm thick, clamped. Submerged hyphae 1.5-4.5 µm diam, frequently-branched, diverticulate, staghorn-like, some coiled and contorted, hyaline or pale brown, inamyloid, thin-walled, clamped. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (-), Peroxidase (+). Week VI: Laccase (+), Tyrosinase (-), Peroxidase (+). **Nobles Code:** 2a.3c.11a.11i.37.(38).39.44.54.54a. **Stalpers Code:** 1.3.7.13.17.20.(25).28.34.(37a).38e.39.45.52.53.61.65.67.89.89a.

**Medium: PDA. Mean Growth Rate:** (n = 21) 1 wk, 8.5 mm; 2 wks, 24.4 mm; 3 wks, 38.6 mm; 4 wks, 53.5 mm; 5 wks, 62.8 mm; 6 wks,

plates covered. **Macromorphology:** Advancing zone submerged, silky; hyphae hyaline or tan. Aerial mycelium irregularly zonate or azonate, with various woolly and felty regions colored white, buff, "cinnamon buff," "cinnamon," "Mikado brown," or "Vandyke brown;" some isolates with thinly crustose regions similarly colored; with numerous dark brown watery droplets on the surface. Reverse reddish brown, brown or dark brown. Odor not distinctive. Bacterial contaminants inhibit growth of colony and induce fungal production of a dark brown, agar-soluble pigment. **Micromorphology:** Advancing zone hyphae 1.5-4 µm diam, frequently-branched, diverticulate, staghorn-like, hyaline, inamyloid, thin-walled, clamped. Aerial hyphae forming a well-developed, thick *textura intricata*; hyphae 1.5-3 µm diam, densely interwoven, infrequently- and frequently-branched, diverticulate, many staghorn-like, hyaline or brownish orange, inamyloid, with walls up to 0.8 µm thick, clamped; no irregularly swollen elements. Submerged hyphae similar to aerial hyphae but less pigmented. **Phenoloxidase Reactions:** Same as on MEA. **Nobles Code:** 2a.3c.11a.11i.(36).37.39.46.54.54a. **Stalpers Code:** 1.3.8.9.13.22.25.(28).(29).(30).34.38c.38e.39.45.52.53.61.64.65.67.89.89a. **Isolates Examined:** DED 4218, 4273, 4437, 4467, 4503, 4573; Thorn 870813/01.

**Commentary**. Few taxa in this study formed pigmented tissues on MEA. *M. pyrrhocephalus* was one of these, developing "cinnamon" and "Mikado brown" *textura intricati* by Week VI. PDA-grown isolates formed similar tissues, although they were much thicker on the latter medium. Cultural morphology of isolates of *M. pyrrhocephalus* was similar to that of isolates of *M. scorodonius*. For a comparison, see the

commentary on *M. scorodonius*. It should be noted that isolates of *M. pyrrhocephalus* obtained from southern Appalachian specimens formed cultural features identical to those of an isolate obtained from a Canadian specimen (Thorn 870813/01).

***MARASMIUS SCORODONIUS***

**Medium: MEA. Mean Growth Rate:** (n = 15) 1 wk, 12.4 mm; 2 wks, 32.9 mm; 3 wks, 51.5 mm; 4 wks, plates typically covered, isolate #3975 only 37 mm at Week VI. **Macromorphology:** Advancing zone submerged, silky or rarely plumose; hyphae hyaline. Aerial mycelium appressed, cottony or felty, white, with small crustose, avellaneous or pale brown patches in older regions. Reverse unchanged. Odor not distinctive or faintly of coconut. **Micromorphology:** Advancing zone hyphae 1.5-4 µm diam, frequently-branched, diverticulate, staghorn-like, some elements irregular in outline; hyphae hyaline, inamyloid, thin-walled, clamped. Aerial hyphae in cottony or felty regions grading from loosely interwoven to a well-developed *textura intricata*; hyphae 1-1.5 µm diam, cylindric, infrequently-branched, or hyphae 1.5-4 µm diam, frequently-branched, diverticulate, staghorn-like, hyaline, thin-walled, clamped; hyphae becoming progressively more irregular in outline, thicker-walled and more tightly interwoven in older regions. Aerial hyphae of crustose regions forming a well-developed *textura angularis* composed of jigsaw puzzle-shaped cells 4-12 µm diam, some elongate, some subglobose; surface of cells even or nodulose; walls hyaline or pale brown, inamyloid, up to 1 µm thick; with scattered frequently-branched, cylindric hyphae interwoven in the tissue.

Submerged hyphae 2-4.5 µm diam, loosely interwoven, infrequently-branched, sparsely diverticulate, somewhat swollen at branch inceptions, hyaline, inamyloid, thin-walled, clamped. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (+), Peroxidase (+). Week VI: Laccase (+), Tyrosinase (weakly +), Peroxidase (+). **Nobles Code:** 2.3c.11.26.36.(37).38.44.(53).54.(54a). **Stalpers Code:** 1.2.3.8.13.21.25.28.30.(34).(36).37a.39.44.45.48.52-55.61.64.65.67. 80.89.(89a).

**Medium: PDA. Mean Growth Rate:** (n = 15) 1 wk, 5 mm; 2 wks, 19.9 mm; 3 wks, 35.8 mm; 4 wks, 47 mm; 5 wks, plates typically covered (isolate #3975 only 43 mm at Week VI). **Macromorphology:** Advancing zone narrow, submerged, silky; hyphae hyaline; surrounded by a narrow zone of white, subfelty mycelium. Aerial mycelium at Week I mainly white and felty, with a region surrounding inoculum plug pale brown and crustose; by Week VI typically becoming zonate, zones alternately thinly felty and thickly felty, ranging in coloration from buff-brown to brown or dark brown; occasionally older regions crustose, colored buff, beige or avellaneous; with numerous golden or dark brown watery droplets on the surface. Reverse pale ochraceous or greyish brown. Odor not distinctive or like pine needles. **Micromorphology:** Advancing zone hyphae 2-3 µm diam, infrequently-branched, non-diverticulate, hyaline, inamyloid, thin-walled, clamped. Aerial hyphae forming a well-developed, thick *textura angularis/epidermoidea* composed of jigsaw puzzle-shaped elements up to 8 µm diam, some short-celled and angular, others long-celled and irregular in outline; hyphal walls brown, inamyloid, up to 1.5 µm thick, sometimes roughened; this tissue

overlaid by a thin layer of loosely interwoven hyphae 2-4 µm diam, or of hyphae agglutinated into bundles of 5-20; hyphae infrequently-branched, non-diverticulate, hyaline or pale brown, inamyloid, clamped. Submerged hyphae similar to advancing zone hyphae. **Phenoloxidase Reactions:** Same as on MEA. **Nobles Code:** 2.3c.11.26.37.39.45.(53). 54.(54a). **Stalpers Code:** 1.2.3.8.9.13.25.(28).29.34.(36).38d.38e. 39.44.45.48.52-55.64.67.80.89.(89a). **Isolates Examined:** DED 3875, 3952, 3975, 4500, 4554.

**Commentary**. Diagnostic features of isolates of *M. scorodonius* include: a) on MEA: white felty mats formed of *textura intricata* plus patches of avellaneous or pale brown crustose mycelium formed of *textura angularis*; and b) on PDA: zonate, felty, brown mats formed of *textura angularis/epidermoidea*, overlaid by pallid interwoven hyphae. Cultures of *M. scorodonius* are superficially similar to those of *M. pyrrhocephalus*. MEA-grown isolates of the latter species differ, however, in forming culture mats colored cinnamon overall and lacking areas of *textura angularis*. PDA-grown isolates of *M. pyrrhocephalus* differ in forming azonate, cinnamon-tinted culture mats also lacking areas of *textura angularis*. In addition, isolates of *M. pyrrhocephalus* reacted negatively to spot tests for tyrosinase on both media, whereas isolates of *M. scorodonius* reacted positively on both media.

It is interesting that the crustose layer characterized by the presence of a *textura angularis/epidermoidea* in PDA-grown isolates, is not macroscopically obvious. Culture mats of *M. scorodonius* are typically characterized as felty. The felty texture, however, is the

result of loosely interwoven hyphae that overlay a micromorphologically distinct crustose layer.

***MARASMIUS DELECTANS***

**Medium: MEA**. **Mean Growth Rate:** (n = 3) 1 wk, 12 mm; 2 wks, 27 mm; 3 wks, 43 mm; 4 wks, 58 mm; 5 wks, plates covered. **Macromorphology:** Advancing zone submerged, silky; hyphae hyaline. Aerial mycelium absent or consisting of a few silky, radiating, hyaline hyphal strands. Reverse unchanged. Odor not distinctive or slightly musty. **Micromorphology:** Advancing zone hyphae 2-4 µm diam, mainly undifferentiated, some frequently-branched, diverticulate and staghorn-like; hyaline, inamyloid, thin-walled, clamped, few clamps sprouting. Aerial hyphae rare, 1.5-3 µm diam, loosely interwoven, similar to advancing zone hyphae but with scattered dextrinoid dendrotrichomoid elements, plus repent dextrinoid skeletalized hyphae with scattered, aseptate, filiform side-branches similar to "arms" of dendrotrichomoid elements. Submerged hyphae 1.5-6 µm diam, frequently-branched, diverticulate, many twisted and contorted, few with intercalary swellings, hyaline, inamyloid, thin-walled, clamped. **Phenoloxidase Reactions:** Week II: Laccase (-), Tyrosinase (weakly +), Peroxidase (-). Week VI: Laccase (-), Tyrosinase (weakly +), Peroxidase (+). **Nobles Code:** 2b.3c.(8d).11a.26.36.38.45.51.54a. **Stalpers Code:** 2.3.8.13.16.30.37a.39.(42).45.52.53.61.68a.80.89a.

**Medium: PDA**. **Mean Growth Rate:** (n = 3) 1 wk, 4 mm; 2 wks, 8 mm; 3 wks, 11 mm; 4 wks, 15 mm; 5 wks, 20 mm; 6 wks, 24 mm. **Macromorphology:** Advancing zone silky or plumose; hyphae white or

cream-colored. Aerial mycelium at first appressed, subfelty, white or buff; remaining so on the margin at Week VI, central region becoming felty or farinaceous and colored cream or ochraceous, inoculum plug greyish brown with a thinly felty covering of creamy ochraceous mycelium. Reverse grading from cream to ochraceous or brown. Odor not distinctive. **Micromorphology:** Advancing zone hyphae similar to those on MEA. Aerial hyphae in younger regions 1.5-4 µm diam, frequently-branched, diverticulate, staghorn-like, hyaline, inamyloid, thin-walled, clamped; with scattered, repent, dextrinoid skeletalized hyphae with aseptate, filiform side-branches -200 X <1.5 µm, similar to "arms" of dendrotrichomoid elements. Aerial hyphae of older regions forming an incomplete *textura globulosa*; hyphae interwoven, highly irregular in outline, strangulate or with subglobose intercalary or terminal swellings up to 8 µm diam, hyaline or pale yellow, dextrinoid in mass, thin-walled, clamped; with scattered dextrinoid dendrotrichomoid elements. Submerged hyphae 2.5-4 µm diam, strongly coralloid, wavy in outline, frequently-branched, hyaline, inamyloid, thin-walled, clamped. **Phenoloxidase Reactions:** Week II: Laccase (-), Tyrosinase (+), Peroxidase (+). Week VI: Laccase (-), Tyrosinase (+), Peroxidase (+). **Nobles Code:** 2b.3c.(8d).10.11a.26.37.39.47.54a. **Stalpers Code:** 2.3.10.13.(18).25.31.35.38a.38d.38e.39.45.52.53.61. 63.65.68a.75.80.89a. **Isolates Examined:** DED 4518.

**Commentary**. Tissue isolates of *M. delectans* were difficult to obtain from fresh basidiomata, as were axenic spore prints from which polysporous cultures could be obtained. In most attempts, the cultures became contaminated within a few days, even when the youngest

basidiomata were sampled. Consequently, of the seven specimens cultured, only one axenic isolate was obtained. Spot tests for laccase production on replicates of this isolate yielded negative results on both MEA and PDA. This was an unexpected result (since all other taxa tested positive for laccase, and the genus is considered a "white-rot" genus) and may not be representative of the species. More isolates should be obtained and tested before concluding that somatic hyphae of *M. delectans* do not produce laccase.

PDA-grown isolates are characterized by: a) slow growth rate; b) formation of felty, cream or ochraceous colored mats with matching reverse coloration; c) formation of incomplete *textura globosa* tissue; d) strongly coralloid submerged hyphae, wavy in outline; and e) formation of dextrinoid dendrotrichomoid elements on both MEA and PDA. No other taxa examined exhibited this combination of features.

***MARASMIUS COHAERENS** VAR. **COHAERENS***

**Medium: MEA. Mean Growth Rate:** (n = 3) 1 wk, 3 mm; 2 wks, 10 mm; 3 wks, 16 mm; 4 wks, 26 mm; 5 wks, 35 mm; 6 wks, 40 mm. **Macromorphology:** Advancing zone submerged, silky; hyphae hyaline. Aerial mycelium absent or consisting of a few silky, white hyphal strands. Submerged mycelium radiating-silky, hyaline. Reverse unchanged. Odor not distinctive. **Micromorphology:** Advancing zone hyphae 1.5-3 μm diam, frequently-branched, diverticulate, staghorn-like, hyaline, inamyloid, thin-walled, clamped. Aerial hyphae rare, similar to advancing zone hyphae but giving rise to numerous dextrinoid dendrotrichomoid elements. Submerged hyphae loosely interwoven,

similar to advancing zone hyphae. **Phenoloxidase Reactions:** Week II: Laccase (-), Tyrosinase (-), Peroxidase (-). Week VI: Laccase (weakly +), Tyrosinase (-), Peroxidase (+). **Nobles Code:** 2a.3c.11a.36.38. 47.54a. **Stalpers Code:** 1.3.10.13.16.30.37a.39.45.52.61.65.68a.89a.

**Medium: PDA. Mean Growth Rate:** (n = 3) 1 wk, 1 mm; 2 wks, 4 mm; 3 wks, 7 mm; 4 wks, 10 mm; 5 wks, 12 mm; 6 wks, 15 mm. **Macromorphology:** Advancing zone raised by Week VI, silky or cottony, colored buff, tan or pale brown. Aerial mycelium appressed, thinly felty overall, colored white, buff or tan near the margin, beige, greyish brown or brown near the inoculum plug, with a narrow ring of beige farinaceous mycelium surrounding the plug. Reverse grading from orange-cream or pale greyish brown to greyish brown or dark brown. Odor not distinctive. **Micromorphology:** Advancing zone hyphae 1.5-3 µm diam, frequently-branched, diverticulate, staghorn-like, hyaline, inamyloid, thin-walled, clamped. Aerial hyphae densely interwoven, in some areas composed of infrequently-branched, non-diverticulate hyphae 1.5-3 µm diam, in other areas composed of frequently-branched hyphae 2-5 µm diam, irregular in outline, strangulate; hyphae hyaline or pale ochraceous, dextrinoid in mass, thin-walled or with walls up to 0.8 µm thick, clamped; with scattered dextrinoid dendrotrichomoid elements with filiform "arms" up to 170+ µm long. Submerged hyphae similar to advancing zone hyphae, 2-4 µm diam, many cells empty. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (+), Peroxidase (+). Week VI: Laccase (+), Tyrosinase (+), Peroxidase (+). **Nobles Code:** 2.3c.11a.37.39.47.54a. **Stalpers Code:** 1.2.3.10.12.(18).25.34.38a. 38e.39.44.45.52.53.61.65.(67).68a.89a. **Isolates Examined:** DED 4522.

**Commentary**. PDA-grown isolates of *M. cohaerens* var. *cohaerens* differed from other slow-growing taxa (*e.g., M. cystidiosus, strictipes, spissus*) in culture mat coloration and micromorphology, reverse coloration, and formation of dextrinoid dendrotrichomoid elements. In PDA-grown isolates of *M. cohaerens* var. *cohaerens*, culture mats were beige or greyish brown with cream-colored or greyish brown reverse. No distinct tissue was formed by the aerial mycelium, but numerous dextrinoid dendrotrichomoid elements were present. Isolates of *M. cystidiosus, M. strictipes* and *M. spissus* formed brownish orange or reddish brown culture mats with matching reverse coloration, distinct culture mat tissues (*i.e., textura intricata* or *textura epidermoidea*), and lacked dendrotrichomoid elements. For a comparison of cultural features of *M. cohaerens* var. *cohaerens* with var. *lachnophyllus*, see the commentary on the latter variety.

***MARASMIUS COHAERENS** VAR. **LACHNOPHYLLUS***

**Medium: MEA. Mean Growth Rate:** (n = 12) 1 wk, 4.5 mm; 2 wks, 10.9 mm; 3 wks, 18.5 mm; 4 wks, 24 mm; 5 wks, 30.6 mm; 6 wks, 35.5 mm. **Macromorphology:** Advancing zone submerged, silky or with plumose outgrowths at Week VI; hyphae hyaline or buff. Aerial mycelium absent or consisting of a few appressed, silky, radiating white hyphal strands. Submerged mycelium weakly zonate, colored buff, tan or pale greyish orange. Reverse unchanged. Odor not distinctive. **Micromorphology:** Advancing zone hyphae 1.5-3.5 µm diam, mostly frequently-branched and diverticulate, some infrequently-branched and sparsely diverticulate, hyaline, inamyloid or weakly dextrinoid in

mass, thin-walled, clamped. Aerial hyphae similar to advancing zone hyphae, 1.5-4 µm diam, giving rise to numerous dextrinoid dendrotrichomoid elements. Submerged hyphae 2-5 µm diam, frequently-branched, diverticulate, many staghorn-like or coralloid, many intercalary cells swollen, hyaline, inamyloid, thin-walled, clamped. **Phenoloxidase Reactions:** Week II: Laccase (+/-), Tyrosinase (weakly +), Peroxidase (+). Week VI: Laccase (-), Tyrosinase (weakly +), Peroxidase (+). **Nobles Code:** 2.3c.11a.26.36.38.47.54a. **Stalpers Code:** 1.2.3.9.10.13.16.30.37a.39.44.45.52.53.61.65.68a.80.89a.

**Medium: PDA. Mean Growth Rate:** (n = 12) 1 wk, 1 mm; 2 wks, 3.5 mm; 3 wks, 6.3 mm; 4 wks, 8.4 mm; 5 wks, 11.5 mm; 6 wks, 14 mm. **Macromorphology:** Advancing zone very narrow, slightly raised, silky and white at first, by Week VI becoming felty and reddish orange or pale greyish brown. Aerial mycelium appressed, or raised and radially folded; initially felty overall, colored white or buff, overlaying pale orangish tan submerged mycelium; becoming zonate by Week VI, felty on the margin, crustose in older regions, zones colored pale greyish brown, greyish orange, or dark brown, sometimes overlaid by orangish tan, farinose mycelium. Reverse grading from greyish orange to "tawny" or dark brown; with a "tawny" pigment diffused in the agar well beyond the colony margin. Odor mildly musty or of coconut. **Micromorphology:** Advancing zone hyphae similar to those on MEA. Aerial hyphae of younger regions 1.5-3 µm diam, loosely interwoven, frequently-branched, diverticulate; aerial hyphae of older regions forming a well-developed *textura intricata*; hyphae 2-4 µm diam, infrequently- or frequently-branched, with scattered broad diverticula,

hyaline or pale yellow, dextrinoid in mass, with walls up to 1 µm thick, clamped; some regions with numerous suberect terminal cells, these strangulate, rarely lobed; aerial hyphae giving rise to dextrinoid dendrotrichomoid elements which often form a densely interwoven layer overlaying the *textura intricata*. Submerged hyphae 2-5 µm diam, infrequently-branched, irregular in outline, hyaline or pale ochraceous, weakly dextrinoid, thin-walled, clamped, with a KOH-soluble brown pigment. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (weakly +), Peroxidase (+). Week VI: Laccase (+/-), Tyrosinase (weakly +), Peroxidase (+). **Nobles Code:** 2.3c.11i.37.39. 47.51.54a. **Stalpers Code:** 1.2.3.10.25.28.29.(30).34.36.38b.38e.39. 44.45.52.53.61.64.65.(67).68a.89a. **Isolates Examined:** DED 4071, 4387, 4438, 4589.

**Commentary**. PDA-grown isolates of var. *lachnophyllus* are characterized by: a) felty to crustose, zonate culture mats colored greyish brown, greyish orange and dark brown; b) matching reverse coloration with widely diffused tawny pigment; c) *textura intricata* tissue; and d) numerous dextrinoid dendrotrichomoid elements which sometimes form a densely interwoven layer over the culture mat tissue. Isolates of var. *lachnophyllus* differed from those of var. *cohaerens* in formation of a distinct culture mat tissue, and in presence of a widely diffused tawny pigment in the agar. Isolates of the former variety differed from those of *M. strictipes* and *M. cystidiosus* in formation of dextrinoid dendrotrichomoid elements, and in reverse coloration. In var. *lachnophyllus*, the reverse of PDA-grown isolates exhibited a diffused tawny pigment, *i.e.*, orange with brown tints,

whereas in isolates of *M. strictipes* and *M. cystidiosus* the reverse showed yellow, orange or golden colors, lacking brown tints.

***MARASMIUS CILIATOMARGINATUS***

**Medium: MEA. Mean Growth Rate:** (n = 3) 1 wk, 20.5 mm; 2 wks, 49.5 mm; 3 wks, plates covered. **Macromorphology:** Advancing zone submerged, silky; hyphae hyaline. Aerial mycelium absent or consisting of a few silky, radiating white hyphal strands. Reverse unchanged. Odor not distinctive. **Micromorphology:** Advancing zone hyphae 1.5-3 µm diam, frequently-branched, diverticulate, staghorn-like, hyaline, inamyloid, thin-walled, clamped. Aerial hyphae rare, mostly infrequently-branched, with few staghorn-like elements, otherwise like advancing zone hyphae. Submerged hyphae 2-7 µm diam, infrequently-branched, sparsely diverticulate, hyaline, inamyloid, thin-walled, clamped. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (-), Peroxidase (+). Week VI: Laccase (-), Tyrosinase (-), Peroxidase (-). **Nobles Code:** 2a.3c.11a.36.38.43.54a. **Stalpers Code:** 1.3.7.13.16.30.37a.39.44.45.52-54.61.65.89a.

**Medium: PDA. Mean Growth Rate:** (n = 3) 1 wk, 21 mm; 2 wks, 54.5 mm; 3 wks, plates covered. **Macromorphology:** Advancing zone submerged, silky; hyphae hyaline. Aerial mycelium at first cottony or subfelty, by Week II becoming felty or subcrustose, colored "light buff" overall. Reverse ochraceous with scattered dark brown spots. Odor mildly raphanoid. **Micromorphology:** Advancing zone hyphae 1.5-2 µm diam, frequently-branched and diverticulate, and 2-4 µm diam, infrequently-branched and sparsely diverticulate; hyphae hyaline,

weakly dextrinoid in mass, thin-walled, clamped. Aerial mycelium forming a well-developed *textura intricata*; hyphae 2.5-7 µm diam, cylindric or irregular in outline, infrequently-branched, with or without scattered broad diverticula, hyaline or pale ochraceous, inamyloid, clamped, with walls up to 0.5 µm thick; tissue of older regions overlaid by interwoven, inamyloid or dextrinoid dendrotrichomoid elements plus repent, narrow (-1.5 µm diam), skeletalized hyphae with aseptate, filiform side-branches similar to "arms" of dendrotrichomoid elements. Submerged hyphae 2-4 µm diam, infrequently-branched, irregularly cylindric, hyaline or pale brown, inamyloid, thin-walled, clamped. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (weakly +), Peroxidase (+). Week VI: Laccase (-), Tyrosinase (+), Peroxidase (+). **Nobles Code:** 2.3c.8d.11i.36. 39.43.51.54a. **Stalpers Code:** 1.2.3.7.13.25.31.38d.38e.39.44.45.47. 52-54.64.65.(67).68a.89a. **Isolates Examined:** DED 4414.

**Commentary**. Diagnostic features of PDA-grown isolates of *M. ciliatomarginatus* include: a) moderately fast growth rate; b) felty or subcrustose culture mats evenly colored "light buff"; c) ochraceous reverse with brown spots; d) raphanoid odor; e) *textura intricata* tissue; and f) numerous dextrinoid dendrotrichomoid elements. Although cultures of this species are superficially similar to those of other fast growing taxa with pallid culture mats (*e.g., M. graminum, falcatipes, pseudobambusinus*), when taken in combination, the suite of characters described above is distinctive for *M. ciliatomarginatus*.

***MARASMIUS FALCATIPES***

**Medium: MEA. Mean Growth Rate:** (n = 9) 1 wk, 30.7 mm; 2 wks, plates covered. **Macromorphology:** Advancing zone submerged, silky; hyphae hyaline. Aerial mycelium at first downy or subcottony, white; by Week VI becoming cottony, remaining white or in older regions becoming pale ochraceous or brownish orange. Reverse unchanged. Odor not distinctive. **Micromorphology:** Advancing zone hyphae 1.5-3.5 µm diam, infrequently-branched and non-diverticulate, or frequently-branched and diverticulate, hyaline, inamyloid, thin-walled, clamped. Aerial hyphae rare, 1.5-4 µm diam, typically frequently-branched, densely diverticulate, with scattered bundles of infrequently-branched and sparsely diverticulate hyphae; hyphae hyaline, inamyloid, thin-walled, clamped. Submerged hyphae similar to aerial hyphae but many staghorn-like, some contorted. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (weakly +/-), Peroxidase (weakly +). Week VI: Laccase (-), Tyrosinase (-), Peroxidase (+). **Nobles Code:** 2.3c.11a. 36.38.42.54a.56. **Stalpers Code:** 1.2.3.6.13.17.21.30.37a.39.45.52. 53.61.65.89a.91.

**Medium: PDA. Mean Growth Rate:** (n = 9) 1 wk, 29.7 mm; 2 wks, plates covered. **Macromorphology:** Advancing zone submerged, silky; hyphae hyaline. Aerial mycelium thickly woolly overall, initially white, by Week VI becoming cream buff with scattered patches of ochraceous or pale brown mycelium. Submerged mycelium ochraceous. Reverse grading from cream to golden, brownish orange or brown. Odor not distinctive. **Micromorphology:** Advancing zone hyphae 1.5-3.5 µm diam, mostly infrequently-branched and non-diverticulate, few

frequently-branched and diverticulate, hyaline, inamyloid, thin-walled, clamped. Aerial hyphae 1.5-3 µm diam, densely interwoven, many infrequently-branched and non-diverticulate, many frequently-branched and diverticulate, hyaline, inamyloid; with or without narrow dextrinoid, skeletalized hyphae and dextrinoid dendrotrichomoid elements; with glassy, hyaline, amorphous crystals among aerial mycelium. Submerged hyphae 2-4 µm diam, interwoven, frequently-branched, densely diverticulate, hyaline or pale ochraceous, inamyloid, thin-walled, clamped. **Phenoloxidase Reactions**: Week II: Laccase (+), Tyrosinase (+), Peroxidase (+). Week VI: Laccase (weakly +/-), Tyrosinase (+), Peroxidase (+). **Nobles Code**: 2.3c.8d.11a.36.(37). 39.42.54a.56. **Stalpers Code**: 1.2.3.6.13.22.30.31.(32).38a.39b.39e. 39.45.52.53.61.65.(67).(68a).82.89a.91. **Isolates Examined**: DED 4415, 4456, 4490.

**Commentary**. *Marasmius falcatipes* is one of the faster growing species in culture, with isolates covering 90 mm Petri plates in two weeks (on MEA and PDA). Of the taxa studied, only *M. graminum* grew faster (60 mm at Week I). Compared with *M. falcatipes*, PDA-grown isolates of *M. rotula* and *M. pseudobambusinus* displayed similar growth rates (31.7 mm and 30 mm at Week I, respectively), but these species formed different culture mat morphologies. Isolates of *M. rotula* were easily distinguished by formation of avellaneous or brown crustose mats composed of *textura angularis* tissue, whereas isolates of *M. pseudobambusinus* were more difficult to separate from cultures of *M. falcatipes*. In most macro- and micromorphological features, cultures of *M. pseudobambusinus* and *M. falcatipes* were indistinguishable.

Several subtle features may be used, however, to separate the species. PDA-grown isolates of *M. pseudobambusinus* tended to form weakly zonate culture mats with zones colored "clay" or "cinnamon buff," the aerial hyphae were often overlaid by a dense tangle of dextrinoid dendrotrichomoid elements, and spot tests for tyrosinase were negative. In comparison, culture mats of PDA-grown isolates of *M. falcatipes* were never zonate and only isolated patches of pigmented aerial mycelium were observed. Moreover, dendrotrichomoid elements were less well-developed, and spot tests for tyrosinase were positive.

For a comparison of the differences between isolates of *M. falcatipes* and *M. graminum*, see the commentary on the latter species.

***MARASMIUS SPISSUS***

**Medium: MEA. Mean Growth Rate:** (n = 3) 1 wk, 5 mm; 2 wks, 10 mm; 3 wks, 17 mm; 4 wks, 24 mm; 5 wks, 30 mm; 6 wks, 35 mm. **Macromorphology:** Advancing zone submerged, silky; hyphae hyaline. Aerial mycelium absent or consisting of a few silky, radiating, white hyphal strands. Reverse unchanged. Odor fragrant, slightly spicy. **Micromorphology:** Advancing zone hyphae 1.5-3.8 µm diam, frequently-branched, densely diverticulate, staghorn-like, hyaline, inamyloid, thin-walled, clamped. Aerial hyphae rare, 1.5-5 µm diam, strongly contorted and diverticulate, otherwise similar to advancing zone hyphae; with clusters of glassy, hyaline, somewhat triangular crystals among hyphae. Submerged hyphae similar to advancing zone hyphae, but many irregularly swollen at branch inceptions. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (-), Peroxidase (+).

Week VI: Laccase (+), Tyrosinase (-), Peroxidase (+). **Nobles Code:** 2a.3c.11a.(26).36.38.47.50.54a. **Stalpers Code:** 1.3.10.13.16.30.36. 37a.39.45.52.53.61.65.(80).82.89a.

**Medium: PDA. Mean Growth Rate:** (n = 3) 1 wk, 3 mm; 2 wks, 4 mm; 3 wks, 6 mm; 4 wks, 7 mm; 5 wks, 8 mm; 6 wks, 9 mm. **Macromorphology:** Advancing zone raised, somewhat lumpy, at first silky, but crustose by Week VI, colored deep red or reddish brown. Aerial mycelium forming two distinct zones: marginal region lumpy-crustose, deep reddish brown; region surrounding inoculum plug felty or velutinous, colored dark ferruginous. Submerged mycelium deep reddish brown. Reverse yellowish at Week I, but becoming deep red by Week II, with a deep red or reddish orange pigment diffused in the agar well beyond the colony margin. Odor not distinctive. **Micromorphology:** Advancing zone hyphae 2-5 µm diam, infrequently-branched, non-diverticulate or sparsely diverticulate, irregular in outline, hyaline, inamyloid, clamped. Aerial mycelium of crustose regions forming a well-developed *textura epidermoidea* composed of irregularly-shaped, long-celled hyphae 2-5 µm diam, infrequently- or frequently-branched, non-diverticulate or sparsely diverticulate, occasionally with intercalary or terminal swellings up to 15 µm diam; cells hyaline or reddish brown, clamped, with walls 0.5-1.5 µm thick. Aerial mycelium of velutinous regions composed of numerous suberect or erect hyphae 2-4 µm diam, strangulate, irregular in outline, hyaline or pale ochraceous, thin-walled, arising from and overlaying a *textura epidermoidea* tissue. Submerged hyphae similar to elements of *textura epidermoidea*, but not tightly packed together and mostly thin-walled. **Phenoloxidase**

**Reactions:** Week II: Laccase (+), Tyrosinase (-), Peroxidase (-). Week VI: impossible to determine because of darkly pigmented hyphae and agar. **Nobles Code:** 2a.3c.11.26.37.39.47.54a. **Stalpers Code:** 1.10.12.25.26.28.32.38c.39.44.45.48.52-55.64.65. 67.(75).80.89a. **Isolates Examined:** DED 4598.

**Commentary**. PDA-grown isolates of *M. spissus* are strikingly beautiful. Culture mats grew very slowly and were characterized by crustose and velutinous mycelium colored deep red or deep reddish brown. Although colonies grew to only 9 mm radius by Week VI, a deep red or reddish orange pigment diffused through the agar and filled the entire plate. These features, in combination with *textura epidermoidea* tissue and absence of dendrotrichomoid elements, are diagnostic for *M. spissus*. No isolates of any other taxon studied formed such brilliant red pigments on PDA, and consequently, cultures of *M. spissus* are not likely to be confused with those of any other.

***MARASMIUS SULLIVANTII***

**Medium: MEA**. **Mean Growth Rate:** (n = 15) 1 wk, 5.4 mm; 2 wks, 15.1 mm; 3 wks, 25.1 mm; 4 wks, 37.4 mm; 5 wks, 44.3 mm; 6 wks, 50.1 mm. **Macromorphology:** Advancing zone submerged, silky; hyphae hyaline. Aerial mycelium absent or consisting of a few, silky, radiating, white hyphal strands and a few white farinose regions. Reverse unchanged. Odor not distinctive. **Micromorphology:** Advancing zone hyphae 2-4 µm diam, mostly frequently-branched and diverticulate, few infrequently-branched and non-diverticulate, hyaline, inamyloid, thin-walled, clamped. Aerial hyphae rare, loosely interwoven, mostly

infrequently-branched and non-diverticulate or sparsely diverticulate, otherwise similar to advancing zone hyphae; with numerous, small, dextrinoid dendrotrichomoid elements; some hyphae with glassy, hyaline, plaque-like incrusting crystals. Submerged hyphae similar to advancing zone hyphae, but many irregularly swollen up to 6.5 µm diam. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (-), Peroxidase (+). Week VI: Laccase (+), Tyrosinase (-), Peroxidase (+). **Nobles Code:** 2a.3c.11a.26.36.38.47.54a. **Stalpers Code:** 1.3.9.13. 16.(20).30.37a.39.44.45.52-54.61.65.68a.80.82.89a.

**Medium: PDA. Mean Growth Rate:** (n = 15) 1 wk, 4.6 mm; 2 wks, 10.2 mm; 3 wks, 16.4 mm; 4 wks, 22.4 mm; 5 wks, 24.7 mm; 6 wks, 27 mm. **Macromorphology:** Advancing zone initially submerged, silky, white; by Week VI becoming raised, felty, colored buff or pale cream. Aerial mycelium initially appressed, felty, colored white or buff, overlaying pale yellowish grey or pale olivaceous brown submerged mycelium; by Week II becoming slightly raised and radially folded, crustose; by Week VI becoming zonate, zones colored cream buff, "olive buff," "deep olive buff" or pale greyish brown; sometimes the crustose layer is overlaid in spots by farinose, buff or cream colored mycelium. Reverse cream, or grading from cream to greyish cream, "olive buff," "deep olive buff" or greyish brown. Odor not distinctive. **Micromorphology:** Advancing zone hyphae 1.5-3 µm diam, cylindric, non-diverticulate, hyaline, weakly dextrinoid in mass, thin-walled, clamped. Aerial mycelium of marginal region forming a *textura intricata*; hyphae irregularly-shaped, swollen, hyaline, strongly dextrinoid in mass, thin-walled, clamped. Aerial mycelium of crustose

regions forming an incomplete *textura globulosa* composed of highly inflated, intercalarly and terminally swollen elements up to 20 µm diam, loosely interwoven in some areas, more tightly interwoven in other areas, with undifferentiated, cylindric hyphae interspersed among the swollen cells; some areas of tissue with erect, strangulate or cylindric terminal cells; with or without scattered dextrinoid dendrotrichomoid elements; hyphae hyaline, dextrinoid, thin-walled, clamped. Submerged hyphae 2-5 µm diam, ranging from infrequently-branched and non-diverticulate, to frequently-branched and diverticulate, often irregular in outline, hyaline, inamyloid, clamped. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (+/-), Peroxidase (+). Week VI: Laccase (+), Tyrosinase (+), Peroxidase (+). **Nobles Code:** 2.3c.10.26.37.39. 47.54a. **Stalpers Code:** 1.2.3.9.10. 12.(18).25.28.29.31.(34).38a.38e.38f.39.44.45.52-55.63.65.68a.75. 80.89a. **Isolates Examined:** DED 4072, 4342, 4434, 4452, 4595.

**Commentary**. Distinctive features of PDA-grown isolates of *M. sullivantii* included: a) zonate, crustose culture mats (with farinaceous areas) ranging in coloration from cream buff to olive buff and greyish brown; b) reverse coloration matching that of culture mats; and c) incomplete *textura globulosa* tissue. PDA-grown cultures of this species were superficially similar to those of *M. nigrodiscus*, but the latter formed felty culture mats composed of *textura intricata* tissue, and deep yellow acicular crystals were clustered throughout the culture mat.

***MARASMIUS PSEUDOBAMBUSINUS***

**Medium: MEA. Mean Growth Rate:** (n = 3) 1 wk, 27.5 mm; 2 wks, plates covered. **Macromorphology:** Advancing zone submerged, silky; hyphae hyaline. Aerial mycelium absent at Week II, becoming downy and white by Week VI. Reverse unchanged. Odor not distinctive. **Micromorphology:** Advancing zone hyphae 1.5-3.8 µm diam, typically infrequently-branched, sparsely diverticulate, some staghorn-like especially side branches away from the growing tip. Aerial hyphae rare, similar to advancing zone hyphae but many frequently-branched and densely diverticulate; some hyphae incrusted with small, glassy, hyaline, granular crystals. Submerged hyphae similar to advancing zone hyphae, with some swollen at branch inceptions. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (-), Peroxidase (+). Week VI: Laccase (+), Tyrosinase (-), Peroxidase (+). **Nobles Code:** 2a.3c.11a.36.38.42.56. **Stalpers Code:** 1.3.6.13.16.(17).30.37a.39. 45.52.53.61.65.82.91.

**Medium: PDA. Mean Growth Rate:** (n = 3) 1 wk, 30 mm; 2 wks, plates covered. **Macromorphology:** Advancing zone silky or woolly, hyaline or white. Aerial mycelium woolly overall at Week II, by Week VI majority of plate woolly but with a narrow appressed cottony or felty zone surrounding the inoculum plug; woolly region weakly zonate, zones colored "light buff," "clay color," and "cinnamon buff." Reverse "cinnamon buff" with patches of pale brownish orange. Odor not distinctive. **Micromorphology:** Advancing zone hyphae 1.5-5 µm diam, infrequently-branched, diverticulate, hyaline, inamyloid, thin-walled, clamped. Aerial mycelium a thick layer of loosely interwoven hyphae;

hyphae 1.5-4 µm diam, infrequently- or frequently-branched, sparsely diverticulate, hyaline, inamyloid, thin-walled; overlaid by a dense tangle of skeletalized hyphae 0.5-1.5 µm diam, these frequently-branched, aseptate, hyaline, inamyloid or weakly dextrinoid, similar to "arms" of dendrotrichomoid elements; with glassy, hyaline, amorphous crystals interspersed among aerial hyphae. Submerged hyphae 2-6.5 µm diam, frequently-branched, diverticulate, irregular in outline, some intercalary cells swollen, some hyphae coiled and contorted, hyaline, inamyloid, thin-walled, clamped. **Phenoloxidase Reactions:** Same as on MEA. **Nobles Code:** 2a.3c.8d.11a.26.37.39.42.56. **Stalpers Code:** 1.3.12.(21).22.25.32.38b.39.44.45.47.52-54.61.65.68a.80.82.91. **Isolates Examined:** DED 4353.

**Commentary**. PDA-grown isolates of *M. pseudobambusinus* were characterized by: a) fast growth rate; b) weakly zonate woolly culture mats with zones colored "clay" or "cinnamon buff;" c) aerial hyphae overlaid by a dense tangle of dendrotrichomoid-like elements; and d) negative tyrosinase reactions. For a comparison of cultural features of isolates of *M. pseudobambusinus* with those of *M. graminum* and *M. falcatipes*, see the commentaries on the latter species.

***MARASMIUS HAEMATOCEPHALUS*** var. ***HAEMATOCEPHALUS***

**Medium: MEA**. **Mean Growth Rate:** (n = 6) 1 wk, 14.8 mm; 2 wks, 36.5 mm; 3 wks, 55 mm; 4 wks, plates covered. **Macromorphology:** Advancing zone submerged, silky; hyphae hyaline. Aerial mycelium absent or consisting of a few silky, radiating, white hyphal strands. Submerged mycelium white or pale orange white under inoculum plug.

Reverse unchanged or cream-colored. Odor not distinctive. **Micromorphology:** Advancing zone hyphae 1.5-3 µm diam, frequently-branched, diverticulate, hyaline, inamyloid, thin-walled, clamped. Aerial hyphae rare, similar to advancing zone hyphae but many staghorn-like; some hyphae incrusted with numerous small, glassy, hyaline, granular or acicular crystals. Submerged hyphae 2-6 µm diam, frequently-branched, some strongly coralloid, irregular in outline, some intercalary cells swollen, hyaline, inamyloid, thin-walled, clamped. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (-), Peroxidase (+). Week VI: Laccase (weakly +), Tyrosinase (weakly +/-), Peroxidase (+). **Nobles Code:** 2.3c.11a.26.36.38.44.54.(54a). **Stalpers Code:** 1.2.3.8.13.16.20.30.37a.39.44.45.52-54.61.65.80.82. 89.(89a).

**Medium: PDA. Mean Growth Rate:** (n = 6) 1 wk, 5 mm; 2 wks, 23.8 mm; 3 wks, 39.5 mm; 4 wks, plates covered. **Macromorphology:** Advancing zone submerged, silky, hyphae hyaline or pale cream buff. Aerial mycelium zonate; inward side of zones appressed-silky and buff-colored, marginal side of zones tomentose and colored "cinnamon buff;" inoculum plug felty, colored "light buff." Submerged mycelium near plug colored orange, brownish orange or brown. Reverse unchanged. Odor not distinctive. **Micromorphology:** Advancing zone hyphae of several types: a) 1.5-3 µm diam, infrequently-branched; b) 1-2 µm diam, frequently-branched, diverticulate; c) 2-4 µm diam, staghorn-like; all hyphae hyaline, inamyloid or dextrinoid in mass, thin-walled, clamped. Aerial hyphae interwoven, similar to advancing zone hyphae, but overlaid in areas with narrow (0.5-1.5 µ diam), dextrinoid,

skeletalized hyphae, these infrequently-branched or with numerous aseptate, filiform side-branches similar to "arms" of dendrotrichomoid elements; some aerial hyphae with hyaline, granular or acicular crystal incrustations. Submerged hyphae similar to advancing zone hyphae but with intercalary cells swollen up to 8 µm diam, dextrinoid in mass, clamped. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (+), Peroxidase (+). Week VI: Laccase (+), Tyrosinase (+), Peroxidase (+). **Nobles Code:** 2.3c.8d.11a.26.36.38.44.54.(54a). **Stalpers Code:** 1.2.3.8.9.13.20.22.25.31.32.37a.44.45.47.52-54.61. 65.80.82.89.(89a). **Isolates Examined:** DED 4321, 4640.

**Commentary**. Diagnostic features of PDA-grown isolates of *M. haematocephalus* var. *haematocephalus* include: a) moderately fast growth rate; b) pallid, zonate, silky and tomentose culture mats; c) submerged hyphae near and under the inoculum plug colored brownish orange or brown, and agar lacking diffused pigments; and d) interwoven, inamyloid, thin-walled aerial hyphae overlayed by dextrinoid skeletalized hyphae with aseptate filiform side-branches.

Isolates of var. *haematocephalus* are not likely to be confused with isolates of other species if all of the features enumerated above are considered. For a comparison with var. *anomaloides* see the commentary on that variety.

***MARASMIUS HAEMATOCEPHALUS*** var. ***ANOMALOIDES***

**Medium: MEA**. **Mean Growth Rate:** (n = 6) 1 wk, 14.8 mm; 2 wks, 30.8 mm; 3 wks, 44 mm; 4 wks, 56.5 mm; 5 wks, plates covered. **Macromorphology:** Advancing zone submerged, silky; hyphae hyaline.

Aerial mycelium absent or consisting of a few silky, radiating hyaline hyphal strands. Reverse unchanged. Odor not distinctive. **Micromorphology:** Advancing zone hyphae 1.5-3 µm diam, infrequently- or frequently-branched, diverticulate, many staghorn-like, hyaline, inamyloid, thin-walled, clamped. Aerial hyphae rare, 1.5-4 µm diam, similar to advancing zone hyphae; some hyphae incrusted with glassy, hyaline, granular or acicular crystals. Submerged hyphae 2-7 µm diam, frequently-branched, diverticulate, hyaline, inamyloid, thin-walled, clamped. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (-), Peroxidase (+). Week VI: Laccase (+), Tyrosinase (-), Peroxidase (+). **Nobles Code:** 2a.3c.11a.36.38.45.54.(54a). **Stalpers Code:** 1.3.8.13.16.20.30.37a.39.44.45.52-54.61.65.82.89.(89a).

**Medium: PDA. Mean Growth Rate:** (n = 6) 1 wk, 14 mm; 2 wks, 39.8 mm; 3 wks, 60.5 mm; 4 wks, plates covered. **Macromorphology:** Advancing zone silky or cottony, hyaline or white. Aerial mycelium zonate; inward side of zones felty, colored "light buff," marginal side of zones woolly, colored "cinnamon buff;" inoculum plug appressed-felty, colored "light buff." Submerged mycelium near and under plug greyish brown or brown. Reverse with a pale brownish orange diffused pigment. Odor slightly rancid, like cat urine. **Micromorphology:** Advancing zone hyphae 1.5-4 µm diam, infrequently- or frequently-branched, diverticulate, some staghorn-like, hyaline, weakly dextrinoid in mass, thin-walled, clamped. Aerial hyphae interwoven, similar to advancing zone hyphae, but with scattered, inamyloid or weakly dextrinoid skeletalized hyphae <1.5 µm diam, these with numerous aseptate filiform side-branches similar to "arms" of dendrotrichomoid

elements; some aerial hyphae with glassy, hyaline, granular or acicular crystal incrustations. Submerged hyphae similar to advancing zone hyphae but with intercalary cells swollen up to 7 µm diam. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (+), Peroxidase (+). Week VI: Laccase (+), Tyrosinase (+), Peroxidase (+). **Nobles Code:** 2.3c.8d.11a.26.36.39.44.53.54.(54a). **Stalpers Code:** 1.2.3.7.8.13.22.25.31.32.36.38b.39.44.45.47.52-54.61.65.80.82.89.(89a). **Isolates Examined:** DED 4322, 4711.

**Commentary**. Isolates of *M. haematocephalus* var. *anomaloides* were nearly indistinguishable from those of var. *haematocephalus*, differing in only a few macromorphological characters. PDA-grown isolates of var. *anomaloides* grew slightly faster than those of var. *haematocephalus* (60.5 mm at Week III v.s. 39.5 mm, respectively), had a slightly rancid odor, and showed a pale brownish orange pigment diffused in the agar. In contrast, isolates of var. *haematocephalus* lacked a distinctive odor and did not develop diffused pigments.

***MARASMIUS SICCUS***

**Medium: MEA. Mean Growth Rate:** (n = 6) 1 wk, 16.3 mm; 2 wks, 37.3 mm; 3 wks, 58.5 mm; 4 wks, plates covered. **Macromorphology:** Advancing zone submerged, silky; hyphae hyaline. Aerial mycelium poorly-developed, consisting of a few silky, radiating, hyaline or white hyphae. Reverse unchanged. Odor not distinctive. **Micromorphology:** Advancing zone hyphae 1.5-4 µm diam, frequently-branched, non-diverticulate or diverticulate, some coiled, hyaline, inamyloid, thin-walled, clamped. Aerial hyphae rare, similar to

advancing zone hyphae but with scattered, dextrinoid dendrotrichomoid elements. Submerged hyphae loosely interwoven, highly irregular in outline, with numerous intercalary and terminal swellings up to 13 µm diam, hyaline, inamyloid, thin-walled, clamped. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (weakly +/-), Peroxidase (+). Week VI: Laccase (-), Tyrosinase (-), Peroxidase (+). **Nobles Code:** 2.3c.(11a).26.38.44.54a. **Stalpers Code:** 1.2.3.8.13.(16).20. 30.37a.39.44.45.52-55.65.68a.80.89a.

**Medium: PDA. Mean Growth Rate:** (n = 6) 1 wk, 11.5 mm; 2 wks, 33 mm; 3 wks, 53 mm; 4 wks, plates covered. **Macromorphology:** Advancing zone silky or plumose, hyphae white or pale yellow. Aerial mycelium initially cottony, colored white or buff, with rare pink, subfelty areas, overlaying pale pinkish brown submerged mycelium; by Week VI mycelium becoming appressed and weakly zonate, pink tones disappearing; zones cottony, colored buff, cream or pale yellowish white, and subfelty, colored cream buff, greyish yellow or pale ochraceous; all zones overlaying dark ochraceous ("Saccardo umber") submerged mycelium. Reverse splotchy, with areas colored cream, ochraceous, brown or dark brown; with a golden or ochraceous pigment diffused through the agar. Odor slightly musty. **Micromorphology:** Advancing zone hyphae 1.5-4 µm diam, frequently-branched, non-diverticulate or diverticulate, hyaline, inamyloid, thin-walled, clamped. Aerial hyphae 2-5 µm diam, densely interwoven but not forming a distinct tissue, frequently-branched, sparsely diverticulate, hyaline, inamyloid, thin-walled, clamped; with scattered, narrow, dextrinoid skeletalized hyphae, these typically unbranched, but occasionally with aseptate, filiform side-branches

similar to "arms" of dendrotrichomoid elements. Submerged hyphae 2-5 μm diam, frequently-branched, diverticulate, hyaline or pale ochraceous, inamyloid, thin-walled, clamped; with hyaline, irregularly-shaped, globular crystals in the agar. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (weakly +), Peroxidase (+). Week VI: Laccase (-), Tyrosinase (+), Peroxidase (+). **Nobles Code:** 2.3c.8d.11a.37.39.44.51.54a. **Stalpers Code:** 1.2.3.8.13.21. 24.31.35.36.38a.38d.38e.39.45.46.52.53.65.(67).83.89a. **Isolates Examined:** DED 4314, 4464.

**Commentary**. PDA-grown isolates of *M. siccus* were morphologically similar to those of *M. fulvoferrugineus* and *M. decipiens*. All three species formed cottony to woolly or subfelty to felty culture mats colored buff, cream buff, ochraceous or with grey tones, and all had similar phenoloxidase reactions. PDA-grown isolates of *M. fulvoferrugineus* differed from those of *M. siccus* in slower growth rate, reddish brown or dark brown reverse coloration with "orange rufous" diffused pigments, and in absence of dextrinoid skeletalized aerial hyphae. In PDA-grown isolates of *M. siccus*, red tones were absent in the agar. For a comparison with cultures of *M. decipiens*, see the commentary on that species.

***MARASMIUS PULCHERRIPES***

**Medium: MEA. Mean Growth Rate:** (n = 24) 1 wk, 11.9 mm; 2 wks, 29.4 mm; 3 wks, 43.6 mm; 4 wks, plates covered. **Macromorphology:** Advancing zone submerged, silky; hyphae hyaline. Aerial mycelium absent or poorly-developed, appressed, silky or subcottony, hyphae

hyaline or pale olive buff. Submerged mycelium grading in color from margin inward, hyaline, pale yellowish olive, greyish olive and olive brown. Reverse pale yellowish olive. Odor mildly fruity. **Micromorphology:** Advancing zone hyphae 1.5-3.5 µm diam, frequently-branched, diverticulate, staghorn-like, hyaline, inamyloid, thin-walled, clamped. Aerial hyphae rare, similar to advancing zone hyphae, but many with hyaline, short-acicular crystal incrustations. Submerged hyphae 2-5 µm diam, loosely interwoven, frequently-branched, many coralloid, many swollen at branch inceptions; hyaline, pale yellow or pale yellowish olive, inamyloid, thin-walled, clamped. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (weakly +), Peroxidase (+). Week VI: Laccase (+/-), Tyrosinase (weakly +/-), Peroxidase (weakly +/-). **Nobles Code:** 2.3c.11a.37.38.44.50.54a. **Stalpers Code:** 1.2.3.8.13.16.(35).36.38d.38f.39.45.52.53.61.65.(67).82.89a.

**Medium: PDA. Mean Growth Rate:** (n = 24) 1 wk, 8.1 mm; 2 wks, 16.9 mm; 3 wks, 24.1 mm; 5 wks, 36.2 mm; 6 wks, 44.6 mm. **Macromorphology:** Advancing zone submerged or with few aerial hyphae, silky or cottony, forming plumose outgrowths after several weeks, colored white, buff, olive buff, greyish buff or rarely with pink tints. Aerial mycelium initially thickly cottony or woolly, colored buff, pinkish buff, olive buff or olivaceous, overlaying dark olivaceous submerged mycelium; by Week VI becoming zonate, zones buff or olive buff and woolly, yellowish olive and subfelty, olive or dark olive and felty, dark olive or charcoal and subcrustose, rarely avellaneous and felty. Submerged mycelium olive or dark olive. Reverse colors matching those of the culture mat, with a tawny or tawny

olive pigment diffused in the agar. Odor musty, slightly like pipe tobacco. **Micromorphology:** Advancing zone hyphae similar to those on MEA, staghorn-like, weakly dextrinoid in mass. Aerial hyphae 2-4 µm diam, forming a densely interwoven layer with suberect or erect terminal cells; hyphae frequently-branched, sparsely diverticulate, hyaline, pale yellow or pale olive, thin-walled, inamyloid, clamped; with deep green globular crystals (in KOH) among aerial hyphae, also some hyphal contents deep green. Older subcrustose aerial mycelium formed of interwoven, irregularly swollen hyphae up to 14 µm diam, ochraceous or olivaceous, with walls up to 1 µm thick. Submerged hyphae 2-3 µm diam, frequently-branched, sparsely-diverticulate, pale olive, inamyloid, thin-walled, clamped; hyphal contents globular, olivaceous. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (weakly +), Peroxidase (+). Week VI: Laccase (+), Tyrosinase (+), Peroxidase (+). **Nobles Code:** 2.3c.11a.26.37.39.47. 51.54a. **Stalpers Code:** 1.2.3.9.13.21.22.25.29.36.38e.38.39.44.45. 52-55.61.65.67.80.82.89a. **Isolates Examined:** DED 4017, 4057, 4075, 4326, 4343, 4390, 4487, 4596.

**Commentary**. Isolates of *M. pulcherripes* were distinct from those of all other species in this study because of the formation of olivaceous pigments. When grown on MEA, pale yellowish olive or greyish olive pigments developed in most isolates by Week II. On PDA, deep olivaceous pigments were present from the onset of growth. Eight isolates were examined from material collected in various areas of the southern Appalachian Mountains, and very little variation in pigmentation was observed between isolates. The presence of olivaceous

pigments in PDA-grown cultures of *M. pulcherripes* is an unusual phenomenon, considering that no such pigments are formed in basidiomata of this species. In general, the members of sect. *Sicci* examined in these cultural studies formed similar pigments in culture to those exhibited by their basidiomata (*cf., M. siccus, fulvoferrugineus, falcatipes, spissus, pseudobambusinus,* etc.).

***MARASMIUS FULVOFERRUGINEUS***

**Medium: MEA. Mean Growth Rate.** (n = 12) 1 wk, 9 mm; 2 wks, 16.5 mm; 3 wks, 26.9 mm; 5 wks, 44.7 mm; 6 wks, 51.7 mm. **Macromorphology:** Advancing zone submerged, silky; hyphae hyaline. Aerial mycelium poorly-developed, appressed, silky, hyaline; with plumose outgrowths developed on margin by Week VI. Reverse unchanged. Odor not distinctive or mildly of coconut. **Micromorphology:** Advancing zone hyphae 1.5-3 µm diam, frequently-branched, diverticulate, hyaline, inamyloid, thin-walled, clamped. Aerial hyphae rare, similar to advancing zone hyphae, but giving rise to scattered dextrinoid dendrotrichomoid elements. Submerged hyphae 1-5 µm diam, loosely interwoven, frequently-branched, many cells empty, hyaline, inamyloid, thin-walled, clamped. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (weakly +/-), Peroxidase (+). Week VI: Laccase (+/-), Tyrosinase (-), Peroxidase (+). **Nobles Code:** 2.3c.11a.26.38.47.54a. **Stalpers Code:** 1.2.3.9.13.16.(20).30.37a.39.45.52.53.65.68a.89a.

**Medium: PDA. Mean Growth Rate.** (n = 12) 1 wk, 2.6 mm; 2 wks, 12 mm; 3 wks, 21.4 mm; 5 wks, 33.9 mm; 6 wks, 38.9 mm. **Macromorphology:** Advancing zone silky or cottony, colored buff or

"tawny." Aerial mycelium near margin woolly or tomentose, colored white, buff, cream buff or pale greyish brown; aerial mycelium near inoculum plug felty, colored cream, mustard yellow or orange buff. Submerged mycelium dark brownish orange. Reverse reddish brown or dark brown with scattered brownish orange areas; with an "orange rufous" pigment diffused in the agar. Odor mildly musty. **Micromorphology:** Advancing zone hyphae 1.5-3.5 µm diam, infrequently-branched, rarely diverticulate, hyaline, inamyloid, thin-walled, clamped. Aerial hyphae 1.5-5 µm diam, interwoven, frequently-branched, non-diverticulate or sparsely diverticulate, some hyphae irregular in outline, hyaline, inamyloid or weakly dextrinoid in mass, thin-walled or with walls up to 0.8 µ thick, clamped; with numerous hyaline, irregularly-shaped or globular crystals among hyphae; no dendrotrichomoid elements observed. Submerged hyphae similar to aerial hyphae; with scattered hyaline, octahedral crystals in agar. **Phenoloxidase Reactions:** Week II: Laccase (+), Tyrosinase (weakly +), Peroxidase (+). Week VI: Laccase (-), Tyrosinase (+), Peroxidase (+). **Nobles Code:** 2.3c.7.(11a). 36.39.47.51.54a. **Stalpers Code:** 1.2.3.9.13.22.25.30.31.36.38b.38c. 38e.39.45.52.53.(65).82.83.89a. **Isolates Examined:** DED 4324, 4420, 4501, 4656.

**Commentary**. Diagnostic features of PDA-grown isolates of *M. fulvoferrugineus* included: a) moderately slow growth rate; b) woolly and felty culture mats ranging in color from white, buff or cream buff, to orange buff, mustard yellow or greyish brown; c) reddish brown reverse coloration with an "orange rufous" diffused pigment; d) crystal formation; and e) absence of conspicuous dendrotrichomoid

elements. Cultures of this species were superficially similar to those of *M. decipiens* and *M. siccus*. For a comparison of cultural morphologies, see the commentaries on the latter species.

## SYNOPTIC KEY

A synoptic key is included with the hope that it may facilitate identification of cultures of *Marasmius* species. Unlike a dichotomous key, where entry into the key must be at the first couplet, the synoptic key may be entered at any point. Only those cultural characters which have been determined as taxonomically valuable have been included. Important diagnostic features of MEA-grown isolates are itemized separately from those of PDA-grown isolates. All character states have been determined from six week-old cultures. Parentheses indicate that the taxon only rarely exhibits that particular feature or that not all isolates of the taxon show the feature. Species are indicated in the key by the number given in the list below.

1. *brevipes*
2. *straminipes* var. *straminipes*
3. *straminipes* var. *fibulatus*
4. *pallidocephalus*
5. *androsaceus*
6. *graminum*
7. *capillaris*
8. *rotula*
9. *felix*
10. *decipiens*
11. *nigrodiscus*
12. *cystidiosus*
13. *oreades*
14. *strictipes*
15. *pyrrhocephalus*

16. *scorodonius*
17. *delectans*
18. *cohaerens* var. *cohaerens*
19. *cohaerens* var. *lachnophyllus*
20. *ciliatomarginatus*
21. *falcatipes*
22. *spissus*
23. *sullivantii*
24. *pseudobambusinus*
25. *haematocephalus* var. *haematocephalus*
26. *haematocephalus* var. *anomaloides*
27. *siccus*
28. *pulcherripes*
29. *fulvoferrugineus*

## MEA-GROWN ISOLATES

CULTURE MAT TEXTURE

Aerial mycelium absent or poorly-developed: 1, 4, 6, 9, 10, 11, 12, 13, 14, 17, 18, 19, 20, 22, 23, 24, 25, 26, 27, 28, 29.

Aerial mycelium well-developed, cottony or woolly, lacking crustose regions at Week VI: 2, 3, 5, 21.

Aerial mycelium with crustose regions by Week VI: (5), 7, 8, 15, 16.

SUBMERGED MYCELIUM COLORATION

Submerged mycelium distinctly pigmented, ochraceous, brownish orange or olivaceous: 10, (15), (19), 28.

Submerged mycelium unpigmented, hyaline or white: all other taxa.

CULTURE MAT MICROMORPHOLOGY

Distinct tissues formed, *i.e., textura intricata* or *textura angularis*: 5, 7, 8, 15, 16.

No distinct tissues formed: all other taxa.

Dendrotrichomoid elements formed (at least in some isolates): 10, (14), 17, 18, 19, 23, 27, 29.

No dendrotrichomoid elements formed: all other taxa.

Aerial hyphae with hyaline, crystal incrustations: 14, 23, 24, 25, 26, 28.

Aerial hyphae lacking crystal incrustations, although non-incrusting crystals may be present among hyphae or in agar: all other taxa.

## PDA-GROWN ISOLATES

MEAN GROWTH RATE

Plates covered by Week II: 6, 8, 21, 24.

Plates covered by Week III: 7, 20.

Plates covered by Week IV: 1, 3, 4, 9, 25, 26, 27.

Plates covered by Week V: 16.

Plates covered by Week VI: 5, 15.

Plates 40-70 mm radius at Week VI: 2, (5), 10, 13, (16), 28, (29)

Plates <40 mm radius at Week VI: 11, 12, 13, 14, 17, 18, 19, 22, 23, 29.

CULTURE MAT COLORATION

Aerial mycelium entirely white, buff, tan or cream-colored: 1, 4, (5), 6, 9, 10, 13, 17, 20, 21, 23, 24, 25, 26, (27), 29.

Aerial mycelium orange or brownish orange (at least in part): 2, 3, 5, 6, 7, 12, (13), 14, 15, 19, 24, 25, 26.

Aerial mycelium red or brownish red (at least in part): (14), 22.

Aerial mycelium yellow or ochraceous (at least in part): 5, 10, 17, (21), 29.

Aerial mycelium brown, greyish brown or dark brown (at least in part): 1, 2, 3, 5, 8, 11, 14, 15, 16, 18, 19, (21), 23, 29.

Aerial mycelium olivaceous (at least in part): 23, 28.

CULTURE MAT TEXTURE

Silky, downy, cottony or floccose: 4, 9, (24), 25, 27.

Woolly: 1, 2, 3, 4, 5, 6, (7), 9, 10, 13, 15, 21, 24, 25, 26, 28, 29.

Subfelty or felty: 2, 3, 5, (7), (8), 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 22, 24, 26, 27, 28, 29.

Crustose: 1, 2, 3, 5, 7, 8, 14, (15), (16), 19, 22, 23.

Zonate: 2, 3, 5, 7, 15, 16, 19, 23, 25, 26, (27), 28.

REVERSE COLORATION

Unchanged: 1, 6, 8, 13, 25.

Cream: 1, 4, 5, 6, 7, 8, 9, 11, 13, 14, 17, 18, 21, 23, 25, 27.

Orange or brownish orange: 2, 3, 5, (6), 7, 9, 10, 12, 13, 14, (18), 19, 21, 24, 26.

Red or brownish red: 15, 22, 29.

Yellow or ochraceous: 2, 3, 4, 5, 11, 14, 16, 17, 20, 27.

Brown, greyish brown or dark brown: 2, 3, 5, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 27, 29.

Olivaceous: 23, 28.

ODOR OF CULTURES

Sweet or fruity: 4, (5).

Musty or of coconut: 10, 11, 12, 14, 19, 27, 28, 29.

Antiseptic or of ethanol: 1.

Rancid or raphanoid: 20, 26.

Not distinctive: all other taxa.

TISSUE-TYPE

No distinct tissue formed: 4, (5), 6, 9, 10, 13, 18, 21, 24, 25, 26, 27, 28, 29.

*textura globulosa*: 17, 23.

*textura angularis*: 5, 7, 8, 16.

*textura intricata*: 2, 5, 11, 12, 14, 15, 19, 20, 23.

*textura epidermoidea*: 1, 2, 3, 5, 14, 16, 22.

OTHER DIFFERENTIATED ELEMENTS

Dendrotrichomoid elements and/or dextrinoid skeletalized hyphae with aseptate, filiform side-branches present: (6), 10, 11, 13, 17, 18, 19, 20, 21, 23, 24, 25, 26, 27.

Dendrotrichomoid elements and dextrinoid skeletalized hyphae absent: 1, 2, 3, 4, 5, 7, 8, 9, 12, 14, 15, 16, 22, 28, 29.

Submerged hyphae with swollen intercalary or terminal cells: 2, 3, 6, 7, 8, 9, 11, (22), 24, 25, 26.

Submerged hyphae lacking swollen cells: 1, 4, 5, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 23, 27, 28, 29.

CLAMP CONNECTIONS

Absent: 2, 4.

Present: all other taxa.

CRYSTAL FORMATION

Hyphae with crystal incrustations: 6, 25, 26.

Non-incrusting crystals present among aerial hyphae: 11, 21, 24, 28, 29.

Non-incrusting crystals present in agar: 27, 29.

Crystals absent: all other taxa.

# CHAPTER VII

## PHENOLOXIDASE STUDIES

Species of *Marasmius* and allied genera [*i.e., Marasmieae* and *Collybieae sensu* Singer (1986)] constitute a large part of the litter-decomposing mushrooms of the world. Most are saprophytic, but a few are parasitic on economically important plants (*e.g.*, grasses, rubber, tea, coffee, sugarcane). In addition, many *Marasmii* are host-specific, capable of utilizing the litter of only a single host genus or family (Singer, 1976; Desjardin, 1985a,b). Lindeberg (1944, 1955) indicated that many saprophytic basidiomycetes, such as *Collybia* and *Marasmius*, were able to decompose lignin as well as polysaccharides present in forest litter. Although the specific effects of these organisms on lignin are poorly understood, Kirk (1971) suggested that their mode of attack was by the production of the extracellular phenol-oxidizing enzymes laccase (*p*-diphenol: oxygen oxidoreductase, EC 1.10.3.2), tyrosinase (*o*-diphenol: oxygen oxidoreductase, EC 1.10.3.1) and peroxidase (donor: hydrogen peroxide reductase, EC 1.11.1.7). This hypothesis was later confirmed by Harkin and Obst (1973) and others. Traditionally, the term "white-rot" has been applied to those fungi capable of degrading lignin plus carbohydrates, while the term "brown-rot" has been applied to fungi that degrade only the carbohydrate portion of litter, leaving a brownish, crumbly residue composed primarily of lignin (Davidson *et al.*, 1938, 1942; Nobles, 1948; Stalpers, 1978).

Until 1958, presence or absence of phenoloxidases was determined by the Bavendamm test (Bavendamm, 1928). As described by Bavendamm, fungi were grown on malt extract agar containing 0.5% gallic acid or tannic acid. Fungi producing phenoloxidases (*i.e.*, corresponding to white-rot fungi) formed darkly pigmented diffusion zones around the culture mat, whereas brown-rot fungi did not form dark discolored areas. Although originally white-rot versus brown-rot data were used only as a means of easily dividing cultures into two groups (*cf.*, Nobles, 1965; Stalpers, 1978), recently this difference has been considered fundamental and used taxonomically at the generic level (Gilbertson, 1980; Redhead & Ginns, 1985).

For the majority of taxa examined in the pioneering works on cultural morphology of Basidiomycetes (Davidson *et al.*, 1938, 1942; Nobles, 1948), rot-type was diagnosed using the Bavendamm test. A number of taxa, however, gave inconclusive results. Moreover, it was noted by these workers and others (Lyr, 1958) that the high concentration of gallic or tannic acid suggested by Bavendamm inhibited mycelial growth or induced abnormal growth in some taxa. To avoid such complications, Lyr (1958) suggested reducing the concentration of gallic or tannic acid to 0.08-0.1%, and Boidin (1951) suggested avoiding the use of these acids altogether, instead using guaiacol in malt agar at pH 4.5. Around the same time, several other workers suggested additional ways to avoid the shortcomings of the Bavendamm test while yielding comparable results; *e.g.*, Jorgensen and Vejlby (1953) used red cabbage extract in malt agar, and Etheridge (1957) used

a casein hydrolyzate medium with wood meal from which the phenolic substances had been removed.

All of the above-mentioned tests for phenoloxidase production shared the same problem: preparation of the media was laborious and the incubation period was too time-consuming. Another problem was the inability of the tests to differentiate between laccase, tyrosinase or peroxidase. Nobles (1958) was the first to develop a rapid spot test for the determination of extracellular oxidases. This test involved placing a drop of gum guaiac solution (0.5 gm gum guaiac in 30 ml 95% ethanol) on actively growing cultures. If extracellular oxidase was present in the cultures, a blue color appeared in 2 to 3 minutes after application. Although this test was originally thought to be specific for laccase (Nobles, 1958), it was shown later by Harkin and Obst (1973) that tyrosinase and peroxidase catalyzed the same reaction. To summarize, if one wanted to determine the presence of phenoloxidases in cultures, most of the tests noted above would be satisfactory (some more so than others depending on the species examined). However, if one wanted to differentiate the different phenoloxidases present, none of the aforementioned tests were satisfactory.

During a search for enzyme-specific spot tests, Harkin and Obst (1973) discovered that syringaldazine [N, N'-*bis*-(3,5-dimethoxy-4-hydroxybenzylidene) hydrazine] was an excellent substrate for the rapid detection of laccase, or in its absence, of peroxidase. Syringaldazine proved to be specific for laccase because: a) when added directly to tyrosinase, no positive reaction resulted; and b) it did not autooxidize and form organic hydroperoxide, so interference from

peroxidase plus endogenous hydroperoxide was excluded. A positive test was indicated by a red, reddish violet or purple reaction. In the absence of laccase in cultures, Harkin and Obst (1973) indicated that peroxidase production could be tested with syringaldazine plus a drop of aqueous 0.3% hydrogen peroxide (positive reaction = purple). Taylor (1974) and Stalpers (1978) noted that peroxidase could be detected by application of 0.4% hydrogen peroxide plus 1% pyrogallol (1,2,3-trihydroxybenzene), resulting in a yellowish brown positive reaction. Additionally, Marr (1979, 1984) indicated that L-tyrosine and *p*-cresol were excellent substrate-specific reagents for the detection of tyrosinase (*i.e.*, not oxidized by laccase or peroxidase, and non-autooxidizable *in vitro*). A positive test was indicated by a brownish orange or reddish brown reaction.

Recently, Marr *et al.* (1986) revealed the taxonomic potential of substrate-specific spot tests for laccase and tyrosinase. In a study of 222 species representing 22 families of Basidiomycetes, Marr *et al.* segregated the taxa into four categories delimited by the quantities of laccase and tyrosinase present. Their study did not entail a comparison of phenoloxidase type or quantity in cultures of somatic hyphae. Rather, they examined phenoloxidase activity in freshly obtained basidiomata of each taxon. The four categories established by Marr *et al.* (1986) were: Group I - Laccase and tyrosinase absent; Group II - Tyrosinase dominant; Group III - Laccase dominant; Group IV - Laccase and tyrosinase reactions equivalent. Only two species of *Marasmius sensu stricto* were included (*M. pallidocephalus, M. rotula*), but each was placed in a different category. No data on laccase and

tyrosinase production by cultures of *Marasmius* species could be located in the literature.

With Marr's *et al*. (1986) analyses and the paucity of published data in mind, the following questions were asked. Can the presence or absence of laccase, tyrosinase and peroxidase in *Marasmius* species be used as a taxonomic character? If so, then at what taxonomic level: infrageneric, interspecific or infraspecific? Is phenoloxidase production consistent within species? Does age or culture medium affect phenoloxidase production? Is the occurrence of phenoloxidases in cultures of *Marasmius* directly correlated with their occurrence in basidiomata? Answers to these questions were sought through an investigation of phenoloxidase production in southern Appalachian *Marasmii*.

## RESULTS AND DISCUSSION

Spot tests for presence or absence of laccase, tyrosinase and peroxidase were performed on somatic hyphae of 90 isolates representing 29 taxa of *Marasmius*. The isolates tested were the same as those utilized in the studies on cultural morphology (Table 2, Chapter VI). In addition, spot tests for laccase and tyrosinase were performed on living basidiomata of the same collections from which the 90 isolates were obtained, plus an additional 25 collections representing various of the 29 taxa (Table 4).

**TABLE 4.** Collections of *Marasmius* Species from which Basidiomata were Spot Tested for Phenoloxidase Production.

| Specific Epithet | Collection # |
|---|---|
| *androsaceus* | 3579, 3694, 3806, 3917, 3937, 3955, 4107, 4328, 4450, 4475, 4481, 4491 |
| *brevipes* | 4367, 4586 |
| *capillaris* | 3855, 4077, 4239, 4345, 4465, 4493 |
| *ciliatomarginatus* | 4414 |
| *cohaerens* var. *cohaerens* | 4522 |
| *cohaerens* var. *lachnophyllus* | 4056, 4065, 4071, 4167, 4262, 4387, 4438, 4589 |
| *cystidiosus* | 4594 |
| *decipiens* | 3612, 4272, 4480, 4608 |
| *delectans* | 4066, 4146, 4518 |
| *falcatipes* | 4415, 4456, 4490 |
| *felix* | 4471, 4486 |
| *fulvoferrugineus* | 4074, 4324, 4420, 4501, 4656, 4713 |
| *graminum* | 3838, 4386, 4615 |
| *haematocephalus* var. *anomaloides* | 4322, 4711 |
| *haematocephalus* var. *haematocephalus* | 4321, 4640 |
| *nigrodiscus* | 4055, 4301, 4392, 4443, 4599, 4666 |
| *oreades* | 4019 |
| *pallidocephalus* | 3581, 3691, 4615 |
| *pseudobambusinus* | 4353 |
| *pulcherripes* | 4017, 4057, 4075, 4326, 4343, 4390, 4487, 4596 |
| *pyrrhocephalus* | 4218, 4273, 4437, 4467, 4503, 4573 |
| *rotula* | 3550, 3583, 3818, 4241, 4461, 4466, 4555 |
| *scorodonius* | 3952, 4238, 3875, 3975, 4500, 4554 |
| *siccus* | 4156, 4314, 4464 |
| *spissus* | 4391, 4433, 4598 |
| *straminipes* var. *fibulatus* | 4447, 4474 |
| *straminipes* var. *straminipes* | 4325 |
| *strictipes* | 4067, 4073, 4129, 4411, 4439, 4453 |
| *sullivantii* | 3854, 4072, 4342, 4434, 4452, 4595 |

**Spot Tests on Cultures**

The reagents used in spot tests for the presence of phenoloxidases in cultures of *Marasmius* were as follows: 1) to test for laccase: syringaldazine (Harkin & Obst, 1973) and α-naphthol (Stalpers, 1978); 2) to test for tyrosinase: L-tyrosine (Marr, 1979) and *p*-cresol (Marr, 1979); 3) to test for peroxidase: hydrogen peroxide plus pyrogallol (Stalpers, 1978). Spot test reactions were recorded for all reagents at 5, 10, 15, 30 and 60 minutes, and at 3 and 24 hours. In the majority of tests, alternate reagents for a specific enzyme yielded similar results, albeit the time required for a positive reaction to develop varied between reagents. Marr (1979) indicated that in spot tests on basidiomata of agarics, positive reactions should develop within 30 minutes; *e.g.*, positive syringaldazine reactions typically developed within 5-15 minutes and often decolorized by 30 minutes. He suggested recording all reactions at 0, 5, 15 and 30 minutes. My observations of spot tests on cultures indicated that for most reagents, longer reaction periods were required. This may be because the quantity of mycelium reacting with the drops of reagent in cultures is much less than that in corresponding basidiomata where hyphae are tightly packed, and consequently positive reactions in cultures may be more difficult to visualize. In comparison, Stalpers (1978) suggested reading spot test results at 3, 24 and 72 hours. In the majority of *Marasmius* isolates yielding positive syringaldazine reactions, a purplish pigment formed within 10 minutes and often decolorized by 60 minutes (however, some isolates did not decolorize by 24 hours). Correlator tests with α-naphthol, however, yielded positive reactions

typically after 60 minutes, with the darkest reactions apparent at 3-24 hours. In spot tests for tyrosinase activity in cultures, positive reactions with L-tyrosine and *p*-cresol did not develop in most isolates until 3 hours after reagent application and were strongest at 24 hours. Positive reactions to spot tests for peroxidase typically developed by 15-30 minutes and were directly correlated with spot tests for laccase. The latter result suggests that either laccase and peroxidase always occur concurrently in cultures of *Marasmius*, or that the test for peroxidase used in this study was not substrate-specific (*i.e.*, laccase interfered with the test). The latter hypothesis will be discussed further below.

Minimal attempt was made to quantify spot test reactions (*viz.*, positive, weakly positive or negative). It was assumed that rapidity of reaction (relative to the reagent in question) correlated with quantity of enzyme present. If no reaction occurred within 24 hours, it was recorded as negative. If a positive reaction occurred within 30 minutes for syringaldazine and hydrogen peroxide plus pyrogallol, or within 3 hours for α-naphthol, L-tyrosine and *p*-cresol, it was recorded as positive. If a positive reaction occurred after these time periods, it was recorded as weakly positive (wk +). If a positive reaction occurred in some isolates of a given taxon but not in other isolates, it was recorded as positive or negative (+/-). Positive reactions for the various reagents were described as follows: Syringaldazine - pinkish purple or purple; α-naphthol - greyish blue, greyish purple or deep blue; L-tyrosine and *p*-cresol - brownish orange or reddish brown;

hydrogen peroxide plus pyrogallol - yellowish orange, ochraceous or dark yellowish brown.

During preliminary studies it was noticed that some isolates yielded positive spot tests for phenoloxidases on some media, but negative results on other media. Likewise, it was observed that some isolates yielded positive spot test results at Week II, but negative results at Week VI, or vice versa. To examine these phenomena further, spot tests were performed at Week II and Week VI on all isolates grown on MEA and PDA. Results of these tests for laccase, tyrosinase and peroxidase activity in cultures of *Marasmius* are itemized separately below.

**Laccase Activity**. In the majority of isolates tested, both laccase-specific substrates yielded similar results, albeit reaction times for syringaldazine were much faster than those for α-naphthol. In a few isolates, syringaldazine tests were positive but α-naphthol tests were negative [*M. capillaris* isolates #4465 & 4493 on MEA at Week II, 4345 on MEA at Week VI, 4345 & 4465 on PDA at Week VI; *M. felix* isolates #4471 & 4486 on PDA at Week VI; *M. oreades* isolate Halling #5958 on MEA & PDA at Week VI]. In rare cases, syringaldazine tests were negative while α-naphthol tests were positive [*M. decipiens* isolates #4272 & 4480 on PDA at Week II, 4480 & 4608 on PDA at Week VI; *M. haematocephalus* var. *anomaloides* isolate #4711 on PDA at Week VI]. It must be noted, however, that in all other isolates of the taxa mentioned above, or in the same isolates but grown on different media or sampled at different ages, results of spot tests with both reagents were the same. In cases where results of both reagents were not the

same, if either reagent induced a positive reaction, the taxon was recorded as positive. Only when no reaction was observed in both reagents was the taxon recorded negative. Results of spot tests for laccase activity are listed in Table 5.

In all taxa examined except *M. delectans*, positive spot test reactions for laccase were observed on at least one medium at Week II and/or Week VI. These data indicate that isolates of various taxa react differently to spot tests for laccase dictated by growth medium and age of cultures. MEA-grown isolates of certain taxa (*e.g., M. straminipes*, selected isolates of *M. androsaceus*) tested negative for laccase at Week II, but positive at Week VI. All or selected MEA-grown isolates of other taxa (*viz., M. capillaris, felix, cystidiosus, oreades, cohaerens* var. *lachnophyllus, ciliatomarginatus, falcatipes, siccus, pulcherripes, fulvoferrugineus*) tested positive for laccase at Week II, but yielded negative results at Week VI. The latter phenomenon was also observed in isolates of various PDA-grown taxa (*cf., M. rotula, felix, strictipes,* etc.).

One must be very careful in diagnosing presence or absence of laccase in cultures of *Marasmius*. For example, all or selected MEA-grown isolates of *M. brevipes, decipiens, oreades,* and *cohaerens* var. *lachnophyllus* yielded negative results throughout six weeks of growth. If these taxa were tested only from MEA-grown cultures (as was the case in early cultural studies), one would conclude that laccase was not produced by these taxa. When these taxa were grown on PDA, however, all isolates yielded laccase-positive results. Because 28 of 29 *Marasmius* taxa tested in this study produced laccase in culture,

**TABLE 5.** Results of Spot Tests for **Laccase** Activity in Cultures of *Marasmius* Species.

| Specific Epithet | **MEA**-grown Isolates Week II | Week VI | **PDA**-grown Isolates Week II | Week VI | Sect. |
|---|---|---|---|---|---|
| *brevipes* | - | - | + | + | *Rhi.* |
| *androsaceus* Morph. A | +/- | + | + | + | *And.* |
| Morph. B | +/- | + | + | + | |
| Morph. C | - | wk+ | + | + | |
| *pallidocephalus* | + | wk+ | + | + | *And.* |
| *straminipes* var. *fibulatus* | - | + | + | + | *And.* |
| *straminipes* var. *straminipes* | - | + | - | + | *And.* |
| *felix* | + | +/- | + | +/- | *Epi.* |
| *pyrrhocephalus* | + | + | + | + | *All.* |
| *scorodonius* | + | + | + | + | *All.* |
| *capillaris* | + | +/- | + | + | *Mar.* |
| *graminum* | + | + | + | + | *Mar.* |
| *rotula* | + | + | + | +/- | *Mar.* |
| *cystidiosus* | + | - | + | + | *Glo.* |
| *decipiens* | - | - | + | wk+ | *Glo.* |
| *nigrodiscus* | + | + | + | + | *Glo.* |
| *oreades* | +/- | - | + | + | *Glo.* |
| *strictipes* | + | + | + | +/- | *Glo.* |
| *ciliatomarginatus* | + | - | + | - | *Sic.* |
| *cohaerens* var. *cohaerens* | - | wk+ | + | + | *Sic.* |
| *cohaerens* var. *lachnophyllus* | +/- | - | + | +/- | *Sic.* |
| *delectans* | - | - | - | - | *Sic.* |
| *falcatipes* | + | - | + | wk+/- | *Sic.* |
| *fulvoferrugineus* | + | +/- | + | - | *Sic.* |
| *haematocephalus* var. *anomaloides* | + | + | + | + | *Sic.* |
| *haematocephalus* var. *haematocephalus* | + | wk+ | + | + | *Sic.* |
| *pseudobambusinus* | + | + | + | + | *Sic.* |
| *pulcherripes* | + | +/- | + | + | *Sic.* |
| *siccus* | + | - | + | - | *Sic.* |
| *spissus* | + | + | + | ? | *Sic.* |
| *sullivantii* | + | + | + | + | *Sic.* |

laccase occurrence is of limited taxonomic value at the species or infrageneric levels.

*Marasmius delectans* was the only taxon in this study that yielded negative results in spot tests for laccase. As mentioned in the commentary on cultural morphology, only one isolate of this species was available for study, and it is possible that this isolate did not adequately represent the species. Conversely, it is possible that the species does produce laccase, but not on the media used in this study. Harkin and Obst (1973) cited a similar example. *Cryptoderma yamanoii* Imaz. causes white rot of wood, but when cultures were grown on MEA, syringaldazine spot tests yielded negative results. When grown *in vitro* on sterilized wood, however, laccase production was readily detectable with syringaldazine. Several other examples of white-rotters yielding negative phenoloxidase results in culture were provided by Harkin *et al.* (1974).

**Tyrosinase Activity**. Marr (1984) indicated that L-tyrosine and *p*-cresol were equally substrate-specific for tyrosinase, but he preferred to use L-tyrosine because it is not carcinogenic. Past problems with the insolubility of L-tyrosine were overcome by Marr by dissolving L-tyrosine in boiling water and applying the reagent hot (95-100 °C). Other workers (Käärik, 1965; Capellano & Demoulin, 1969) preferred the use of *p*-cresol over L-tyrosine because *p*-cresol gave a more intense and faster reaction. In this study with cultures of *Marasmius*, *p*-cresol gave more satisfactory results than L-tyrosine, undoubtedly a consequence of L-tyrosine's insolubility. In those taxa with

presumably high concentrations of tyrosinase, positive *p*-cresol reactions developed within 10-15 minutes, whereas positive L-tyrosine reactions required up to 30 minutes or longer to develop (*e.g.*, PDA-grown isolates of *M. scorodonius, delectans*). In taxa with presumably low concentrations of tyrosinase, positive *p*-cresol reactions developed by 1-3 hours, whereas positive L-tyrosine reactions required up to 24 hours to develop. In many cases, L-tyrosine tests read negative at 24 hours where *p*-cresol reactions were positive. Results of spot tests for tyrosinase activity are listed in Table 6.

Isolates of various taxa reacted differently to spot tests for tyrosinase dictated by growth medium and age of cultures. Isolates of some taxa yielded negative results on MEA but positive results on PDA (*e.g.*, morphology A isolates of *M. androsaceus*; some isolates of *M. capillaris, rotula, decipiens, oreades, falcatipes, fulvoferrugineus, haematocephalus* var. *haematocephalus, siccus, sullivantii*; all isolates of *M. ciliatomarginatus, cohaerens* var. *cohaerens, haematocephalus* var. *anomaloides*). In a few taxa, some isolates were negative at Week II but positive at Week VI (*e.g.*, on MEA: *M. oreades, haematocephalus* var. *haematocephalus*; on PDA: *M. capillaris, oreades, strictipes, sullivantii*), while others were positive at Week II but negative at Week VI (*e.g.*, on MEA: *M. decipiens, cystidiosus, strictipes, falcatipes, fulvoferrugineus, pulcherripes, siccus*; on PDA: *M. capillaris, rotula, decipiens, nigrodiscus*).

A few patterns of tyrosinase activity at the infrageneric level are indicated by the data in Table 6. All members of sect. *Androsacei* tested negative for tyrosinase activity, with only morphology A

**TABLE 6.** Results of Spot Tests for **Tyrosinase** Activity in Cultures of *Marasmius* Species.

| Specific Epithet | **MEA**-grown Isolates Week II | Week VI | **PDA**-grown Isolates Week II | Week VI | Sect. |
|---|---|---|---|---|---|
| *brevipes* | - | - | - | - | *Rhi.* |
| *androsaceus* Morph. A | - | - | + | + | *And.* |
| Morph. B | - | - | - | - | |
| Morph. C | - | - | - | - | |
| *pallidocephalus* | - | - | - | - | *And.* |
| *straminipes* var. *fibulatus* | - | - | - | - | *And.* |
| *straminipes* var. *straminipes* | - | - | - | - | *And.* |
| *felix* | - | - | - | - | *Epi.* |
| *pyrrhocephalus* | - | - | - | - | *All.* |
| *scorodonius* | + | wk+ | + | + | *All.* |
| *capillaris* | - | - | wk+/- | wk+/- | *Mar.* |
| *graminum* | - | - | - | - | *Mar.* |
| *rotula* | - | - | wk+ | - | *Mar.* |
| *cystidiosus* | + | - | + | wk+ | *Glo.* |
| *decipiens* | wk+/- | - | wk+ | wk+/- | *Glo.* |
| *nigrodiscus* | wk+ | - | wk+ | - | *Glo.* |
| *oreades* | - | wk+/- | - | + | *Glo.* |
| *strictipes* | wk+ | wk+/- | wk+/- | wk+ | *Glo.* |
| *ciliatomarginatus* | - | - | wk+ | + | *Sic.* |
| *cohaerens* var. *cohaerens* | - | - | + | + | *Sic.* |
| *cohaerens* var. *lachnophyllus* | wk+ | wk+ | wk+/+ | wk+ | *Sic.* |
| *delectans* | wk+ | wk+ | + | + | *Sic.* |
| *falcatipes* | wk+/- | - | + | + | *Sic.* |
| *fulvoferrugineus* | wk+/- | - | wk+ | + | *Sic.* |
| *haematocephalus* var. *anomaloides* | - | - | + | + | *Sic.* |
| *haematocephalus* var. *haematocephalus* | - | wk+/- | + | + | *Sic.* |
| *pseudobambusinus* | - | - | - | - | *Sic.* |
| *pulcherripes* | wk+ | wk+/- | wk+ | + | *Sic.* |
| *siccus* | wk+/- | - | wk+ | + | *Sic.* |
| *spissus* | - | - | - | ? | *Sic.* |
| *sullivantii* | - | - | +/- | + | *Sic.* |

isolates of *M. androsaceus* yielding positive spot tests. It is interesting that the morphology A isolates of *M. androsaceus* were obtained from basidiomata testing positive for tyrosinase activity; basidiomata of all other collections of *M. androsaceus* tested negative (see below for a further discussion). In addition, the members of sects. *Rhizomorphigena* and *Epiphylli* tested negative for tyrosinase activity. Isolates of all members of sect. *Globulares* tested positive, and all but one species of sect. *Sicci* tested positive for tyrosinase (*M. pseudobambusinus* tested negative). Data on PDA-grown isolates of *M. spissus* were inconclusive due to a dark reddish brown pigment present in culture mats which interfered with visualizing a positive or negative reaction. Whether the patterns outlined above hold true for all known members of these sections remains to be tested. Of the two members of sect. *Alliacei* examined, *M. scorodonius* tested positive for tyrosinase activity on both media, while *M. pyrrhocephalus* tested negative. Although basidiomata of these two species are readily separated by morphological features, cultures are quite similar and spot tests may be a valuable aid in diagnosing cultures (see commentaries on these species in Chapter VI). In addition, sect. *Marasmius* contains members which tested positive (*M. capillaris, rotula*) and negative (*M. graminum*) for tyrosinase. Thus, presence or absence of tyrosinase may be taxonomically significant at the infrageneric and interspecific levels.

**Peroxidase Activity**. Harkin and Obst (1973) indicated an excellent spot test for peroxidase was syringaldazine plus hydrogen

peroxide. This test is effective, however, only in the absence of laccase since laccase can oxidize syringaldazine and interfere with the test. Because all taxa examined in this study (except *M. delectans*) were syringaldazine-positive, the test for peroxidase suggested by Harkin and Obst (1973) could not be used. Instead, a spot test reagent used by Taylor (1974) and Stalpers (1978) was utilized. This reagent was equal parts of 0.4% hydrogen peroxide and 1% pyrogallol in water, freshly prepared and added separately to the cultures. Apparently, however, this reagent is not substrate-specific. Marr (1979) noted that laccase and tyrosinase also can oxidize pyrogallol resulting in a complex mixture of products with the principal product being purpurogallin, an orange pigment. Results of spot tests with hydrogen peroxide plus pyrogallol are listed in Table 7.

In these tests, positive reactions were determined by the development of yellowish orange, ochraceous or dark yellowish brown pigments. Isolates of all taxa in this study yielded positive reactions with this reagent. Because of the probable interference from laccase and/or tyrosinase with the pyrogallol reactions, I hesitate to suggest that peroxidase was formed by cultures of all species of *Marasmius* tested. Unfortunately, no substrate-specific spot test for peroxidase has been discovered that is effective in the presence of laccase and/or tyrosinase. The only valid conclusion that can be drawn from the data in Table 7 is that phenoloxidases of some type were produced by isolates of all taxa examined. From these data and those in Tables 5 and 6, it can be postulated that *Marasmius* is a white-rot genus.

**TABLE 7.** Results of Spot Tests with **Hydrogen Peroxide plus Pyrogallol** on Cultures of *Marasmius* Species.

| Specific Epithet | **MEA**-grown Isolates Week II | Week VI | **PDA**-grown Isolates Week II | Week VI | Sect. |
|---|---|---|---|---|---|
| *brevipes* | - | wk+ | + | + | *Rhi.* |
| *androsaceus* Morph. A | + | wk+ | + | + | *And.* |
| Morph. B | + | wk+ | + | + | |
| Morph. C | + | + | + | + | |
| *pallidocephalus* | - | + | + | + | *And.* |
| *straminipes* var. *fibulatus* | wk+ | wk+ | + | + | *And.* |
| *straminipes* var. *straminipes* | wk+ | wk+ | - | + | *And.* |
| *felix* | + | + | + | + | *Epi.* |
| *pyrrhocephalus* | + | + | + | + | *All.* |
| *scorodonius* | + | + | + | + | *All.* |
| *capillaris* | + | + | + | + | *Mar.* |
| *graminum* | + | + | + | + | *Mar.* |
| *rotula* | + | + | + | + | *Mar.* |
| *cystidiosus* | + | wk+ | + | + | *Glo.* |
| *decipiens* | - | - | + | + | *Glo.* |
| *nigrodiscus* | + | + | + | + | *Glo.* |
| *oreades* | + | wk+ | + | + | *Glo.* |
| *strictipes* | + | + | + | + | *Glo.* |
| *ciliatomarginatus* | + | - | + | + | *Sic.* |
| *cohaerens* var. *cohaerens* | - | + | + | + | *Sic.* |
| *cohaerens* var. *lachnophyllus* | + | + | + | + | *Sic.* |
| *delectans* | - | + | + | + | *Sic.* |
| *falcatipes* | wk+ | + | + | + | *Sic.* |
| *fulvoferrugineus* | + | + | + | + | *Sic.* |
| *haematocephalus* var. *anomaloides* | + | + | + | + | *Sic.* |
| *haematocephalus* var. *haematocephalus* | + | + | + | + | *Sic.* |
| *pseudobambusinus* | + | + | + | + | *Sic.* |
| *pulcherripes* | + | wk+/- | + | + | *Sic.* |
| *siccus* | + | + | + | + | *Sic.* |
| *spissus* | + | + | - | ? | *Sic.* |
| *sullivantii* | + | + | + | + | *Sic.* |

**Spot Tests on Basidiomata**

Marr (1984) and Marr *et al*. (1986) recommended spot testing of entire radial sections of basidiomata for phenoloxidase activity instead of testing small samples in depression plates as was the common practice. This technique allowed a means of visualizing localization of enzymes in basidiomata as well as a means of quantifying the results. He used a point system to score the reaction patterns observed, which converted reaction-area to a numerical 5-point scale (0-4), and mean values were recorded for each taxon. This scale indicated the extent rather than the intensity of the reaction. This methodology was attempted with basidiomata of *Marasmii*, but because of the small size and lack of substantial tramal tissues in the majority of *Marasmii* tested, scoring the reaction areas was nearly impossible. Moreover, the majority of *Marasmii* form basidiomata with very narrow (<2 mm), darkly pigmented stipes and many develop deeply pigmented pilei, so visualizing positive reactions was inherently difficult. Instead, spot test reactions were scored as weakly positive (small portions of the external surface or basal mycelium positive), positive (all or nearly all of the external surface, and/or basal mycelium, and often internal tissues positive), or negative (no reactions observed on basidiomata or basal mycelium). Spot tests were read at 15, 30 and 60 minutes. In general, if basidiomata reacted positively, a distinct diagnostic pigment developed within 30 minutes. In a few cases, presumably in basidiomata with low concentrations of phenoloxidases, positive reactions required 60 minutes to develop. In those taxa yielding positive spot tests, reaction areas were typically the basal

mycelium, external surface of stipe, pileus and lamellae, and rarely the stipe tramal tissue. Syringaldazine was used to test for laccase activity, while L-tyrosine and *p*-cresol were used to test for tyrosinase activity. Of the latter two reagents, *p*-cresol yielded more satisfactory results (again because of insolubility problems with L-tyrosine). Results of spot tests for laccase and tyrosinase production by basidiomata are listed in Table 8.

In general, spot tests for laccase were negative. In those few taxa yielding positive reactions (*e.g., M. nigrodiscus, strictipes, spissus*), only the basal mycelium reacted positively. The remainder of the basidiome was negative. Basidiomata formed by the latter three species arise from thick, woolly mats of basal mycelium which bind the litter layer together. It could be argued that the basidiomata were negative *in toto*, the basal mycelium not being part of the basidioma proper (*i.e.*, the sexual reproductive structure), but being merely an extension of the vegetative mycelium (*i.e.*, non-sexual thallus). It could be argued also, however, that the basidia are the only sexual portion of the basidioma, and the remainder of the basidioma is merely an extension of the vegetative mycelium. Nonetheless, for the sake of categorizing phenoloxidase reactions in basidiomata (*sensu* Marr *et al.*, 1986), I propose considering the basal mycelium of *Marasmius* species as separate from the basidiomata. Therefore, it can be stated that spot tests for laccase activity were negative on basidiomata of the *Marasmii* tested, while weakly positive on the vegetative mycelium *in situ* of a few species.

**TABLE 8.** Results of Spot Tests for **Laccase** and **Tyrosinase** Activity in Basidiomata of *Marasmius* Species.

| Specific Epithet | Laccase | Tyrosinase | Sect. |
|---|---|---|---|
| *brevipes* | - | - | *Rhi.* |
| *androsaceus* | - | wk+/- | *And.* |
| *pallidocephalus* | - | - | *And.* |
| *straminipes* var. *fibulatus* | - | - | *And.* |
| *straminipes* var. *straminipes* | - | - | *And.* |
| *felix* | - | - | *Epi.* |
| *pyrrhocephalus* | - | - | *All.* |
| *scorodonius* | - | - | *All.* |
| *capillaris* | - | wk+/- | *Mar.* |
| *graminum* | - | - | *Mar.* |
| *rotula* | - | wk+/- | *Mar.* |
| *cystidiosus* | - | + | *Glo.* |
| *decipiens* | - | wk+ | *Glo.* |
| *nigrodiscus* | wk+/- | + | *Glo.* |
| *oreades* | - | wk+ | *Glo.* |
| *strictipes* | wk+/- | wk+ | *Glo.* |
| *ciliatomarginatus* | - | + | *Sic.* |
| *cohaerens* var. *cohaerens* | - | + | *Sic.* |
| *cohaerens* var. *lachnophyllus* | - | + | *Sic.* |
| *delectans* | - | + | *Sic.* |
| *falcatipes* | - | + | *Sic.* |
| *fulvoferrugineus* | - | + | *Sic.* |
| *haematocephalus* var. *anomaloides* | - | + | *Sic.* |
| *haematocephalus* var. *haematocephalus* | - | + | *Sic.* |
| *pseudobambusinus* | - | - | *Sic.* |
| *pulcherripes* | - | wk+ | *Sic.* |
| *siccus* | - | + | *Sic.* |
| *spissus* | wk+ | + | *Sic.* |
| *sullivantii* | - | + | *Sic.* |

The pattern observed for tyrosinase activity in cultures correlated directly with that observed in basidiomata of corresponding species, with one exception (*cf.* Tables 6 and 8). All members of sect. *Androsacei* yielded negative spot test reactions for tyrosinase, with only three collections of *M. androsaceus* yielding weakly positive reactions. The latter three collections (nos. 3806, 3937, 4475) produced cultures with morphology A (see culture studies) which also exhibited positive tyrosinase reactions. These results warrant further investigation and indicate the need for an in-depth study of the physiology of this cosmopolitan species. Basidiomata of representatives of sects. *Rhizomorphigena* and *Epiphylli* also yielded negative results to spot tests for tyrosinase activity. Basidiomata of all members of sect. *Globulares*, and all but one species of sect. *Sicci* yielded positive tyrosinase reactions (basidiomata of *M. pseudobambusinus* tested negative as did cultures of the same species). Tyrosinase reactions exhibited by cultures of members of sect. *Marasmius* were the same as those exhibited by basidiomata of the same species.

The one exception to the pattern was *M. scorodonius* (sect. *Alliacei*). Basidiomata of this species tested negative for tyrosinase (Table 8), whereas cultures of the same taxon tested positive (Table 6).

Using Marr's *et al.* (1986) system for grouping basidiomata of agarics, the species of *Marasmius* tested in this study would belong to Groups I and II. Members of sects. *Rhizomorphigena, Androsacei, Epiphylli* and *Alliacei* would belong to Group I (laccase and tyrosinase

negative), while the majority of members of sects. *Marasmius, Globulares* and *Sicci* would belong to Group II (tyrosinase dominant). Exceptions to these categorizations include: a) several collections of *M. androsaceus* would belong to Group II; and b) *M. graminum* (sect. *Marasmius*) and *M. pseudobambusinus* (sect. *Sicci*) would belong to Group I.

## CONCLUSIONS

From data accumulated on phenoloxidase production by cultures and basidiomata of selected species of *Marasmius*, it can be postulated that *Marasmius* is a white-rot genus. The phenol-oxidizing enzymes laccase and/or tyrosinase were produced by cultures and/or basidiomata of all taxa tested. The spot test reagents syringaldazine and *p*-cresol were effective in diagnosing the occurrence of laccase and tyrosinase, respectively.

Laccase activity was observed in cultures of all but one species (*M. delectans* yielded negative results), whereas laccase activity was not observed in basidiomata of any species tested (although basal mycelia reacted weakly positive in three species). Tyrosinase presence in cultures of *Marasmius* was directly correlated with its presence in corresponding basidiomata. Tyrosinase activity was observed in nearly all members of sects. *Marasmius, Globulares* and *Sicci*, whereas no tyrosinase activity was observed in most members of sects. *Rhizomorphigena, Androsacei, Epiphylli* and *Alliacei* (exceptions are itemized above). Results of spot tests for peroxidase activity were

inconclusive because of the probable interference of laccase and/or tyrosinase with the test reactions.

Growth medium and culture age influenced results of spot tests for phenoloxidase production. Nonetheless, when isolates were grown and tested on various media at Weeks II and VI, decisions could be made concerning phenoloxidase production by a given species. From the test results it can be inferred that for most taxa tested, infraspecific variation in occurrence of specific phenoloxidases was low. For example, if one isolate of a given species tested positive for a particular phenoloxidase, all other isolates of that species tested positive for the same phenoloxidase on some medium at some age. Hence, phenoloxidase production for that species could be evaluated. Few exceptions to this pattern were observed (*viz.*, tyrosinase activity in morphology A isolates of *M. androsaceus*, and a few PDA-grown isolates of *M. capillaris*). It should be emphasized that a single spot test on a culture of given age and media-type is inadequate to evaluate presence or absence of phenoloxidase production by a given species. Numerous isolates of the species should be tested on various media at various mycelial ages before valid decisions can be made.

Presence or absence of laccase and tyrosinase in *Marasmius* species is taxonomically significant at the generic level (all *Marasmii* tested produced laccase in culture and/or basidiomata), infrageneric level (tyrosinase production was observed in some sections of the genus but not in others), and specific level (within sections, some species produced tyrosinase while others did not).

# THE GENUS *MARASMIUS*

# FROM THE

# SOUTHERN APPALACHIAN MOUNTAINS

A Dissertation

Presented for the

Doctor of Philosophy

Degree

The University of Tennessee, Knoxville

Dennis Edmund Desjardin

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# CHAPTER VIII

## STUDIES OF TYPE SPECIMENS AND REPRESENTATIVE MATERIAL

Data from type studies are essential to establish stable species concepts and to avoid perpetuating misapplication of epithets. To clarify the taxonomy and nomenclature of southern Appalachian *Marasmii*, it was necessary to examine type specimens of all epithets based on North American collections and originally described in *Marasmius*, species transferred to *Marasmius* by other workers, and species with protologues suggesting affinities with *Marasmius*. In addition, because of the occurrence in the southern Appalachians of *Marasmii* seemingly closely allied with tropical species, type specimens of many species described from the neotropics or tropics were examined. For taxa lacking type specimens, neotype or lectotype specimens have been designated where appropriate, or "representative" material has been chosen to represent my concept of the species. Notes on the current condition of each type specimen are presented. Descriptions of macromorphological characters are derived from features of dried basidiomata. For descriptions of fresh basidiomata refer to the protologue of each taxon. Commentaries on current taxonomic disposition of each epithet are provided following the type descriptions.

The descriptions below are arranged alphabetically by the final basionymic epithet, whether specific or infraspecific. See Chapter II, Materials and Methods, for details on technique.

***MARASMIUS ACERINUS*** Peck, New York State Mus. Bull. 5(25): 648. 1899.

HOLOTYPE: United States, New York, North Elba, on Marey trail near Adirondack Lodge, on bark of mountain maple (*Acer spicatum*), 10 Aug. 1898 (NYS).

The collection consists of approximately 15 basidiomata in good condition, many loose in the box but many others attached to bark fragments. **Pileus** 6-10 mm diam, umbilicate, margin incurved, striate, glabrous, colored buff-brown or brown. **Lamellae** adnate or subdecurrent, subdistant, moderately broad, cream colored. **Stipe** 6-10 X ≈1 mm, compressed, equal or tapering toward the base, pruinose or pubescent, subinsitititious, brown at apex, dark brown at base. Basidiomata lignicolous, gregarious.

**Basidiospores** 6.8-9.6 X 3.8-4.8 µm [$\bar{x}$ = 8 ± 0.7 X 4.3 ± 0.3 µm, E = 1.6-2.1, Q = 1.87 ± 0.15, n = 23], ellipsoid or amygdaliform, hyaline, inamyloid, smooth. **Basidia** 24-29 X 6-7.5 µm, 4-spored, rarely 2-spored, clavate. **Basidioles** cylindric or clavate. **Hymenial cystidia** absent. **Pileipellis** a cutis of radially arranged hyphae; hyphae 3.2-8 µm diam, non-diverticulate, non-gelatinous, smooth and hyaline or with brown pigment incrustations, inamyloid, clamped, with walls up to 1 µm thick; terminal cells cylindric or clavate, repent or suberect. **Pileus trama** loosely interwoven; **lamellar trama** regular; hyphae 4-7.5 µm diam, non-inflated, imbedded in a gelatinous matrix, hyaline, inamyloid, clamped, with walls up to 2 µm thick. **Stipe tissue** monomitic; **cortical hyphae** 3.5-8 µm diam, parallel, with annular or helical incrustations, these olivaceous brown in KOH, inamyloid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** 2.5-8 µm

diam, monomitic, subparallel, non-inflated, weakly gelatinous, hyaline, inamyloid, clamped, thick-walled. **Stipe vesture** of loosely interwoven hyphae giving rise to erect or suberect **caulocystidia,** these irregularly cylindric or clavate, smooth and hyaline or with pale brown incrustations, inamyloid, with walls <0.8 µm thick.

**Commentary.** *Marasmius acerinus* is considered here a synomym of *Micromphale foetidum* (Sow.:Fr.) Sing. *Marasmius acerinus* was cited in the protologue as being collected "on dead bark of mountain maple, *Acer spicatum*, near Adirondack Lodge, August." Label data accompanying the specimen cited above match those of the protologue and this specimen is considered here as holotypic. Gilliam (1976: 127) erroneously cited the type specimen as: "St. Lawrence Co., Fine, 4 Aug. 1909, Peck (NYS)." I have examined this "authentic" specimen and determined that it is not conspecific with the holotype specimen of *M. acerinus*, but rather is conspecific with *Collybia dichrous* (Berk. & Curt.) Gilliam.

***MARASMIUS ACTINOPUS*** Montagne, Ann. Sci. Nat. Bot. 4(1): 112. 1854.

LECTOTYPE (*des mihi*): French Guyana, Leprieur, *tecum divedo n. sp.* (K, Berkeley Herbarium).

The collection consists of two pilei and four stipes in poor condition, infected with several Deuteromycete taxa. **Pileus** 4 mm diam, convex, sulcate or striate, glabrous, dark brown. **Lamellae** not observable. **Stipe** ≈25 X <1 mm, glabrous, shiny, dark brown, non-insititious, with coarse, dingy buff-colored basal mycelial hairs, lignicolous.

**Basidiospores** 13.6-15.2 X 4.4-4.8 µm (6 seen), clavate, inequilateral, hyaline, inamyloid, smooth. **Hymenial elements** not observed (material too scanty and badly infected). **Pileipellis** hymeniform, not mottled, of *Siccus*-type broom cells; main body 12-16 X 5-7.5 µm, cylindric or clavate, basal portion thin-walled, hyaline; apical setulae 2.5-6.5 X 0.5-2 µm, conic or subconic, thick-walled or solid, ochraceous. **Tramal hyphae** 3-10 µm diam, interwoven, non-inflated, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 4-8 µm diam, parallel, dark tawny, dextrinoid, smooth, clamped, with walls up to 1.2 µm thick; **medullary hyphae** 3-8 µm diam, parallel, hyaline, weakly dextrinoid, thin-walled, clamped. **Stipe vesture** and **caulocystidia** absent; surface overlayed in areas by narrow (<1.5 µm), unclamped, hyaline hyphae plus *Penicillium*-like conidiophores.

**Commentary.** There is some confusion concerning the correct application of the binomial *Marasmius actinopus* Mont. Type material consists of two syntype specimens, one in the Berkeley Herbarium at Kew (K!), and another at Paris (PC!). Dennis (1951a) indicated that the stipe was "minutely downy with undulating, cylindric, thin-walled hyaline hairs up to 110 X 6-7 µm," citing the Kew material as syntype and one personal collection from Venezuela. Singer (1958) provided a few details on micromorphology of the syntype specimens but noted that he had not studied the fibrillosity of the surface of the stipe, and cited Dennis' observation of cylindrical hairs. Subsequently, Singer (1965) provided a description of "*M. actinopus*" derived from Bolivian material (also citing the Kew syntype and Dennis' Venezuelan material)

and figured four caulocystidia, presumably drawn from the Bolivian collection. My examinations of both syntype specimens failed to indicate the presence of caulocystidia. The Paris syntype consists of five non-insititious stipes which are all macroscopically glabrous and lack pilei. The Kew syntype, here designated the lectotype, consists of two pilei plus four, glabrous, non-insititious stipes. The base of each stipe is connected to a woody substrate by coarse, dingy buff or pale fulvous, radiating mycelial hairs, a feature responsible for Montagne's choice of epithet. Indeed, the protologue indicates the stipe "*glaberrimo, basi floccosa radiante instructo*" and later "*stipes...laevis...basi mycelio fulvo radiato strigosus (unde nomen) radiis brevibus*." Nowhere does Montagne indicate a minutely downy, pubescent or hirsute stipe as conceived by Dennis (1951a) and Singer (1965, 1976), and my examinations of the syntype specimens support Montagne's description of glabrous, smooth stipe.

Singer's (1976) misapplication of the epithet resulted in the establishment of series *Actinopodes* (Type: *M. actinopus* Mont.) to accommodate species in sect. *Sicci* with setoid bodies or cystidiiform elements present on pileus, lamellae and/or stipe. Because the type material of *M. actinopus* lacks such elements and is therefore not conspecific with *M. actinopus sensu* Singer, another name is needed for the latter taxon and consequently for the series comprising species with setoid bodies or cystidiiform stipe elements. Until Singer's material determined as *M. actinopus* has been examined and compared with previously described material, a new epithet will not be proposed for

this species. Because Singer (1958) originally grouped *M. actinopus sensu* Singer with *M. atrorubens* (Berk.) Berk., *M. bahamensis* Murr., and *M. rubroflavus* (Theissen) Sing., in stirps *Atrorubens*, I have chosen the latter epithet as an acceptable name for the series in sect. *Sicci* comprising taxa with cystidiiform stipe elements, *viz.*, ser. *Atrorubenses* (= ser. *Actinopodes pro parte*). A formal proposal is made elsewhere in this manuscript.

***MARASMIUS ALACHUANUS*** Murrill, Lloydia 5(2): 140. 1942.

≡*Marasmius cohortalis* var. *alachuanus* (Murr.) Singer, Fl. Neotrop. Monogr. 17: 281. 1976.

HOLOTYPE: United States, Florida, Alachua Co., Gainesville, High Hammock, 16 Aug. 1939, W. A. Murrill, F19885 (FLAS).

Notes with the holotype specimen: "greg. cesp. or in ring. Not on sticks. Umbil. 3 cm d., sulcate to center & somewhat pitted, glabr. milk-white, marg. entire, gs dist, interv, inserted, sq. adnate, some divided at base, entire, rather brd. St hollow, sm glabr white ab. worm col to chest. below, 5 X 0.2-0.3, terete or compressed, anise odor, taste sl. farin."

The collection consists of approximately 20 intact basidiomata in fair condition, plus fragments of several more. **Pileus** 15-20 mm diam, plano-convex and depressed or umbilicate, glabrous, rugulo-striate, ochraceous. **Lamellae** adnate, subdistant or distant, intervenose, narrow, pale reddish brown. **Stipe** 35-45 X <2 mm, compressed, equal, glabrous, dull, reddish brown, non-insititious.

**Basidiospores** 5.6-7.6 X 3.2-4.4 µm [$\bar{x}$ = 6.7 ± 0.6 X 3.7 ± 0.3 µm, E = 1.6-2.3, Q = 1.8 ± 0.14, n = 30], ellipsoid or subamygdaliform, hyaline, inamyloid, smooth. **Basidia** 19-22 X 5-6.5 µm, 4-spored, clavate. **Basidioles** cylindric or clavate. **Pleurocystidia** absent. **Cheilocystidia** 16-24 X 7-12(13.5) µm, numerous, similar to pileipellis elements, broadly clavate, hyaline, inamyloid, thin-walled. **Pileipellis** hymeniform, of *Globulares*-type elements; cell reviving poorly. 16-28 X 9-18(24) µm, broadly clavate or subvesiculose, rarely sphaeropedunculate, pale yellow or pale ochraceous, majority thin-walled and inamyloid, few thicker-walled and weakly dextrinoid. **Tramal hyphae** 4-16(24) µm diam, interwoven, hyaline, dextrinoid, thin-walled, clamped, non-gelatinous, non-incrusted. **Stipe tissue** monomitic; **cortical and medullary hyphae** similar, 3.5-12 µm diam, parallel, cylindric, hyaline, pale yellow or pale ochraceous, strongly dextrinoid, clamped, with walls up to 1.8 µm thick. **Caulocystidia** 16-36 X 8-13 µm, numerous, scattered or clustered, repent or erect, clavate or subvesiculose, hyaline, inamyloid, thin-walled, basally clamped.

**Commentary**. *Marasmius alachuanus* was considered by Singer (1976) as a variety of *M. cohortalis* Berkeley [Vidensk. Meddel. Dansk Naturhist. Foren. Kjöbenhavn 34, 1879]. I have not studied the holotype specimen of the latter name [Brazil, Glaziou no. 9171 (K)] and cannot comment on the appropriateness of the transfer. *Marasmius alachuanus* belongs in sect. *Globulares*. An earlier type study was provided by Hesler (1957).

***MARASMIUS ALBICEPS*** Peck, Annual Rep. New York State Mus. 43: 67 (21 in reprint) Pl. 2, figs. 15-18, ("1889") 1890.

≡ *Mycena albiceps* (Pk.) Gilliam, Mycotaxon 4(1): 127. 1976.

HOLOTYPE: United States, New York, Manor, Sept. 1889 (erroneously labeled 1899), C. H. Peck (NYS).

The collection consists of 11 basidiomata, some in good condition, others flattened and fragmented. **Pileus** <2 mm diam, campanulate, weakly striate, glabrous, pale brown. **Lamellae** subdecurrent, subdistant, broad, concolorous with pileus. **Stipe** 10-15 X <0.3 mm, filiform, glabrous, non-insititious, black.

**Basidiospores** ellipsoid or subamygdaliform, hyaline, strongly amyloid, smooth; from 4-spored basidia: 6.4-8 X 3.4-4.2 µm [$\bar{x}$ = 7.3 ± 0.5 X 3.9 ± 0.2 µm, E = 1.7-2, Q = 1.9 ± 0.1, n = 30]; from 2-spored basidia: 8.4-10.4 X 4-4.8 µm [$\bar{x}$ = 9.2 ± 0.6 X 4.4 ± 0.3, E = 1.9-2.4, Q = 2.1 ± 0.15, n = 10]. **Basidia** 20-25 X 7-10 µm, 2- or 4-spored, clavate. **Basidioles** broadly clavate. **Pleurocystidia** absent. **Cheilocystidia** 8-16 X 4-8 µm, abundant (lamellar edge sterile), irregularly cylindric, often lobed, with apical diverticula 1.5-6.5 X 1-1.8 µm, these irregularly cylindric, obtuse, hyaline, thin-walled. **Pileipellis** a thin *Rameales*-structure of densely diverticulate hyphae 4-10 µm diam; diverticula 1-5.6 X 0.5-1.5 µm, rod-like, obtuse, seldom nodulose, thin-walled, hyaline, inamyloid or weakly dextrinoid. **Hypodermium** pseudoparenchymatous, of very broad (up to 26 µm diam), short-celled elements plus longer-celled but highly inflated elements, hyaline, dextrinoid, thin-walled, clamped. **Pileus trama** interwoven; **lamellar trama** interwoven; hyphae 3-12 µm diam, often inflated,

hyaline, dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-4.5 µm diam, parallel, outermost surface strongly diverticulate; hyphal walls ranging from hyaline at the apex to brown at the base, <1 µm thick, dextrinoid, clamped; diverticula 1-4 X 0.5-1 µm, rod-like, obtuse, hyaline; **medullary hyphae** 2.5-8 µm diam, non-inflated or weakly-inflated, hyaline, dextrinoid, thin-walled, clamped.

**Commentary**. *Marasmius albiceps* belongs in *Mycena* sect. *Polyadelphia* Singer ex Maas Geesteranus. Gilliam (1976: 127) noted a few microscopic details of the holotype specimen when she published the transfer to *Mycena*, and Maas Geesteranus (1986) added a few additional details plus four line drawings. Although Maas Geesteranus (1986) was unable to recover cheilocystidia owing to the scantiness and poor condition of the type specimen, I was able to observe such structures as described and illustrated above. In addition, Maas Geesteranus indicated that the species was known only from its type locality, when in reality it is widespread in eastern North America, from New York southward to North Carolina and Tennessee. A description and photograph of material collected in North Carolina was provided by Coker (1929). Peck's original notes on this species are on page 132 of his notebook for 1888-1889 (NYS).

***COLLYBIA ALBOGRISEA*** Peck, Bull. Torrey Bot. Club 22: 199. 1895.

≡ *Gymnopus albogriseus* (Pk.) Murrill, N. Amer. Fl. 9(5): 368. 1916.

≡ *Marasmius albogriseus* (Pk.) Singer, Ann. Mycol. 41: 130. 1943.

HOLOTYPE: United States, California, Pasadena, 10 Jan. 1895, A. J. McClatchie no. 814. In soil among leaves (NYS).

The collection consists of more than 20 basidiomata in good condition, some in cespitose clusters, others single, one attached to an oak involucre. **Pileus** 8-28 mm diam, convex or plano-convex, glabrous, even or with margin short-striate, yellowish brown with a slightly darker disc. **Lamellae** adnate, subdistant, broad, pale brownish. **Stipe** 20-45 X 2.5-4 mm, hollow, terete or compressed, apex glabrous and brown or fulvous, base felty and cream-colored, non-insititious.

**Basidiospores** 6.4-8.4 X 3.8-4.8 µm [$\bar{x}$ = 7.3 ± 0.5 X 4.1 ± 0.3 µm, E = 1.5-2, Q = 1.8 ± 0.1, n = 31], amygdaliform, hyaline, inamyloid, smooth. **Basidia** 28-38 X 4.5-8 µm, 4-spored, clavate. **Basidioles** cylindric or subclavate. **Hymenial cystidia** absent. **Pileipellis** hymeniform, of *Globulares*-type elements, 9.5-15 X 4.8-8(10) µm, cylindric, clavate or vesiculose, smooth, hyaline or pale yellow in KOH, inamyloid, thin-walled. **Pileus trama** loosely interwoven; **lamellar trama** regular; hyphae 4-10 µm diam, often inflated, hyaline, dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-8 µm diam, parallel, cylindric, seldom inflated, hyaline or pale yellow, dextrinoid, thin-walled, clamped; **medullary hyphae** similar but hyaline throughout and weakly dextrinoid. **Caulocystidia** 16-32 X 6-12 µm, common, often clustered, cylindric or clavate, rarely lobed, hyaline, inamyloid or weakly dextrinoid, typically thin-walled, rarely with walls up to 1 µm thick, basally clamped.

**Commentary.** *Collybia albogrisea* belongs in *Marasmius* sect. *Globulares*. Descriptions and commentaries on this species include those by Smith (1938a), Singer (1943, 1958a, 1965, 1976), Singer and

Digilio (1952), Halling (1983), Halling *et al*. (1985), and Desjardin (1987).

***MARASMIUS ALBOMARGINATUS*** Clements, Bot. surv. Nebraska 4: 20. 1896.

HOLOTYPE: United States, Nebraska, Beatrice, July 24, Pound and Clements, on shaded ground (NEB).

No material remains in the holotype packet and no other authentic specimens of this species have been located. According to Pennington (1915: 284), "The single type specimen examined seems to be a small species of *Mycena*." Until material matching the protologue is recollected in the vicinity of Beatrice, Nebraska, and designated as neotype, the taxon *M. albomarginatus* must remain a *species inquirenda*.

***MARASMIUS ALIENUS*** Peck, New York State Mus. Bull. 139: 25. 1910

HOLOTYPE: United States, New York, St. Lawrence Co., Fine, 7 Aug. 1909, C. H. Peck, on mossy logs (NYS).

The collection consists of 8 basidiomata in good condition. **Pileus** 5-10 mm diam, convex, surface suede-like, even, tan or pale ochraceous. **Lamellae** subdecurrent, subdistant, narrow, pale brown. **Stipe** 25-30 X 1 mm, terete, equal, pruinose above, base covered with buff colored tomentum, non-insititious.

**Basidiospores** 9.6-12.8 X 3.6-4.8 µm [$\bar{x}$ = 11.1 ± 0.9 X 4.2 ± 0.3 µm, E = 2.4-3.2, Q = 2.7 ± 0.2, n = 25], elongate-ellipsoid, inequilateral, hyaline, inamyloid, smooth. **Basidia** 24-34 X 5.5-7.5 µm, 4-spored, subclavate. **Basidioles** subclavate or clavate. **Hymenial cystidia** abundant on lamellar edges, less numerous on lamellar faces,

45-56 X 5-7.5 µm, irregularly fusoid or narrowly fusoid-ventricose, often pedicellate, arising from subhymenium and projecting well beyond basidioles, hyaline, thin-walled, inamyloid, basally clamped. **Pileipellis** a cutis composed of interwoven, somewhat contorted hyphae; hyphae 2.5-4 µm diam, typically irregular in outline, with flexuous branchlets and terminal cells, these often lobed (not a true *Rameales*-structure); elements hyaline, inamyloid, thin-walled, non-incrusted, non-gelatinous, clamped. **Tramal hyphae** 3-10.5 µm diam, interwoven, hyaline, inamyloid, thin-walled, non-gelatinous, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-5 µm diam, parallel, hyaline or pale yellow, inamyloid, clamped, with walls up to 1.2 µm thick, non-incrusted; **medullary hyphae** similar but hyaline throughout and up to 9.5 µm diam. **Stipe vesture** of loosely interwoven hyphae 1.5-5 µm diam, giving rise terminally or laterally to flexuous or elongate-fusoid **caulocystidia**, 16-35 X 3.2-4.5 µm, these obtuse, hyaline, inamyloid, thin-walled or with walls up to 0.5 µm thick.

**Commentary.** *Marasmius alienus* was placed in synonymy under *Marasmiellus papillatus* (Pk.) Redhead & Halling [Bas.: *Marasmius papillatus* Peck (1872)] by Redhead and Halling (1982). I agree that the two taxa are conspecific but propose that the species is better placed in the genus *Neoclitocybe* Singer. See the commentary following the type study of *Marasmius papillatus* for a further discussion.

***AGARICUS ANDROSACEUS*** L.: Fries, Syst. Mycol. 1: 137. 1821.

[*Agaricus androsaceus* Linnaeus, Sp. Pl. 1175. 1753.]

≡ *Marasmius androsaceus* (L.: Fr.) Fr., Epicr. Syst. Mycol. 385. 1838.

≡ *Chamaeceras androsaceus* (L.: Fr.) O. Kuntze, Revis. Gen. Pl. Pars 3(2): 454. 1898.

≡ *Setulipes androsaceus* (L.: Fr.) Antonin, Česká Mykol. 41(2): 86. 1987.

REPRESENTATIVE MATERIAL: Finland, Pohjois-Häme, Toivakka, Huikko, ≈500 m NNE of the old school, 7 Jul. 1979, E. Ohenoja; on needles and leaves in mixed heathy forests of *Vaccinium myrtillus, Betula pubescens, Pinus sylvestris, Picea abies, Sorbus aucuparia* (NY).

The collection consists of approximately 10 basidiomata in good condition but many fragmented, growing from needles of *Pinus sylvestris*. **Pileus** 2-6 mm diam, convex, glabrous, short-striate, dull, dark brown. **Lamellae** adnexed, distant, broad, pale brown. **Stipe** 30-45 X <0.5 mm, filiform, glabrous, shiny, black, insititious; with numerous wiry black rhizomorphs.

**Basidiospores** 7.2-9.2 X 3.4-4.4 µm [$\bar{x}$ = 8 ± 0.5 X 3.9 ± 0.2 µm, E = 1.8-2.5, Q = 2.1 ± 0.1, n = 25], ellipsoid or amygdaliform, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 17.5-24 X 5.5-8 µm, 4-spored, clavate. **Basidioles** subclavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** numerous (lamellar edge sterile), 16-24 X 5.5-8 µm, irregularly cylindric or clavate, rarely lobed, diverticulate, hyaline overall, thin-walled, basally clamped; diverticula 1.5-5 X 0.5-2 µm, typically apical, irregularly cylindric, sometimes lobed, obtuse, thin-walled, hyaline. **Pileipellis** not hymeniform; hyphae 3.5-6.5(8) µm diam, interwoven, weakly diverticulate, rarely smooth, typically incrusted with thick, brown, plaque-like pigments; walls brown or dark brown, up to 1 µm thick,

inamyloid, clamped; terminal cells broom-cell-like; diverticula 1.5-5 X 1-2 µm, scattered along hyphae or clustered on hyphal ends, irregular in outline, obtuse, sometimes lobed. **Tramal hyphae** 2.5-7 µm diam, interwoven, smooth or weakly incrusted nearest the pileipellis, branched, non-gelatinous, hyaline, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-6 µm diam, parallel, cylindric, non-incrusted, brown or dark brown, dextrinoid, with walls up to 1 µm thick, clamped; **medullary hyphae** 2.5-6.5 µm diam, parallel, hyaline, inamyloid, thin-walled, clamped. **Caulocystidia** absent.

**Commentary.** No holotype specimen or authentic material of *M. androsaceus* exists. Linnaeus (1753) cited the substrate as needles of *Pinus*, and Fries (1821) indicated that the species grew on needles of *Pinus sylvestris* as well as bark of *Betula, Quercus, Fagus* and *Juniperus*. Until topotype material is collected from needles of *Pinus* in the vicinity of Uppsala, Sweden, and designated as neotype, the specimen cited above, collected on needles of *Pinus sylvestris* in Finland, will serve to represent my concept of this species. *Marasmius androsaceus* is the type species of sect. *Androsacei* Kühner.

***MARASMIUS ANOMALUS*** Lasch *in* Rabenhorst, Klotzschii Herb. Vivum Mycol., Cent. 19, no. 1806. 1854. [*non Marasmius anomalus* Peck, 1872]

LECTOTYPE (*des mihi*): Germany, Driesen, Lasch no. 1806 (FH).

The Farlow Herbarium isotype exsiccata specimen is designated as lectotype. This collection consists of 7 basidiomata pressed flat and glued to a sheet directly above the printed label which reads: "1806. *Marasmius anomalus m. Pileo membranaceo campanulato obtuso*

*plicato obscure-alutaceo, lamellis (sine collario) liberis latis distantibus albidis, saepe fusco marginatis, stip. longo glabro nigro-fusco superne subincrassato basi insititio. In loco arenoso sepulcrorum publicor. pr. Driesen. Lasch.*"

**Pileus** 3-8 mm diam, convex, disc rugulose, margin striate, subglabrous, dark ochraceous or brownish orange with a darker disc. **Lamellae** adnexed, distant, moderately broad, non-marginate, paler than the pileus. **Stipe** 15-35 X <1 mm, terete, equal, glabrous, shiny, apex yellowish brown or brown, base brown or reddish brown, subinsititious or non-insititious, attached to grass roots or leaves.

**Basidiospores** 12.5-16.8 X 3.5-4.8 µm [$\bar{x}$ = 15 ± 1.7 X 4 ± 0.4 µm, E = 3.1-4.3, Q = 3.7 ± 0.4, n = 10], clavate or subfusiform, hyaline, inamyloid, smooth. **Basidia** 28-32 X 5.5-7.5 µm, 4-spored, subclavate. **Basidioles** subclavate. **Pleurocystidia** 32-50(60) X 7-12 µm, numerous, clavate or ventricose, non-refractive or weakly refractive, arising from subhymenium and projecting slightly above basidioles, hyaline, inamyloid, thin-walled. **Cheilocystidia** similar to *Siccus*-type pileipellis elements; main body 12-16(20) X 4.5-9 µm, clavate, hyaline, thin-walled; apical setulae 2-5.5 X 0.5-2 µm, irregular in outline, obtuse, sometimes verrucose, hyaline or pale yellow, thin- or thick-walled. **Pileipellis** hymeniform, not mottled or weakly mottled, of *Siccus*-type broom cells, plus rare non-setulose clavate elements; main body 9-20 X 5.5-10(12) µm, cylindric or clavate, typically hyaline and thin-walled, rarely with ochraceous walls up to 1 µm thick; apical setulae 1.5-5(6) X 0.5-1.5 µm, irregular in outline, some narrow and crowded, others broader and more widely spaced, many verrucose, colored

melleous or tawny, weakly dextrinoid, thick-walled or solid. **Tramal hyphae** 3-8 µm diam, interwoven, cylindric, non-gelatinous, smooth, hyaline, dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-6 µm diam, parallel, non-incrusted, ochraceous or tawny, dextrinoid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** similar but hyaline and thin-walled. **Caulocystidia** absent.

**Commentary**. Type material of this species was issued by Rabenhorst as no. 1806 in the Klotzschii Herbarium Vivum Mycologicum Exsiccati, Cent. XIX, issued 1854. Each specimen was accompanied by a description in Latin, and the same description was published in Bot. Zeitung 12(11): 185, 1854. Of the two isotype specimens I have examined (FH, BPI), I have chosen the Farlow Herbarium specimen as lectotype because it contains more basidiomata and more spores were recovered. Both exsiccata specimens examined were conspecific. *Marasmius anomalus* belongs in sect. *Sicci*, subsect. *Siccini*, ser. *Haematocephali*. Contemporary descriptions of this species include those by Singer (1965, 1976), Noordeloos (1987), and Antonin (1988).

***MARASMIUS ANOMALUS*** Peck, Annual Rep. New York State Mus. 24: 76. 1871 (1872) [*non Marasmius anomalus* Lasch *in* Rabenhorst, 1854.].

≡ *Marasmius fasciatus* Pennington *nom. nov.*, N. Amer. Fl. 9(4): 270. 1915.

≡ *Collybia fasciata* (Penn.) Halling, Mycologia Mem. 8: 81. 1983.

HOLOTYPE: United States, New York, Catskill, July 1871, C. H. Peck (NYS).

The collection consists of two loose basidiomata pressed flat and somewhat fragmented. **Pileus** 10-15 mm diam, plano-convex, margin incurved, surface glabrous or minutely radially streaked, reddish brown. **Lamellae** free, close, narrow, pale reddish brown. **Stipe** length undeterminable (fragmented), width 1.5-2 mm, glabrous or minutely pruinose, hollow, reddish brown, non-insititious, basal mycelial hairs strigose, pale yellowish buff.

**Basidiospores** 6.4-8 X 3.2-4 µm [$\bar{x}$ = 7.2 ± 0.7 X 3.6 ± 0.2 µm, E = 1.8-2.2, Q = 2 ± 0.1, n = 8], ellipsoid or lacrymoid, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 20-24 X 5-6.5 µm, 4-spored, clavate. **Basidioles** subclavate. **Hymenial cystidia** not observed. **Pileipellis** a cutis of repent, radially arranged hyphae; hyphae 3.5-9.5(11) µm diam, cylindric or rarely contorted, branched, non-diverticulate or with scattered knob-like branchlets, smooth or more commonly with granular or helical pigment incrustations, dark ochraceous or brown, inamyloid, non-gelatinous, clamped; terminal cells cylindric, clavate or rarely ventricose, otherwise similar to intercalary cells. **Tramal hyphae** 3.5-12 µm diam, interwoven, cylindric or inflated, smooth or rarely weakly incrusted, hyaline or pale yellow, inamyloid, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-8 µm diam, parallel, ochraceous or brownish orange, inamyloid, thin-walled, clamped; **medullary hyphae** 4-16 µm diam, subparallel or interwoven, hyaline, inamyloid, thin-walled, clamped. **Caulocystidia** scattered, 25-60 X 4-6.5 µm (at apex), cylindric, obtuse, hyaline, inamyloid, thin-walled.

**Commentary.** The specific epithet *anomalus* was homonymic in *Marasmius* when published by Peck (1872), but was latter corrected to *M. fasciatus* by Pennington (1915). The non-hymeniform pileipellis of repent hyphae with scattered branchlets and inamyloid tramal tissues indicate that this specimen belongs in *Collybia* sect. *Subfumosae*. I concur with Halling's (1983) transfer to that genus. An unpublished watercolor painting of the holotype specimen is archived at NYS.

Peck's concept of this species was quite variable. Five specimens deposited at NYS and determined by Peck as *M. anomalus* represent four different species. One specimen annotated "Forge, Herkimer Co., Peck, Aug." is conspecific with the holotype and represents the only other authentic specimen of *Collybia fasciata*. One specimen annotated "Osceola, Lewis Co., Peck, Aug." represents *Collybia acervata* (Fr.) Kummer; one specimen annotated "Caroga, Fulton, Peck, Aug." represents *Marasmius cystidiosus* (Smith & Hesler) Gilliam [*fide* Gilliam (1976); I could not locate this specimen at NYS]; and two specimens annotated "Round Lake, Saratoga Co., Peck, Aug." and "Selkirk, Albany Co., Peck, Aug." represent *Marasmius spissus* Gilliam.

***MARASMIUS APPLANATIPES*** Desjardin, Mycologia 77(6): 899. 1985.

HOLOTYPE: United States, California, Sierra Co., Yuba Pass, Hwy 49, 8 Oct. 1983, D. E. Desjardin no. 2330 (SFSU).

Collection consists of approximately 8 basidiomata in excellent condition. Nothing more can be added to the description and illustrations presented in the originating publication. See there for details.

***MARASMIUS ARMENIACUS*** Gilliam, Mycologia 67(4): 837. 1975.

≡ *Marasmius pusio* var. *armeniacus* (Gilliam) Desjardin *comb. et stat. nov.* (below).

HOLOTYPE: United States, Indiana, Monroe Co., Cedar Bluffs near Victor, 23 Aug. 1970, Gilliam no. 932a; gregarious on dead grass culms in open juniper savanna on limestone hill (MICH).

The portion of the holotype examined consisted of several basidiomata in good condition attached to grass leaf fragments. **Pileus** 2-4 mm diam, convex, even, subvelutinous, ferruginous. **Lamellae** adnate, subdistant, narrow, buff-colored. **Stipe** 8-13 X 0.5 mm, central, terete, pruinose overall, pallid, insititious.

**Basidiospores** 8 X 4 µm (only one observed; see the protologue for more details), ellipsoid, hyaline, inamyloid, smooth. **Basidia** not observed. **Basidioles** 14.5-22.5 X 5-6.5 µm, subclavate or broadly fusoid, hyaline. **Pleurocystidia** absent. **Cheilocystidia** abundant, similar to *Siccus*-type pileipellis elements; main body 10-21.5 X 4-6.5 µm, clavate, rarely lobed, hyaline, thin-walled; apical setulae 1-2.5 X 0.5-1 µm, knob-like or rod-like, often verrucose, hyaline, thin-walled. **Pileipellis** hymeniform, weakly mottled, of *Siccus*-type broom cells; main body 9.5-16 X 4-6 µm, clavate, hyaline, thin-walled; apical setulae 1-3.5 X 0.5-1 µm, solid or thick-walled, orange, weakly dextrinoid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 1.5-5.5 µm diam, cylindric, smooth, non-gelatinous, hyaline, weakly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 1.5-5.5 µm diam, cylindric, non-incrusted, hyaline or pale yellow, strongly dextrinoid, thin-walled (at apex) or with walls up to

0.8 µm thick (at base), clamped; **medullary hyphae** similar to cortical hyphae but hyaline and thin-walled throughout, with rare refractive oleiferous hyphae interspersed. **Stipe vesture** of three types of **caulocystidia:** 1) rare, non-setulose elements, 6.5-18 X 2.5-4 µm, irregularly cylindric, sometimes lobed, obtuse, hyaline, thin-walled; 2) abundant *Siccus*-type elements, 6.5-16 X 2.5-6 µm, with small, irregular, verrucose, hyaline setulae; 3) rare setoid hairs near the stipe base, up to 40 X 2-3.5 µm, acuminate, dendrotrichomoid, hyaline, dextrinoid, with walls up to 1 µm thick.

**Commentary.** *Marasmius armeniacus* is here considered a variety of *M. pusio* Berkeley & Curtis, and is transferred as:

***Marasmius pusio*** var. ***armeniacus*** (Gilliam) Desjardin ***comb. et stat. nov.*** [Bas.: *Marasmius armeniacus* Gilliam, *ibid.*].

Variety *armeniacus* differs from var. *pusio* in forming orange or pale brownish orange pilei throughout development, and in fruiting on leaves of grasses or rarely *Rubus*. In contrast, pilei of var. *pusio* were described as purplish brown when young (Berkeley & Curtis, 1853), although they may become brownish orange in the herbarium, and basidiomata are formed on the bark of hardwoods. Variety *armeniacus* is similar to *M. pusio* var. *graminivorus* Singer, but the latter differs in forming basidiomata with more eccentrically attached pilei, shorter stipes, and in forming slightly longer spores, *viz.*, L = 8.4-11.2 µm, $\bar{L}$ ≈ 9.6 µm [Gilliam (1975) reported the spores of *M. armeniacus* as 7.1-9 µm long]. Refer to type studies of *M. pusio* and *M. pusio* var. *graminivorus* for comparison. *Marasmius pusio* var. *armeniacus* belongs

in sect. *Sicci* ser. *Leonini* because of pileipellis morphology and absence of pleurocystidia.

***MARASMIUS ATLANTICUS*** Singer, Fl. Neotrop. Monogr. 17: 77. 1976.

HOLOTYPE: United States, Florida, Highlands Co., Highlands Hammock St. Park near Sebring, 21 Aug. 1942, Singer no. F347 (F).

The collection consists of one basidiomata in fair condition. **Pileus** 6 mm diam, convex, subgranulose to suede-like, weakly striate, beige. **Lamellae** adnate, subdistant, moderately broad, non-collariate, non-marginate, pallid. **Stipe** 20 X 0.8 mm, terete, apex pallid grey, base dark greyish brown, covered overall with white pubescence, insititious on undetermined leaf fragment.

**Basidiospores** 6.8-8.4 X 3.2-4 µm [$\bar{x}$ = 7.5 ± 0.5 X 3.6 ± 0.3 µm, E = 1.8-2.3, Q = 2.1 ± 0.1, n = 15], ellipsoid or subamygdaliform, hyaline, inamyloid, smooth. **Basidia** 20-24 X 5.5-7 µm, 4-spored, clavate. **Basidioles** cylindric or subfusoid. **Pleurocystidia** absent. **Cheilocystidia** 16-22.5 X 5-8 µm, numerous, irregularly cylindric, clavate, or variously lobed, hyaline, thin-walled. **Pileipellis** not hymeniform, composed of a cutis of interwoven hyphae; hyphae 4-12 µm diam, cylindric, frequently-branched, non-gelatinous, smooth or more often with thin, zebroid, pale ochraceous incrustations, weakly diverticulate but not a *Rameales*-structure, hyaline (where non-incrusted), inamyloid, unclamped; diverticula short and broadly obtuse. **Tramal hyphae** 3-6.5 µm diam, interwoven, hyaline, inamyloid, smooth, unclamped. **Stipe tissue** monomitic; **cortical hyphae** 3.2-6 µm diam, parallel, hyaline and thin-walled at apex, brown and thick-walled

(up to 1.5 µm) at base, dextrinoid, unclamped; **medullary hyphae** 4-8 µm diam, subparallel, hyaline, inamyloid, thin-walled or with walls up to 1 µm thick, unclamped. **Caulocystidia** 32-48 X 8-12.5 µm (at stipe apex), numerous, subclavate or clavate, non-diverticulate, hyaline and thin-walled, or pale yellow and with walls up to 1 µm thick, inamyloid.

**Commentary**. *Marasmius atlanticus* is a clampless member of sect. *Androsacei*.

***AGARICUS ATRORUBENS*** Berkeley, London J. Bot. 1: 138. 1842.

≡ *Marasmius atrorubens* (Berk.) Berkeley, Hooker's J. Bot. Kew Gard. Misc. 8: 137. 1856.

≡ *Androsaceus atrorubens* (Berk.) Patouillard, Essai tax. Hyménomyc.: 141. 1900.

LECTOTYPE: Surinam, Hostmann no. 297 [K - Hooker Herbarium; reported by Singer (1958: 108) as the holotype]. [ISOLECTOTYPES: K - Berkeley Herbarium; K - Cooke Herbarium.]

The lectotype collection consists of one basidiomata pressed flat and loose in the packet. **Pileus** 8 mm diam, fragmented, plano-convex, subvelutinous, striate, deep brown. **Lamellae** non-collariate, close, narrow, pallid, edges concolorous with the pileus. **Stipe** 24 X 0.5 mm, broken off at the base, pale brown and beset with fine bristly pallid hairs; no substrate present.

**Basidiospores** 13.6-18.8 X 3.6-4.2 µm (only 4 recovered), clavate, hyaline, inamyloid, smooth. **Basidia** and **basidioles** collapsed, poorly reviving. **Pleurocystidia** 20-28 X 6.5-8 µm, ventricose or fusoid, scattered, weakly refractive or highly refractive and appearing thick-

walled, hyaline or pale yellow. **Cheilocystidia** similar to *Siccus*-type pileipellis elements; main body 12-16 X 5-6.5 µm, cylindric or clavate, hyaline, thin-walled; apical setulae 3-9.5 X 0.8-2 µm, crowded, conic, obtuse or subacute, pale tawny, thick-walled. **Pileipellis** hymeniform, weakly mottled, of *Siccus*-type broom cells; main body 8-16 X 4-6.5 µm, cylindric or clavate, thin-walled and hyaline or thick-walled and ochraceous; apical setulae 3-5.6(10) X 0.8-1.2(2.5) µm, crowded, cylindric or conic, obtuse or subacute, pale ochraceous or brown, thick-walled or solid. **Tramal hyphae** 3-6 µm diam, interwoven, hyaline, inamyloid or weakly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-5.5 µm diam, parallel, stramineous or brown, dextrinoid, with walls up to 1.5 µm thick, clamped; **medullary hyphae** similar but hyaline and thinner-walled. **Caulocystidia** 32-100$^{+}$ X 6-11 µm (at stipe apex), numerous, typically setoid, acuminate and sharply acute, rarely clavate or cylindric and then much shorter than the setoid elements, hyaline or pale yellow, inamyloid or weakly dextrinoid, with walls typically 1.5 µm thick.

**Commentary**. Dennis (1951b) indicated that pleurocystidia were absent on the holotype specimen, and he was unable to recover spores. Because of Dennis' observations, Singer (1976) described a cystidiate variety, *M. atrorubens* var. *cystidifer* Sing., with spores 14-20.5 X 3-5 µm. I was able to demonstrate the presence of refractive, fusoid-ventricose pleurocystidia in the lectotype basidiome of *M. atrorubens*, and recovered four spores as indicated above. In all micromorphological features, the lectotype specimen of *M. atrorubens*

matches the protologue of var. *cystidifer* and it is possible that the latter epithet is superfluous. I have not examined the holotype specimen of var. *cystidifer* and cannot, therefore, verify this contention.

The Berkeley Herbarium isolectotype (K!) consists of one basidiome that is conspecific with the lectotype. The Cooke Herbarium isolectotype (K!) consists of one pileus and four stipes, and represents a mixed collection as noted by Singer (1958, 1976). The intact basidiome of this collection has a glabrous stipe, and two additional stipes are glabrous. These individuals undoubtedly represent a species other than *M. atrorubens*. The remaining stipe in the collection is hispid, the ornamentation formed of acuminate, setoid caulocystidia. The latter basidiome fragment may represent *M. atrorubens* but it is impossible to diagnose accurately without a pileus.

*Marasmius atrorubens* belongs in sect. *Sicci* ser. *Atrorubenses* Desjardin [= ser. *Actinopodes* Sing. *pro parte*]. A formal proposal of this new series is presented elsewhere in this manuscript.

***GYMNOPUS AURANTIACUS*** Murrill, Bull. Torrey Bot. Club 66: 157. 1939.

≡ *Collybia aurantiaca* (Murr.) Murrill, Bull. Torrey Bot. Club. 66: 160. 1939.

≡ *Marasmius aurantiacus* (Murr.) Singer, Sydowia 18: 268. 1965.

≡ *Marasmius corrugatus* var. *aurantiacus* (Murr.) Singer, Fl. Neotrop. Monogr. 17: 193. 1976.

HOLOTYPE: United States, Florida, Alachua Co., Gainesville, Planera Hammock, 21 July 1938, West, Arnold & Murrill no. F17904 (FLAS).

The collection consists of $20^{+}$ basidiomata, mostly with pilei broken away from stipes, the latter lignicolous on oak bark. Notes with collection: "hemispheric, sm, glab, pallid, worm color, no orange, 2 cm largest; sps 6-8 X 3 fusiform; more yellow in younger; st white, sm, glab, rusty to fulvous below; gs white, arc adnate insert." **Pileus** 5-8 mm diam, convex, even, glabrous, pale ferruginous overall or with slightly darker margin, context thin. **Lamellae** adnate, subdistant, very narrow, concolorous with pileus. **Stipe** ≈30 X 1-2 mm, terete, glabrous above, base covered with white or buff-colored tomentum, non-insititious, dark reddish brown overall; in subcespitose clusters on oak bark.

**Basidiospores** 7.2-9 X 3.4-4.2 µm [$\bar{x}$ = 8.2 ± 0.5 X 3.9 ± 0.2 µm, E = 1.9-2.4, Q = 2.1 ± 0.1, n = 30], ellipsoid, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 4-spored. **Basidioles** 18-22 X 5-8 µm, subclavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** numerous, similar to *Siccus*-type pileipellis elements; main body 14-22 X 5-12 µm, hyaline and thin-walled overall. **Pileipellis** hymeniform, not mottled, of *Siccus*-type broom cells; main body 10-23 X 6.5-10 µm, clavate, thin-walled or with walls up to 0.5 µm thick, hyaline or pale melleous, clamped, rarely a few elements thicker-walled and more deeply pigmented; apical setulae 2-10 X 0.5-2.5 µm, rod-shaped or subconic, typically obtuse but some subacute, thick-walled or solid, ranging in color from subhyaline to pale melleous or orange. **Tramal hyphae** 2-8 µm

diam, interwoven, hyaline, strongly dextrinoid, some slightly inflated, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** and **medullary hyphae** little differentiated, 2.5-10 µm diam, hyaline to pale reddish brown in cortical layer, hyaline in medulla, strongly dextrinoid throughout, with walls up to 2.5 µm thick, clamped. **Stipe vesture** at apex composed of numerous *Siccus*-type broom cells similar to those of the pileipellis, with melleous setulae, plus rare dextrinoid dendrotrichomoid elements interspersed; broom cells less numerous near stipe base where **caulocystidia** are irregularly cylindric, obtuse, thick-walled, hyaline or pale yellow.

**Commentary.** *Gymnopus aurantiacus* was considered by Singer (1976) as a variety of *Marasmius corrugatus* (Pat.) Sacc. & Sydow [Syll. Fung. 16: 54, 1902; Bas.: *Androsaceus corrugatus* Patouillard, Bull. Soc. Mycol. 16: 175, 1900]. I have not studied the holotype specimen of *A. corrugatus* [Guadeloupe, Basse-Terre, Duss (FH - Patouillard Herb.)] and cannot comment on the appropriateness of the transfer. Data from the holotype specimen of *G. aurantiacus* indicate the taxon belongs in *Marasmius* sect. *Sicci* ser. *Leonini*. According to Singer (1976), var. *aurantiacus* differs from var. *corrugatus* in possessing broom cells on the stipe surface and in cespitose habit. An earlier type study of *G. aurantiacus* was provided by Hesler (1959a).

***MARASMIUS AZTECUS*** Singer, Fl. Neotrop. Monogr. 17: 235. 1976.

HOLOTYPE: Mexico, near Peña Blanca, SE of Valle de Bravo, 2100 m, 26 Sep. 1967, Guzman no. 6148, *ad frustula putrida et semiputrida*

*lignea inter folia dejecta quercina, gregatim in silva mixta (Quercus et Pinus)* (ENCB). [ISOTYPE: (F!)].

The isotype collection consists of 5 basidiomata in excellent condition. **Pileus** 10-28 mm diam, convex, striate, subvelutinous, deep orange with ferruginous margin and/or striae. **Lamellae** subdistant, adnexed, narrow, cream-colored and orange-marginate. **Stipe** 70-110 X 2 mm, terete, glabrous, subshiny, apex cream or stramineous, central region reddish brown, base dark brown, non-insititious, with pale fulvous, strigose basal mycelial hairs.

**Basidiospores** 10.8-12.8 X 3.6-4.2 µm [$\bar{x}$ = 11.8 ± 0.7 X 3.9 ± 0.2 µm, E = 2.8-3.2, Q = 3 ± 0.1, n = 20], subclavate, subfusiform or elongate-ellipsoid, hyaline, inamyloid, smooth. **Basidia** 24-32 X 6.5-8.5 µm, 4-spored, clavate. **Basidioles** subclavate or fusoid. **Pleurocystidia** not differentiated from fusoid, non-refractive, thin-walled basidioles (several mounts of each basidiome examined). **Cheilocystidia** similar to the *Siccus*-type pileipellis elements; main body 12-17.5 X 5-6.5 µm, numerous, cylindric or clavate; apical setulae 2.5-5 X 1-1.5 µm, conic, orange, thick-walled. **Pileipellis** hymeniform, weakly mottled, of *Siccus*-type broom cells; main body 8-15 X 4-8 µm, cylindric, clavate or rarely lobed, hyaline and thin-walled, or pale orange with slightly thick walls; apical setulae 2.5-7.5 X 0.5-1.2 µm, conic, subacute, solid, golden or orange, dextrinoid. **Tramal hyphae** 3-8 µm diam, interwoven, hyaline, strongly dextrinoid, thin-walled or with walls up to 1 µm thick, non-gelatinous, smooth, clamped. **Stipe tissue** monomitic; **cortical hyphae** 4-10 µm diam, parallel, hyaline or yellow at the apex, grading into reddish brown,

olivaceous brown or brown at the base, dextrinoid, smooth, with walls up to 1.5 µm thick, clamped; **medullary hyphae** 4-16 µm diam, hyaline, pale yellow or olivaceous yellow, dextrinoid, thinner-walled, clamped. **Caulocystidia** absent.

**Commentary.** In the protologue, Singer (1976) reported the presence of numerous pleurocystidia, and consequently placed the species in ser. *Haematocephali* of sect. *Sicci*. Although I examined several lamellar mounts of each basidiome in the isotype specimen, I was unable to demonstrate the presence of well differentiated pleurocystidia. Non-sterigmate hymenial elements ranged in shape from cylindric to clavate, ventricose or fusoid, were thin-walled and non-refractive, all arose from nearly the same level and projected to nearly the same level, and were considered by me to represent basidioles (cystidioles?). *Marasmius aztecus* is here considered to belong in ser. *Leonini* of sect. *Sicci*.

***MARASMIUS BADICEPS*** Peck, Bull. Torrey Bot. Club 24: 142. 1897.

≡ *Marasmius badius* Peck, Bull. Torrey Bot. Club 22: 487. 1895. [*non Marasmius badius* Berk. & Curt., J. Linn. Soc., Bot. 10: 294. 1869.]

***MARASMIUS BADIUS*** Peck, Bull. Torrey Bot. Club 22: 487. 1895. [*non Marasmius badius* Berk. & Curt., J. Linn. Soc., Bot. 10: 294. 1869.]

≡ *Marasmius badiceps* Peck, Bull. Torrey Bot. Club 24: 142. 1897.

HOLOTYPE: United States, Kansas, Rooks Co., July 24, 1895, Kansas Fungi no. 1814, E. Bartholomew, rotten sticks on wet ground (FH).

The collection consists of five basidiomata pressed flat but in good condition. **Pileus** 6-10 mm diam, convex, margin weakly striate, glabrous, pale brown or brown. **lamellae** adnate, close or subdistant, narrow, pale orange-cream. **Stipe** 25-30 X 1.5 mm, terete, slightly enlarged near base, apex pruinose and reddish brown, base dark brown or black but covered with a pallid pubescence, non-insititious, lignicolous.

**Basidiospores** 5.6-7.2 X 3-3.6 µm [$\bar{x}$ = 6.4 ± 0.6 X 3.2 ± 0.2 µm, E = 1.8-2.4, Q = 2 ± 0.1, n = 25], ellipsoid, lacrymoid or pip-shaped, hyaline, inamyloid, smooth. **Basidia** 16-25 X 4-6.5 µm, 4-spored, subclavate. **Basidioles** cylindric, subclavate or fusoid. **Hymenial cystidia** absent. **Pileipellis** not hymeniform, composed of a cutis of radially arranged hyphae; hyphae 4-12 µm diam, intercalary cells cylindric, terminal cells clavate, non-diverticulate, non-gelatinous, smooth or more often with pale brown incrustations, clamped; walls thin, subhyaline or pale brown, inamyloid. **Tramal hyphae** 5-14 µm diam, interwoven, few inflated up to 20 µm diam, non-gelatinous, typically smooth, hyaline and thin-walled, clamped; hyphae in lamellar trama less inflated. **Stipe tissue** monomitic; **cortical hyphae** 3.5-8 µm diam, subparallel, smooth or with annular incrustations, subhyaline or pale greyish brown, inamyloid, clamped, with walls up to 1 µm thick; **medullary hyphae** similar but non-incrusted, hyaline and up to 12 µm diam. **Stipe vesture** at apex of scattered **caulocystidia** 18-26.5 X 5.5-8 µm, cylindric, clavate or rarely ventricose, broadly obtuse, rarely

with one or several knob-like projections, hyaline, inamyloid, thin-walled.

**Commentary.** Pileipellis morphology, microchemical reactions and stipe attachment of the holotype specimen of *M. badius* indicate that this taxon belongs in *Collybia* sect. *Vestipedes* (Fr.) Quélet, and is transferred as:

***Collybia badiceps*** (Pk.) Desjardin ***comb. nov.*** [Bas.: *Marasmius badiceps* Peck, *ibid.*].

*Collybia badiceps* is similar to *C. subnuda* (Ellis *ex* Pk.) Gilliam and *C. fasciata* (Penn.) Halling [sect. *Subfumosae sensu* Halling (1983)]. *Collybia subnuda* differs in forming longer spores and numerous cheilocystidia, and *C. fasciata* differs in forming pileipellis elements with scattered diverticula, slightly longer spores and darker stipe. Refer to the type studies of *M. subnuda* Ellis *ex* Peck and *M. anomalus* Peck [≡ *C. fasciata*] for comparison.

***MARASMIUS BAHAMENSIS*** Murrill *in* Pennington, N. Amer. Fl. 9(4): 265. 1915.

HOLOTYPE: Bahama Islands, New Providence, Lake Cunningham, 8 Sept. 1904, E. G. Britton no. 611, on fallen dead leaves and twigs (NY).

The collection consists of approximately 20 basidiomata pressed flat but in good condition. **Pileus** 5-12 mm diam, plano-convex, striate, subvelutinous, golden or orange-ochraceous. **Lamellae** adnate or adnexed, close, narrow or moderately broad, pale cream-colored, non-marginate. **Stipe** 25-35 X 0.5-1 mm, terete, equal, pruinose or hispid

overall, ochraceous, non-insititious, with radiating, strigose, tawny-ochraceous basal mycelium.

**Basidiospores** 12-16 X 3.4-4.4 µm [$\bar{x}$ = 13.9 ± 1.1 X 3.8 ± 0.2 µm, E = 3.2-4.4, Q = 3.7 ± 0.3, n = 25], subclavate or subfusiform, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 18.5-24 X 5.5-8 µm, 4-spored, clavate. **Basidioles** fusoid-ventricose. **Pleurocystidia** absent. **Cheilocystidia** similar to *Siccus*-type pileipellis elements; main body 13-17.5 X 5.5-9 µm, cylindric or clavate, typically hyaline and thin-walled, rarely firm-walled and yellow or golden; apical setulae 2-5.5 X 0.8-2 µm, conic, subacute, ranging from hyaline and thin-walled to pale yellow or golden and thick-walled. **Pileipellis** hymeniform, not mottled, of *Siccus*-type broom cells; main body 9.5-16 X 4-9 µm, cylindric or clavate, hyaline and thin-walled or golden and firm-walled; apical setulae 2.5-6 X 0.8-2 µm, conic, subacute, yellow, golden or pale tawny, thick-walled or solid. **Tramal hyphae** 3-7.5 µm diam, interwoven, cylindric, non-gelatinous, smooth, hyaline, strongly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3.2-8 µm diam, parallel, hyaline at apex, pale ochraceous at base, strongly dextrinoid, smooth, clamped, with walls up to 1 µm thick; **medullary hyphae** similar but hyaline and thin-walled throughout. **Stipe vesture** of numerous, scattered **caulocystidia**, at stipe apex 20-35 X 6.5-10 µm, irregularly cylindric, clavate or ventricose, typically broadly obtuse, hyaline or pale yellow, with walls up to 1 µm thick; at stipe base up to $100^{+}$ X 4.5-8 µm, cylindric or acuminate, subacute, subhyaline or stramineous, with walls up to 1.2 µm thick.

**Commentary.** *Marasmius bahamensis* belongs in sect. *Sicci* ser. *Atrorubenses* [= ser. *Actinopodes* Singer *pro parte*].

***AGARICUS BAMBUSINUS*** Fries, Linnaea 5: 507. 1830.

≡ *Marasmius bambusinus* (Fr.) Fries, Epicr. Syst. Mycol. 385. 1838.

REPRESENTATIVE MATERIAL: Colombia, Dept. Valle del Cauca, Buenaventura, Quebrada La Brea, 24 Apr. 1968, Singer no. B6345; *ad folia monocotyledonae in silva pluviali tropicali* (F). [Holotype: Brazil, Beyrich, not located.]

The specimen here used as representative material consists of one basidiome in good condition. **Pileus** 5 mm diam, plano-convex, subvelutinous, sulcate, reddish brown. **Lamellae** adnate, remote, moderately broad, dark cream, some lamellae reddish-marginate, interlamellar spaces pale reddish brown. **Stipe** 7 X <0.3 mm, terete, glabrous, pale ferruginous, non-insititious, arising from a pad of white mycelium; attached to a grass leaf.

**Basidiospores** 15.2-18.4 X 3.6-4.6 µm [$\bar{x}$ = 16.5 ± 0.8 X 4 ± 0.2 µm, E = 3.8-4.6, Q = 4.1 ± 0.2, n = 20], clavate or subfusiform, hyaline, inamyloid, smooth. **Basidia** 4-spored, clavate. **Basidioles** ventricose. **Pleurocystidia** 30-45 X 6.5-9 µm, numerous, irregularly cylindric, broadly obtuse, not appendiculate or apically constricted, refractive, hyaline, thin-walled. **Cheilocystidia** similar to *Siccus*-type pileipellis elements; main body 11-16 X 4.5-7 µm, cylindric or subclavate, hyaline, thin-walled; apical setulae 2.5-8 X 1.5-2.5 µm, rod-shaped or subconic, obtuse or rarely subacute, subhyaline or pale melleous, thick-walled. **Pileipellis** hymeniform, not mottled, of

*Siccus*-type broom cells; main body 8-15 X 5-8 µm, cylindric or clavate, ranging from hyaline and thin-walled to firm-walled and pale tawny; apical setulae 2.5-7.5 X 1.2-2.5 µm, rod-shaped or subconic, obtuse or subacute, typically solid, pale ferruginous or tawny. **Tramal hyphae** 3-8 µm diam, interwoven, hyaline, dextrinoid, thin-walled, clamped. **Stipe tissue** not examined, material too scanty.

**Commentary.** I have not located the Beyrich type material and am accepting Singer's (1976) concept of the species. Singer has studied many marasmioid agarics which fruit on bamboo, and he has indicated that the specimen described above, as well as several specimens collected in Brazil and various other regions of South America (Singer, 1976), are concordant in all features with the Friesian protologue of *M. bambusinus.* Until Beyrich's type material is located, or if it no longer exists until topotypical material is collected and designated as neotype, the above cited specimen will serve to represent my concept of the species.

***MARASMIUS BAMBUSINIFORMIS*** Singer, Fl. Neotrop. Monogr. 17: 167. 1976.

HOLOTYPE: Ecuador, Napo, Lago Agrio, 16 May 1973, Singer no. B7480, *ad culmum Gramineae cuiusdam* (F).

The collection consists of one basidiome in good condition attached to a grass culm. **Pileus** 4 mm diam, convex, shallowly sulcate, subvelutinous, ferruginous. **Lamellae** remote (7), non-collariate, narrow, non-marginate, pallid. **Stipe** 15 X 0.2 mm, glabrous, pallid above, reddish brown below, non-insititious, with buff-colored basal mycelium.

**Basidiospores** 16.8-20 X 3.8-4.6 µm [$\bar{x}$ = 18.6 ± 1.1 X 4.2 ± 0.2 µm, E = 4-5, Q = 4.5 ± 0.3, n = 10], clavate, hyaline, inamyloid, smooth. **Basidia** not observed. **Basidioles** 24-28 X 7-9 µm, clavate or ventricose. **Pleurocystidia** absent. **Cheilocystidia** of two types: 1) rare, strangulate elements 32-40 X 5.5-8 µm, refractive, apically constricted several times, obtuse, hyaline; 2) numerous *Siccus*-type elements; main body 9.5-16 X 5.5-8 µm, typically hyaline and thin-walled, rarely with pale tawny firm walls; apical setulae 2-6.5 X 0.5-1.8 µm, irregularly cylindric, wavy in outline, sometimes branched, hyaline of pale tawny, thin-walled or thick-walled. **Pileipellis** hymeniform, weakly mottled, of *Siccus*-type broom cells; main body 12-16 X 6.5-10 µm, cylindric or clavate, sometimes lobed, many hyaline and thin-walled, others ferruginous and thick-walled; apical setulae 2-5 X 1-1.5 µm, irregularly cylindric, wavy in outline, obtuse or subacute, pale orange or ferruginous, thick-walled or solid. **Tramal hyphae** 2.5-4 µm diam, interwoven, cylindric, non-gelatinous, hyaline, weakly dextrinoid, thin-walled, clamped. **Stipe tissue** not examined, material too scanty.

**Commentary.** Pileipellis morphology and absence of pleurocystidia indicate *M. bambusiniformis* belongs in sect. *Sicci* ser. *Leonini*.

***MARASMIUS BELLIPES*** Morgan, J. Mycol. 11: 207. 1905.

LECTOTYPE: United States, 11 Sept. 1905, Morgan (ISC) [indicated as the holotype by Gilliam (1976)].

The lectotype collection consists of several basidiomata in fair condition. Notes with the collection: "*M. bellipes* Morgan sp. nov.

Type! sp. lanceolate 10-12 X 3. Pileus 1.5-2.5 cm in diameter, stipe 3-6 cm long, 1 mm thick." No local was cited but the material was probably collected in the Miami Valley of Ohio.

**Basidiospores** 9-12(13.6) X 3.2-4 µm [$\bar{x}$ = 11 ± 0.9 X 3.7 ± 0.3 µm, E = 2.4-3.6, Q = 3 ± 0.3, n = 40], ellipsoid or elongate-amygdaliform, hyaline, inamyloid, smooth. **Basidia** 21-32 X 4.5-7 µm, 4-spored, subclavate. **Basidioles** subclavate or fusoid. **Pleurocystidia** absent; many non-refractive, hyaline, fusoid basidioles with collapsed apices present which appear pleurocystidioid in morphology, but these all arising from about the same level and not projecting beyond other hymenial elements. **Cheilocystidia** numerous, similar to *Siccus*-type pileipellis elements; main body 9.5-17.5 X 4.5-7 µm, hyaline, thin-walled; apical setulae 2.5-8 X 1.2-2 µm, conic or irregular in outline, seldom branched, subacute, typically firm-walled, rarely solid, hyaline or pale yellow. **Pileipellis** hymeniform, not mottled or weakly mottled, of *Siccus*-type broom cells; main body 8-18 X 4-10 µm, mainly hyaline and thin-walled, some elements thick-walled and brownish orange, these interspersed among thin-walled elements; apical setulae 2.5-6.5 X 1.2-2.5 µm, cylindric, conic or irregular in outline, obtuse or subacute, thick-walled or solid, ochraceous or brownish orange, weakly dextrinoid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-6.5(-12) µm diam, cylindric or slightly inflated, non-gelatinous, hyaline, dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-6 µm diam, parallel, cylindric, smooth, pale yellow, ochraceous or brown, strongly dextrinoid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** 3-8 µm diam (-11.5 µm at

stipe base), subparallel, hyaline, dextrinoid, thin-walled at stipe apex, up to 1 µm thick at stipe base, clamped. **Stipe vesture** present at apex only, composed of scattered clusters of setulae arising intercalarily from the repent cortical hyphae or arising terminally from poorly developed main bodies; setulae 2.5-12 X 1.2-2.5 µm, irregularly cylindric, often wavy in outline, subacute, thick-walled or solid, ochraceous or brownish orange.

**Commentary.** Of the five authentic specimen of *M. bellipes* deposited in the Morgan Herbarium (ISC), two specimens were undoubtedly in the hands of Morgan at the time of publication of the epithet, *viz.*, "Morgan, 8 June 1892," and "Morgan, 11 Sept. 1905." The remaining three specimens were all labeled "Preston, Ohio, 1906, A. P. & L. V. Morgan no. 26," collected after publication of the epithet. There is a note with the "11 Sept. 1905" specimen written in Morgan's handwriting that states: "*M. bellipes* Morgan, sp. nov. Type!" Although Morgan explicitly intended the "11 Sept. 1905" specimen to represent the holotype, no specimens were cited in the protologue, and the latter specimen is correctly referred to as the lectotype.

Gilliam (1976) reported presence of "clavate to cylindric, capitellate or appendiculate, hyaline" pleurocystidia in *M. bellipes*. I was unable to demonstrate the presence of clearly differentiated pleurocystidia in the lectotype specimen or in any of the authentic specimens. Many of the basidioles revived poorly and matched exactly the "pleurocystidial" morphology described by Gilliam. All of these elements, however, were non-refractive, arose from the same level as the other hymenial elements and did not project significantly beyond

them. I consider pleurocystidia absent in *M. bellipes*, a condition that indicates the species belongs in ser. *Leonini* of sect. *Sicci*.

***MARASMIUS BIFORMIS*** Peck, New York State Mus. Bull. 67: 25. 1903.

≡ *Collybia biformis* (Pk) Singer, Sydowia 15: 55. 1961.

HOLOTYPE: United States, New York, Sandlake, Aug. 1902, C. H. Peck (NYS).

The collection consists of approximately 50 basidiomata in good condition. **Pileus** 5-12 mm diam, convex, often with a shallow central depression, striate, radially streaked, brown or dark brown. **Lamellae** adnate, close or subdistant, narrow, tan or cream-colored. **Stipe** 25-45 X 1-1.5 mm, terete, equal or with a slightly broader base, pubescent and buff, tan or greyish at apex, tomentose and tawny or ferruginous at base, non-insititious.

**Basidiospores** 6.6-8.8 X 3.2-4.4 µm [$\bar{x}$ = 7.6 ± 0.6 X 3.5 ± 0.3 µm, E = 1.8-2.5, Q = 2.2 ± 0.2, n = 30], ellipsoid in face view, lacrymoid or pip-shaped in profile, hyaline, inamyloid, smooth. **Basidia** 24-29 X 4.5-7 µm, 4-spored, subclavate. **Basidioles** cylindric, broadly obtuse or attenuated slightly at apex. **Pleurocystidia** absent. **Cheilocystidia** 20-32 X 4-6.5 µm, numerous, irregularly cylindric, often contorted and constricted, sometimes with one or more lateral, broadly rounded projections, hyaline, thin-walled. **Pileipellis** not hymeniform, formed of a cutis of radially arranged hyphae; hyphae 3.2-9 µm diam, cylindric, non-inflated, non-gelatinous, typically heavily incrusted with annular or helical brown pigments, rarely with small, rod-like divertula or branchlets, more commonly non-diverticulate, clamped;

walls hyaline or pale brown, thin. **Tramal hyphae** 3-6.5 µm diam, interwoven, weakly incrusted nearest the pileipellis, smooth elsewhere, cylindric, branched, non-gelatinous, hyaline, inamyloid, clamped, thin-walled. **Stipe tissue** monomitic; **cortical hyphae** 2.5-6.5 µm diam, parallel, hyaline or pale yellow at stipe apex, pale orange at stipe base, smooth, inamyloid, clamped, with walls up to 2 µm thick; **medullary hyphae** 3-10 µm diam, subparallel, hyaline, inamyloid, clamped, with walls up to 1.5 µm thick. **Stipe vesture** of tightly interwoven hyphae 3-5 µm diam, giving rise to clusters of erect **caulocystidia:** at apex 30-60+ X 4-6 µm, cylindric, flexuous or irregular in outline, obtuse, hyaline, thin-walled; at base 100+ X 4-6 µm, cylindric, obtuse, pale yellow or pale orange, inamyloid, with walls up to 1 µm thick.

**Commentary.** Pileipellis morphology, microchemical reactions and stipe attachment of the holotype basidiomata of *M. biformis* indicated that the species belongs in *Collybia* sect. *Subfumosae.* See Halling (1983) for a further discussion of the species, and Hesler (1959b) for minimal details on the holotype specimen.

***MARASMIUS BOREALIS*** Gilliam, Mycologia 67(4): 831. Figs. 21-23. 1975.

HOLOTYPE: United States, Michigan, Chippewa Co., Hiawatha National Forest, south of Whitefish Bay, 11 Aug. 1971, Gilliam no. 1188, gregarious on maple leaves in beech-maple woods (MICH).

The portion of the holotype examined consisted of several basidiomata in excellent condition. **Pileus** 5-8 mm diam, campanulate or convex, striate, subvelutinous, golden or deep ochraceous. **Lamellae**

distant, narrow, pale yellow. **Stipe** 30 X 0.5 mm, terete, equal, glabrous, shiny, apex reddish brown, base brown, non-insititious.

**Basidiospores** 13.4-17 X 3.6-4.8 µm [$\bar{x}$ = 14.8 ± 0.9 X 4.2 ± 0.3 µm, E = 3.1-4.1, Q = 3.6 ± 0.2, n = 40], clavate, curved, hyaline, inamyloid, smooth. **Basidia** 28-32 X 5.5-9 µm, 4-spored, subclavate. **Basidioles** cylindric or subclavate. **Pleurocystidia** absent. **Cheilocystidia** common, similar to *Siccus*-type pileipellis elements; main body 9.5-15 X 5-8 µm, cylindric or clavate, hyaline, thin-walled; apical setulae 1.5-5 X 0.5-1.2 µm, irregularly cylindric or conic, rarely branched, hyaline, thin-walled or firm-walled. **Pileipellis** hymeniform, not mottled, of *Siccus*-type broom cells; main body 9.5-16 X 4-8 µm, cylindric, clavate or subvesiculose, typically hyaline and thin-walled, few elements with pale yellow walls up to 0.5 µm thick; apical setulae 2-5 X 0.8-1.5 µm, irregularly cylindric or subconic, rarely lobed, obtuse or subacute, subhyaline, pale yellow or pale orange, thick-walled or solid. **Tramal hyphae** 3-7.5 µm diam, interwoven, cylindric, branched, non-gelatinous, smooth, hyaline, dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2-5 µm diam, parallel, hyaline at the apex, dark ochraceous or brown at the base, strongly dextrinoid, clamped, with walls up to 1.2 µm thick; **medullary hyphae** 3.5-8 µm diam, subparallel, hyaline, dextrinoid, thin-walled, clamped. **Stipe vesture** typically absent, or consisting of scattered clusters of setulae 1.5-6.5 X 1-2 µm, arising directly from the repent cortical hyphae, similar to setulae on pileipellis broom cells.

**Commentary.** Pileipellis morphology and absence of pleurocystidia on the holotype specimen of *M. borealis* indicate that the species belongs in sect. *Sicci* ser. *Leonini*. A black and white photograph of the holotype specimen was published in Mycotaxon 4(1): 79, 1976.

***MARASMIUS BREVIPES*** Berkeley & Ravenel *in* Berkeley & Curtis, Ann. Mag. Nat. Hist. ser. 2, 12: 426. 1853.

≡ *Micromphale brevipes* (Berk. & Rav. *in* Berk. & Curt.) Singer *in* Dennis, Kew Bull. 8: 42. 1953

HOLOTYPE: United States, South Carolina, Santee Canal, June, Ravenel no. 1527 [also numbered 1922], dead twigs of oak (K).

The portion of the holotype examined consisted of 8 basidiomata in fair condition attached to oak bark. **Pileus** 3-4 mm diam, convex, glabrous, dark brown. **Lamellae** adnate, distant, narrow, forked near the margin, brown. **Stipe** <10 X <1 mm, central or eccentric, glabrous, solid, black, insititious on bark or arising directly from coarse, black, wiry rhizomorphs.

**Basidiospores** 7.2-10.4 X 3.6-5.2 µm [$\bar{x}$ = 9 ± 1.0 X 4.3 ± 0.5 µm, E = 1.9-2.2, Q = 2.1 ± 0.1, n = 16], ellipsoid or amygdaliform, hyaline, inamyloid, smooth. **Basidia** 20-26 X 5.5-7.5 µm, 4-spored, subclavate. **Basidioles** fusoid. **Pleurocystidia** absent. **Cheilocystidia** rare, scattered among basidiomorphous elements, 21-28 X 4-7 µm, irregularly cylindric, sometimes lobed, with apical or subapical diverticula 1.5-5 X 1-2.5 µm, typically hyaline and thin-walled overall, rarely pale brown and slightly thick-walled. **Pileipellis** not hymeniform, composed of interwoven, heavily pigment-incrusted hyphae; hyphae 3-8 µm diam,

weakly diverticulate, non-gelatinous, incrustations brown; walls up to 2 µm thick; terminal cells coralloid, with numerous irregularly shaped, obtuse diverticula 1-4 X 1-2 µm. **Hypodermium** of interwoven, heavily incrusted hyphae; hyphae 3-6 µm diam, non-gelatinous, frequently-branched, moderately thick-walled, incrustations brownish, inamyloid. **Tramal hyphae** 2.5-6.5 µm diam, interwoven, cylindric, smooth or weakly incrusted, non-gelatinous, hyaline or pale brown, inamyloid, clamped, with walls up to 1.5 µm thick. **Stipe tissue** monomitic but composed of three types of generative hyphae: 1) **cortical hyphae** 2.5-6 µm diam, parallel, cylindric, incrusted with granular brown pigments, strongly dextrinoid, with walls up to 2 µm thick; 2) thin-walled **medullary hyphae** 2.5-4 µm diam, short-celled, highly-branched, smooth, hyaline, inamyloid, clamped; 3) skeletalized **medullary hyphae** 6-14 µm diam, long-celled, unbranched, smooth or weakly roughened, thick-walled (up to 4 µm), hyaline, inamyloid, clamped. **Stipe vesture** absent. **Rhizomorphic tissue** similar to that of the stipe.

**Commentary.** Recently, Desjardin and Petersen (1989c) transferred sect. *Rhizomorphigena* of *Micromphale* into the genus *Marasmius* because the type species of the section (*Marasmius westii* Murr.) showed features more characteristic of *Marasmius* than of *Micromphale*. I consider *M. westii* conspecific with *M. brevipes*, and consequently the latter species is considered to belong to *Marasmius* sect. *Rhizomorphigena*. Refer to Desjardin and Petersen (1989c) for illustrations of micromorphological features of the holotype specimen

and for a further discussion of the species and the section. Compare also the type study of *Marasmius westii*.

***MARASMIUS BULLIARDII*** Quélet, Bull. Soc. Bot. France 24: 323. 1877 (1878).

≡ *Androsaceus bulliardii* (Quél.) Patouillard, Essai tax. Hyménomyc.: 141. 1900.

REPRESENTATIVE MATERIAL: France, Montmorency, Oct. 1881, ad folia putrida, E. Boudier Herb. (PC). No holotype exists.

The collection consists of several basidiomata, pressed flat but in fair condition, attached to undetermined hardwood leaves. **Pileus** 2-3 mm diam, convex, glabrous, brown. **Lamellae** subdistant, collariate, moderately broad, pallid. **Stipe** 20-35 X <1 mm, terete, glabrous, dark brown or black, insititious, with numerous sterile side-branches arising along the length of the stipe; with scattered wiry black rhizomorphs.

**Basidiospores** (7.4)8-10.8(12) X 4-5 µm [$\bar{x}$ = 9.6 ± 1.0 X 4.4 ± 0.3 µm, E = 1.7-2.5, Q = 2.2 ± 0.2, n = 20], ellipsoid or amygdaliform, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 4-spored. **Basidioles** cylindric or fusoid. **Pleurocystidia** absent. **Cheilocystidia** similar to *Rotalis*-type pileipellis elements but hyaline overall. **Pileipellis** hymeniform, not mottled or weakly mottled, of *Rotalis*-type broom cells; main body 9.5-17.5 X 5-10 µm, cylindric, clavate or subvesiculose, hyaline and thin-walled, or tawny to pale brown and thick-walled; setulae divergent, 1.5-3 X 1-2 µm, cylindric, broadly obtuse, tawny or pale brown, thick-walled or solid. **Tramal**

**hyphae** 2.5-5 µm diam, interwoven, cylindric, branched, non-gelatinous, hyaline, inamyloid or weakly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-5 µm diam, parallel, smooth or weakly incrusted, dark brown, inamyloid or weakly dextrinoid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** 3,2-5.5 µm diam, parallel, hyaline or pale yellow, inamyloid, clamped, with walls up to 1 µm thick; tissue of sterile side-branches similar in all respects to that of the stipe proper. **Stipe vesture** absent.

**Commentary**. No type specimen or authentic material of *M. bulliardii* exists (Cailleux, pers. comm.). Until topotypical material is collected, cultured, and designated neotype, the specimen cited above will serve to represent my concept of the species. *Marasmius bulliardii* belongs in sect. *Marasmius* subsect. *Marasmius*.

***MARASMIUS BUXI*** Fries *in* Quélet, Mém. Soc. Emul. Montbéliard, ser. II, 5: 224. 1872.

≡ *Androsaceus buxi* (Fr. *in* Quél.) Patouillard, Essai tax. Hyménomyc.: 141. 1900.

REPRESENTATIVE MATERIAL: France, environs d'Eaux-Bonnes (Basses-Pyr.), August 1882, N. Patouillard & E. Doassans, Société Dauphinoise Exs. no. 3969; sur *Buxus sempervirens* L. feuilles et brindilles tombées à terre (PC). No holotype exists.

**Basidiospores** 8.4-10.4 X 4.4-5 µm [$\bar{x}$ = 9.2 ± 0.7 X 4.7 ± 0.2 µm, E = 1.7-2.3, Q = 2 ± 0.2, n = 10], ovate or ellipsoid, hyaline, inamyloid, smooth. **Basidia** not observed. **Basidioles** 24-32 X 5-6.5 µm, fusoid or ventricose. **Pleurocystidia** absent. **Cheilocystidia** 35-44 X

5.5-7.5 µm, fusoid-capitulate or subtibiiform, rarely narrowly ventricose, hyaline, thin-walled, uncommon. **Pileipellis** hymeniform, mottled, of *Rotalis*-type broom cells; main body 12-24 X 6.5-10 µm, clavate, vesiculose or rarely sphaeropedunculate, many thin-walled and hyaline or subhyaline, many brown with walls up to 4 µm thick; setulae divergent, 1-4 X 0.5-1.5 µm, typically brown and solid, rarely thinner walled and pallid; some thick-walled elements lacking setulae, few with granular roughening over apical region; with scattered tibiiform **pilocystidia** interspersed among *Rotalis*-type elements, these thin-walled, hyaline, similar to cheilocystidia. **Tramal hyphae** 2.5-6 µm diam, interwoven, cylindric, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-5.5 µm diam, parallel, dark brown, dextrinoid, clamped, with walls up to 1.2 µm thick; **medullary hyphae** 2.5-6.5 µm diam, parallel, hyaline or pale yellow, inamyloid, thin-walled, clamped. **Stipe vesture** of scattered, poorly developed **caulocystidia** 8-16 X 4.5-6.5 µm, irregularly cylindric, obovate, clavate, sometimes constricted, hyaline or pale yellow at apex, pale brown at base, with walls up to 2 µm thick.

**Commentary.** No holotype specimen or authentic material of *M. buxi* exists (Cailleux, pers. comm.). Until topotypical material is collected, cultured and designated the neotype, the specimen cited above will serve as my concept of the species. Although the protologue indicated that the stipe surface bore "courts poils hyalins," hair-like processes on the stipe surface are no longer apparent on the specimen described above. It is possible that they were present but collapsed and overlooked. The material is in poor condition and revived poorly.

Contemporary descriptions and illustrations of *M. buxi* are those of Malençon and Bertault (1975) and Noordeloos (1987). *Marasmius buxi* belongs in sect. *Hygrometrici*.

***MARASMIUS CAESIUS*** Murrill, Bull. Torrey Bot. Club 67: 148. 1940.

HOLOTYPE: United States, Florida, Gainesville, 28 May 1938, W. A. Murrill no. F18263, oak sticks in high hammock (FLAS).

The collection consists of approximately 10 basidiomata in good condition, some loose in the packet, others attached to oak sticks. **Pileus** 2-6 mm diam, campanulate or convex, some with a small central papilla, pruinose, even, creamy tan colored. **Lamellae** adnate, subdistant or distant, narrow or moderately broad, non-collariate, pallid. **Stipe** 10-12 X <0.5 mm, terete, pruinose or pubescent, concolorous with the pileus or slightly darker at base, subinsititious, arising from a small ring of radiating, cream-colored mycelium.

**Basidiospores** tetrahydric, 8.4-10.8 X 7.2-9.8 µm (measured point to point X point to point, *i.e.*, could fit in a rectangle with sides measured as above) [$\bar{x}$ = 9.6 ± 0.7 X 8.3 ± 0.8 µm, E = 1-1.4, Q = 1.2 ± 0.1, n = 20], hyaline, inamyloid. **Basidia** 24-32 X 6.5-8 µm, 4-spored, clavate. **Basidioles** subclavate. **Pleurocystidia** absent. **Cheilocystidia** numerous, lamellar edge sterile, 20-40 X 4-6.5 µm, irregularly cylindric with numerous lateral diverticula, apex either diverticulate or smooth and then broadly obtuse-capitate or cylindric, hyaline, thin-walled overall; diverticula 1.5-6.5 X 1-3.2 µm, knob-like, rod-like or irregular in outline, obtuse, thin-walled. **Pileipellis** not hymeniform, formed of a well-developed *Rameales-*

structure; hyphae 4-6.5 µm diam, strongly diverticulate, hyaline, inamyloid, thin-walled, clamped; diverticula 1.5-5 X 1-2.5 µm, bulbous, cylindric or irregular in outline, obtuse, thin-walled, hyaline; terminal cells similar to the cheilocystidia, often capitate; cells from pileus margin typically erect and cheilocystidioid. **Tramal hyphae** 2.5-6.5 µm, interwoven, cylindric, non-diverticulate, non-gelatinous, smooth, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 2-5.5 µm diam, subparallel, hyaline or pale yellow, inamyloid, clamped, with walls up to 0.5 µm thick. **Stipe vesture** a well-developed *Rameales*-structure, similar in all respects to the pileipellis.

**Commentary.** Pileipellis and spore morphologies in combination with microchemical reactions and macromorphological features indicate that *M. caesius* is a synonym of *Tetrapyrgos nigripes* (Schw.) Horak [Sydowia 39: 102, 1986; ≡ *Marasmiellus nigripes* (Schw.) Singer, Pap. Michigan Acad. Sci. 32: 130, 1946 (1948)].

***MARASMIUS CAESPITOSUS*** Peck, Bull. Buffalo Soc. Nat. Sci. 1: 58. 1873 (1874).

HOLOTYPE: United States, New York, Richmondville, June 1872, C. H. Peck, on birch stumps in woods (NYS).

The collection consists of more than 30 basidiomata in fair condition, mostly infected with a Deuteromycete; mostly loose in the box, but nine basidiomata are glued to several slips of paper. **Pileus** 5-17 mm diam, convex or plano-convex, glabrous or suede-like, even, dark brown. **Lamellae** adnate or shallowly adnexed, close, moderately

broad, pale orange. **Stipe** 10-20 X 1-3 mm, terete, equal or many with a subbulbous base, pruinose or pubescent overall, brown, non-insititious, base with downy cream-colored mycelium, lignicolous, many in cespitose clusters.

**Basidiospores** 8-11.2 X 3.2-3.8 µm [$\bar{x}$ = 9.5 ± 0.7 X 3.5 ± 0.2 µm, E = 2.4-3.1, Q = 2.8 ± 0.2, n = 20], elongate-ellipsoid, slightly inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** not observed, collapsed. **Basidioles** 20-25 X 5-6.5 µm, cylindric or subclavate. **Pleurocystidia** absent. **Cheilocystidia** 20-33.5 X 6.5-15(21.5) µm, numerous, ventricose, clavate or broadly clavate, rarely sphaeropedunculate, typically smooth, rarely weakly zebroid-incrusted, hyaline or pale brown (from incrustations), thin-walled. **Pileipellis** not hymeniform, composed of a cutis of interwoven hyphae; hyphae 4-20 µm diam, cylindric; terminal cells repent or suberect, cylindric or clavate, rarely lobed or with a few diverticula, typically smooth, seldom weakly incrusted with brown pigment but arising from heavily incrusted hyphae; incrustations brown (becoming olivaceous in KOH), granular or helical, thick; hyphal walls hyaline or pale brownish, inamyloid, thin. **Tramal hyphae** 4-12 µm diam, interwoven, cylindric, non-gelatinous, smooth or weakly incrusted, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 2.5-10 µm diam, subparallel, smooth, hyaline or pale brown (at stipe base), inamyloid, thin-walled, clamped. **Stipe vesture** of clustered **caulocystidia** at stipe apex 6.5-40$^{+}$ X 6-9.5 µm, irregularly cylindric or clavate, obtuse, sometimes lobed, hyaline, inamyloid, thin-walled.

**Commentary.** Pileipellis, spore and cheilocystidia morphologies in conjunction with macromorphological features indicate that *M. caespitosus* is a synonym of *Collybia dichrous* (Berk. & Curt.) Gilliam. Compare with the type study of *Marasmius dichrous* Berk. & Curt.

***MARASMIUS CALAMI*** Petch, Trans. Brit. Mycol Soc. 31: 43. 1947.

≡ *Marasmiellus calami* (Petch) Singer, Sydowia 9: 383. 1955.

HOLOTYPE: Sri Lanka, Peradeniya, Royal botanical Garden, 25 Dec. 1923, T. Petch no. 6708, on *Calamus* (K).

The portion examined consisted of two loose basidiomata in fair condition. **Pileus** plane, rugulose-reticulate, pallid, context thin. **Lamellae** narrow, pallid, strongly intervenose. **Stipe** up to 10 mm X 1 mm, pallid, pruinose, slightly eccentric.

**Basidiospores** 14.4-17.6 X 4-5.6 µm [$\bar{x}$ = 15.6 ± 0.9 X 4.8 ± 0.5 µm, E = 2.6-3.7, Q = 3.3 ± 0.3, n = 12], clavate and curved or subfusiform, hyaline, inamyloid, smooth. **Basidia** not observed. **Basidioles** 27-40 X 8-10.5 µm, clavate (not fusoid). **Pleurocystidia** absent. **Cheilocystidia** presence undeterminable; no intact lamellar edges present. **Pileipellis** not hymeniform, composed of a poorly-developed *Rameales*-structure; hyphae 3-6.5 µm diam, repent, interwoven, sparcely diverticulate, gelatinized, hyaline, thin-walled, inamyloid, clamped; diverticula scattered, rod-like or knob-like, hyaline, thin-walled; pileus margin with numerous cylindric or subclavate, obtuse terminal cells. **Pileus trama** interwoven; hyphae 3-8 µm diam, few inflated up to 15 µm diam, strongly gelatinized, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical** and **medullary hyphae**

similar, 2.5-6 µm diam, parallel or subparallel, cylindric, smooth, hyaline or pale yellow, clamped, with walls up to 0.8 µm thick. **Caulocystidia** scattered, cylindric, obtuse, hyaline, thin-walled.

**Commentary.** In an earlier type study by Singer (1955: 382), the tramal hyphae were reported as not gelatinized, and cheilocystidia were described as "filamentous to somewhat swollen at places, wavy to nodose or with side branchlets, or forked, numerous but intermixed with some basidia, 36 X 3.5-4.2 µm." I was unable to examine cheilocystidial morphology because no intact lamellar edges were present on the holotype specimens. I was, however, able to demonstrate distinctly gelatinized tissue in the pileus trama. Because of the large spores and *Rameales*-type pileipellis, Singer (1955) transferred the species to *Marasmiellus*. Pegler (1986) included the species in *Marasmiellus* sect. *Distantifolii* because of the pleurotoid habit, gelatinized tramal tissue and large spores. Although the features emphasized by Singer (1955) and Pegler (1986) are characteristic of members of *Marasmiellus* sect. *Distantifolii*, it should be noted, however, that the pleurotoid habit, pileus with greenish tinges (Petch, 1947), gelatinized tissues and strongly intervenose lamellae of *M. calami* are features diagnostic for *Campanella* sect. *Campanella* subsect. *Aerugineae* Singer (1975a).

***MARASMIUS CALLICARPELLUS*** Murrill, Lloydia 8(4): 273. 1945 (1946).

HOLOTYPE: United States, Florida, Alachua Co., Gainesville, 8 Nov. 1932, West & Murrill no. F9926, dead sticks in woods (FLAS).

The collection consists of several stipe bases attached to undetermined twigs. No pilei are present. **Stipe** bases downy or

pubescent, dingy buff-colored, non-insititious, arising from a pad of white or buff-colored mycelium.

**Stipe tissue** monomitic; **cortical hyphae** 2.5-5 µm diam, parallel, hyaline or tawny, dextrinoid, smooth, clamped, with walls up to 1 µm thick; **medullary hyphae** 2.5-7.5 µm diam, parallel, hyaline, inamyloid or weakly dextrinoid, clamped, with walls up to 0.5 µm thick. **Stipe vesture** composed of scattered *Siccus*-type broom cells plus setoid hairs at stipe base; *Siccus*-type elements with main body 8-15 X 4-6.5 µm, irregular in outline, often lobed, hyaline, thin-walled; setulae 1-2.5 X 0.5-1.5 µm, numerous, nodose or rod-shaped, thin-walled, hyaline; setoid hairs up to 200 X 2-4 µm, ranging from acuminate-acute to dendrotrichomoid, hyaline, dextrinoid, thick-walled. No pileal features obtainable. No spores observed.

**Commentary.** No pilei are present in the holotype specimen, and consequently many taxonomically valuable characters are undeterminable. Nonetheless, the stipe vesture morphology described above, in combination with macromorphological features outlined in the protologue and details on the type specimen reported by Hesler (1959b) allow for accurate placement of this species. Basidiomata were described by Murrill (1946a) as: pileus convex, 1.5 mm broad, glabrous, rugose-sulcate on drying, colored ochraceous-isabelline; lamellae adnate, inserted, medium broad, rather close, white; stipe capillary, about 10 mm long, glabrous, white above, dark fulvous below, whitish-myceloid at the base; lignicolous on twigs. Although Murrill (1946) reported the spores as "globose, about 2 µm," Hesler (1959b) reported them as measuring "7-8 X 3-4 µm." In addition, Hesler noted that the

pileipellis was formed of broom cells. My examination of stipe tissues indicated the presence of thin-walled, unpigmented *Siccus*-type broom cells on the stipe surface, plus scattered dextrinoid setoid hairs and dendrotrichomoid elements at the stipe base. These data in combination indicate that *M. callicarpellus* is a synonym of *Marasmius pusio* Berk. & Curt. Compare with the type study of the latter species.

***MARASMIUS CAMPANULATUS*** Peck, Annual Rep. New York State Mus. 23: 126. 1873.

NEOTYPE (*des mihi*): United States, New York, Selkirk, Aug., C. H. Peck "typical form" (NYS) [designated as lectotype by Gilliam (1976: 89)].

The collection consists of 24 basidiomata in good condition glued to nine slips of paper, plus five loose basidiomata. **Pileus** 6-15 mm diam, campanulate or convex, striate or sulcate, subvelutinous, disc reddish brown, margin ferruginous. **Lamellae** adnexed, distant, narrow, pallid, non-marginate, not intervenose. **Stipe** 30-50 X 0.5-1 mm, terete, equal or slightly broader near the base, glabrous, shiny, apex pale ferruginous, base brown, non-insititious, with pallid basal mycelium.

**Basidiospores** 16-20.4 X 3.2-4 µm [$\bar{x}$ = 18.5 ± 1.3 X 3.7 ± 0.2 µm, E = 4.3-5.4, Q = 4.9 ± 0.3, n = 25], clavate or subfusiform, sometimes curved, hyaline, inamyloid, smooth. **Basidia** 28-32 X 6-7.5 µm, 4-spored, subclavate. **Basidioles** subclavate or fusoid. **Pleurocystidia** 32-50 X 6-8 µm, common, irregularly cylindric, cylindric or subclavate, typically broadly obtuse, sometimes short-appendiculate, refractive,

hyaline or pale yellow, thin-walled, with or without curved bases, arising from deep in subhymenium or lamellar trama and projecting beyond basidioles. **Cheilocystidia** similar to *Siccus*-type pileipellis elements; main body 13.5-20 X 4-6.5 µm, cylindric or clavate, seldom lobed, hyaline, thin-walled; apical setulae 2-8 X 0.5-1 µm, cylindric or conic, subacute or acute, rarely branched, hyaline and firm-walled, or pale yellow and thick-walled. **Pileipellis** hymeniform, not mottled, of *Siccus*-type broom cells; main body 9.5-20 X 5-8 µm, cylindric or clavate, sometimes lobed, typically hyaline and thin-walled, seldom slightly thicker-walled and pale orange; apical setulae 1.5-5.5 X 0.5-1.5 µm, crowded, cylindric or conic, subacute, rarely branched, orange or brownish orange, thick-walled or solid; pigmented portions dextrinoid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-6.5 µm diam, cylindric, branched, non-gelatinous, smooth, hyaline, dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-6.5 µm diam, parallel, cylindric, smooth, ochraceous, brownish orange or brown, strongly dextrinoid, with walls up to 1.5 µm thick; **medullary hyphae** 4-12 µm diam, subparallel, hyaline, dextrinoid or only weakly so, clamped, with walls up to 1.5 µm thick. **Stipe vesture** absent.

**Commentary**. No specimens were indicated as type material in the protologue, although Peck (1873) noted that the species was collected in July and August. The specimen cited above was designated by Gilliam (1976) as the lectotype, but should be regarded more properly as a neotype specimen. No date is cited on the packet and no reference to what year this specimen was collected could be located in Peck's

notebooks (archieved at NYS). Consequently, it is impossible to determine whether Peck had this specimen in hand at the time of publication of the epithet, *i.e.* "original material" (Art. 7.5, ICBN). The specimen was determined by Peck as *M. campanulatus* and a note on the specimen label states, "typical form." This material is here designated the neotype. *Marasmius campanulatus* represents a synonym of *M. siccus* (Schw.) Fr.

***MARASMIUS RESINOSUS*** var. ***CANDIDISSIMUS*** Peck, New York State Mus. Bull. 94: 40. 1905. *nom. nov. illeg.* for *Marasmius resinosus* var. *niveus* Peck, New York State Mus. Bull. 67: 38. 1903.

Refer to the type study of *M. resinosus* var. *niveus*.

***MARASMIUS CAPILLARIS*** Morgan, J. Cincinnati Soc. Nat. Hist. 6: 194. 1883.

NEOTYPE (*des mihi*): United States, Ohio, Preston, Oct. 1890, Morgan, on old leaves (ISC), [designated as lectotype by Gilliam (1976: 121)].

The collection consists of approximately six basidiomata all badly fragmented. **Pileus** convex, umbilicate, striate, central depression pallid, margin brown. **Lamellae** collariate, broad, distant, cream-colored. **Stipe** ≈ 20 X <0.5 mm, terete, glabrous, shiny, black, insititious.

**Basidiospores** 7.6-10.8 X 3.4-4.4 µm [$\bar{x}$ = 9.2 ± 0.7 X 3.9 ± 0.2 µm, E = 2-2.7, Q = 2.4 ± 0.2, n = 30], ellipsoid or amygdaliform, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 16-24 X

5.5-8.5 µm, 4-spored, clavate. **Basidioles** clavate or ventricose. **Pleurocystidia** absent. **Cheilocystidia** numerous, similar to *Rotalis*-type pileipellis elements; main body 11-16 X 4.8-10 µm, cylindric or clavate, hyaline, typically thin-walled, rarely firm-walled (-0.5 µm thick); setulae divergent, 0.5-2 X 0.5-1.5 µm, rod-like, obtuse, hyaline, thick-walled or solid. **Pileipellis** hymeniform, not mottled, of *Rotalis*-type broom cells; main body 12-24 X 6.5-20(24) µm, cylindric, clavate or sphaeropedunculate, ranging from thin-walled and hyaline to thick-walled and dark ochraceous or brown; setulae divergent, 0.5-2 X 0.5-1.5 µm, knob-like or rod-like, obtuse, numerous, often crowded, lateral and apical, typically solid, dark ochraceous or brown. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-5.5 µm diam, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 4-8 µm diam, parallel, pale ochraceous (stipe apex) or dark brown (stipe base), strongly dextrinoid, smooth, clamped, with walls up to 2.5 µm thick; **medullary hyphae** 2-8 µm diam, parallel, hyaline or pale yellow, inamyloid or weakly dextrinoid, clamped, with walls up to 1 µm thick. **Stipe vesture** absent.

**Commentary.** Morgan (1883) did not cite a holotype specimen in the protologue, and the oldest authentic specimen determined as *M. capillaris* in the Morgan Herbarium (ISC) is dated "Oct. 1890." The latter specimen was inappropriately designated the lectotype by Gilliam (1976). Because no "original material" is available to choose as lectotype (Arts. 7.4, 7.5, ICBN), the specimen cited above is here designated the neotype. The collariate lamellae and pileipellis

morphology exhibited by the neotype specimen of *M. capillaris* indicate the species belongs in sect. *Marasmius* subsect. *Marasmius*.

***MARASMIUS CARICICOLA*** Kauffman *in* Pennington, N. Amer. Fl. 9(4): 277. 1915.

"TYPE" (Pennington, 1915b): United States, Michigan, near Ann Arbor, Oct. 1907, C. H. Kauffman, upon stems of sedges in marshes (Herb. Kauffman).

No material with label data matching those cited as the type in the protologue exists at MICH, depository for Kauffman's herbarium. One collection, erroneously labeled "type," contains the following handwritten label data: "On *Carex* (Mud L. swampy edge) (and Horseshoe L., Whitemore L., Michigan) Type." No date was given. A new label on this collection reads: "Nov. 12, 1910, C. H. Kauffman, Neotype." To date, no specimen has been officially designated as neotype. It may be presumed from the handwritten label data that the collection indicated above consists of a combination of three separate specimens. Additionally, it is probable that these three specimens were in the hands of the describing author at the time of publication, and may represent potential lectotype material, if the specimens could be segregated. Unfortunately the material is in such poor condition and so little remains, that it is insufficient for microscopic analysis. Even if it were possible to segregate the individual specimens according to locale collected (an impossible feat), I cannot recommend designation of the material as lectotype. Ideally, new material should

be collected and cultured from leaves of *Carex* in the vicinity of Ann Arbor, Michigan, and designated as the neotype.

Several authors have interpreted the taxonomic disposition of *M. caricicola* based on Kauffman's descriptions (*in* Pennington, 1915; 1918), and on examination of the extant Kauffman specimens cited above. Bas (1961) and Gilliam (1976) considered *M. caricicola* as a distinct species belonging in sect. *Epiphylli*. Alternatively, Redhead (1981) considered *M. caricicola* a synonym of *M. caricis* Karsten, and suggested that placement in sect. *Alliacei* was more appropriate because of the stipe-substrate insertion. Although Redhead (1981) presented a strong case for accepting the two species as conspecific, the taxonomic disposition of *M. caricicola* will remain uncertain until carefully selected neotype material is designated and compared with the holotype specimen of *M. caricis* [Finland, Tavastia australis, Mustiala, 30 Sept. 1870, P. A. Karsten (H)].

***MARASMIUS CASTANEICOLOR*** Pennington, N. Amer. Fl. 9(4): 274. 1915.

HOLOTYPE: United States, Louisiana, St. Martinville, 24 July 1888, A. B. Langlois no. 1426, on dejected oak leaves (NY).

The original label on the collection reads: "Flora Ludoviciana, A. B. Langlois no. 1426. *Marasmius epiphyllus* var. *castaneus* Ell. & Lang. Brown pileus, white lamellae, foot of stem ferruginous, on dejected oak lvs. St. Martin, 24 VII 1888." The collection consists of six basidiomata in fair condition. **Pileus** 6-8 mm diam, convex, some shallowly depressed, glabrous, even or short-striate, dark brown. **Lamellae** adnate or adnexed, close, narrow, pallid, non-collariate.

**Stipe** 18-22 X <1 mm, terete, pale brown but covered overall with buff-colored pruinae, non-insititious, with pallid, strigose basal mycelial hairs.

**Basidiospores** 7.2-9 X 3.6-4.2 µm [$\bar{x}$ = 7.9 ± 0.5 X 3.9 ± 0.2 µm, E = 1.8-2.2, Q = 2 ± 0.1, n = 20], ellipsoid or lacrymoid, hyaline, inamyloid, thin-walled. **Basidia** 20-24 X 4.5-6.5 µm, 4-spored, subclavate. **Basidioles** cylindric or fusoid. **Pleurocystidia** absent. **Cheilocystidia** numerous, 10-28 X 5-9 µm, irregularly cylindric or subclavate, often lobed, diverticulate, hyaline, thin-walled; diverticula 2.5-8 X 1.5-4.5 µm, lateral or apical, irregular in outline, broadly obtuse. **Pileipellis** not hymeniform, formed or a cutis of radially arranged hyphae; hyphae 4-6.5 µm diam, cylindric, heavily incrusted, typically non-diverticulate or with rare broad branchlets, clamped; incrustations brown, copius, granular or zebroid; hyphal walls hyaline or brown, inamyloid, up to 0.5 µm thick; terminal cells cylindric, obtuse, non-diverticulate. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-6.5 µm diam, cylindric, typically smooth, rarely weakly incrusted, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-5.5 µm diam, parallel, ochraceous, strongly dextrinoid, smooth, clamped, with walls up to 1 µm thick; **medullary hyphae** 3-8 µm diam, subparallel, hyaline, inamyloid, thin-walled, clamped. **Stipe vesture** composed of numerous **caulocystidia** up to 100+ X 3-5.5µm, irregularly cylindric or flexuous, often gradually narrowed near tip, obtuse or subacute, hyaline or pale yellow, ranging from inamyloid to strongly dextrinoid, with walls up to 1 µm thick.

**Commentary.** *Marasmius castaneicolor* is an exceedingly problematical taxon. Pileipellis morphology in combination with a non-insititious stipe suggest placement in *Collybia* sect. *Vestipedes* (Fr.) Quél. or sect. *Subfumosae* Sing. *ex* Halling, depending upon the degree of emphasis placed on frequency of diverticula. The dextrinoid stipe cortical hyphae and caulocystidia, however, suggest otherwise. Most macro- and micromorphological features of the holotype specimen of *M. castaneicolor* are identical to those of the holotype specimen of *Marasmius olneii* Berk. & Curt. [≡ *Marasmiellus olneii* (Berk. & Curt.) Desjardin]. Features in common include basidiome stature and coloration, spore size, cheilocystidia and caulocystidia morphology, and stipe tissue dextrinoidity. The pileipellis of *M. olneii*, however, is composed of strongly diverticulate hyphae with coralloid terminal cells. In contrast, the cuticular hyphae of *M. castaneicolor* are typically non-diverticulate, with cylindric terminal cells and rare broad branchlets. Cuticular hyphae in both species are commonly covered with brownish, zebroid pigment-incrustations. Although pileipellis morphology and stipe-substrate insertion are important taxonomic characters at the generic level, suggesting that *M. castaneicolor* belongs in *Collybia*, the overwhelming number of features in concordance with *M. olneii* indicate that the two species are congeneric. The holotype specimen of *M. olneii* is accepted by this author as belonging in *Marasmiellus* because of *Rameales*-type pileipellis morphology, and formation of pallid, pubescent, insititious or subinsititious stipe (refer to the type study of *M. olneii* for

further details). *Marasmius castaneicolor* is transferred here to the genus *Marasmiellus* sect. *Dealbati* subsect. *Quercini* as:

***Marasmiellus castaneicolor*** (Pennington) Desjardin, ***comb. nov.*** [Bas.: *Marasmius castaneicolor* Penn., *ibid.*].

This species may be conspecific with and represent an earlier epithet for *Marasmiellus dryogeton* Singer (1973: 64). Hesler (1959b) provided a few details on the holotype specimen of *M. castaneicolor*.

***MARASMIUS CHIAPASENSIS*** Singer, Fl. Neotrop. Monogr. 17: 73. 1976.

HOLOTYPE: Mexico, Chiapas, Sospiro (Finca) along road to El Pozo, 4 Aug. 1969, Singer no. M8969, *ad folia coriacea arborum Dicotyledonum in silva tropicali* (F).

The collection consists of two basidiomata, one intact, one fragmented, in good condition. **Pileus** 2 mm diam, convex, glabrous or suede-like, pale broan, even. **Lamellae** adnate, close or subdistant, narrow, non-collariate, pale cream-colored. **Stipe** 10 X 0.1 mm, wiry, brown, pruinose overall, insititious; with few concolorous rhizomorphs present.

**Basidiospores** 6-7.2 X 3-3.2 µm (only 5 observed), ellipsoid or amygdaliform, hyaline, inamyloid, smooth. **Basidia** 15-18.5 X 5.5-6.5 µm, 4-spored, clavate. **Basidioles** clavate or ventricose. **Pleurocystidia** absent. **Cheilocystidia** *Siccus*-type broom cells plus a few interspersed repent, diverticulate elements; main body 11-17.5 X 4-7.2 µm, cylindric or clavate, hyaline, thin-walled; setulae 1.5-5 X 1.2-2 µm, apical or subapical, rarely lateral, cylindric or irregular in outline, obtuse, seldom branched, hyaline, typically thin-walled,

rarely firm-walled. **Pileipellis** not hymeniform, composed of a well-developed *Rameales*-structure with broom cell-type terminal elements; hyphae 3.2-5 µm diam, densely diverticulate, subhyaline or pale ochraceous, inamyloid, non-incrusted, thin-walled, unclamped; broom cell-type elements suberect or erect, cylindric or clavate; diverticula and setulae 1.5-5 X 0.5-1.5 µm, rod-like or irregular in outline, obtuse, typically hyaline and thin-walled, seldom slightly thick-walled and pale ochraceous. **Pileus trama** interwoven; hyphae 3-5.8 µm diam, weakly incrusted with brownish or dark ochraceous granular pigments in hypodermial region, non-incrusted elsewhere, thin-walled or firm-walled, inamyloid, unclamped. **Lamellar trama** regular; hyphae 1.5-3.8 µm diam, cylindric, non-gelatinous, hyaline, inamyloid, thin-walled, unclamped. **Stipe tissue** monomitic; **cortical hyphae** 3-5.5 µm diam, parallel, ochraceous or dark brown, dextrinoid, smooth, with walls up to 1.8 µm diam, unclamped; **medullary hyphae** 3-6.5 µm diam, subparallel, hyaline or pale yellow, inamyloid, thick-walled, clamps present but uncommon, some septa with incomplete clamps. **Caulocystidia** 16-32 X 5.5-11(-13.5) µm (stipe apex), cylindric or broadly clavate, obtuse, clustered, hyaline or rarely pale ochraceous, thin-walled or with walls up to 1 µm thick.

**Commentary.** The *Rameales*-type pileipellis with broom cell-type terminal cells, wiry insititious stipe and dextrinoid stipe cortical hyphae indicate *M. chiapasensis* belongs in sect. *Androsacei*. Clamp connections were rarely observed in the holotype specimen, present only on the stipe medullary hyphae. Singer (1976) reported that clamps were present along with many "secondary septa."

***MARASMIUS CILIATOMARGINATUS*** Desjardin *in* Desjardin & Petersen, Mycotaxon 34(1): 76. 1989.

HOLOTYPE: United States, North Carolina, Macon Co., Highlands, Horsecove, 10 Aug. 1987, Desjardin no. 4414, *ad folia dejecta dicotyledonum* (TENN no. 47626).

The collection consists of approximately 20 basidiomata in excellent condition. **Pileus** 4-15 mm diam, campanulate, rugulo-striate, subvelutinous, disc and striae dark reddish brown, margin dark ferruginous. **Lamellae** nearly free, close or subdistant, narrow, cream-colored with reddish tawny margins. **Stipe** 15-40 X <1 mm, terete, pruinose overall, pale brown, non-insititious, basal mycelium buff or cream-colored.

**Basidiospores** 13.6-16 X 3.2-4 µm [$\bar{x}$ = 14.7 ± 0.9 X 3.7 ± 0.3 µm, E = 3.4-4.4, Q = 4 ± 0.3, n = 17], clavate or subfusiform, curved in profile, hyaline, inamyloid, smooth. Refer to the protologue for illustrations and details on other micromorphological features of the holotype specimen.

**Commentary**. *Marasmius ciliatomarginatus* belongs in sect. *Sicci* ser. *Atrorubenses* [= ser. *Actinopodes* Sing. *pro parte*].

***MARASMIUS CLAVAEFORMIS*** Berkeley, London J. Bot. 6: 316. 1847.

HOLOTYPE: United States, Ohio, Waynesville, Aug. 31, 1844, T. G. Lea, on dead sticks (K).

The collection consists of one basidiome in fair condition. **Pileus** 6 mm diam, convex, glabrous, even, white or dingy buff-colored. **Lamellae** subdecurrent, distant, narrow, pallid. **Stipe** 20 X 1 mm,

terete, pubescent, buff-colored, subinsititious, slightly enlarged at the base.

**Basidiospores** 8-10.8 X 6.8-9.2 μm (only 10 observed), tetrapodal, hyaline, inamyloid. **Basidia** not observed. **Basidioles** 32-36 X 6-8 μm, subclavate or cylindric. **Pleurocystidia** absent. **Cheilocystidia** undeterminable, lamellar edges badly eroded. **Pileipellis** not hymeniform, composed of a well-developed *Rameales*-structure; hyphae 4-6.5 μm diam, interwoven, densely diverticulate, hyaline, inamyloid, thin-walled; diverticula small, rod-like or knob-like, hyaline, thin-walled; terminal cells often with a smooth, bulbous apex but diverticulate elsewhere, these suberect, or erect especially on pileus margin. **Tramal hyphae** 2.5-6 μm diam, interwoven, cylindric, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** badly infected with a *Penicillium*-like fungus; details of micromorphology unobtainable.

**Commentary.** Pileipellis morphology and tetrapodal spores of the holotype specimen indicate that *M. clavaeformis* is a synonym of *Tetrapyrgos nigripes* (Schw.) Horak [≡ *Marasmiellus nigripes* (Schw.) Sing.]. Three specimens determined as *M. clavaeformis* in the Curtis Herbarium (FH) are conspecific with the holotype and represent *T. nigripes* [*viz.*, North Carolina, Hillsborough, Aug., Curtis no. 474; Pennsylvania, 1851, Michener no. 358; New Hampshire, 1860, Blake no. 729]. A fourth specimen at FH determined as *M. clavaeformis* represents *Marasmiellus tricolor* (Alb. & Schw.: Fr.) Sing. [*viz.*, South Carolina, Santee Canal, June 1847, Ravenel no. 162, Curtis no. 3032].

***MARASMIUS CLEMENTSIANUS*** Saccardo & Sydow, Syll. Fung. 14: 101. 1899.

≡ *Marasmius fulviceps* Clements, Bot. Surv. Nebraska 4: 20. 1896, [*non Marasmius fulviceps* Berk., London J. Bot. 6: 490. 1847.]

***AGARICUS COHAERENS*** Persoon : Fries, Syst. Mycol. 1: 253. 1821.

[*Agaricus cohaerens* Pers., Syn. Meth. Fung. 306. 1801.]

≡ *Marasmius cohaerens* (Pers.: Fr.) Cooke & Quélet, Clav. Syn. Hymenomyc. Eur. 153. 1878.

≡ *Mycena cohaerens* (Pers.: Fr.) Kummer, Fürher Pilzk. 111. 1871.

REPRESENTATIVE MATERIAL: France, Marcy 1' Etoile (Rhóne), 9 Oct. 1943, Josserand (MICH) [as *M. ceratopus* (Pers.) Quél.]. No holotype exists.

The collection consists of six intact basidiomata plus fragments of several others. **Pileus** 12-14 mm diam, convex or campanulate, even, subvelutinous, cinnamon or ferruginous. **Lamellae** adnexed, subdistant, moderately broad, pruinose, cinnamon-colored. **Stipe** 44-55 X 1-2 mm, terete, base slightly enlarged, glabrous and shiny above a base covered with buff-colored, appressed, downy mycelium, non-insititious; upper half concolorous with the pileus, base dark reddish brown.

**Basidiospores** 7.6-11.2 X 4.4-5.6 µm [$\bar{x}$ = 9 ± 0.8 X 5 ± 0.3 µm, E = 1.5-2, Q = 1.8 ± 0.1, n = 25], ellipsoid or pip-shaped, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 24-28 X 6-9.5 µm, clavate, 4-spored. **Basidioles** subcylindric or clavate. **Hymenial setae** 45-80 X 6.4-10(-11.2) µm [$\bar{W}$ = 10.6 µm], numerous on lamellar faces and edges, fusoid, lanceolate or ventricose-acuminate, acute, brownish orange, dextrinoid; walls 1.2-4 µm thick in upper portion of cell,

thinner near base of cell. **Pleurocystidia** absent. **Cheilocystidia** scattered, similar to *Siccus*-type pileipellis elements. **Pileipellis** hymeniform, of *Siccus*-type broom cells plus pilosetae; **pilosetae** similar to hymenial setae but somewhat thicker-walled, brownish orange, seldom apically branched; *Siccus*-type elements with main body 9.5-16 X 5-8 µm, cylindric, clavate or irregular in outline, typically hyaline and thin-walled, some pale brownish orange and firm-walled; apical setulae 2.5-10 X 1-2 µm, conic, acute, thick-walled or solid, yellow or brownish orange, dextrinoid; some elements intermediate in morphology between broom cells and setae, with 2-5 solid, apical setulae up to 20+ µm long. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-10 µm diam, cylindric, branched, hyaline, dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-6 µm diam, parallel, ranging from pale yellow to brown, dextrinoid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** 3-8 µm diam, parallel, hyaline or pale yellow, dextrinoid, thin-walled or with walls up to 0.8 µm thick, clamped. **Stipe vesture** poorly-developed, of scattered **caulosetae** similar to hymenial setae.

**Commentary.** No holotype specimen of *A. cohaerens* exists in the Persoon herbarium (L) [see Singer (1961a)]. Until topotypical material is collected from the Harz Mts. near Göttingen, West Germany (Persoon's collecting area), cultured and designated neotype, the specimen cited above will serve to represent my concept of the species. *Marasmius cohaerens* is the type species of ser. *Spinulosi* (Clémençon) Desjardin [= ser. *Actinopodes* Sing. (1976) *pro parte*]of sect. *Sicci*.

***MARASMIUS CONCINNUS*** Ellis & Everhart, Proc. Acad. Nat. Sci Philadelphia 45: 441. 1894.

HOLOTYPE: United States, Delaware, Mt. Cuba, 20 Sept. 1893, Commons no. 2306, on dead branches of *Euonymus atropurpureus* (NY). [ISOTYPE: PH].

The holotype specimen consists of two stipes plus one intact basidiome. **Pileus** 0.75 mm diam, convex with an incurved margin, granulose or suede-like, even, avellaneous. **Lamellae** adnate, subdistant, narrow, pallid. **Stipe** <0.5 X <0.3 mm, central, terete, apex pruinose, base pubescent, yellowish-tawny overall, non-insititious, lignicolous.

**Basidiospores, basidia** and **basidioles** not observed, material too immature. **Pleurocystidia** not observed. **Cheilocystidia** numerous, irregularly cylindric, subclavate, often lobed, diverticulate; main body 8-16 X 3-5.5 µm, hyaline, thin-walled; diverticula 1.5-4.5 X 1-1.5 µ, typically apical, rarely lateral, knob-like or irregular in outline, obtuse, thin-walled, hyaline. **Pileipellis** a well-developed *Rameales*-structure; hyphae interwoven, densely diverticulate; terminal elements often erect and forming nearly a trichodermium, these similar in morphology to the cheilocystidia; all elements hyaline, inamyloid, thin-walled, clamped. **Tramal hyphae** 2-4 µm diam, interwoven, non-gelatinous, smooth, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 2-8(-10) µm diam, subparallel, hyaline, dextrinoid, clamped, walls up to 1 µm thick. **Stipe vesture** composed of numerous **caulocystidia** plus *Crinipellis*-type hairs nearest the stipe base;

caulocystidia 9.5-30 X 3.5-8 µm, irregularly cylindric or subclavate, often lobed, apically smooth or more often with numerous diverticula which are irregular in outline and obtuse; elements hyaline, inamyloid, thin-walled; *Crinipellis*-type hairs up to 200+ X 4-7 µm, filiform or lanceolate, acute, basal portion somewhat swollen, hyaline or pale yellow, dextrinoid, with walls up to 1.5 µm thick.

**Commentary.** Two specimens with label data matching those cited in the protologue were located, one deposited at NY, the other at PH. The epithet was published by Ellis and Everhart (*ibid.*) based on a specimen collected by Albert Commons. The Albert Commons Herbarium is currently housed at PH, and the specimen deposited there labeled "*Marasmius concinnus*, Delaware, Mt. Cuba, 20 Sept. 1893, Commons no. 2306," is considered by me to represent the original collection from which a portion was selected and sent to Ellis for determination. The portion at NY is considered the holotype specimen because it was retained by Ellis and presumably was the portion on which the protologue was based. The PH specimen is considered an isotype. Both specimens are conspecific, but unfortunately, all extant material is immature. No well-developed basidia nor spores were observed. Pileipellis morphology suggests affinities with certain *Marasmielli*, but a non-insititious stipe and dextrinoid *Crinipellis*-type stipe hairs are unusual. Gilliam (1976) suggested *M. concinnus* was closest to *Collybia* sect. *Subfumosae*. The epithet will remain a *nomen incertae sedis* until further material is collected from woody debris of *Euonymus atropurpureus* in the vicinity of Mt. Cuba, Delaware.

***MARASMIUS CONTRARIUS*** Peck, New York State Mus. Bull. 150: 34. 1911.

≡ *Collybia contraria* (Pk.) Halling, Mycol. Memoirs 8: 75. 1983.

HOLOTYPE: United States, New York, Essex Co., North Elba, 18 June, C. H. Peck (NYS).

The collection consists of approximately 50 basidiomata in good condition. **Pileus** 6-12 mm diam, plano-convex, glabrous, even, disc dark brown, margin dark ochraceous. **Lamellae** adnate or subdecurrent, close or subdistant, narrow, greyish orange. **Stipe** 20-30 X 1 mm, terete or compressed, equal above a slightly enlarged base, pubescent above, tomentose at the base, dark ochraceous or brown, non-insititious.

**Basidiospores** 7.6-10.4 X 3.6-5 µm [$\bar{x}$ = 9.2 ± 0.7 X 4.4 ± 0.4 µm, E = 1.8-2.3, Q = 2.1 ± 0.1, n = 30], ellipsoid or lacrymoid, hyaline, inamyloid, smooth. **Basidia** 24-28 X 4.5-7 µm, 4-spored, clavate. **Basidioles** subclavate or clavate. **Hymenial cystidia** absent. **Pileipellis** not hymeniform, composed of a cutis of repent, radially arranged hyphae; hyphae 2.5-6 µm diam, cylindric or contorted, with scattered knobs or branchlets (not densely diverticulate), smooth or weakly-incrusted, pale yellow or pale brown in KOH, thin-walled, clamped. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-7.5 µm diam, less contorted than in pileipellis, typically cylindric, hyaline or pale yellow, inamyloid, clamped, thin-walled. **Stipe tissue** monomitic; **cortical hyphae** 3-6.5 µm diam, subparallel, ochraceous or pale brown, pale olivaceous in KOH, inamyloid, with smooth walls up to 1.5 µm thick; **medullary hyphae** similar but up to 8 µm diam, hyaline and thinner-walled. **Caulocystidia** up to $100^{+}$ X 5.5-8 µm, abundant,

irregularly cylindric or flexuous, obtuse, hyaline or pale ochraceous, inamyloid, with walls up to 2.4 µm thick.

**Commentary**. Pileipellis and spore morphologies plus microchemical reactions indicate *M. contrarius* belongs in *Collybia* sect. *Subfumosae*. My analysis of the holotype specimen is concordant in all respects with the description reported by Halling (1983a).

***MARASMIUS COPELANDII*** Peck, Bull. Torrey Bot. Club 31: 182. 1904 [*ut Marasmius copelandi*].

HOLOTYPE: United States, California, San Mateo Co., Woodside, 7 Dec. 1902, Copeland no. 14 (NYS).

The collection consists of portions of seven basidiomata in fair condition. Notes with collection: "Taste and odor strongly mephitic. Pileus 1-2 cm wide, slightly convex, tough, tawny, thin. Gills few, very unequal, about 16, major ones adnate. Stipe 4-6 cm high, 1-2 mm thick, uniform, hollow, tough, pubescent, rich brown below, lighter above. On dead leaves of *Quercus densiflora*." **Pileus** 5-10 mm diam, convex, disc even, margin short-striate, glabrous, ochraceous. **Lamellae** adnate, close, moderately broad, pale ochraceous. **Stipe** up to 45 X 1-1.5 mm, terete, enlarged slightly near base, brown and pubescent above, dark brown tomentose below, non-insititious.

**Basidiospores** 13.2-17.2 X 3.2-4.4 µm [$\bar{x}$ = 15 ± 1.2 X 3.6 ± 0.3 µm, E = 3.6-4.6, Q = 4.1 ± 0.3, n = 30], clavate, often curved, hyaline, inamyloid, smooth. **Basidia** 30-37.5 X 6-7.2 µm, 4-spored, subclavate. **Basidioles** cylindric or subclavate. **Pleurocystidia** absent. **Cheilocystidia** 26-40 X 6-12 µm, abundant, cylindric, clavate, or

irregular in outline, often lobed or with 1-4 broad apical diverticula, hyaline, inamyloid, thin-walled. **Pileipellis** hymeniform, irregularly mottled, of *Globulares*-type elements, 20-33 X 12-21(-24) µm, clavate, obovate, subvesiculose or sphaeropedunculate, few lobed, broadly obtuse, many hyaline or pale yellow and thin-walled, others ochraceous or pale brown and thick-walled; all elements inamyloid, clamped. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-8 µm diam, cylindric, rarely slightly inflated, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2-7 µm diam, parallel, cylindric, ochraceous, brownish orange or pale brown (pale olivaceous grey in KOH), inamyloid, with walls up to 2 µm thick; **medullary hyphae** 4-12 µm diam, subparallel, hyaline, inamyloid, clamped, with walls up to 1 µm thick. **Stipe vesture** of numerous **caulocystidia** 20-100$^{+}$ X 4-10 µm, irregularly cylindric, some contorted, obtuse, subhyaline, pale yellow or ochraceous, inamyloid, with walls up to 3 µm thick.

**Commentary.** Pileipellis morphology, microchemical reactions and stipe-substrate insertion indicate that *M. copelandii* belongs in sect. *Alliacei*. Refer to Desjardin (1987a,b) for illustrations of microscopic features of the holotype specimen and for discussions on the species.

***MARASMIUS COPROPHILUS*** Spegazzini, Bol. Acad. Nac. Ci. 29: 122. 1926.

HOLOTYPE: Argentina, Córdoba, Alta Gracia, 20 Jan. 1925, Bruch no. 67, [Herbario Spegazzini no. 2681] (LPS).

The collection consists of numerous cespitose or subcespitose stipes lacking pilei, arising from fragments of dung, plus a few fragments of pilei with hymenophore removed by insect damage; no intact lamellae present. Notes on the packet: "*pileus roseo-testaceus, laevis. Lamellae 10-15, non-collariatae, latus candidae, acie integrae, non connexae, nec rugose [?]. Stipe tenuis, laevis, umbrinus, nitidulum.*

**Basidiospores** 18.4-22.4 X 4.8-5.6 µm, [$\bar{x}$ = 20.6 ± 1.4 X 5.3 ± 0.4 µm, E = 3.3-4.7, Q = 3.9 ± 0.5, n = 8], clavate, sometimes slightly curved, hyaline, inamyloid, smooth. **Hymenial elements** not observed; material badly insect damaged. **Pileipellis** hymeniform, weakly mottled, of *Siccus*-type broom cells; main body 10-15 X 5-9 µm, subcylindric or clavate, seldom apically lobed, many golden and thin-walled or firm-walled, many others tawny with walls up to 2.5 µm thick; apical setulae 1.5-4.5 X 0.5-1.5 µm, irregular in outline, obtuse, crowded, solid, tawny; pigmented portion inamyloid or weakly dextrinoid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-6.5 µm diam, cylindric, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3.2-5.6 µm diam, parallel, dark brownish orange or pale brown, dextrinoid, smooth, with walls up to 1.2 µm thick; **medullary hyphae** 4-8 µm diam, parallel, hyaline, weakly dextrinoid, thin-walled, clamped. **Caulocystidia** absent, or with a few setulose outgrowths on cortical hyphae of the stipe apex.

**Commentary.** Singer (1965, 1976) placed *M. coprophilus* in synomymy with *M. anomalus* Lasch *in* Rabenhorst. In an earlier type study, Singer

(1952) noted that the hymenium of the holotype contained "opalescent clavate cystidia" but he was unable to recover spores. The holotype specimen is badly insect-damaged and on the few pileal fragments present the hymenophore has been eaten away. Consequently, I was unable to observe hymenial cystidia. Eight spores were recovered from the surface of the stipe apex of one basidiome, and these measured 18.4-22.4 X 4.8-5.6 μm. Notes with the holotype specimen indicate the pileus as "*roseo-testaceus, laevis*." The latter combination of features (*viz.*, "*roseo-testaceus*," smooth pileus and spore size), coupled with habit on dung may be used to separate *M. coprophilus* from *M. anomalus sensu stricto*. Isotype specimens of *M. anomalus* examined by me have spores measuring 12.5-16.8 X 3.5-4.8 μm. In addition, the pileus was described by Lasch as "*obscure-alutaceo, plicato*" and basidiomata were formed on grass leaves. Because of these distinctly different features, I prefer to retain *M. coprophilus* as a species distinct from *M. anomalus* Lasch.

A subcespitose habit on dung, unusual in the genus, is shared by *M. puniceus* Thiers, described from material collected in Texas. *Marasmius puniceus* differs from *M. coprophilus* in forming sulcate, bright red pilei, and smaller spores. Refer to the type study of *M. puniceus* for further details.

***MARASMIUS CRESCENTIAE*** Murrill *in* Pennington, N. Amer. Fl. 9(4): 259. 1915.

HOLOTYPE: Cuba, 5 mi east of Santiago de las Vegas, 11 Sept. 1904, F. S. Earle no. 184, on rotting fruits of Calabash (NY).

The collection consists of one third of one convex pileus, ochraceous on the margin and brown on the disc; plus one fragmented, glabrous, reddish brown, insititious stipe.

**Basidiospores** 7.2-9.2 X 3.6-4.6 µm [$\bar{x}$ = 8 ± 0.7 X 4.2 ± 0.3 µm, E = 1.6-2.3, Q = 1.9 ± 0.2, n = 15], ellipsoid, slightly inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** not observed. **Basidioles** 16-20 X 5-6.5 µm, ventricose or fusoid. **Pleurocystidia** 24-32 X 7-8.5 µm, scattered, lageniform, obtuse, hyaline, thin-walled. **Cheilocystidia** not observed. **Pileipellis** hymeniform, not mottled, of *Rotalis*-type broom cells; main body 9.5-14 X 5.5-10 µm, clavate or subvesiculose, many hyaline and thin-walled, others pale brown and slightly thick-walled; setulae divergent, 1.2-2.5 X 0.5-1.2 µm, rod-shaped, obtuse, thick-walled or solid, subhyaline or brown; with few pilocystidia similar in morphology to the pleurocystidia interspersed among *Rotalis*-type elements. **Stipe tissue** monomitic; **cortical hyphae** 3.5-5.5 µm diam, parallel, cylindric, typically covered on the outermost surface with numerous diverticula, these small and rod-shaped; walls tawny or brownish, inamyloid, up to 1.5 µm thick; **medullary hyphae** 3-6 µm diam, non-diverticulate, hyaline, inamyloid, thin-walled, clamped. **Stipe vesture** of scattered diverticula arising directly from repent cortical hyphae.

**Commentary.** Pileipellis morphology and macromorphological features of the holotype specimen of *M. crescentiae* indicate that the species belongs in sect. *Hygrometrici*. *Marasmius crescentiae* is nearly indistinguishable from *M. ilicis* Singer, and if conspecific, would represent an earlier epithet. Singer (1976) indicated that spores of

*M. crescentiae* were narrower than those of *M. ilicis* (*i.e.*, 2.7 µm *vs.* 3.5-5 µm, respectively), and separated the species based on this feature. My examinations of the holotype specimens of both species indicate overlapping spore width ranges, *viz.*, 3.6-4.6 µm ($\bar{W}$ = 4.1 µm) for *M. crescentiae*, versus 3.2-4 µm ($\bar{W}$ = 3.6 µm) for *M. ilicis*. I did not observe spores on the holotype specimen of *M. crescentiae* as narrow as those reported by Singer.

*Marasmius crescentiae* is similar to *M. minutus* Peck, but the latter differs in forming a reddish brown pileus (not ochraceous or brownish orange as described for *M. crescentiae*), and narrower spores. Refer to the type studies of *M. ilicis* and *M. minutus* for further details.

***MARASMIUS CRYPTOTRICHUS*** Singer, Fl. Neotrop. Monogr. 17: 72. 1976.

HOLOTYPE: Mexico, Morelos, NW of Tepoztlán, 27 June 1969, Singer no. M8250, *ad folia dejecta Quercus* (F).

The collection consists of one basidiome in good condition. **Pileus** 5 mm diam, convex, striate, granulose, greyish-avellaneous. **Lamellae** adnexed, close, narrow, non-marginate, pallid. **Stipe** 30 X <0.5 mm, terete, reddish brown above, dark brown below, covered overall with white or buff-colored, silky, pubescent hairs, insititious on an oak leaf; with few reddish brown, wiry rhizomorphs.

**Basidiospores** 5.6-6.8 X 3-4 µm [$\bar{x}$ = 6.1 ± 0.4 X 3.5 ± 0.3 µm, E = 1.6-2, Q = 1.7 ± 0.1, n = 20], ellipsoid or lacrymoid, hyaline, inamyloid, smooth. **Basidia** 20-25.5 X 5-6.5 µm, 4-spored, clavate. **Basidioles** subclavate or fusoid. **Pleurocystidia** absent.

**Cheilocystidia** broom cell-like; main body 12-24 X 4-6.5 µm, cylindric or subclavate, hyaline, thin-walled; apical setulae 2-5.5 X 1-1.5 µm, rod-shaped, obtuse or subacute, hyaline and thin-walled. **Pileipellis** not hymeniform, composed of a *Rameales*-structure formed of diverticulate hyphae and broom cell-type terminal cells; hyphae 3-5.5 µm diam, interwoven, hyaline or pale brown, inamyloid, typically non-incrusted, non-gelatinous, diverticula concentrated on exteriormost surface of hyphae; terminal cells similar in morphology to the cheilocystidia; diverticula 1.5-6.5 X 0.5-1.5 µm, rod-shaped, obtuse, thin-walled, hyaline. **Hypodermial hyphae** 3-6 µm diam, heavily incrusted with plaque-like or amorphous, greyish brown pigments. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-6 µm diam, cylindric, non-incrusted, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-5 µm diam, parallel, cylindric, smooth, tawny or ferruginous, strongly dextrinoid, clamped, with walls up to 1 µm thick; **medullary hyphae** 2.5-7.5 µm diam, parallel, hyaline, weakly dextrinoid, thin-walled, clamped. **Caulocystidia** up to 200 X 5-8 µm, upper half to two thirds of cell filiform and thin-walled, lower portion slightly enlarged and thicker-walled, hyaline or pale melleous, inamyloid.

**Commentary.** Pileipellis morphology, microchemical reactions and presence of rhizomorphs exhibited by the holotype specimen indicate *M. cryptotrichus* belongs in sect. *Androsacei*.

***MARASMIUS CUCULLATUS*** Ellis, Bull. Torrey Bot. Club 6: 76. 1876.

≡ *Mycena cucullata* (Ellis) Redhead, Sydowia 37: 252. 1984. [*non Mycena cucullata* (Pers.: Fr.) Bon & Chevassut *nom. inval.*, Doc. Mycol. 3: 30. 1973.]

LECTOTYPE (*des mihi*): United States, New Jersey, Newfield, Oct. 1875, J. B. Ellis, on dead twigs of *Vaccinium corymbosum*; North American Fungi Exs. no. 702 (NY - Ellis Collection). [ISOLECTOTYPES: BPI!, FH!, NY!, DAOM, other distributions].

The exsiccata specimen from the Ellis Collection selected as lectotype consists of several stipes lacking pilei plus a small portion of one pileus. Refer to the protologue for details on macromorphology.

**Basidiospores** 7.2-9.6 X 4-5.6 µm (only 5 recovered), ovate or ellipsoid, hyaline, amyloid, smooth. **Basidia** 22-28 X 6.5-8 µm, 4-spored, clavate. **Basidioles** clavate. **Pleurocystidia** 28-36 X 7-10 µm, fusoid-ventricose of lageniform, obtuse, hyaline, thin-walled, projecting beyond the basidioles. **Cheilocystidia** similar to pleurocystidia or some with few apical diverticula. **Pileipellis** not hymeniform, a weakly gelatinized cutis of repent, interwoven, strongly diverticulate hyphae; hyphae 3.5-8 µm diam, hyaline, dextrinoid, thin-walled, clamped; diverticula 1-2.5 X 0.5-1.5 µm, concentrated on the exteriormost sides of hyphae, knob-like or rod-like, hyaline, thin-walled. **Hypodermial hyphae** highly inflated, up to 28 µm diam, short-celled, hyaline, dextrinoid, thin-walled. **Pileus** and **lamellar tramal hyphae** similar, 4-10 µm diam, hyaline, dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-7.5 µm diam, similar to the pileipellis elements, strongly diverticulate, cylindric,

hyaline, weakly dextrinoid or inamyloid, thin-walled, clamped; **medullary hyphae** 3-8 µm diam, cylindric, hyaline, strongly dextrinoid, thin-walled, clamped. **Stipe vesture** of scattered, cylindric, obtuse, thin-walled **caulocystidia**, these mostly collapsed and unmeasurable.

**Commentary.** Type material of *M. cucullatus* was distributed as no. 702 in Ellis' North American Fungi Exsiccati. Although Gilliam (1976) reported the "type specimen" as being deposited at NY, there are three separate specimens at NY that match the data cited in the protologue. The Ellis Collection exsiccata specimen is here designated the lectotype. Pileipellis and hypodermium morphologies, microchemical reactions and amyloid spores of *M. cucullatus* indicate that the species belongs in *Mycena*.

***MARASMIUS CUCURBITULA*** Montagne, Syll. Crypt. 141. 1856.

HOLOTYPE: United States, Ohio, Columbus, Sullivant no. 62 (PC).

The collection consists of three basidiomata in fair consition. **Pileus** ≈25 mm diam, convex, glabrous, even, dark brown. **Lamellae** adnexed, close or crowded, narrow, brown. **Stipe** ≈40 X 3-4 mm, equal, glabrous and dark brown over most of the length, base covered with tan tomentum, non-insititious on decayed wood.

**Basidiospores** 4.8-6.4 X 2.8-3.6 µm [$\bar{x}$ = 5.5 ± 0.4 X 3.3 ± 0.3 µm, E = 1.4-2.1, Q = 1.7 ± 0.2, n = 20], ovate or ellipsoid, hyaline, inamyloid, smooth. **Basidia** 17.5-22.5 X 5-6.5 µm, 4-spored, clavate. **Basidioles** subclavate. **Pleurocystidia** absent. **Cheilocystidia** 16-24 X 3.2-6 µm, irregularly cylindric or contorted, often lobed or with few, broad, apical or lateral diverticula, hyaline, thin-walled.

**Pileipellis** not hymeniform, composed of a cutis of interwoven hyphae; hyphae 4-12 µm diam, frequently-branched, short-celled, smooth or with a few pale brown incrustations, hyaline or pale ochraceous, inamyloid, thin-walled, clamped. **Pileus trama** interwoven; **lamellar trama** subparallel; hyphae 3-8(-10) µm diam, cylindric, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-6 µm diam, subparallel, ochraceous, inamyloid, thin-walled, clamped; **medullary hyphae** similar but hyaline and up to 8 µm diam. **Stipe vesture** absent, or of a few cylindric, obtuse, thin-walled, hyaline caulocystidia.

**Commentary.** Pileipellis and cheilocystidia morphologies, spore size, inamyloid tramal tissues and non-insititious stipe indicate that *M. cucurbitula* belongs in *Collybia* sect. *Levipedes*, and is a synonym of *C. dryophila* (Bull.: Fr.) Kummer.

***MARASMIUS CYRILLIDIS*** Dennis, Kew Bull. 22(1): 76. 1968.

HOLOTYPE: Jamaica, north slope of High Peak, 22 Dec. 1949, Dennis no. J40, on fallen leaves of *Cyrilla racemifloria* (K).

The portion of the holotype examined consists of two intact basidiomata in good condition, arising from leaf petioles; plus a few black rhizomorphs loose in the packet. **Pileus** 2 mm diam, convex, short-striate, dark brown. **Lamellae** adnexed, subdistant, narrow, non-collariate, pallid. **Stipe** 20 X <0.3 mm, wiry, glabrous, shiny, black, insititious.

**Basidiospores** 5.6-8 X 3.2-4 µm [$\bar{x}$ = 6.7 ± 1.1 X 3.5 ± 0.3 µm, E = 1.6-2.1, Q = 1.9 ± 0.2, n = 6], ellipsoid, hyaline, inamyloid, smooth.

**Hymenial elements** not observed; material too scanty [refer to Dennis (*ibid.*) for details]. **Pileipellis** not hymeniform, composed of repent, interwoven hyphae with broom cell-like terminal elements; hyphae 3-5.5 µm diam, cylindric, smooth or weakly incrusted, with few scattered diverticula, hyaline or pale brown, inamyloid, thin-walled; terminal cells densely diverticulate or coralloid, suberect or erect; diverticula 1.5-3.2 X 1.5-3.2 µm, knob-like or rod-like, obtuse, hyaline, thin-walled. **Hypodermial hyphae** typically incrusted with granulose or plaque-like, brown pigments. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2-5.6 µm diam, cylindric, frequently-branched, hyaline, inamyloid, clamped, with walls up to 1 µm thick. **Stipe tissue** monomitic; **cortical hyphae** 2-5 µm diam, parallel, cylindric, pale brownish orange but often incrusted with granular pale brown pigments, dextrinoid, clamped, with walls up to 1 µm thick; **medullary hyphae** 3-6 µm diam, parallel, hyaline, inamyloid, thin-walled, clamped. **Caulocystidia** absent.

**Commentary.** The type material was too scanty to make more than one mount, and unfortunately, no hymenial elements were observed and only six spores were recovered. Nonetheless, pileipellis morphology and insititious stipe with dextrinoid cortical hyphae indicate that *M. cyrillidis* belongs in sect. *Androsacei*.

***COLLYBIA CYSTIDIOSA*** A. H. Smith & Hesler, J. Elisha Mitchell Sci. Soc. 56: 305. 1940.

≡ *Marasmius cystidiosus* (Smith & Hesler) Gilliam, Mycotaxon 4(1): 47. 1976.

HOLOTYPE: United States, North Carolina, Swain Co., Great Smoky Mts. National Park, Indian Creek, 30 July 1939, L. R. Hesler no. 12195, on humus in woods (MICH).

The portion of the holotype examined consisted of one basidiomata in excellent condition. **Pileus** 20 mm diam, campanulate, glabrous, non-striate, disc pale reddish brown, margin dark ochraceous. **Lamellae** adnexed, close, narrow, ochraceous, non-marginate. **Stipe** 55 X 3 mm, enlarged towards the base, glabrous, hollow, tissue thin, tawny or ferruginous overall, non-insititious.

**Basidiospores** 7.2-9.8 X 3.2-4 µm [$\bar{x}$ = 8.2 ± 0.6 X 3.6 ± 0.3 µm, E = 1.9-2.7, Q = 2.3 ± 0.2, n = 30], elongate-ellipsoid, hyaline, inamyloid, smooth. **Basidia** 17.5-24 X 4.8-6.5 µm, 4-spored, rarely 2-spored, clavate. **Basidioles** cylindric or clavate. **Pleurocystidia** 32-70(-80) X 5-8(-12) µm, abundant, ventricose, fusoid or lanceolate, few cylindric, hyaline, highly refractive, inamyloid, thin-walled, arising from deep in subhymenium or lamellar trama and projecting well beyond basidioles. **Cheilocystidia** 12-24 X 4-6.5 µm, abundant, cylindric or clavate, hyaline, non-refractive, inamyloid, thin-walled or thick-walled. **Pileipellis** hymeniform, of *Globulares*-type elements, 16-36 X 5-14(-16) µm, cylindric, clavate or sphaeropeduncluate, sometimes irregular in outline, seldom lobed; cells from disc region ochraceous or pale brown with walls up to 1 µm thick; cells from marginal region hyaline or pale ochraceous, thin-walled or firm-walled; all cells smooth, inamyloid or weakly dextrinoid, basally clamped. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 4-16 µm diam, cylindric, irregular in outline or inflated, hyaline, strongly dextrinoid, thin-

walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 4-12 µm diam, parallel, ochraceous, strongly dextrinoid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** up to 18 µm diam, subparallel, otherwise similar to cortical hyphae; with rare, cylindric or contorted, refractive, oleiferous hyphae interspersed. **Caulocystidia** absent.

**Commentary.** A hymeniform pileipellis of clavate elements, dextrinoid tramal tissues, inamyloid spores and basidiomata stature exhibited by the holotype specimen indicate that *C. cystidiosa* belongs in *Marasmius* sect. *Globulares*. *Marasmius cystidiosus* is similar in many respects to *Marasmius nigrodiscus* (Pk.) Halling, but the latter differs in spore size and stipe surface morphology. Refer to the type study of *Collybia nigrodisca* for comparison.

***MARASMIUS DECIPIENS*** Halling, Desjardin & Tish, Mycotaxon 22(2): 474. 1985.

HOLOTYPE: United States, North Carolina, Transylvania Co., Cedar Mt. near Brevard, Sherwood Forest, 19 June 1980, Tish no. 1602-F (NY).

Nothing can be added to the description and illustrations presented by us in the originating publication. See there for details. *Marasmius decipiens* belongs in sect. *Globulares*.

***MARASMIUS DECURRENS*** Peck, Annual Rep. New York State Mus. 24: 77. 1872. [*non Marasmius decurrens* Montagne, Ann. Sci. Nat. Bot. ser. 4, 1: 118. 1854.]

≡ *Marasmius resinosus* Peck *nom. nov.*, Bull. Buffalo Soc. Nat. Sci. 4(4): 181. 1883.

HOLOTYPE: United States, New York, Albany, Albany Rural Cemetary, July-Aug. 1872, C. H. Peck (NYS).

The collection consists of seven basidiomata pressed flat and glued to five slips of paper, plus six loose basidiomata, all in fair condition. **Pileus** 4-10 mm diam, convex or plano-convex, granulose, even, cream-colored or pale golden. **Lamellae** adnate, close, narrow, golden, edges with golden globules. **Stipe** 25-30 X 0.75 mm, terete, equal above a slightly enlarged base, pruinose, golden with globular granules, non-insititious.

**Basidiospores**. 5.4-8 X 2.8-4 µm [$\bar{x}$ = 6.6 ± 0.7 X 3.3 ± 0.4 µm, E = 1.6-2.6, Q = 2 ± 0.2, n = 30], ellipsoid, inequilateral in profile, hyaline, amyloid, smooth. **Basidia** 16-20 X 5-6.5 µm, 4-spored, cylindric or subclavate. **Basidioles** cylindric or subclavate. **Pleurocystidia** absent or rare, similar to the non-diverticulate cheilocystidia. **Cheilocystidia** 24-40(-60) X 4.8-7.5 µm, abundant, lamellar edge sterile, cylindric, flexuous, subclavate or clavate, obtuse, refractive, hyaline; with scattered narrow, diverticulate (dendrophysoid) elements similar to those of the pileipellis. **Pileipellis** a subhymeniform layer of erect, suberect or repent pilocystidia, plus interspersed erect diverticulate (dendrophysoid) elements; **pilocystidia** 17-60 X 5-8 µm, cylindric, flexuous or clavate, obtuse, refractive, hyaline or pale yellow, often with pale yellow, amorphous adherent exudates, seldom with yellow oily contents, thin-walled, inamyloid; **diverticulate elements** 16-28 X 2-5 µm, irregularly

cylindric, often branched (dendroid), hyaline, non-refractive, thin-walled; diverticula 1.5-6 X 1-2.5 µm, knob-like or rod-like, hyaline, thin-walled. **Tramal hyphae** 2.5-12 µm diam, subparallel to interwoven, cylindric or slightly inflated, often agglutinated, short-celled nearest the pileipellis (but not pseudoparenchymatous), hyaline, dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-4 µm diam, subparallel, cylindric, smooth, hyaline or pale yellow, refractive or non-refractive, dextrinoid, clamped, with walls up to 1 µm thick; **medullary hyphae** 3.5-10(-14.5) µm diam, subparallel, hyaline, strongly dextrinoid, clamped, thin-walled. **Stipe vesture** of numerous **caulocystidia** similar to pilocystidia, some with yellow, amorphous, adherent exudates.

**Commentary**. The holotype specimen of *M. decurrens* is conspecific with *Resinomycena rhododendri* (Pk.) Redhead & Singer. For a discussion of this species refer to Redhead and Singer (1981). Redhead (1987) considers the genus *Resinomycena* to be allied with *Helotium, Hydropus* and *Mycena* and places these genera in the *Xerulaceae* Jülich.

***MARASMIUS DELECTANS*** Morgan, J. Mycol. 11: 206. 1905.

LECTOTYPE [Gilliam (1976: 58)]: United States, Ohio, Preston, 1895, A. P. & L. V. Morgan no. 21 (ISC).

The collection consists of numerous badly fragmented basidiomata. **Pileus** convex, even on disc, short-striate on margin, glabrous, yellowish brown. **Lamellae** adnate, subdistant or distant, broad, pallid. **Stipe** terete, glabrous, brown overall, non-insititious.

**Basidiospores** 6-8.8 X 3.4-4.4 µm [$\bar{x}$ = 7.3 ± 0.7 X 3.7 ± 0.3 µm, E = 1.6-2.3, Q = 1.9 ± 0.2, n = 30], ellipsoid in face view, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 17.5-24 X 5-6.5 µm, 4-spored, subclavate. **Basidioles** cylindric or subclavate. **Pleurosetae** 24-65 X 5.5-8 µm, abundant, lanceolate, fusoid-ventricose or irregular in outline, acute, sometimes branched near the apex, hyaline or pale yellow; walls refractive, strongly dextrinoid, up to 2.5 µm thick. **Cheilosetae** transitional in morphology between *Siccus*-type broom cells and setoid elements; main body 16-24 X 5.5-8 µm, irregularly cylindric or subclavate, hyaline, thick-walled, dextrinoid; apical setulae 3-16 X 1.5-3.5 µm, few (1-6), conic or irregular in outline, subacute, solid, hyaline; lamellar edge with interspersed pleurosetoid elements. **Pileipellis** hymeniform, not mottled, of *Siccus*-type broom cells, pilosetae and elements transitional in morphology; 1) ***Siccus*-type broom cells** with main body 12-20 X 5-10 µm, irregularly cylindric or clavate, typically thick-walled, hyaline, weakly dextrinoid; apical setulae 1.5-7 X 1.5-2.5 µm, conic, subacute or acute, thick-walled or solid, subhyaline, pale yellow or pale ochraceous, ranging in number from 4-12; few clavate or subvesiculose elements 10-16 X 6.5-10 µm lacking setulae interspersed; 2) **pilosetae** similar to pleurosetae, scattered, few; 3) **transitional elements** similar to *Siccus*-type cells but with fewer and longer apical setulae; setulae up to 20 µm long, conic, acute, 2-5 per cell, yellowish, dextrinoid, with walls up to 2 µm thick. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-12 µm diam, cylindric or inflated, non-gelatinous, smooth, hyaline, inamyloid or weakly dextrinoid, thin-

walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-5.5 µm diam, subparallel or parallel, ochraceous (at apex) or brown (at base), strongly dextrinoid, smooth, clamped, with walls up to 2 µm thick; **medullary hyphae** 2.5-10 µm diam, subparallel, hyaline, dextrinoid, clamped, with walls up to 1 µm thick. **Stipe vesture** absent.

**Commentary.** Pileipellis morphology, hymenial setae and non-insititious stipe of the holotype specimen indicate that *M. delectans* belongs in sect. *Sicci* ser. *Spinulosi* (Clémençon) Desjardin. Refer to the description of this species by Gilliam (1976) and the analysis presented in Chapter IV for further details.

***COLLYBIA DELICATA*** Thiers, Mycologia 50: 519. 1958.

HOLOTYPE: United States, Texas, Brazos Co., Wellborn, hardwoods near clay pits, 9 June 1952, H. D. Thiers no. 1684, gregarious to subcespitose in humus under oaks (MICH).

The portion of the holotype examined consisted of one basidiome in excellent condition. **Pileus** 50 mm diam, expanded-campanulate, disc even, margin short-striate, glabrous, beige or leather-colored. **Lamellae** adnate, close, broad, concolorous with the pileus. **Stipe** 40 X 5 mm diam, hollow, equal, furfuraceous, buffy-tan, non-insititious.

**Basidiospores** 6.4-8 X 3.6-5.4 µm [$\bar{x}$ = 7.4 ± 0.5 X 4.4 ± 0.4 µm, E = 1.3-2.2, Q = 1.7 ± 0.2, n = 30], ovate or ellipsoid, hyaline, inamyloid, smooth. **Basidia** 24-30(-35) X 5.5-8 µm, 4-spored, clavate. **Basidioles** cylindric or subclavate. **Hymenial cystidia** (30-)44-80 X 8.5-13 µm, abundant on sides and edges of lamellae (typically somewhat smaller on lamellar edges), fusoid or ventricose, rarely clavate, non-

refractive, hyaline, thin-walled (often collapsed when revived), inamyloid. **Pileipellis** hymeniform, not mottled, of *Globulares*-type elements, 16-24 X 7-17.5 µm, subcylindric, clavate or subvesiculose, broadly obtuse, subhyaline or pale yellow, inamyloid or weakly dextrinoid, thin-walled, clamped. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3.5-10(-12.5) µm diam, cylindric or inflated, non-gelatinous, smooth, hyaline, strongly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 2.5-8 µm diam, subparallel, hyaline, dextrinoid, clamped, with walls up to 1 µm thick. **Stipe vesture** a thin layer of tangled hyphae giving rise to suberect or erect **caulocystidia**, 12-40 X 6-8 µm, cylindric or clavate, obtuse, hyaline, thin-walled.

**Commentary**. I agree with Halling's (1983b) diagnosis that *C. delicata* is a synonym of *Marasmius nigrodiscus* (Pk.) Halling. In the protologue, Thiers (*ibid.*) indicated that the two types of pleurocystidia and cheilocystidia, presence of caulocystidia and spore size exhibited by *C. delicata* were characters useful in separating the species from *C. glatfelteri* (Murr.) Murr. and *C. tenuifolia* (Murr.) Murr. The latter two species are considered by this author and Halling (1983b) as synonyms of *M. nigrodiscus*. The holotype specimens of the latter three species all exhibit hymenial cystidia, caulocystidia and spores similar in morphology to those of *C. delicata*. Refer to the type studies of these taxa for comparison.

***MARASMIUS DICHROUS*** Berkeley & Curtis, Ann. Mag. Nat. Hist. II, 12: 426. 1853.

≡ *Collybia dichrous* (Berk. & Curt.) Gilliam, Mycotaxon 4(1): 130. 1976.

HOLOTYPE: United States, South Carolina, Society Hill, July 1849, Curtis no. 2834, *ad lign., putrid, humid, in paludosis exsiccatis* (K). [ISOTYPE: FH!].

The isotype collection consists of eight basidiomata pressed flat and glued to a slip, all in fair condition. **Pileus** 6-20 mm diam, convex, even overall or short-striate, glabrous, dark brown. **Lamellae** adnate, close, broad, ventricose, ochraceous or pale brown, non-marginate. **Stipe** 15-20 X 1-3 mm, terete, apex flared, base subbulbous, pubescent overall, pale brown, non-insititious.

**Basidiospores** 7.6-11.2 X 3.2-4 µm [$\bar{x}$ = 8.8 ± 0.9 X 3.5 ± 0.2 µm, E = 2.1-3.1, Q = 2.5 ± 0.3, n = 20], ellipsoid or subcylindric, hyaline, inamyloid, smooth. **Basidia** 25-29 X 6-8 µm, 4-spored, subclavate. **Basidioles** cylindric, subclavate or subfusoid. **Pleurocystidia** absent. **Cheilocystidia** 25-36 X 7-12 µm, clavate to broadly clavate, abundant, hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, formed of a cutis of radially arranged hyphae; hyphae 4-16 µm diam, weakly interwoven, cylindric or slightly inflated, hyaline or pale brown and typically heavily incrusted, mostly non-diverticulate, but some with scattered, broad, knob-like diverticula, inamyloid, clamped; terminal cells repent or suberect, broadly clavate or ventricose, 40-52 X 12-16 µm; incrustations annular or helical, brown. **Pileus trama** interwoven; **lamellar trama** regular; hyphae similar to pileipellis hyphae but less incrusted (non-incrusted in the lamellae) and non-diverticulate. **Stipe tissue** monomitic; **cortical hyphae** 3.5-8 µm diam, subparallel,

cylindric, smooth, ochraceous or brown, inamyloid, clamped, with walls up to 2 µm thick; **medullary hyphae** similar but hyaline and thinner-walled. **Stipe vesture** of numerous, densely distributed **caulocystidia** up to 50 X 6-7.5 µm, cylindric, strangulate, subclavate or slightly irregular in outline, subhyaline, ochraceous or pale brown, inamyloid, with walls up to 2 µm thick.

**Commentary.** Pileipellis morphology and non-insititious stipe of the holotype specimen of *M. dichrous* indicate that the species is best placed in *Collybia* sect. *Subfumosae* as proposed by Gilliam (1976) and Halling (1983a).

***MARASMIUS DOMESTICUS*** Murrill, Bull. Torrey Bot. Club 66: 160. 1939.

≡ *Collybia domestica* (Murr.) Singer, Sydowia 15: 55. 1961. [*non Collybia domestica* (Murr.) Murrill, Mycologia 8: 218. 1916. Bas.: *Gymnopus domesticus* Murr., N. Amer. Fl. 9(5): 371. 1916.]

HOLOTYPE: United States, Florida, Alachua Co., Gainesville, 3 June 1938, leg. E. West, Murrill no. F18279, in lawn (FLAS).

The collection consists of 20 basidiomata mostly in good condition, some infected by an undetermined Deuteromycete. **Pileus** 1-20 mm diam, convex or campanulate, even, glabrous, brown overall. **Lamellae** adnate, close or subdistant, narrow, pale brown. **Stipe** 20-35 X 1-1.5 mm, terete, apex equal or flared, pruinose, base equal, pubescent, greyish brown overall, non-insititious.

**Basidiospores** 7.6-9.2 X 4.4-6 µm [$\bar{x}$ = 8.3 ± 0.4 X 5.2 ± 0.5 µm, E = 1.3-1.8, Q = 1.6 ± 0.1, n = 25], ovate, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 21.5-24 X 6.5-8 µm, 4-spored,

clavate. **Basidioles** subclavate or ventricose. **Pleurocystidia** absent. **Cheilocystidia** not observed; lamellar edges badly fragmented or parasitized. **Pileipellis** not hymeniform, composed of a cutis of repent, interwoven hyphae; hyphae 2.5-8 µm diam, obscurely radially arranged, cylindric, non-inflated, non-gelatinous, non-diverticulate or with a few, scattered, knob-like diverticula; walls smooth or weakly incrusted, pale brown, inamyloid, thin. **Tramal hyphae** 3-10 µm diam, interwoven, smooth, hyaline, inamyloid, non-gelatinous, thin-walled, clamped. **Stipe tissue** monomitic; **cortical** 2.5-8 µm diam, subparallel, cylindric, smooth, ochraceous, inamyloid, clamped, with walls up to 1 µm thick; **medullary hyphae** similar but hyaline and thinner-walled. **Stipe vesture** a layer of loosely tangled, contorted hyphae 3.5-5 µm diam, with irregularly cylindric, rarely lobed terminal cells; hyaline or pale yellow, inamyloid, with walls up to 1 µm thick.

**Commentary.** Pileipellis morphology and non-insititious stipe indicate that *M. domesticus* belongs in *Collybia* as proposed by Singer (1961b). Scattered diverticulate projections on pileipellis hyphae suggest that the species is best placed in sect. *Subfumosae*. *Collybia domestica* (Murr.) Sing. is distinct from most small, terrestrial Collybiae because of broad spores. Unfortunately, the specific epithet is homonymic in *Collybia* and a new name is needed for the taxon originally described in *Marasmius*. Until specimens of potentially synonymous taxa are examined, a new epithet will not be proposed. An earlier type study of *M. domesticus* was provided by Hesler (1959b).

***MARASMIUS ELONGATIPES*** Peck, Bull. Buffalo Soc. Nat. Sci. 4: 181. 1882.

≡ *Marasmius longipes* Peck, Bull. Buffalo Soc. Nat. Sci. 1: 58. 1873 [*non Marasmius longipes* Montagne, Ann. Nat. Sci. Bot. IV, 1: 114. 1854].

***MARASMIUS EPIFAGUS*** Gilliam, Mycologia 67: 821. 1975.

HOLOTYPE: United States, Michigan, Washtenaw Co., Sharon Hollow, northwest of Manchester, 1 Oct. 1971, A. H. Smith no. 80656 [erroneously published as no. 80658] (MICH).

The portion of the holotype examined consisted of two basidiomata in good condition attached to a *Fagus* leaf. **Pileus** 1-1.5 mm diam, plano-convex, even, glabrous, beige. **Lamellae** poorly-developed, remote, narrow, pale cream-colored. **Stipe** 3-8 X <0.1 mm, terete, equal, pruinose overall, apex cream, base brown, insititious.

**Basidiospores** 8.8-9.6 X 3.8-4 µm (4 recovered), ellipsoid, hyaline, inamyloid, smooth. **Basidia** 23-26 X 6.5-8 µm, 4-spored, clavate. **Basidioles** subclavate. **Hymenial cystidia** numerous on lamellar sides and edges, 36-48 X 6.5-9 µm, fusoid or fusoid-ventricose, not capitate, arising from subhymenium and projecting up to 24 µm beyond basidioles, hyaline, inamyloid, thin-walled apically and basally, thick-walled centrally, non-refractive. **Pileipellis** hymeniform, not mottled, composed of versiform elements ranging from clavate to ventricose, lageniform or vesiculose, often with 2-5 broad, finger-like projections on the apex; main body 12-26 X 6.5-13 µm, smooth or apically roughened, non-gelatinous, typically hyaline or pale yellow and thin-walled, few yellow and thick-walled, often with

refractive contents; apical projections 3-10 X 2.5-5 µm, cylindric or subconic, obtuse, smooth or roughened, concolorous with main body; with few interspersed pilocystidia similar to hymenial cystidia but often with roughened walls. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 1.5-5 µm diam, cylindric, smooth, non-gelatinous, hyaline, inamyloid, clamped, thin-walled. **Stipe tissue** monomitic; **cortical hyphae** 1.5-5 µm diam, parallel, smooth, hyaline (at stipe apex) or brown (stipe base), inamyloid, with walls up to 1.5 µm thick; **medullary hyphae** 2.5-6.5 µm diam, cylindric, hyaline, inamyloid, thin-walled, clamped. **Stipe vesture** of numerous versiform **caulocystidia** 8-28 X 5-10 µm, cylindric, clavate, ventricose or irregular in outline, hyaline at stipe apex, ochraceous or pale brown at stipe base, inamyloid, with walls up to 2 µm thick.

**Commentary**. *Marasmius epifagus* is considered by Gilliam (1975a, 1976) and me to belong to *Marasmius* sect. *Epiphylli*. Singer (1986) suggested the species was better placed in the genus *Gloiocephala* sect. *Gloiocephala* subsect. *Confusae* Singer [*nom. superfl.*; = subsect. *Gloiocephala* (Art. 22.1, ICBN)]. Basidiomata size, pileipellis morphology and growth on *Fagus* are diagnostic features. Refer to the commentary on *M. epifagus* in Chapter IV for a further discussion of current taxonomic disposition of the species.

***ANDROSACEUS EPIPHYLLOIDES*** Rea, Trans. Brit. Mycol. Soc. 3(4): 286. 1910.

≡ *Marasmius epiphylloides* (Rea) Sacc. & Trott., Syll. Fung. 23: 145. 1925.

REPRESENTATIVE MATERIAL: Belgium, Courtrai, Dec., Westendorp and Wallays, Herbier Cryptogamique ou Collection de Plantes Cryptogames et Agames qui croissent en Belgique no. 586, as *Agaricus epiphyllus*; sur les feuilles mortes du lierre (*Hedera helix*) (NY).

The collection consists of 3 basidiomata in fair condition. **Pileus** 1.5-3 mm diam, convex, even, pruinose, buff-colored. **Lamellae** well-developed, adnate, remote, narrow, cream, not intervenose. **Stipe** 4-6 X 0.5 mm, terete, pruinose, brown, insititious.

**Basidiospores** 11.6-14.8 X 4-4.8 µm [$\bar{x}$ = 13.2 ± 0.9 X 4.4 ± 0.3 µm, E = 2.7-3.5, Q = 3 ± 0.2, n = 20], elongate-ellipsoid or cylindric, hyaline, inamyloid, smooth. **Basidia** 30-35 X 6.5-8.5 µm, 4-spored, clavate or subclavate. **Basidioles** cylindric or subclavate. **Hymenial cystidia** common on lamellar sides and edges, 55-70 X 6.5-8 µm, cylindric-subcapitate or capitulate, projecting up to 32 µm beyond basidioles, hyaline, thin-walled. **Pileipellis** hymeniform, of *Rotalis*-type broom cells plus interspersed pilocystidia; ***Rotalis*-type broom cells** with main body 12-32 X 8-24 µm, clavate, vesiculose or sphaeropedunculate, hyaline, few thin-walled, mainly thick-walled (up to 2 µm); divergent setulae 2-7(-9) X 1.5-2.5 µm [longer than typical for this cell-type], cylindric, obtuse, hyaline, solid; **pilocystidia** 45-72 X 8-12 µm, capitulate, ventricose-subcapitate or obclavate, apically thin-walled, basally thick-walled (up to 1 µm), hyaline. **Tramal hyphae** 3-8 µm diam, interwoven, cylindric, branched, non-gelatinous, smooth, hyaline, inamyloid, clamped, with walls up to 1 µm thick. **Stipe tissue** monomitic; **cortical hyphae** 2.5-5 µm diam, parallel, cylindric, smooth, brownish orange or pale brown, inamyloid,

with walls up to 2 µm thick; **medullary hyphae** similar but hyaline or pale yellow and thinner-walled. **Stipe vesture** of scattered **caulocystidia** up to 50 X 8-15 µm, similar to capitate pilocystidia or cylindric and broadly obtuse, brownish orange or brown, inamyloid, with walls up to 2 µm thick.

**Commentary**. I have not studied the holotype specimen of *A. epiphylloides*, but the specimen cited above will serve to represent my concept of the species. *Marasmius epiphylloides sensu* Kühner (1933), Kühner and Romagnesi (1953), Singer (1943), Clémençon (1982) and Noordeloos (1987) is a very distinct European species, characterized by pileipellis morphology, spore size, basidiomata coloration and habit on leaves of *Hedera helix*. All of the above authors have included the species in sect. *Epiphylli*, and Singer (1973b) established the monotypic subsection *Epiphylloidei* to accommodate *M. epiphylloides*. Although many of the macro- and micromorphological features suggest that placement in sect. *Epiphylli* is appropriate, other features indicate affinity with members of sect. *Hygrometrici*. For example, *Rotalis*-type pileipellis elements plus capitate, thick-walled pilocystidia exhibited by basidiomata of *M. epiphylloides* are commonly formed by members of sect. *Hygrometrici*, whereas such elements are unknown in any other species of sect. *Epiphylli*. Conversely, unpigmented pilei and sometimes poorly-developed lamellae of *M. epiphylloides* are characteristic of sect. *Epiphylli*. *Marasmius epiphylloides* is seemingly intermediate between sects. *Epiphylli* and *Hygrometrici*, and is retained here in sect. *Epiphylli* until further evidence is accumulated to support a transfer.

***AGARICUS EPIPHYLLUS*** Persoon: Fries, Syst. Mycol. 1: 139. 1821.

[*Agaricus epiphyllus* Pers., Syn. Meth. Fung. 468. 1801.]

≡ *Androsaceus epiphyllus* (Pers.: Fr.) Patouillard, Essai Tax. Hyménomyc. 141. 1900.

≡ *Marasmius epiphyllus* (Pers.: Fr.) Fries, Epicr. Syst. Mycol. 386. 1838.

NEOTYPE: Sweden, Ulfült near Femsjö, 19 Aug. 1964, Singer no. C4130 (BAFC) [not examined]. REPRESENTATIVE MATERIAL: Sweden, Femsjö, 1911, L. Romell (NY).

The representative specimen examined consisted of four basidiomata in good condition attached to an undetermined leaf. **Pileus** 2-4 mm diam, plano-convex, even, glabrous, pale cream. **Lamellae** well-developed, distant, narrow, not-intervenose, cream-colored. **Stipe** 15-20 X <0.5 mm, terete, pruinose, apex cream, base greyish brown, insititious.

**Basidiospores** 10-13.6 X 4-4.8 µm [$\bar{x}$ = 11.7 ± 0.9 X 4.4 ± 0.2 µm, E = 2.4-2.9, Q = 2.7 ± 0.2, n = 15], ellipsoid, hyaline, inamyloid, smooth. **Basidia** 26-35 X 5.6-8 µm, 4-spored, clavate. **Basidioles** cylindric or subclavate. **Hymenial cystidia** 33-42 X 7-8.5 µm, common, fusoid-ventricose or narrowly ventricose-rostrate, hyaline, typically thin-walled, rarely with central portion of cell firm-walled, non-refractive, inamyloid. **Pileipellis** hymeniform, not mottled, composed of clavate, ventricose, vesiculose or sphaeropedunculate elements, 12-28 X 7-13 µm, typically with walls 0.5-1.5 µm thick, few thicker-walled, non-gelatinous, hyaline, inamyloid, clamped; with numerous **pilocystidia** interspersed, these 25-36 X 5.6-8µm, fusoid-ventricose or

irregularly fusoid, projecting, thick-walled, hyaline. **Tramal hyphae** 4-8 µm diam, interwoven, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-6 µm diam, parallel, cylindric, smooth, hyaline (at stipe apex) or brownish orange to brown (stipe base), inamyloid, clamped, with walls up to 1.2 µm thick; **medullary hyphae** 2-7.5 µm diam, parallel, cylindric, hyaline, inamyloid, thin-walled or with walls up to 0.5 µm thick; with few oleiferous hyphae interspersed. **Stipe vesture** of scattered **caulocystidia** 12-36 X 5.5-8 µm, cylindric, clavate or acuminate, obtuse or subacute, hyaline (at stipe apex) or pale brown (stipe base), thick-walled.

**Commentary**. No holotype specimen of *A. epiphyllus* exists. To clarify the taxonomic boundaries of the species, Singer (1969) designated a "topotypical" specimen cited above as neotype. Until recently, the circumscription of *M. epiphyllus* encompassed taxa with thick-walled pileipellis elements as well as those with thin-walled elements. The species more commonly encountered in the environs of Femsjö, Fries' collecting area, possesses thick-walled pileipellis elements and consequently, this is the form chosen by Singer to represent *M. epiphyllus*. The species with thin-walled pileipellis elements which also grows in Europe (as well as North and South America), was described by Singer (1969) as *M. tenuiparietalis*. *Marasmius epiphyllus* is the type species of sect. *Epiphylli* Kühner.

***MARASMIUS EPODIUS*** Bresadola, Fung. Trident. 1: 88. 1881.

REPRESENTATIVE MATERIAL: Italy, Trento, Aug. 1888, J. Bresadola (BPI). Type material not located.

The topotypical authentic specimen examined consisted of five basidiomata in good condition. **Pileus** 6-10 mm diam, convex, sulcate, glabrous, dark cream-colored or ochraceous. **Lamellae** remote, broad, non-collariate, pallid, non-marginate. **Stipe** 28-35 X 0.25-0.75 mm, terete, glabrous, brown or bronze, non-insititious.

**Basidiospores** from three different basidiomata as follows: 1) 12.8-16 X 3.6-4.4 µm [$\bar{x}$ = 14.2 ± 1.0 X 4 ± 0.2 µm, E = 3.1-4.2, Q = 3.6 ± 0.3, n = 15]; 2) 15.6-18.4 X 3.6-4.8 µm [$\bar{x}$ = 16.8 ± 0.9 X 4.1 ± 0.3 µm, E = 3.3-4.6, Q = 4.1 ± 0.3, n = 16]; 3) 16-22.4 X 3.6-4.8 µm [$\bar{x}$ = 19.3 ± 1.9 X 4.1 ± 0.4 µm, E = 3.5-5.5, Q = 4.7 ± 0.5, n = 18]; clavate or subclavate, often curved in profile, hyaline, inamyloid, smooth. **Basidia** 23-26 X 6-7.5 µm, 4-spored, clavate. **Basidioles** clavate. **Pleurocystidia** 36-50 X 8-12 µm, scattered, clavate or ventricose, sometimes apically once-constricted, non-refractive or refractive, hyaline. **Cheilocystidia** similar to *Siccus*-type pileipellis elements; main body 12-16 X 4.5-7 µm, cylindric or clavate, hyaline, thin-walled; apical setulae 2-7(rarely up to 12) X 0.8-2 µm, irregular in outline, often wavy, obtuse, seldom branched, subhyaline or melleous, thick-walled. **Pileipellis** hymeniform, weakly mottled, of *Siccus*-type broom cells; main body 8-14 X 5-10 µm, cylindric or clavate, rarely lobed, mostly thin-walled and hyaline but with scattered thick-walled, yellowish elements; apical setulae 1.2-4 X 0.8-1.5 µm, irregular in outline, obtuse or subacute, few verrucose,

thick-walled or solid, ranging from hyaline to pale yellow; mature pilei with few interspersed elements lacking setulae or with 2-6 broadly obtuse, knob-like projections. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-7 µm diam, cylindric, branched, smooth, hyaline, inamyloid or weakly dextrinoid, non-gelatinous, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-5 µm diam, parallel, cylindric, smooth, brownish orange, dextrinoid, clamped, with walls up to 1 µm thick; **medullary hyphae** similar but hyaline and thin-walled. **Caulocystidia** absent.

**Commentary.** No holotype specimen of *M. epodius* was located. The authentic topotypical specimen cited above will serve to represent my concept of the species until fresh topotypical material is collected, cultured and designated the neotype. The substantial spore size variability of basidiomata comprising this collection is of interest. Spores ranged in mean length from 14.2 µm in one basidiome, to 16.8 µm in another, to 19.3 µm in a third basidiome, while all other macro- and micromorphological features remained constant. Maire (1908) described var. *microsporus* (as *Androsaceus epodius* var. *microsporus* Maire) to accommodate specimens with spores 12-15 µm long. Note, however, that these measurements fall within the range of variation exhibited by the single collection described above. Recently, Antonin (1988) transferred Maire's epithet as a variety of *M. anomalus* Lasch *in* Rabenhorst. *Marasmius epodius* has been considered by Singer (1976), Antonin (1988) and me to be a synonym of *M. anomalus* Lasch *non* Peck. Compare with the type study of *M. anomalus* Lasch.

***MARASMIUS FAGINEUS*** Morgan, Cincinnati Soc. Nat. Hist. 6: 192. 1883.

NEOTYPE (*des mihi*): United States, Ohio, 17 July 1906, Morgan, on bark of living oak (ISC).

The collection consists of several basidiomata in good condition. **Pileus** convex or plano-convex, glabrous but radially streaked, even, brown. **Lamellae** adnate, close or subdistant, narrow, pale brown. **Stipe** terete, apex flared, equal centrally, base tuberculate, pubescent overall, brown, non-insititious.

**Basidiospores** 8-11.2 X 3-4 µm [$\bar{x}$ = 9.2 ± 0.9 X 3.4 ± 0.3 µm, E = 2.4-3.1, Q = 2.7 ± 0.2, n = 20], ellipsoid or subcylindric, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 22-25 X 5-6.5 µm, 4-spored, clavate. **Basidioles** cylindric or clavate. **Pleurocystidia** absent. **Cheilocystidia** 22-36 X 9-17.5 µm, common, clavate or sphaeropedunculate, often voluminous, hyaline, thin-walled. **Pileipellis** not hymeniform, formed of a cutis of weakly interwoven, radially arranged hyphae; hyphae 3.5-10 µm diam, cylindric or weakly inflated, non-diverticulate or with rare branchlets, smooth or more often with brown, annular or amorphous pigment incrustations, non-gelatinous, inamyloid, thin-walled, clamped; terminal cells repent or suberect, clavate. **Tramal hyphae** interwoven, similar to pileipellis hyphae but typically non-incrusted. **Stipe tissue** monomitic; **cortical hyphae** 2.5-8(-10) µm diam, subparallel, cylindric, smooth, hyaline (at stipe apex) or ochraceous to brown (stipe base), inamyloid, thick-walled, clamped; **medullary hyphae** similar but hyaline and thin-walled. **Stipe vesture** of numerous, often clustered **caulocystidia** 8-40+ X 6.5-10 µm, cylindric, clavate or irregular in outline, often constricted,

rarely apically lobed, hyaline or pale yellow, inamyloid, with walls up to 1.5 µm thick.

**Commentary.** Gilliam (1976) indicated that *M. fagineus* was published in 1905 and erroneously cited a Morgan specimen collected on 17 July 1906 as the type specimen. The epithet was first published in 1883 (Morgan, *ibid.*) and no specimens were cited in the protologue. No holotype or potential lectotype specimens were located in Morgan's herbarium housed at ISC, and moreover, no specimens determined by Morgan as *M. fagineus* could be found. In order to properly dispose of the epithet, a neotype specimen must be selected. The specimen cited by Gilliam (1976: 131) as type of *M. fagineus* is labeled "*Marasmius* sp., on bark of living oak, 17 July 1906, Morgan" (no locale given), and was annotated by Gilliam as "= *M. fagineus, M. caespitosus*, = *Collybia dichrous*." Macromorphologically this specimen matches the protologue of *M. fagineus* very well in all features except substrate. Morgan cited the substrate as the bark of living beech trees. I concur with Gilliam that the specimen cited by her is conspecific with *C. dichrous*, and in keeping with the current concept of *M. fagineus* (see Gilliam, 1976; Halling, 1983a) designate the Morgan specimen collected on 17 July as neotype of *M. fagineus*. Consequently, *M. fagineus* becomes a synonym of *Collybia dichrous* (Berk. & Curt.) Gilliam.

***MARASMIUS FALCATIPES*** Desjardin *in* Desjardin & Petersen, Mycotaxon 34(1): 85. 1989.

HOLOTYPE: United States, North Carolina, Macon Co., Highlands, Horse Cove, 10 Aug. 1987, Desjardin no. 4415 (TENN no. 47629).

The collection consists of approximately 15 basidiomata in excellent condition, attached to leaves or sticks of undetermined dicots. **Pileus** 1-5 mm diam, plano-convex or plane, striate, glabrous, tan, beige, greyish brown or brown. **Lamellae** adnate, subdistant, narrow, not-intervenose, buff or cream-colored, non-marginate. **Stipe** eccentric, <2 X <0.2 mm, curved, terete, pruinose, buff or cream-colored, non-insititious.

**Basidiospores** 8.8-10.8 X 3.6-4 µm [$\bar{x}$ = 9.8 ± 0.7 X 3.8 ± 0.2 µm, E = 2.4-2.8, Q = 2.6 ± 0.1, n = 15], ellipsoid or amygdaliform, often with a slight suprahilar depression and abaxial bulge, hyaline, inamyloid, smooth. Refer to the protologue for illustrations and details on other micromorphological features of the holotype specimen.

**Commentary.** *Marasmius falcatipes* belongs in sect. *Sicci* ser. *Haematocephali*.

***MARASMIUS FASCIATUS*** Pennington, N. Amer. Fl. 9(4): 270. 1915.

≡ *Marasmius anomalus* Peck, Annual Rep. New York State Mus. 24: 76. 1871 (1872) [*non Marasmius anomalus* Lasch *in* Rabenhorst, Klotzschii Herb. Vivum Mycol., Cent. 19, no. 1806. 1854].

≡ *Collybia fasciata* (Penn.) Halling, Mycologia Mem. 8: 81. 1983.

***MARASMIUS FELIX*** Morgan, J. Mycol. 12: 2. 1906.

NEOTYPE (*des mihi*): United States, Ohio, Preston, 1906, A. P. & L. V. Morgan no. 129 (ISC). [ISONEOTYPE: ISC!]

The collection consists of approximately 30 stipes lacking pilei, plus numerous badly fragmented pilei. **Pileus** convex or plano-convex,

even, glabrous, cream, pale ochraceous or pale orange. **Lamellae** well-developed, distant, narrow, adnexed, not intervenose, pallid. **Stipe** 40-50 X <1 mm, terete, equal, pruinose, shiny, brown, insititious.

**Basidiospores** 8.8-11.4 X 4-5.4 µm [$\bar{x}$ = 10.1 ± 0.8 X 4.4 ± 0.3 µm, E = 1.6-2.6, Q = 2.3 ± 0.2, n = 20], ellipsoid, slightly inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 24-32 X 7-9 µm, 4-spored, clavate. **Basidioles** subcylindric or clavate. **Cystidioles** fusoid or narrowly ventricose-rostrate. **Hymenial cystidia** common, 36-52 X 5.5-8 µm, capitulate or fusoid-subcapitate nearest the lamellar edges, ventricose-rostrate and typically non-capitate on the lamellar sides, mostly thin-walled, few with walls up to 0.5 µm thick, hyaline, inamyloid, non-refractive. **Pileipellis** hymeniform, weakly mottled, composed of clavate, ventricose, broadly lageniform or vesiculose elements 14-20 X 6.5-15 µm, ranging from subhyaline to pale yellowish or brownish orange, with walls 0.5-2 µm thick, thicker-walled and more deeply pigmented elements interspersed; all elements lacking diverticula, inamyloid. **Tramal hyphae** 3-6.5 µm diam, interwoven, cylindric, non-gelatinous, smooth, hyaline, inamyloid, clamped, with walls up to 1 µm thick. **Stipe tissue** monomitic; **cortical hyphae** 2.5-5 µm diam, parallel, smooth, subhyaline (at stipe apex) or brownish orange (stipe base), inamyloid, with walls up to 1.5 µm thick; **medullary hyphae** 2.5-9 µm diam, similar but hyaline and thinner-walled. **Stipe vesture** of scattered **caulocystidia** 8-45 X 4.5-8 µm, cylindric, ventricose or fusoid, obtuse or subacute, brownish orange, inamyloid, with walls up to 2 µm thick.

**Commentary.** No specimens were explicitly cited in the protologue, although the species was reported as growing on leaf veins and petioles of *Platanus* from Preston, Ohio. There are two specimens determined by Morgan as *M. felix* deposited in Morgan's herbarium at ISC. Both are dated 1906, numbered 129, and were collected at Preston, Ohio. It is quite probable that neither of these specimens were in the hands of the originating author at the time of publication of the epithet. The protologue appeared in the January 1906 issue of the Journal of Mycology, issued 8 March 1906. The species is known to form basidiomata from September through November throughout its range (Indiana southward to Florida; Desjardin unpubl. data), and it is highly unlikely that material was collected in Ohio during the period January through early March. It can be argued, therefore, that the Morgan specimens dated 1906 were collected after submission of the manuscript and do not represent potential lectotype material. One of the specimens is here designated the neotype, and the second, conspecific specimen is considered an isoneotype.

Pileipellis morphology, presence of hymenial cystidia, inamyloid tramal tissues and insititious stipe are features indicating that *Marasmius felix* belongs in sect. *Epiphylli*.

***MARASMIUS FERRUGINEUS*** Berkeley & Curtis, L. Linn. Soc. Bot. 10: 297. 1869.

[*Agaricus ferrugineus* Berkeley, London J. Bot. 2: 630. 1843. *non Agaricus ferrugineus* (Pers.) Pers., Syn. Meth. Fung. 400. 1801].

≡ *Marasmius gardneri* Singer, Sydowia 12: 114. 1958. *nom. superfl.*

HOLOTYPE: Brazil, Minas Gerais, Gardner (K - Berkeley Herb.).

The collection consists of four basidiomata pressed flat but in fair condition. **Pileus** 4-5 mm diam, convex, sulcate, subvelutinous, deep reddish-ferruginous. **Lamellae** distant, moderately broad or narrow, pallid, non-marginate, non-collariate. **Stipe** ≈15 X <0.5 mm, terete, glabrous, rusty brown above, brown below, non-insititious, lignicolous.

**Basidiospores** 15.2-20 X 3.8-4.8 µm [$\bar{x}$ = 17.5 ± 1.5 X 4.4 ± 0.3 µm, E = 3.5-5.3, Q = 4 ± 0.5, n = 11], clavate or subfusiform, seldom curved, hyaline, inamyloid, smooth. **Basidia** 25-29 X 7-9 µm, 4-spored, clavate. **Basidioles** cylindric or subclavate. **Pleurocystidia** numerous, 33-44 X 10-14.5 µm, broadly clavate, ventricose or ventricose-rostrate, arising from deep in subhymenium and projecting beyond basidioles, refractive, hyaline or seldom pale golden, thin-walled. **Cheilocystidia** not observed; material too scanty. **Pileipellis** hymeniform, weakly mottled, of *Siccus*-type broom cells; main body 9.5-17.5 X 6.5-12 µm, cylindric or clavate, typically hyaline and thin-walled, few pale tawny and slightly thick-walled; apical setulae 1.5-5 X 0.5-1.2 µm, irregularly cylindric, verrucose, obtuse or subacute, pale golden or tawny, thick-walled or solid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-6 µm diam, cylindric, non-gelatinous, smooth, hyaline, dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-5.5 µm diam, parallel, tawny or ferruginous, dextrinoid, clamped, with walls up to 1 µm thick; **medullary hyphae** 2.5-10 µm diam, subparallel, hyaline, weakly dextrinoid, clamped, with walls up to 0.5 µm thick. **Stipe vesture** absent.

**Commentary.** According to Arts. 13.1 and 55.1 of the Sydney Code (ICBN), *Coprinus ferrugineus* Pers. [Tent. Disp. Meth. Fung. 62. 1797] and the subsequent transfer as *Agaricus ferrugineus* (Pers.) Pers. [Syn. Meth. Fung. 400. 1801] were validly published because the epithets were not sanctioned by Fries (1821). Although publication of *Agaricus ferrugineus* Berk. (1843) was homonymic (Art. 64.1), the subsequent transfer of Berkeley's taxon to *Marasmius* (Berkeley & Curtis, 1869) was legitimate (Art. 72.1) but the epithet dates from 1869 and is correctly cited as *Marasmius ferrugineus* Berk. & Curt. Singer (1958) was aware of the earlier Persoon epithet, and because he believed that *M. ferrugineus* was illegitimate (*i.e.*, based on a homonymic basionym), he introduced the new epithet *Marasmius gardneri* Sing. to replace Berkeley's name. *Marasmius gardneri* is, however, superfluous (Art. 63.1) as a replacement for *M. ferrugineus*. Later, Singer (1976) accepted *M. ferrugineus* as legitimate and transferred *M. gardneri* as a variety under *M. ferrugineus* for taxonomic reasons outlined below. Type material of *A. ferrugineus* Berk. exists as two identically labeled packets; one described above in the Berkeley Herbarium (K), and one described by Singer (1958: 114) in the Hooker Herbarium (K). The Berkeley Herbarium packet was considered by Singer (1976, but not 1958) and me to be the material on which Berkeley based the epithet. Singer based his concept of the species on the Hooker Herbarium material and he had not examined the Berkeley Herbarium specimen at the time (1958) he proposed *M. gardneri*. Subsequently, Singer (1976) indicated that the type material of *A. ferrugineus* Berk. was heterogeneous, with the Berkeley Herbarium specimen representing a long-spored taxon, and the

Hooker Herbarium material representing a short-spored taxon. If it is accepted that the original type material is heterogeneous, the long-spored taxon represented by the Berkeley Herbarium specimen is correctly referred to as *M. ferrugineus*. The short-spored taxon represented by the Hooker Herbarium specimen is correctly referred to as *M. gardneri* (or *M. ferrugineus* var. *gardneri*) unless an earlier name can be found from conspecific material, *e.g.*, possibly *M. paucifolius* Murrill *in* Pennington (1915b; suggested by Singer, 1976). Alternatively, if the type material is considered to be homogeneous (one collection subsequently split), the correct name for the species is *M. ferrugineus*. I have not examined the Hooker Herbarium specimen, but Singer (1976) indicated spore measurements 13.5-18.3 X 3.2-5 µm. I measured spores of the Berkeley Herbarium specimen as 15.2-20 X 3.8-4.8 µm, overlapping the range noted by Singer for the Hooker Herbarium specimen. The taxon belongs in sect. *Sicci* ser. *Haematocephali*.

***MARASMIUS STRAMINIPES*** var. ***FIBULATUS*** Desjardin & Petersen, Mem. New York Bot. Gard. 49: 184. 1989.

HOLOTYPE: United States, North Carolina, Transylvania Co., Pisgah National Forest, Black Mt. trail near Brevard, 24 July 1986, D. E. Desjardin no. 3948 (TENN 47644).

Nothing can be added to the description and illustrations presented in the originating publication. See there for details.

**Commentary.** *Marasmius straminipes* var. *fibulatus* belongs in sect. *Androsacei*.

***MARASMIUS FILOPES*** Peck, Annual Rep. New York State Mus. 24: 77. 1871 (1872).

≡ *Marasmiellus filopes* (Pk.) Redhead, Fungi Canadenses 179. Agric. Can., Ottawa. 1980.

HOLOTYPE: United States, New York, Indian Lake, Oct. 1871, C. H. Peck, on dead leaves of *Abies balsamea* (NYS).

The collection consists of numerous tiny basidiomata insititious on fir needles. **Pileus** 1-2 mm diam, convex or plano-convex, striate, suede-like, buff-colored. **Lamellae** adnate, distant, narrow, pallid, non-collariate. **Stipe** 5-10 X <0.2 mm, filiform, glabrous, dull, pale brown, insititious.

**Basidiospores** 7.4-11.2 X 3.2-4.2 µm [$\bar{x}$ = 9.6 ± 1.0 X 3.7 ± 0.2 µm, E = 1.9-3.1, Q = 2.6 ± 0.3, n = 30], ellipsoid in face view, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 18-28 X 7.5-9.5 µm, 4-spored, clavate. **Basidioles** clavate. **Pleurocystidia** absent. **Cheilocystidia** scattered, irregularly cylindric, sometimes lobed, diverticulate; main body 12-24 X 4-6 µm, hyaline, thin-walled; diverticula apical and/or lateral, rod-like, knob-like or irregular in outline, obtuse, hyaline, thin-walled. **Pileipellis** not hymeniform, composed of a well-developed *Rameales*-structure of interwoven, diverticulate hyphae; hyphae 2-5 µm diam, irregular in outline, hyaline, inamyloid, thin-walled, non-gelatinous, smooth; diverticula 1.5-5 X 1-2.5 µm, scattered, rod-like, knob-like or irregular in outline, obtuse, hyaline, thin-walled; terminal cells similar to the cheilocystidia. **Pileus** and **lamellar trama** interwoven; hyphae 1.5-5.5 µm diam, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-

walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2-4 µm diam, parallel, exteriormost surface strongly diverticulate, non-diverticulate elsewhere, hyaline or yellow at stipe apex, slightly darker at stipe base, inamyloid, thin-walled, clamped; diverticula 1.5-4 X 1-2.5 µm, rod-like, obtuse, thin-walled; **medullary hyphae** 2.5-5 µm diam, parallel, hyaline, inamyloid, thin-walled, clamped.

**Commentary**. The *Rameales*-type pileipellis, inamyloid tramal tissues and insititious stipe of *M. filopes* indicate that the species belongs in the genus *Marasmiellus* sect. *Rameales* subsect. *Ramealini* as transferred by Redhead (*ibid.*).

***GYMNOPUS FLORIDANUS*** Murrill, Bull. Torrey Bot. Club 66: 158. 1939.

≡ *Collybia floridana* (Murr.) Murrill, Bull. torrey Bot. Club 66: 160. 1939.

HOLOTYPE: United States, Florida, 10 mi NW of Gainesville, Kelly's Hammock, 3 Aug. 1938, West & Murrill no. F18290, on sweet-gum log (FLAS). [ISOTYPES: FLAS!, MICH!, NCU!, TENN!]

The holotype collection consists of numerous basidiomata in good condition attached to much-decayed sweet gum wood. **Basidiomata** dried reddish brown overall, hard, plastic-like, very brittle. **Pileus** 4-5 mm diam, convex, some with a small central papilla, translucent-striate, glabrous. **Lamellae** adnate or subdecurrent, distant, narrow, non-collariate. **Stipe** 7-10 X 1 mm, terete, equal, silky, non-insititious, arising from a well-developed pad of radiating white mycelium.

**Basidiospores** not recovered; material very immature or sterile. **Basidia** not observed. **Basidioles** cylindric, subfusoid or subclavate.

**Pleurocystidia** absent. **Cheilocystidia** 22-32 X 3-5 µm, scattered, cylindric, subclavate or flexuous, broadly obtuse, non-diverticulate, projecting up to 10 µm beyond the other hymenial elements, hyaline, thin-walled. **Pileipellis** not hymeniform, composed of a cutis of radially arranged, non-diverticulate hyphae 2.5-8 µm diam; with suberect or erect, intercalary and terminal elements up to 10 µm diam, cylindric or clavate, scattered and somewhat inconspicuous in marginal region, more abundant on the disc; all hyphae hyaline, inamyloid, subgelatinous, smooth, clamped, with walls up to 0.5 µm thick. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-8 µm diam, subgelatinous, smooth, hyaline, inamyloid, clamped; with few refractive, somewhat contorted oleiferous hyphae interspersed. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 2.5-6.5 µm diam, subparallel, cylindric, smooth, hyaline, inamyloid, clamped, thin-walled; with few oleiferous hyphae interspersed in the medulla. **Stipe vesture** of numerous, clustered **caulocystidia** 16-32 X 4=6.5 µm, cylindric, subclavate or flexuous, obtuse, non-diverticulate, hyaline, thin-walled.

**Commentary.** Singer (1948) considered *Gymnopus floridanus* a synonym of *Marasmiellus nigripes* (Schw.) Sing. and this diagnosis has been perpetuated by other authors (*cf.* Halling, 1983a; Horak, 1986). Data obtained from examination of the holotype specimen and four isotype specimens do not support this contention. Although the basidiomata in all specimens examined were very immature and no spores were recovered, many other taxonomically important features were discernable. A pileipellis composed of non-diverticulate,

subgelatinous hyphae with clavate terminal cells, in combination with flexuous cheilocystidia and caulocystidia, and distinctly non-insititious stipe indicate that *G. floridanus* is not conspecific with *M. nigripes*.

It is possible that the type material of *G. floridanus* represents very immature basidiomata of *Marasmiellus subnigricans* (Murr.) Sing. [Bas.: *Marasmius subnigricans* Murrill, Bull. Torrey Bot. Club 67: 152. 1940]. Basidiomata of *G. floridanus* were described by Murrill (*ibid.*) as having glauco-plumbeous pilei, caesious lamellae and hyaline stipe. Basidiomata in the dried state are reddish brown overall. The pileipellis, cheilocystidial and caulocystidial morphologies of *G. floridanus* are similar to those of *M. subnigricans*, as is the unusual feature of darkening when dried. In addition, basidiomata of the latter species often arise from a subiculum-like pad of mycelium, similar to the non-insititious stipe base exhibited by *G. floridanus*. If *G. floridanus* and *M. subnigricans* are considered conspecific, the epithet *floridanus* would have priority. The type material of *G. floridanus* is sterile, however, and the epithet will remain a *nomen incertae sedis* until fertile topotypical material is collected and described.

***MARASMIUS FLORIDANUS*** Murrill, Bull. Torrey Bot. Club 67: 149. 1940.

HOLOTYPE: United States, Florida, Alachua Co., Planera Hammock, 16 July 1938, West, Arnold & Murrill no. F17347, on a decayed hardwood log (FLAS).

Notes with the collection: "fulvous, sm, glabr, [bay young], gs white, adnexed or acutely adnate, st white - br. Too large for glabellus + on wood." Collection consists of approximately 11 basidiomata in good condition, several attached to woody substrate. **Pileus** 7-22 mm diam, convex, striate, subvelutinous, ferruginous or fulvous, striae darker. **Lamellae** adnate, close or subdistant, moderately broad, not intervenose, non-marginate, pale fulvous. **Stipe** 25-50 X 1 mm, terete, equal or with a slightly enlarged base, glabrous, reddish brown, non-insititious, base covered with cream-colored or pale fulvous mycelium.

**Basidiospores** 7.6-11.2 X 2.8-3.6 µm [$\bar{x}$ = 9.1 ± 1.0 X 3.1 ± 0.2 µm, E = 2.2-3.5, Q = 2.9 ± 0.3, n = 30], elongate-ellipsoid in face view, slightly inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 21.5-28 X 5.5-6.5 µm, 4-spored, subclavate. **Basidioles** subclavate or fusoid. **Pleurocystidia** common, 40-58 X (6.5-)8-12 µm, irregularly cylindric, subclavate or ventricose, often apically constricted or with a mucronate projection, arising from deep in subhymenium and projecting up to 8 µm beyond basidioles, refractive, hyaline or pale yellow, thin-walled. **Cheilocystidia** similar to the pleurocystidia and with scattered *Siccus*-type elements similar to the pileipellis broom cells. **Pileipellis** hymeniform, evenly mottled, of *Siccus*-type broom cells; main body 12-18 X 6.5-10.5 µm, cylindric, clavate or irregular in outline, rarely lobed, many elements subhyaline or pale orange and thin-walled, many elements brownish orange and thick-walled; apical setulae 2.5-9.5(-11) X 1-2.5 µm, conic, subacute or obtuse, solid, ranging from pale yellow to orange or brownish orange; pigmented areas

dextrinoid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-10 µm diam, cylindric or few inflated, hyaline, dextrinoid, non-gelatinous, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-8 µm diam, parallel, cylindric, smooth, ochraceous or brownish orange, strongly dextrinoid, clamped, with walls up to 1 µm thick; **medullary hyphae** 3-10.5 µm diam, similar but hyaline and thin-walled. **Stipe vesture** absent.

**Commentary.** A pileipellis of *Siccus*-type broom cells, dextrinoid tramal tissue, conspicuous refractive pleurocystidia and non-insititious stipe are features that indicate *M. floridanus* belongs in sect. *Sicci* ser. *Haematocephali*. Singer (1976) considered *M. floridanus* a synonym of *M. spegazzinii* Sacc. & Sydow [*nom. nov.* for *M. balansae* Spegazzini (1891) *non* Patouillard (1890)]. The holotype specimen of *M. balansae* could not be located (*i.e.*, no longer housed at LPS; H. Spinedi, Curator, pers. comm.) and I cannot, therefore, comment on the conspecificity of *M. balansae* (≡ *M. spegazzinii*) and *M. floridanus*. Minimal notes of the type specimen were provided by Hesler (1957).

***MARASMIUS FULVICEPS*** Clements, Bot. Surv. Nebraska 4: 20. 1896 [*non Marasmius fulviceps* Berkeley, London J. Bot. 6: 490. 1847].

HOLOTYPE: United States, Nebraska, Bellevue, 7 Sept. 1895, Pound & Saunders no. 5030, on dead leaves (NEB).

The collection consists of an unknown number of basidiomata all badly fragmented. **Pileus** sulcate, subvelutinous, ferruginous.

**Lamellae** subdistant or distant, narrow, pallid, non-marginate. **Stipe** glabrous, shiny, brown, non-insititious.

**Basidiospores** 16.4-21.6 X 3.4-4.8 µm [$\bar{x}$ = 19.4 ± 1.2 X 4 ± 0.3 µm, E = 4.2-5.7, Q = 4.8 ± 0.3, n = 32], narrowly clavate, curved in profile, hyaline, inamyloid, smooth. **Basidia** not observed. **Basidioles** fusoid. **Pleurocystidia** common, 36-48 X 6.5-9 µm, cylindric, subclavate or fusoid, typically appendiculate, arising from subhymenium and projecting well beyond basidioles, often basally curved, refractive, hyaline or yellow, thin-walled, inamyloid. **Cheilocystidia** numerous, similar to the *Siccus*-type pileipellis elements; main body 12-20 X 4-6.5 µm, cylindric or subclavate, often lobed, thin-walled, hyaline; apical setulae 2-5 X 0.5-1.5 µm, irregularly cylindric, sometimes branched, obtuse or subacute, hyaline and thin-walled or pale yellow and thick-walled. **Pileipellis** hymeniform, not mottled or only weakly mottled, of *Siccus*-type broom cells; main body 10-16 X 4-8 µm, cylindric, clavate or irregular in outline, sometimes lobed, typically hyaline or pale yellow and thin-walled, scattered elements orange and thick-walled; apical setulae 1.5-5 X 1-2 µm, cylindric or irregular in outline, obtuse or subacute, sometimes branched, thick-walled and yellow or pale orange, or solid and orange or ferruginous; pigmented areas dextrinoid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-10 µm diam, cylindric or slightly inflated, branched, hyaline, inamyloid or weakly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 4-8 µm diam, parallel, cylindric, smooth, brown or reddish brown, dextrinoid, clamped, with walls up to

2.5 µm thick; **medullary hyphae** similar but hyaline and thin-walled. **Stipe vesture** absent.

**Commentary.** Pileipellis morphology, spore size, refractive pleurocystidia and absence of caulocystidia, in combination with macromorphological features indicate that *M. fulviceps* is a synonym of *M. siccus* (Schw.) Fr.

***MARASMIUS FULVOFERRUGINEUS*** Gilliam, Mycotaxon 4(1): 82. 1976.

HOLOTYPE: United States, North Carolina, Henderson Co., Elks, Green Cove, near Tuxedo, 14 Sept. 1974, Gilliam no. 1557 (MICH).

The portion of the holotype examined consisted of two basidiomata in excellent condition. **Pileus** 8-12 mm diam, campanulate, sulcate, subvelutinous, disc deep ferruginous or reddish brown, margin cinnamon-rufous. **Lamellae** distant, moderately broad, non-marginate, cream-colored. **Stipe** ≈45 X 1 mm, terete, equal, glabrous, shiny, brown, non-insititious, arising from a thick pad of buff-colored mycelium.

**Basidiospores** 14.8-19.6 X 4-5.4 µm [$\bar{x}$ = 17.1 ± 1.2 X 4.7 ± 0.3 µm, E = 3-4.5, Q = 3.6 ± 0.3, n = 30], clavate curved in profile, hyaline, inamyloid, smooth. **Basidia** 32-42 X 6.5-9 µm, 4-spored, clavate. **Basidioles** cylindric or subclavate. **Pleurocystidia** absent. **Cheilocystidia** similar to the *Siccus*-type pileipellis elements; main body 12-20 X 5-8 µm, cylindric or subclavate, hyaline, typically thin-walled, rarely firm-walled; apical setulae 2-6.5 X 0.8-1.5 µm, irregularly cylindric, verrucose or smooth, obtuse, solid, hyaline or yellow. **Pileipellis** hymeniform, mottled, of *Siccus*-type broom cells; main body 8-20 X 5.5-13 µm, cylindric, clavate or irregular in outline,

often lobed, many elements thin- or firm-walled and hyaline or pale yellow, many elements thick-walled and ochraceous or brownish orange; apical setulae 1.5-6(-8) X 1-2.5 µm, rod-like or irregular in outline, smooth or verrucose, seldom branched, obtuse, thick-walled or solid, ranging from ochraceous to orange or brownish orange. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 4-9 µm diam, cylindric, non-gelatinous, smooth, hyaline, strongly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-6 µm diam, cylindric, smooth, pale yellow to ochraceous (at stipe apex), or brown (stipe base), strongly dextrinoid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** 3-12 µm diam, hyaline or pale yellow, dextrinoid, clamped, thin-walled. **Stipe vesture** absent, or composed of rare, isolated *Siccus*-type broom cells similar to those of the pileipellis, located on the stipe apex.

**Commentary.** Pileipellis morphology, absence of pleurocystidia and non-insititious stipe of *M. fulvoferrugineus* indicate that the species belongs in sect. *Sicci* ser. *Leonini*. Refer to the protologue and analysis presented in Chapter IV for further details on the species.

***MARASMIUS GLABELLUS*** Peck, Bull. Buffalo Soc. Nat. Sci. 1: 58. 1873 (1874).

HOLOTYPE: United States, New York, Worcester and Croghan, C. H. Peck (NYS).

The type packet contains two internal packets labeled as follows: 1) Worcester and Croghan specimens; 2) Floodwood specimens. The Worcester and Croghan specimens are considered the holotype material.

The latter material consists of 12 basidiomata in fair condition pressed flat and taped to separate slips of paper, plus a pencil-watercolor illustration of three basidiomata. **Pileus** 4-15 mm diam, campanulate or plano-convex, striate or sulcate, subvelutinous, dark ferruginous with paler striae. **Lamellae** adnexed, distant, broad, non-collariate, non-marginate, pale brownish orange. **Stipe** 20-50 X 0.5-1 mm, terete, equal or slightly enlarged toward the base, glabrous, shiny, stramineous above, tawny below, non-insititious, basal mycelium cream-colored.

**Basidiospores** 7.2-11.2 X 4-5.6 µm [$\bar{x}$ = 9 ± 0.9 X 4.7 ± 0.4 µm, E = 1.6-2.2, Q = 1.9 ± 0.1, n = 26], ovate, pip-shaped or ellipsoid, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 28-34 X 5.5-7.5 µm, 4-spored, subclavate. **Basidioles** cylindric or subclavate. **Pleurocystidia** uncommon, 32-52 X 5-8 µm, irregularly cylindric or fusoid, sometimes appendiculate, arising from subhymenium and projecting up to 16 µm beyond basidioles, weakly refractive or non-refractive, hyaline, inamyloid, thin-walled. **Cheilocystidia** common, similar to the *Siccus*-type pileipellis elements; main body 10-20 X 5-8 µm, cylindric, clavate or subvesiculose, typically hyaline and thin-walled, few pale orange and firm-walled; apical setulae 2-6.5 X 1-2 µm, cylindric or coniv, obtuse or subacute, thick-walled or solid, ranging from hyaline to pale yellow or orange. **Pileipellis** hymeniform, weakly mottled, of *Siccus*-type broom cells; main body 10-16 X 6.5-10 µm, cylindric, clavate, subvesiculose or irregular in outline, seldom lobed, many thin-walled and hyaline or pale yellow, many thick-walled and ochraceous or orange; apical setulae 2-6 X 1-2 µm, irregularly

cylindric or conic, obtuse or subacute, solid, pale orange or ochraceous; pigmented areas weakly dextrinoid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-10 µm diam, cylindric or inflated, non-gelatinous, hyaline, weakly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-5(-8) µm diam, parallel, cylindric, smooth, hyaline to pale yellow (at stipe apex) or ochraceous (stipe base), strongly dextrinoid, with walls up to 1 µm thick; **medullary hyphae** similar but hyaline and thin-walled. **Stipe vesture** absent.

**Commentary.** The protologue indicated that the type material was collected in Worcester and Croghan, from July and September. The type material packet deposited in the Peck Herbarium at NYS is labeled "Worcester & Croghan", with no date given, then in different ink "Minerva, July & Aug." Below this is written "1 Floodwood, Aug." The packet contains two internal packets, one containing the Worcester and Croghan specimens, and one containing the Floodwood specimens. Specimens labeled as "Minerva, July & Aug." could not be located. In the "Worcester and Croghan" packet, no indication is given as to which basidiomata were collected at which location, or during which month. In addition, no reference to these specimens could be located in Peck's notebooks (archived at NYS). The first mention of this species in Peck's notebooks is found on page 121 of the notebook for 1888-1889. Because it is impossible to segregate the Worcester material from the Croghan material, the entire collection is considered as the holotype.

*Marasmius glabellus* belongs in sect. *Sicci* ser. *Haematocephali* because of pileipellis morphology, presence of pleurocystidia and non-

insititious stipe. An earlier type study was provided by Hesler (1959b).

***GYMNOPUS GLATFELTERI*** Murrill, N. Amer. Fl. 9(5): 358. 1916.

≡ *Collybia glatfelteri* (Murr.) Murrill, Mycologia 8: 219. 1916.

HOLOTYPE: United States, Missouri, St. Louis Co., St. Louis, 14 July 1902, N. M. Glatfelter no. 888 (NYS).

Glatfelter's notes with the collection: "*Collybia*. White or pale tawny, darker centre which may be ruddy tawny. Smooth, rivulose, margin striate when dry. Flesh thin, white. Gills sinuate, adnexed, broadest behind, pallid, connected. Stem white, equal, hollow, near apex striate and mealy, below slightly scurfy; flexuose, becoming twisted, 4 to 6' long, 2 lines thick. Growing on leaves, tending to deliquese. The change of color in gills and cap, in part, noticeable in all my specimens. Found but once - a colony in a deep ravine."

The collection consists of two basidiomata in good condition, plus one buff-colored spore print on black glossy paper. **Pileus** ≈47 mm diam, plano-umbonate, margin short-striate, glabrous, disc brown, margin dark cream-colored. **Lamellae** adnexed, close, broad, dark cream-colored, non-marginate. **Stipe** 80 X 3 mm, terete, twisted, striate, pruinose, buff-colored, non-insititious.

**Basidiospores** 6.4-8.8 X 3.8-5.2 µm [$\bar{x}$ = 7.3 ± 0.6 X 4.4 ± 0.4 µm, E = 1.4-2, Q = 1.7, n = 25], ovate or ellipsoid, hyaline, inamyloid, smooth. **Basidia** 24-28 X 5-6.5 µm, 4-spored, clavate. **Basidioles** subclavate or fusoid. **Pleurocystidia** numerous, 70-170 X 9.5-13.5 µm [$\bar{W}$ = 12 ± 1.7 µm, n = 20], fusoid, arising from deep in lamellar trama and

projecting well beyond basidioles, refractive, hyaline, thin-walled. **Cheilocystidia** abundant, 22-44 X 8-12 µm, clavate or sphaeropedunculate, erect or suberect, hyaline, non-refractive, thin-walled; plus scattered refractive pleurocystidioid elements. **Pileipellis** hymeniform, not mottled, of *Globulares*-type elements, 16-32 X 6.5-16 (-25) µm, broadly clavate, vesiculose or sphaeropedunculate, hyaline or pale yellow on pileus margin, pale brown on pileus disc, inamyloid or weakly dextrinoid, thin-walled. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-16(-20) µm diam, cylindric or more often inflated (not sarcodimitic), smooth, hyaline, strongly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 2.5-12 µm diam, parallel or subparallel, cylindric or weakly inflated, hyaline or pale yellow, strongly dextrinoid, clamped, with walls up to 1.5 µm thick. **Stipe vesture** of isolated or clustered **caulocystidia** 12-48 X 5-8 µm, subvesiculose, clavate or cylindric, hyaline, inamyloid or weakly dextrinoid, thin-walled.

**Commentary.** The holotype specimen was originally determined and labeled as *Collybia striatulata* Lloyd [*pro tempore*, Mycol. Writ. 1(5): 35, fig. 4, 1900], an epithet that was never validly published. *Gymnopus glatfelteri* is a synonym of *Marasmius nigrodiscus* (Pk.) Halling. An early type study of *G. glatfelteri* was provided by Smith (1938).

***MARASMIUS PUSIO*** var.***GRAMINIVORUS*** Singer, Fl. Neotrop. Monogr. 17: 201. 1976.

HOLOTYPE: Argentina, Jujuy, Lagunas de Yala, 2300-2400 m elev., 13 Feb. 1975, Singer no. T4058, *ad culmos graminum in silva montana alnea* (F).

The collection consists of two basidiomata in good condition. **Pileus** 1-4 mm diam, convex, striate, subvelutinous, orange. **Lamellae** adnexed, distant, moderately broad, buff-colored, edges white-crystalline. **Stipe** 2-4 X <0.5 mm, eccentric, pruinose, pallid, non-insititious, on grass leaves.

**Basidiospores** 8.4-11.2 X 4-4.8 µm [$\bar{x}$ = 9.6 ± 0.9 X 4.5 ± 0.3 µm, E = 1.9-2.7, Q = 2.2 ± 0.2, n = 20], ellipsoid or amygdaliform, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 16-20 X 6.5-8 µm, 4-spored, broadly clavate. **Basidioles** clavate or ventricose. **Pleurocystidia** absent. **Cheilocystidia** numerous, similar to the *Siccus*-type pileipellis elements; main body 10-16 X 5.5-8 µm, clavate, seldom lobed, hyaline, thin-walled; apical setulae 1.5-4 X 0.5-1.2 µm, irregular in outline, wavy, verrucose, obtuse or subacute, hyaline, thin-walled. **Pileipellis** hymeniform, not mottled, of *Siccus*-type broom cells; main body 8-16 X 5.5-8 µm, cylindric or clavate, seldom lobed, hyaline, thin-walled; apical setulae crowded, 1-4 X 0.5-1 µm, filiform or wavy in outline, verrucose, seldom branched, obtuse or subacute, thin-walled or firm-walled, hyaline or pale orange. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-5.5 µm diam, cylindric, non-gelatinous, smooth, hyaline, clamped, thin-walled. **Stipe tissue** monomitic; **cortical hyphae** 1.5-4.5 µm diam, parallel,

cylindric, smooth, pale tawny or pale melleous, dextrinoid, clamped, with walls up to 0.8 µm thick; **medullary hyphae** similar but hyaline and thin-walled. **Stipe vesture** of two types of **caulocystidia:** 1) dendrotrichomoid elements with 2-10 divergent setulae 5-20 X 0.5-1.5 µm, filiform or acuminate, acute, thick-walled, hyaline, dextrinoid; 2) *Siccus*-type broom cells with poorly-developed main body, or clusters of setulae arising directly from repent cortical hyphae; setulae similar to those on pileipellis elements.

**Commentary.** Pileipellis morphology, absence of pleurocystidia and non-insititious stipe are features that indicate *M. pusio* var. *graminivorus* belongs in sect. *Sicci* ser. *Leonini*.

***AGARICUS GRAMINUM*** Libert, Pl. Crypt. Arduennae II. no. 119. 1832.

≡ *Marasmius graminum* (Lib.) Berkeley & Broome *in* Berkeley, Outl. Brit. Fungol. 222. 1860.

LECTOTYPE (*des mihi*): Belgium, Pl. Crypt. Arduennae, Fasc. II, no. 119 (FH).

The description published with the specimen reads: "*Tenellus, pileo convexo plicato rufo, siccitate, subcorrugato; lamellis aequalibus distantibus albis membranae stipitem libere ambienti adnexis, stipite fistuloso nigro apice albo. In foliis putrescentibus graminum. Sero Autumno.*" The lectotype specimen designated above consists of five basidiomata pressed flat and glued to a sheet, all in fair condition. **Pileus** 2-4 mm diam, convex, sulcate, brown. **Lamellae** collariate but collarium poorly-developed, distant (6-8), moderately

broad, pallid, non-marginate. **Stipe** 6-18 X <0.5 mm, wiry, glabrous, shiny, dark brown, insititious on grass leaves.

**Basidiospores** 7.2-10.4 X 4-5.6 µm [$\bar{x}$ = 8.8 ± 0.7 X 4.6 ± 0.4 µm, E = 1.6-2.2, Q = 1.9 ± 0.1, n = 21], ellipsoid, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** not observed. **Basidioles** 13-20 X 6-8 µm, broadly clavate or ventricose. **Pleurocystidia** absent. **Cheilocystidia** numerous, similar to the *Siccus*-type pileipellis elements; main body 8-16 X 5-8 µm, cylindric or clavate, seldom lobed, hyaline, thin-walled; apical setulae 0.5-4 X 0.5-1.5 µm, knob-like or irregular in outline, obtuse, hyaline, thin-walled. **Pileipellis** hymeniform, not mottled, of *Siccus*-type broom cells; main body 8-18 X 5-8(-10) µm, cylindric or clavate, seldom lobed, typically hyaline and thin-walled, rarely firm-walled and pale orange; apical setulae 0.5-2(-3) X 0.5-1.5 µm, knob-like or irregular in outline, obtuse, sometimes lobed or verrucose, thick-walled or solid, yellow or orange. **Tramal hyphae** interwoven, 2-6 µm diam, cylindric, smooth, non-gelatinous, hyaline, weakly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2-5 µm diam, parallel, cylindric, smooth, ochraceous or brown, strongly dextrinoid, clamped, with walls up to 1 µm diam; **medullary hyphae** similar but hyaline and thin-walled. **Stipe vesture** absent.

**Commentary.** Type material of *A. graminum* was distributed by Libert in her Plantae Cryptogamicae Arduennae Exsiccati, Fasc. II, no. 119. Of the three specimens I have examined (two at BPI, one at FH), the Farlow Herbarium specimen contained the most intact basidiomata in the best condition. Because to date no lectotype specimen has been

officially designated, the FH specimen is here designated the lectotype. *Agaricus graminum* belongs in *Marasmius* sect. *Marasmius* subsect. *Penicillati*.

***MARASMIUS GREGARIUS*** Peck, Bull. Torrey Bot. Club 23: 413. 1896.

HOLOTYPE: United States, Kentucky, Mammoth Cave, June, C. G. Lloyd no. 1073 (NYS). [ISOTYPE: FH!]

The collection consists of 15 basidiomata in good condition, mostly attached to a woody substrate, few loose in the box. **Pileus** 3-6 mm diam, plano-umbilicate or subinfundibuliform, margin even or short-striate, glabrous brown. **Lamellae** adnate or subdecurrent, close, narrow, non-collariate, pale cream-colored. **Stipe** 4-6 X <1 mm, terete, equal, pruinose or pubescent, pale brown, insititious or subinsititious, lignicolous.

**Basidiospores** 6.2-8.4 X 3.4-4.8 µm [$\bar{x}$ = 7.3 ± 0.6 X 4 ± 0.4 µm, E = 1.7-2.3, Q = 1.8 ± 0.2, n = 22], ellipsoid or lacrymoid, hyaline, inamyloid, smooth. **Basidia** 22-28 X 5.5-7.5 µm, 4-spored, subclavate. **Basidioles** subclavate or fusoid. **Hymenial cystidia** absent. **Pileipellis** not hymeniform, formed of a cutis of radially arranged, repent hyphae; hyphae 4-8 µm diam, cylindric, non-diverticulate, with granular or helical brown pigment incrustations, non-gelatinous; walls subhyaline, pale brown or brown, inamyloid, up to 1 µm thick. **Tramal hyphae** 2.5-8 µm diam, cylindric, smooth or weakly roughened, hyaline, inamyloid, clamped, loosely interwoven and embedded in a gelatinous matrix, with walls up to 1.5 µm thick. **Stipe tissue** monomitic; **cortical hyphae** 3-6 µm diam, subparallel, hyaline pale yellow or pale

brown, inamyloid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** 3-8 µm diam, similar but hyaline throughout and subgelatinous. **Stipe vesture** of numerous erect or suberect **caulocystidia** 12-48 X 5-7 µm, cylindric, flexuous or clavate, obtuse, hyaline and thin-walled at stipe apex, hyaline or pale yellow and thick-walled at stipe base.

**Commentary.** Features of the holotype specimen of *M. gregarius* that indicate the species is a synonym of *Micromphale foetidum* (Sow.: Fr.) Sing. include: a) pileipellis of radially arranged, non-diverticulate, pigment-incrusted hyphae; b) gelatinous, thick-walled, inamyloid tramal hyphae; c) absence of hymenial cystidia; d) spore size; and e) caulocystidia morphology.

***AGARICUS HAEMATOCEPHALUS*** Montagne, Ann. Sci. Nat. Bot. 2(7): 369. 1837.

≡ *Marasmius haematocephalus* (Mont.) Fries, Epicr. Syst. Mycol. 382. 1838.

REPRESENTATIVE MATERIAL: French Guyana, Ann. 1850, M. Leprieur no. 990, det. by Montagne (PC). Holotype or original material not located.

The authentic specimen used here as representative material consists of three basidiomata pressed flat but in good condition. **Pileus** 10-20 mm diam, campanulate, sulcate, subvelutinous, dark reddish brown or purplish brown. **Lamellae** remote, broad, pallid. **Stipe** 20-35 X <1 mm, terete, glabrous, dark brown.

**Basidiospores** 16-21.6 X 4.4-5.6 µm [$\bar{x}$ = 19.1 ± 1.3 X 4.7 ± 0.4 µm, E = 3.5-4.6, Q = 4.1 ± 0.3, n = 18], clavate or subfusiform, sometimes curved in profile, hyaline, inamyloid, smooth. **Basidia** not observed.

**Basidioles** 24-32 X 6.5-10 µm, ventricose. **Pleurocystidia** few observed, 40-50 X ≈ 8 µm, cylindric or fusoid, refractive, hyaline, arising from subhymenium and projecting well beyond basidioles. **Cheilocystidia** not observed; lamellar edges in poor condition. **Pileipellis** hymeniform, not mottled or weakly mottled, of *Siccus*-type broom cells; main body 10-16 X 5.5-10 µm, cylindric or clavate, typically hyaline and thin-walled, few reddish brown and firm-walled; apical setulae 2.5-8.5 X 0.5-1.5 µm, cylindric or conic, subacute, thick-walled or solid, dark ochraceous or reddish brown (pigment soluble in KOH); pigmented areas dextrinoid. **Tramal hyphae** 2.5-8 µm diam, interwoven, cylindric or slightly inflated, hyaline, strongly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-6 µm diam, parallel, cylindric, smooth, ochraceous or brown, dextrinoid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** similar but hyaline and thinner-walled. **Stipe vesture** absent.

**Commentary.** The species was described from material collected by A. de St. Hilaire from Rio de Janeiro. Although I was unable to locate the holotype specimen or any other original material, the specimen cited above was determined by Montagne and will serve to represent my concept of the species. *Marasmius haematocephalus* is the type species of ser. *Haematocephali* Sing. in sect. *Sicci*.

***MARASMIUS HELIOMYCES*** Murrill, Bull. Torrey Bot. Club 67: 149. 1940.

HOLOTYPE: United States, Florida, Planera Hammock 11 miles NW of Gainesville, 2 Aug. 1938, West & Murrill no. F18269, on dead wood (FLAS).

The collection consists of five basidiomata in fair condition, with some insect damage. **Pileus** 17-27 mm diam, plano-convex, wavy, rugulo-sulcate to disc, glabrous, dark brown or reddish brown, with paler radial streaks. **Lamellae** adnexed, subdistant or distant, broad, ventricose, pale-concolorous with the pileus, non-marginate. **Stipe** ≈ 45 X 2-3 mm, terete, equal, hollow, brittle, glabrous, brown.

**Basidiospores** 8.8-12 X 3.4-4.2 µm [$\bar{x}$ = 10.1 ± 0.9 X 3.9 ± 0.2 µm, E = 2.3-3.1, Q = 2.6 ± 0.2, n = 30], ellipsoid, slightly inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 24-32 X 5-6.5 µm, 4-spored, subclavate. **Basidioles** subclavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** numerous, 24-44 X 8-17 µm, clavate or broadly clavate, rarely sphaeropedunculate or ventricose, hyaline, thin-walled. **Pileipellis** hymeniform, of *Globulares*-type elements, 14-32 X 8-20 µm, clavate, vesiculose or sphaeropedunculate, hyaline or pale ochraceous in KOH, inamyloid, thin-walled. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-10 µm diam, cylindric or often inflated, smooth, hyaline, strongly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 4-11 µm diam, parallel or subparallel, cylindric, smooth, hyaline or pale ochraceous, dextrinoid, thin-walled, clamped. **Stipe vesture** of scattered, isolated **caulocystidia** 5-24 X 4-6.5 µm, cylindric or clavate, hyaline, thin-walled.

**Commentary.** Pileipellis morphology, dextrinoid tramal tissues and non-insititious stipe are features that indicate *M. heliomyces* belongs in sect. *Globulares*. Singer (1958a) redescribed the species from additional material collected in Florida, Hesler (1959b) provided a few

details on the holotype specimen, and Halling (1983b) supplied illustrations of several micromorphological structures.

***MARASMIUS HEMISPHAERICUS*** Murrill, Lloydia 9(4): 320. 1946.

HOLOTYPE: United States, Florida, Alachua Co., Gainesville, 18 June 1944, Murrill no. F38942, bare open ground near grass (FLAS).

Notes with the collection: "bare ground between short grass open lawn, campus. Convex striate finely pruinose dull pale-is. greg. 3-4 mm d. marg thin entire paler context membr., isabel, odorless, bitter. gs adnate (no collar) few inserted, brd distant entire white. st fistulose finely pubescent and white apex, finely tom & umber below, about 2 cm long & 1/2 mm or less thick." Collection consists of approximately 10 basidiomata in good condition. **Pileus** 2-3 mm diam, convex, even, suede-like, beige. **Lamellae** adnate, distant, broad, pallid. **Stipe** 12-15 X <0.5 mm, terete, pruinose, tawny or pale brown, attached to buried roots.

**Basidiospores** 10-11.6 X 4.4-5 µm (4 recovered), ellipsoid, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 25-28 X 6.5-8 µm, 4-spored, clavate. **Basidioles** clavate or fusoid-ventricose. **Pleurocystidia** absent. **Cheilocystidia** numerous, 24-36 X 4-6.5 µm, irregularly cylindric, often lobed, diverticulate, apex often bulbous, hyaline, thin-walled; diverticula 2-10 X 1-3.5 µm, knob-like, rod-like or irregular in outline, obtuse, hyaline, thin-walled. **Pileipellis** not hymeniform, composed of a well-developed *Rameales*-structure; hyphae 4-7 µm diam, irregular in outline, densely diverticulate, hyaline, thin-walled, inamyloid; diverticula 1.5-4(-6) X 1-3 µm, knob-like, rod-like

or irregular in outline, obtuse, hyaline, thin-walled; terminal cells with diverticulate apex or with bulbous apex, bulb thin-walled or firm-walled. **Tramal hyphae** 2.5-8 µm diam, interwoven, cylindric, typically smooth, seldom roughened, non-gelatinous, hyaline or pale yellow, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 2.5-8 µm diam, cylindric, smooth, hyaline, yellow or ochraceous, inamyloid, clamped, with walls up to 0.8 µm thick. **Stipe vesture** a well-developed *Rameales*-structure similar to the pileipellis, with suberect or erect terminal cells.

**Commentary.** The pileipellis is not composed of broom cells as indicated by Hesler (1959b), but rather is formed of a well-developed *Rameales*-structure. This feature, in combination with inamyloid tramal tissues, cheilocystidial morphology, spore size, stipe vesture morphology and macromorphological features, indicate that *M. hemisphaericus* is a synonym of *Marasmiellus tricolor* (Alb. & Schw.: Fr.) Sing.

***MARASMIUS HIRTIPES*** Clements, Bot. Surv. Nebraska 4: 21. 1896.

[*non Marasmius hirtipes* Spegazzini, Anales Mus. Nac. Hist. Nat. Buenos Aires 6: 112. 1898].

LECTOTYPE (*des mihi*): United States, Nebraska, Bellevue, 4 July 1894, Pound & Clements no. 4242, *ad folia emortua* (NEB).

The lectotype specimen here designated consists of several fragmented basidiomata in fair condition. **Pileus** plano-convex, short-striate, glabrous, brownish orange. **Lamellae** adnate, close or

subdistant, narrow or moderately broad, pallid. **Stipe** terete, pubescent, greyish brown, non-insititious.

**Basidiospores** 6.8-8.8 X 3.6-4.2 µm [$\bar{x}$ = 7.9 ± 0.5 X 4 ± 0.2 µm, E = 1.8-2.3, Q = 2 ± 0.1, n = 30], ellipsoid, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 21.5-24 X 5.5-6.5 µm, 4-spored, clavate. **Basidioles** clavate. **Hymenial cystidia** common on lamellar sides and edges, 37-56 X 7-11 µm, capitulate, fusoid-subcapitate, ventricose or lageniform-capitate, often with a golden, refractive internal globule at the apex, hyaline elsewhere, thin-walled, inamyloid, arising from about the same level as basidioles but projecting well beyond the hymenial surface. **Pileipellis** hymeniform, not mottled, of thick-walled *Globulares*-type elements, 16-28 X 10-24 µm, broadly clavate or vesiculose, pale yellow or pale ochraceous, inamyloid, with walls up to 2 µm thick. **Pileus trama** interwoven; **lamellar trama** weakly interwoven; hyphae 3-9 µm diam, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled or with walls up to 0.5 µm thick, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-6.5 µm diam, parallel, cylindric, smooth, ochraceous or brown, inamyloid, clamped, with walls up to 3 µm thick with lumen nearly occluded in some; **medullary hyphae** 2.5-10 µm diam, hyaline, inamyloid, clamped, with walls up to 1 µm thick; with few refractive oleiferous hyphae interspersed. **Stipe vesture** of abundant **caulocystidia** up to $200^{+}$ X 6.5-8 µm, cylindric or acuminate, subacute, hyaline, pale yellow or pale ochraceous, often with globular brownish orange contents in KOH, inamyloid, with walls up to 4 µm thick, with lumen nearly occluded.

**Commentary.** No specimens were cited by Clements (*ibid.*) in the protologue. Two specimens deposited in Clements' herbarium housed at NEB were collected prior to publication of the epithet and represent potential lectotype material. One specimen is labeled: "*Marasmius hirtipes* n. sp., *ad folia emortua*, 4 July 1894, Pound & Clements no. 4242, Bellevue." A second specimen is labeled: "*Marasmius hirtipes*, on leaves, 14 July 1894, Pound & Clements no. 4254, Wabash." Both specimens are conspecific and contain adequate material for diagnosis. The earlier specimen, annotated by Clements as "n. sp." is here designated the lectotype. Macromorphological features of the lectotype specimen, in combination with pileipellis, cheilocystidial and caulocystidial morphologies, indicate *M. hirtipes* is a synonym of *Marasmius pyrrhocephalus* Berk.

***AGARICUS HUDSONII*** Persoon: Fries, Syst. Mycol. 1: 139. 1821.

[*Agaricus hudsonii* Persoon, Synop. Meth. Fung. 390. 1801. *ut Agaricus hudsoni*]

≡ *Marasmius hudsonii* (Pers.: Fr.) Fr., Epicr. Syst. Mycol. 386. 1838.

REPRESENTATIVE MATERIAL: France, Montmorency, Nov. 1885, E. Boudier, *ad folia putrida Ilicis* (PC). No holotype specimen exists.

**Basidiospores** 8-10.8 X 4.4-5.6 µm [$\bar{x}$ = 9.8 ± 0.8 X 5 ± 0.4 µm, E = 1.7-2.3, Q = 2 ± 0.2, n = 10], ovate or ellipsoid, slightly inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** not observed. **Basidioles** 28-31 X 6-8 µm, clavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** scattered, 40-50 X 7-10 µm, fusoid-ventricose and typically subcapitate, seldom ventricose-

rostrate, hyaline, mostly thin-walled overall, sometimes thick-walled centrally with the wall thinning apically and basally, inamyloid, non-refractive. **Pileipellis** hymeniform, not mottled, composed of three types of elements: 1) majority of pileipellis of *Rotalis*-type broom cells; main body 16-32 X 8-20 µm, clavate, subvesiculose or sphaeropedunculate, hyaline, inamyloid, with walls 0.5-2.5+ µm thick; divergent setulae 1.5-3.2 X 1-2.5 µm, rod-like, obtuse, solid, hyaline or pale yellow; 2) scattered **pilocystidia** 35-65 X 8-12.5 µm, lageniform-capitate, hyaline, with walls up to 1 µm thick; 3) scattered **pilosetae** up to 700 X 8-12 µm, elongate-acuminate or lanceolate, acute, with bases swollen up to 16 µm diam, deep reddish brown, inamyloid, with walls up to 4 µm thick. **Tramal hyphae** interwoven; 2.5-5 µm diam, cylindric, branched, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-6 µm diam, cylindric, smooth, brown, inamyloid, clamped, with walls up to 1.2 µm thick; **medullary hyphae** 3-9 µm diam, similar but hyaline and thin-walled. **Stipe vesture** of numerous, scattered **caulocystidia** acuminate or ventricose, non-capitate, up to 40 µm long, basally swollen up to 16 µm diam, narrowing to 4 µm diam at apex, hyaline or pale yellow, thick-walled.

**Commentary.** No holotype specimen of *A. hudsonii* exists. Until topotypical material is collected and cultured from the Harz Mts. near Göttingen, Germany, Persoon's collecting area, the specimen cited above will serve to represent my concept of the species. *Marasmius hudsonii* belongs in sect. *Hygrometrici*.

***MARASMIUS ILICICOLA*** Desjardin *in* Desjardin & Petersen, Mycotaxon 34(1): 72. 1989.

HOLOTYPE: United States, Mississippi, De Soto National Forest, Perry Co., Black Creek Wilderness Area, 16 July 1987, Desjardin no. 4355 (TENN no. 47625).

The collection consists of approximately 50 basidiomata in excellent condition, insititious on leaves of *Ilex opaca*. **Pileus** 2-3 mm diam, plano-convex, mostly umbilicate, some papillate, sulcate, brown with a darker disc. **Lamellae** collariate, distant, broad, pale cinnamon-colored. **Stipe** 8-18 X <0.2 mm, filiform, glabrous, apex pallid, base dark brown; with scattered black rhizomorphs.

Nothing can be added to the description and illustrations of the holotype specimen presented by us in the originating publication. See there for details.

***MARASMIUS ILICIS*** Singer, Lilloa 26: 142. 1953.

ISOSYNTYPE: Brazil, Rio Grande do Sul, Taimbesinho, 5 Nov. 1951, Singer no. B88, *ad folia dejecta Ilicis microdontae* (MICH).

The isosyntype specimen at MICH consists of several fragmented basidiomata in fair condition.

**Basidiospores** 7.4-9.6 X 3.2-4 µm [$\bar{x}$ = 8.9 ± 0.7 X 3.6 ± 0.3 µm, E = 2.1-2.8, Q = 2.5 ± 0.2, n = 22], ellipsoid or subfusiform, hyaline, inamyloid, smooth. **Basidia** not observed. **Basidioles** 12-16 X 5.5-7 µm, broadly clavate or ventricose. **Pleurocystidia** 16-28 X 5.5-8.5 µm, common, lageniform or ventricose-rostrate, non-refractive, hyaline, thin-walled, arising from the same level as basidioles but projecting

up to 12 µm beyond. **Cheilocystidia** not observed; material too scanty. **Pileipellis** hymeniform, mottled, of *Rotalis*-type broom cells plus rare pilocystidia; main body of broom cells 10-16 X 7-12 µm, clavate, vesiculose or sphaeropedunculate, many elements thin-walled and hyaline or pale brown, many elements thick-walled (up to 2 µm) and brown, majority of elements with numerous divergent setulae, few elements entirely smooth or nearly so; divergent setulae 0.5-1.5 X 0.5-1 µm, knob-like or rod-like, obtuse, solid, ranging from hyaline to brown; pilocystidia similar to pleurocystidia, 18-25 X 5-7.5 µm, hyaline or pale brown, typically thick-walled. **Tramal hyphae** 1.5-6 µm diam, interwoven, cylindric, smooth, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 1.5-5 µm diam, parallel, reddish brown, inamyloid, clamped, with walls up to 1.8 µm thick; outermost hyphae covered with numerous diverticula, these similar to the divergent setulae of the pileipellis elements; **medullary hyphae** 2-8 µm diam, subparallel, hyaline, inamyloid, thin-walled, clamped. **Stipe vesture** of scattered *Rotalis*-type broom cells similar to those of the pileipellis.

**Commentary.** *Marasmius ilicis* belongs in sect. *Hygrometrici* dictated by pileipellis morphology, non-collariate lamellae and insititious stipe. The species may be a synonym of *M. crescentiae* Murr. Refer to the type study of the latter for a comparison.

***MARASMIUS INSIPIDUS*** Gilliam, Mycologia 67: 829. 1975.

HOLOTYPE: United States, Ohio, Portage Co., West Branch State

Park, 8 July 1972, Gilliam no. 1500, gregarious to cespitose on oak leaves (MICH).

The portion of the holotype specimen examined consisted on four basidiomata in excellent condition. **Pileus** 4-10 mm diam, convex or plano-convex, even, glabrous or suede-like, brown or dark brown in youngest basidiome, pale brown in older basidiomata. **Lamellae** adnate, non-collariate, close, narrow, pallid. **Stipe** 30-38 X 1 mm, terete, equal, pruinose or pubescent, buff-colored or tan, insititious or subinsititious.

**Basidiospores** 7.2-10 X 3.2-4 µm [$\bar{x}$ = 8.4 ± 0.8 X 3.7 ± 0.3 µm, E = 2-2.8, Q = 2.3 ± 0.2, n = 30], ellipsoid, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 20-28 X 5-6.5 µm, 4-spored, subclavate. **Basidioles** cylindric or subclavate. **Pleurocystidia** absent. **Cheilocystidia** numerous, lamellar edge sterile, 16-30 X 5.5-12 µm, cylindric, clavate or irregular in outline, apically lobed or diverticulate, hyaline, thin-walled or firm-walled; diverticula 2-8 X 1-4 µm, knob-like or more commonly irregular in outline, obtuse, typically thin-walled. **Pileipellis** not hymeniform, composed of a *Rameales*-structure with broom cell-type terminal elements; hyphae 4-8 µm diam, diverticulate or non-diverticulate, smooth or more commonly incrusted with brown, granular or plaque-like annular pigments, inamyloid, clamped, with walls thin or up to 0.5 µm thick; terminal cells 12-24 X 4-16 µm, repent or erect, subvesiculose, clavate or irregular in outline, with numerous lateral and apical diverticula, or with few broad lobed, thin-walled or thick-walled, smooth or incrusted; diverticula 1.5-4.5 X 1-4 µm, knob-like, rod-like or irregular in

outline, obtuse, hyaline, typically thin-walled. **Pileus trama** interwoven; hyphae 3-9(-12) µm diam, cylindric or inflated, brownish-incrusted nearest the pileipellis, smooth elsewhere, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Lamellar trama** regular; hyphae similar to the pileus trama hyphae but less inflated and non-incrusted throughout. **Stipe tissue** monomitic; **cortical hyphae** 3-8 µm diam, parallel, cylindric, smooth, hyaline or pale yellow, dextrinoid, clamped, with walls up to 2 µm thick; **medullary hyphae** 3-11 µm diam, hyaline, inamyloid, thin-walled, clamped. **Stipe vesture** of abundant **caulocystidia** up to $100^{+}$ X 4-8 µm, cylindric, strangulate or flexuous, obtuse, rarely apically lobed, hyaline or pale yellow, dextrinoid, with walls up to 1.5 µm thick.

**Commentary.** Gilliam (1975a,b) placed *M. insipidus* in sect. *Chordales* (= sect. *Alliacei*) because of hymeniform pileipellis, inamyloid tramal tissues and non-collariate lamellae. My examination of the holotype specimen indicated that the pileipellis is not hymeniform, but rather a *Rameales*-structure with broom cell-type terminal elements. The latter feature in combination with pale, pruinose, insititious stipe suggest that *M. insipidus* is best placed in the genus *Marasmiellus*. The distinctive thick-walled, dextrinoid, flexuous caulocystidia, spore size, and pileipellis and cheilocystidial morphologies indicate *M. insipidus* is a synonym of *Marasmiellus olneii* (Berk. & Curt.) Desjardin. Refer to the type study of *Marasmius olneii* Berk. & Curt. for a comparison.

***MARASMIUS ISABELLINUS*** Patouillard *in* Patouillard & Lagerheim, Bull. Soc. Mycol France 9: 126. 1893.

HOLOTYPE: Ecuador, ravine pres de Quito, Feb. 1892 (FH).

The collection consists of four basidiomata attached singly to woody debris, plus four basidiomata loose in the packet, all in fair condition. **Pileus** 3-8 mm diam, plano-convex, suede-like, margin even or weakly striate, pale brown or pale brownish orange. **Lamellae** adnate or adnexed, distant, narrow or moderately broad, anastomosing and/or intervenose in some, pale-concolorous with the pileus. **Stipe** eccentric, very short, pruinose or pubescent, concolorous with the pileus, non-insititious, arising from a small, white, floccose pad.

**Basidiospores** (13-)14.6-17.5 X (4-)4.5-5.6 µm [$\bar{x}$ = 16.3 ± 0.7 X 5 ± 0.4 µm, E = 2.8-3.8, Q = 3.2 ± 0.2, n = 30], clavate, some curved and inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 31-38 X 8-11 µm, 2-spored and 4-spored, clavate. **Basidioles** clavate. **Hymenial cystidia** common on lamellar faces and edges, 40-70 X 4-9 µm, fusoid or irregularly fusoid, arising from deep in subhymenium and projecting up to 20 µm beyond basidioles, often apically coated with subhyaline, pale yellow or pale orange, resinous, granular or plaque-like incrustations; walls hyaline, thin, inamyloid. **Pileipellis** not hymeniform, a poorly-developed *Rameales*-structure composed of interwoven, weakly diverticulate hyphae plus suberect or erect, diverticulate terminal cells; hyphae 3-7 µm diam, irregular in outline, often short-celled, hyaline, typically non-incrusted, non-gelatinous; terminal cells subcylindric, clavate, vesiculose, lobed or irregular in outline; diverticula 2-5 X 1-2 µm, knob-like, rod-like or irregular in outline,

obtuse, thin-walled, hyaline. **Hypodermium** composed of frequently-branched, cylindric or irregular hyphae 3-7.5 µm diam, hyaline and smooth, or more commonly with granular or plaque-like, yellow or ochraceous incrustations, inamyloid or weakly dextrinoid, thin-walled. **Pileus trama** loosely interwoven; **lamellar trama** regular; hyphae 2.5-8 µm diam, smooth, hyaline, dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-5 µm diam, parallel, cylindric, smooth, yellow or ochraceous, dextrinoid, thin-walled, clamped; **medullary hyphae** similar but hyaline. **Stipe vesture** absent, or poorly-developed, composed of scattered hyphae irregular in outline, roughened or with nodulose outgrowths, few terminal cells similar to those of the pileipellis; stipe base with scattered dextrinoid dendrotrichomoid elements.

**Commentary.** *Marasmius isabellinus* belongs in sect. *Fusicystides* Sing., dictated by non-hymeniform pileipellis, dextrinoid tramal tissues, non-collariate lamellae and pleurotoid habit. This monotypic section was originally based on *M. fusicystis* Singer, an epithet now considered a synonym of *M. isabellinus*. The spores of the holotype specimen were slightly larger than those of an additional authentic specimen and a topotype specimen. A specimen labeled "Cotocollao, Ecuador, Feb. 1892, leg. Lagerheim" (FH!) had spores 13-16.6 X 4-5.4 µm [$\bar{x}$ = 14.9 ± 1.1 X 4.8 ± 0.4 µm, Q = 3.1 ± 0.2, n = 20], while a specimen labeled "Pichincha, near Quito, Ecuador, 15 May 1973, Singer no. B7541" (F!) had spores 12.6-17.1 X 4.5-6.3 µm [$\bar{x}$ = 14.5 ± 1.1 X 5.5 ± 0.5 µm, Q = 2.7 ± 0.2, n = 30].

***MARASMIUS JUGLANDIS*** Berkeley & Curtis *apud* Saccardo, Syll. Fung. 9: 67. 1891.

ISOTYPE: United States, Alabama, Oct. 1864, Peters nos. 6 and 28 (= Curtis nos. 6435 and 6451, resp.), *ad trunc. dej. Caryae* (FH - Curtis Herb.). HOLOTYPE: K, not examined.

The isotype collection consists of three basidiomata pressed flat and glued to a slip of paper, in fair condition but infected with undetermined Deuteromycetes. One of the basidiomata is numbered 28, the other two are unnumbered and are presumed to represent Peters no. 6. Notes in Curtis' handwriting on the slip to which the basidiomata are glued read: "Cap flatly expanded, irregular, pale sooty umber, smooth, thin, flaccid, 1/2 - 1 in broad. Stem angled, flattened at top, hollow, pruinose, concolor, darker below. Gills unequal, broad, ventricose, adnate, flaccid, pale watery white."

**Basidiospores** 7.4-9.5 X 3.2-4 µm (6 recovered), ellipsoid or amygdaliform, hyaline, inamyloid, smooth. **Basidia** not observed. **Basidioles** 19-24 X 5-6.5 µm, clavate. **Pleurocystidia** absent. **Cheilocystidia** numerous, 16-28 X 7-10 µm, broadly clavate or subsphaeropedunculate, hyaline, thin-walled. **Pileipellis** not hymeniform, composed of a cutis of radially arranged hyphae; hyphae 4-10(-12.5) µm diam, non-diverticulate or with scattered broad, knob-like branchlets, few smooth, mostly with pale yellow, ochraceous or pale brown, plaque-like annular pigment incrustations, smooth areas hyaline or pale yellow, inamyloid, thin-walled, clamped; terminal cells cylindric or clavate. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 4-12 µm diam, cylindric, smooth, hyaline, inamyloid,

thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-8 µm diam, parallel, cylindric, smooth or incrusted, pale ochraceous or brown, inamyloid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** similar but hyaline and up to 12 µm diam. **Stipe vesture** of abundant **caulocystidia** up to $60^{+}$ X 5-8 µm, clavate or cylindric, obtuse, hyaline, thin-walled (at stipe apex) or thick-walled (stipe base).

**Commentary.** The protologue provided by Saccardo (*ibid.*) is a latin transliteration of notes accompanying the type material (see above). Apparently, the description was sent to Saccardo by Cooke ("*Diagnosin misis cl Cooke*;" Saccardo, 1891), although the diagnosis did not originate from Cooke. Accordingly, the correct citation for the species is *M. juglandis* Berk. & Curt. *apud* Sacc., and not *M. juglandis* Berk. & Curt. *ex* Cooke, as indicated by Saccardo (1891). Spore size was not indicated on notes accompanying the type material, and spore measurements reported by Saccardo are of unknown origin, *i.e.*, from Cooke or Saccardo. Although the spores were reported as subglobose, 4 X 3 µm, these measurements undoubtedly represent Deuteromycete spores from the badly infected material. Macro- and micromorphological features of the isotype specimen indicate that *M. juglandis* is a synonym of *Collybia dichrous* (Berk. & Curt.) Gilliam. Refer to the type study of *Marasmius dichrous* for comparison.

***AGARICUS LACHNOPHYLLUS*** Berkeley, London J. Bot. 6: 312. 1847.

≡ *Collybia lachnophylla* (Berk.) Saccardo, Syll. Fung. 5: 203. 1887.

≡ *Marasmius lachnophyllus* (Berk.) Morgan, J. Mycol. 11: 239. 1906.

≡ *Gymnopus lachnophyllus* (Berk.) Murrill, N. Amer. Fl. 9(5): 360. 1916.

≡ *Marasmius cohaerens* var. *lachnophyllus* (Berk.) Gilliam, Mycotaxon 4(1): 64. 1976.

HOLOTYPE: United States, Ohio, Waynesville, 5 Sept. 1844, T. G. Lea (K). [ISOTYPE: FH!]

The holotype specimen consists of two basidiomata pressed flat and attached to a slip, in good condition. **Pileus** 12-15 mm diam, convex, even (not striate), subvelutinous, dark reddish brown. **Lamellae** close or crowded, narrow or moderately broad, densely pruinose, reddish brown. **Stipe** ≈ 25 X 1.75-2.5 mm, terete or cleft, pruinose overall, pale reddish brown or brown above a buff-colored base, non-insititious.

**Basidiospores** not recovered. **Basidia** not observed. **Basidioles** 17.5-24 X 4-6 µm, cylindric or clavate. **Hymenial setae** numerous on lamellar faces and edges, 80-110 X 10-20 µm, ventricose-acuminate or lanceolate, sharply acute, arising from deep in subhymenium or lamellar trama and projecting well beyond basidioles, apically reddish brown, basally hyaline, with walls up to 4.5 µm thick. **Pileipellis** hymeniform, not mottled, of *Siccus*-type broom cells, pilosetae and elements transitional in morphology; 1) ***Siccus*-type broom cells** with main body 12-20(-28) X 5-10(-11.5) µm, cylindric or clavate, seldom lobed, subhyaline, pale ochraceous or pale reddish, weakly dextrinoid, with walls 0.5-1 µm thick; apical setulae 2.5-10(-12) X 1-2 µm, conic, subacute or acute, thick-walled or solid, ochraceous or reddish brown; 2) **pilosetae** numerous, 40-90 X 9-15 µm, similar to hymenial setae, arising from deep in pileus trama, brownish orange or brownish red,

dextrinoid, with walls up to 4 µm thick; 3) **transitional elements** similar to *Siccus*-type broom cells but typically larger and with fewer and longer apical setulae; setulae up to 30 X 2-3.5 µm, conic, acute, 3-6 per cell, brownish orange or reddish brown, solid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-6.5 µm, cylindric or few inflated up to 10 µm, smooth, non-gelatinous, hyaline, dextrinoid, clamped, thin-walled. **Stipe tissue** monomitic; **cortical hyphae** 2.5-5 µm diam, parallel, cylindric, smooth, pale yellow or ochraceous (stipe apex) or brown (stipe base), dextrinoid, clamped, with walls up to 1 µm thick; **medullary hyphae** 2.5-12 µm diam, hyaline, weakly dextrinoid, clamped, thin-walled. **Stipe vesture** of numerous **caulosetae** 30-80 X 6-10 µm, ventricose-acuminate or lanceolate, sharply acute, ochraceous, dextrinoid, with walls up to 2.5 µm thick.

**Commentary.** *Agaricus lachnophyllus* was first published by Berkeley (1847) in his Decades of Fungi, XII-XIV. The Latin protologue was published again unaltered by Lea (1849). The basionym dates from 1847 and is correctly cited *A. lachnophyllus* Berk., not *A. lachnophyllus* Berk. *in* Lea as indicated by Gilliam (1976). I concur with Gilliam's (1976) diagnosis that *A. lachnophyllus* represents a variety of *M. cohaerens* (Pers.: Fr.) Cooke & Quél., differing from the type variety in closer and narrower lamellae, and in the abundant caulosetae.

***MARASMIUS LEIGHII*** A. H. Smith, Mycotaxon 9: 344. Pl. 1. 1979.

HOLOTYPE: United States, Michigan, Oakland Co., Milford, 30 Aug. 1940, Smith no. 15213, on debris in an oak woods (MICH).

The portion of the holotype specimen examined consisted on two basidiomata in excellent condition. **Pileus** ≈ 35 mm diam, plano-convex, glabrous, even, disc brown, margin ochraceous. **Lamellae** adnexed, close, narrow, ochraceous, non-marginate. **Stipe** ≈ 90 X 2-3 mm, terete, hollow, tissue thin, glabrous, tawny, non-insititious.

**Basidiospores** 7.2-9.6 X 3.4-4.2 µm [$\bar{x}$ = 8.2 ± 0.6 X 3.8 ± 0.2 µm, E = 1.9-2.4, Q = 2.1 ± 0.1, n = 30], ellipsoid or subfusiform, hyaline, inamyloid, smooth. **Basidia** 17.5-24 X 4.5-6.5 µm, 2- or 4-spored, clavate. **Basidioles** subclavate or clavate. **Pleurocystidia** abundant, 30-70 X 5.5-10 µm, clavate, ventricose or fusoid, seldom apically constricted, arising from deep in subhymenium or lamellar trama and projecting well beyond basidioles, refractive, hyaline, inamyloid, thin-walled. **Cheilocystidia** numerous, 20-24 X 5-6.5 µm, basidiomorphous, clavate or broadly clavate, non-refractive or weakly refractive, hyaline, thin-walled. **Pileipellis** hymeniform, not mottled, of *Globulares*-type elements, 12-28 X 7-18 µm, clavate, vesiculose or sphaeropedunculate, seldom lobed; cells from disc region ochraceous or brownish orange with walls up to 1 µm thick; cells from marginal region hyaline or pale yellow, thin-walled or firm-walled; all cells smooth, inamyloid or weakly dextrinoid, basally clamped. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 4-10 µm diam, cylindric or inflated up to 18 µm, hyaline, strongly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 4-13 µm diam, parallel or subparallel, ochraceous, strongly dextrinoid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** up to 23 µm diam, hyaline, dextrinoid, thin-walled, clamped. **Stipe vesture** absent.

**Commentary.** Smith (1979) considered *M. leighii* a distinct species allied with *M. cystidiosus* (Smith & Hesler) Gilliam, *M. cohaerens* (Pers.: Fr.) Cooke & Quél., and *M. delectans* Morgan. With the availability of additional topotypical material of *M. cystidiosus* (deposited at TENN), the criteria utilized by Smith to distinguish *M. leighii* from *M. cystidiosus* are no longer tenable. Smith separated the two taxa on habit, habitat and taste. *Marasmius leighii* was described as forming fasciate basidiomata on decaying hardwood, while *M. cystidiosus* was described as fruiting solitarily on leafy humus. A topotype specimen of *M. cystidiosus* (TENN no. 14266) contains fasciate basidiomata arising from leafy humus, while another topotype specimen (TENN no. 16349) contains solitary basidiomata attached to woody debris. The latter specimens demonstrate the wide range of habit and habitat displayed by *M. cystidiosus* and suggest that these features are not taxonomically significant. The holotype specimens of *M. leighii* and *M. cystidiosus* are microscopically indistinguishable. The only remaining reported difference between the taxa is the mild taste of *M. leighii* and bitter taste of *M. cystidiosus*. I do not consider this feature substantive enough to retain *M. leighii* as a separate species, and therefore, I accept the latter as a synonym of *M. cystidiosus*.

***MARASMIUS LEONINUS*** Berkeley, Hooker's J. Bot. Kew Gard. Misc. 8: 135. 1856.

HOLOTYPE: Brazil, Amazonas, Panuré, March 1853, Spruce no. 112 (K). [ISOTYPE: FH!]

The isotype specimen consists of one basidiome in poor condition. **Pileus** 20 mm diam, plano-convex, striate, subvelutinous, ferruginous with paler streaks over the lamellae. **Lamellae** subdistant, narrow, pallid, non-marginate. **Stipe** 65 X 1 mm, terete, equal, glabrous or minutely pruinose, ferruginous above, darker at the base, non-insititious.

**Basidiospores** 8.8-10.4 X 2.8-3.4 µm (7 recovered), subcylindric or elongate-ellipsoid, slightly inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** not observed; material revived poorly. **Pleurocystidia** absent. **Cheilocystidia** common, similar to the *Siccus*-type pileipellis elements; main body 12-15 X 5-6.5 µm, cylindric or clavate, hyaline, thin-walled; apical setulae 3-8 X 1-1.5 µm, conic, acute, hyaline or pale yellow, thin- or thick-walled. **Pileipellis** hymeniform, not mottled or weakly mottled, of *Siccus*-type broom cells; main body 8-15 X 4-8 µm, cylindric or clavate, rarely lobed, typically hyaline and thin-walled, seldom pale orange and firm-walled; apical setulae 1.5-10 X 0.8-1.5 µm, conic or rod-like, subacute or acute, thick-walled or solid, yellow or orange. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-6.5(-9) µm diam, cylindric, smooth, non-gelatinous, hyaline, dextrinoid, clamped, with walls thin or up to 1.5 µm thick. **Stipe tissue** monomitic; **cortical hyphae** 3.5-10 µm diam, parallel, cylindric, smooth, ochraceous or brown, dextrinoid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** similar but hyaline and thinner-walled. **Stipe vesture** of scattered *Siccus*-type broom cells with poorly-developed main body, 8-10m X 3-5 µm; plus clusters of conic setulae arising directly from cortical hyphae, similar in

morphology to setulae on pileipellis elements; plus rare, small dendrotrichomoid elements with few setulae up to 25 µm long.

**Commentary.** A pileipellis of *Siccus*-type elements, absence of pleurocystidia, dextrinoid tramal tissues and non-insititious stipe are features that indicate *M. leoninus* belongs in sect. *Sicci*. The species is the type of ser. *Leonini* Singer.

***MARASMIUS LEPTOPUS*** Peck, New York State Mus. Bull. 67: 25. 1903.

HOLOTYPE: United States, New York, Bronx Park, 11 Aug. 1902, C. H. Peck (NYS).

The collection consists of approximately 20 basidiomata in good condition, loose in the packet. **Pileus** 3-12 mm diam, plano-convex, even or seldom short-striate, suede-like, disc reddish brown, margin avellaneous. **Lamellae** adnate, close, narrow, cream-colored. **Stipe** 20-30 X <1 mm, terete, equal, pubescent, buff-colored or pale avellaneous, insititious.

**Basidiospores** 7.2-10 X 3-4.2 µm [$\bar{x}$ = 8.6 ± 0.7 X 3.6 ± 0.3 µm, E = 2.1-2.7, Q = 2.4 ± 0.2, n = 32], elongate-ellipsoid, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 21.5-24 X 5-6.5 µm, 4-spored, clavate. **Basidioles** subclavate or subfusoid. **Pleurocystidia** absent. **Cheilocystidia** numerous, clavate or irregularly cylindric, often lobed, diverticulate; main body 13-20 X 4-8 µm; diverticula 2-5.5 X 1.5-2.5 µm, knob-like or irregular in outline, obtuse; elements hyaline, and thin-walled. **Pileipellis** not hymeniform, composed of a *Rameales*-structure with broom cell-type terminal elements; hyphae 4-7 µm diam, diverticulate, irregular in outline, smooth or more commonly

with granular or plaque-like annular, pale brown pigment incrustations, thin-walled, inamyloid, non-gelatinous; terminal cells with main body 12-26 X 6-12 µm, cylindric, clavate or irregular in outline, diverticulate, smooth or incrusted; diverticula 2.5-6 X 1.5-3.5 µm, knob-like, rod-like or irregular in outline, obtuse, hyaline, thin-walled. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-7.5 µm diam, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2-5 µm diam, parallel, cylindric, smooth, hyaline or pale yellow, dextrinoid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** 2-6.5 µm diam, hyaline, inamyloid, thin-walled or with walls up to 1 µm thick, clamped. **Stipe vesture** of abundant **caulocystidia** up to $60^{+}$ X 4.5-10 µm, cylindric, strangulate or flexuous, obtuse, rarely lobed, hyaline, dextrinoid, with walls up to 1.5 µm thick.

**Commentary**. Gilliam (1976) indicated that the holotype specimen was closest to *Collybia* sect. *Subfumosae*. My examination of the holotype specimen indicated a *Rameales*-type pileipellis, inamyloid tramal tissues, and insititious stipe. These features in combination with other macromorphological features, spore size and caulocystidial morphology indicate that *M. leptopus* is a synonym of *Marasmiellus olneii* (Berk. & Curt.) Desjardin. An earlier type study of *M. leptopus* was presented by Hesler (1959b).

***MARASMIUS LEUCOCEPHALUS*** Montagne, Syll. Gen. Sp. Crypt. 142. 1856.

HOLOTYPE: United States, Ohio, Columbus, July, Sullivant no. 167 (PC).

The collection consists of several badly fragmented and infected basidiomata in poor condition. **Basidiomata** dark brown overall as dried. **Pileus** convex, even or short-striate, suede-like. **Lamellae** close or subdistant, moderately broad. **Stipe** terete, equal, pubescent, stipe base absent.

**Basidiospores** 6-7.2 X 5.2-6 µm (2 measured), tetrapodal, hyaline, inamyloid. **Basidia** not observed. **Basidioles** 20-24 X 6-8 µm, cylindric or clavate. **Pleurocystidia** absent. **Cheilocystidia** not observed; material too scanty, lamellar edges fragmented. **Pileipellis** not hymeniform, composed of a well-developed *Rameales*-structure; hyphae 4-7 µm diam, densely diverticulate, irregular in outline, smooth, hyaline, inamyloid, thin-walled, clamped; terminal cells suberect or erect, 12-40 X 4.5-7 µm, cylindric or more often irregular in outline, often lobed, densely diverticulate, apex often bulbous; diverticula 1.5-6.5 X 0.5-2 µm, knob-like, rod-like or irregular in outline, obtuse, hyaline, thin-walled. **Tramal hyphae** 2.5-6 µm diam, interwoven, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 2.5-6 µm diam, parallel, hyaline or pale ochraceous, inamyloid, thin-walled, clamped. **Stipe vesture** a dense *Rameales*-structure, similar to the pileipellis.

**Commentary.** Features that indicate *M. leucocephalus* is a synonym of *Tetrapyrgos nigripes* (Schw.) Horak [≡ *Marasmiellus nigripes* (Schw.) Sing.] include: a) *Rameales*-type pileipellis with capitate and diverticulate terminal cells; b) tetrapodal spores; and c) *Rameales*-type stipe vesture. *Marasmius leucocephalus* is not a synonym of

*Marasmiellus opacus* (Berk. & Curt.) Sing. as reported by Gilliam (1976).

***COLLYBIA LILACINA*** Coker & Beardslee, J. Elisha Mitchell Sci. Soc. 37: 104. 1921.

≡ *Gymnopus lilacinus* (Coker & Beardslee) Murrill, Mycologia 30: 367. 1938.

≡ *Marasmius lilacinus* (Coker & Beardslee) Singer, Lilloa 22: 326. 1949 (1951).

LECTOTYPE (Halling, 1983b): United States, North Carolina, Chapel Hill, 4 June 1919, Coker no. 3290, under *Magnolia soulangeana* in Arboretum (NCU).

Collection consists of two basidiomata with badly fragmented pilei, otherwise in good condition. **Pileus** ≈ 40 mm diam, plano-umbonate, glabrous, even, disc pale brown, margin cream-colored or ochraceous. **Lamellae** adnate, close, broad, concolorous with the pileus margin, non-marginate. **Stipe** ≈ 60 X 3 mm, terete, equal above a slightly inflated base, hollow, twisted-striate, pruinose over most of the length, base cottony, buff-colored at apex and base, pale brown centrally, non-insititious.

**Basidiospores** 6.4-9.6 X 3.8-5.6 µm [$\bar{x}$ = 7.8 ± 0.7 X 4.6 ± 0.5 µm, E = 1.4-2, Q = 1.7 ± 0.1, n = 25], ellipsoid or lacrymoid, hyaline, inamyloid, smooth. **Basidia** 27-32 X 6-8 µm, 4-spored, clavate. **Basidioles** cylindric or subclavate. **Pleurocystidia** numerous, 70-110 X 16-26 µm, broadly clavate, ventricose or ventricose-rostrate, arising from lamellar trama and projecting well beyond basidioles, hyaline,

typically non-refractive, few weakly refractive, thin-walled and readily collapsing. **Cheilocystidia** numerous, 60-120 X 12-28 µm [$\bar{W}$ = 20.5 µm, n = 50], broadly clavate, saccate or ventricose, rarely ventricose-rostrate, hyaline, thin-walled. **Pileipellis** hymeniform, not mottled, of *Globulares*-type cells, 12.5-20 X 6-12.5 µm, cylindric, clavate or vesiculose, subhyaline, pale yellow or ochraceous, inamyloid, thin-walled, basally clamped. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 4-18(-22) µm diam, cylindric or inflated, smooth, hyaline, strongly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 3-12 µm diam, subparallel, cylindric or inflated, hyaline or pale yellow, strongly dextrinoid, clamped, with walls up to 1.5 µm thick. **Stipe vesture** of numerous, suberect or erect **caulocystidia**, 16-40+ X 5-8(-10) µm, cylindric, clavate or irregular in outline, hyaline, weakly dextrinoid, thin-walled.

**Commentary**. In previous type studies of *C. lilacina*, Hesler (1959a) retained the taxon in *Collybia* because dried specimens did not revive well, while Halling (1983b) noted the species was closely allied with *Marasmius nigrodiscus* (Pk.) Halling [Bas.: *Collybia nigrodisca* Pk.], differing mainly in cheilocystidial morphology and basidiomata coloration. Basidiomata of *C. lilacina* develop lilac tints on the pileus disc and stipe surface at maturity and form broadly clavate or saccate cheilocystidia, whereas basidiomata of *Marasmius nigrodiscus* lack lilac tints and form narrower cheilocystidia. In all other macro- and micromorphological features, the two taxa are indistinguishable. To determine whether a direct correlation exists between presence of

lilac tints and broad cheilocystidia, numerous authentic specimens of *C. lilacina* and *M. nigrodiscus* plus specimens determined by me as *M. nigrodiscus* were compared. Topotypical material determined by Coker as *C. lilacina* (NCU!) showed cheilocystidia ranging in mean width from 13.6 µm (n = 20; Coker no. 2589) to 20.5 µm (n = 50; Coker no. 3290 - holotype). In ten authentic specimens of *C. lilacina* (NCU!), mean cheilocystidial width averaged 17.4 µm. In comparison, the holotype specimen of *C. nigrodisca* Pk. (NYS!) has cheilocystidia with mean width of 13.8 µm (n = 20), while other conspecific specimens (*i.e.*, lacking lilac tints) showed cheilocystidial mean widths ranging from 10 µm (n = 30; Desjardin no. 4301, TENN) to 15 µm (n = 20; Peck, 25 Aug. 1904, NYS). In ten specimens of *M. nigrodiscus*, mean cheilocystidial width averaged 12 µm. Although these data indicate overlapping ranges of cheilocystidia mean width between the taxa, in general the lilac-tinted taxon formed broader cheilocystidia, whereas the taxon lacking lilac tints formed narrower cheilocystidia. I consider these differences significant at varietal rank, and not at the species level, especially when weighed against all other concordant features of *M. lilacinus* and *M. nigrodiscus*. Consequently, I transfer *C. lilacina* as:

***Marasmius nigrodiscus*** var. ***lilacinus*** (Coker & Beardslee) Desjardin, ***comb. et stat. nov.*** [Bas.: *Collybia lilacina* Coker & Beardslee, *ibid.*].

***MARASMIUS LIMONISPORA*** Kauffman, Pap. Michigan Acad. Sci. 5: 136. 1925.

HOLOTYPE: United States, Oregon, Mt. Hood, 16 Oct., C. H. Kauffman (MICH).

The portion of the holotype specimen examined was very fragmentary, lacked lamellae and was otherwise in poor condition. Consequently, limited diagnostic information was obtained. The pileipellis was hymeniform, composed of smooth, clavate elements with scattered ventricose-rostrate pilocystidia, and the stipe vesture was composed of numerous flexuous, firm-walled caulocystidia. All tissues were inamyloid. The latter details are concordant with those reported by Josserand and Smith (1941) in their type study of *M. limonispora*, and I concur with their diagnosis that *M. limonispora* is a synonym of *M. chordalis* Fries. Refer to Kauffman (1925) and Josserand and Smith (1941) for further details.

***MARASMIUS LIQUIDAMBARI*** Singer, Fl. Neotrop. Monogr. 17: 70. 1976.

HOLOTYPE: Mexico, Oaxaca, San Agostin, 10 July 1969, Singer no. M8418-20, *ad folia dejecta Liquidambari styracifluae gregatim*, 1800 m (F).

The collection consists of approximately 10 basidiomata in good condition. **Pileus** 2-5 mm, convex-papillate or plane-depressed, even or rarely short-striate, glabrous, disc greyish brown, margin cream-buff. **Lamellae** adnate, distant, narrow, non-collariate, non-marginate, pallid. **Stipe** ≈ 15 X 0.5 mm, terete, equal, glabrous or weakly pruinose, dark brown, insititious; rhizomorphs present.

**Basidiospores** 6-8 X 2.8-3.4 µm [$\bar{x}$ = 6.9 ± 0.8 X 3.1 ± 0.2 µm, E = 1.8-2.7, Q = 2.2 ± 0.3, n = 10], ellipsoid or oblong, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 17.5-20.5 X 5-6.5 µm, 2- or 4-spored, clavate, with sterigmata up to 10 µm long, sometimes of

unequal length. **Basidioles** subclavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** absent; lamellar edge composed of basidiomorphous elements, sterile or fertile. **Pileipellis** not hymeniform, composed of a well-developed *Rameales*-structure with broom cell-type terminal elements; hyphae 2.8-6.5 µm diam, diverticulate, non-incrusted, hyaline, inamyloid, thin-walled, clamped; terminal elements 8-20 X 5-10 µm, cylindric, clavate or irregular in outline, often lobed, diverticulate, hyaline, thin-walled; diverticula 1.5-5 X 0.5-1.5 µm, knob-like or rod-like, obtuse, hyaline, thin-walled. **Hypodermial hyphae** 2.5-6.5 µm diam, in disc region with granular or amorphous, ochraceous or brown pigment incrustations, in marginal region non-incrusted or with few hyphae weakly incrusted, non-gelatinous, with walls up to 1.2 µm thick. **Pileus trama** interwoven; **lamellar trama** regular; hyphae hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-5.5 µm diam, parallel, cylindric, smooth, ochraceous or brown, dextrinoid, clamped, with walls up to 1.2 µm thick; **medullary hyphae** similar but hyaline and inamyloid. **Stipe vesture** of numerous, solitary **caulocystidia** 8-25(-40) X 5.5-8 µm, subclavate, cylindric or flexuous, obtuse, pale ochraceous (at stipe apex) or brown (stipe base), inamyloid, thick-walled (up to 1.5 µm).

**Commentary.** My examination of the holotype specimen yielded data slightly different from those reported in the protologue. I was unable to demonstrate the presence of cheilocystidia on lamellae of three basidiomata. Macroscopically, the lamellar edge was rounded, smooth and concolorous with the lamellar faces, not minutely fimbriate or

crystalline-granulose as is common in taxa with cheilocystidia. In addition, the basidia were predominantly 2-spored, with sterigmata up to 10 µm long. Often, sterigmata were of unequal length and in such cases when spores were still attached, the spores were of unequal size. Singer (1976) reported that caulocystidia were thin-walled, hyaline and 12-70 µm long. I observed caulocystidia to be consistently thick-walled (up to 1.5 µm), ochraceous or brown, and 8-40 µm long.

*Marasmius liquidambari* belongs in sect. *Androsacei*, where it is similar to *M. subalbiceps* Murrill. The latter forms dimorphic caulocystidia, *i.e.*, short, broadly clavate elements, plus elongate, lanceolate, subacute elements.

***MARASMIUS LONGIPES*** Peck, Bull. Buffalo Soc. Nat. Sci. 1: 58. 1873.

[*non Marasmius longipes* Montagne, Ann. Nat. Sci. Bot. IV, 1: 114. 1854.]

≡ *Marasmius elongatipes* Peck *nom. nov.*, Bull. Buffalo Soc. Nat. Sci. 4: 181. 1882.

LECTOTYPE (Gilliam, 1975a: 39): United States, New York, Savannah, Aug. 1872, C. H. Peck no. 40 (NYS).

The lectotype specimen consists of eight basidiomata pressed flat but otherwise in good condition. **Pileus** 4-8 mm diam, plano-convex, glabrous, even, tawny overall. **Lamellae** adnate, close, narrow, non-collariate, non-marginate, ochraceous. **Stipe** 45-60 X 0.5-1 mm, terete, enlarged near the base, somewhat radicating, pubescent above, tomentose below, greyish brown overall.

**Basidiospores** 7.2-9.6 X 3.6-4.8 µm [$\bar{x}$ = 8 ± 0.6 X 4.2 ± 0.4 µm, E = 1.6-2.1, Q = 1.9 ± 0.1, n = 30], ellipsoid, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 16-22 X 5.5-6.5 µm, 4-spored, clavate. **Basidioles** clavate or subfusoid. **Hymenial cystidia** numerous on lamellar faces and edges, 40-60 X 7-9 µm, fusoid or ventricose and typically capitulate, hyaline overall or often with the capitellum containing a tawny refractive residue or incrusted with a tawny exudate, thin-walled, inamyloid. **Pileipellis** hymeniform, not mottled, of *Globulares*-type elements, 16-24 X 10-22 µm, clavate or vesiculose, smooth, yellow or ochraceous, inamyloid, with walls 0.5-1.5 µm thick. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-6.5 µm diam, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-5.5 µm diam, parallel or subparallel, cylindric, smooth, ochraceous or brown, inamyloid, clamped, with walls up to 2 µm diam; **medullary hyphae** 3-12 µm diam, hyaline, inamyloid, clamped, with walls up to 1.5 µm thick. **Stipe vesture** of numerous **caulocystidia** up to $200^{+}$ X 8-12 µm, cylindric, obtuse, pale yellow or ochraceous, inamyloid, with walls up to 5 µm thick, thinning towards the cells apex.

**Commentary.** The box containing the type material is labeled "*Marasmius elongatipes* Peck, originally publ. as *M. longipes* Peck, Savannah & Bethlehem, N.Y., Aug. & Oct., 1872, C. H. Peck." The box contains one internal packet labeled "*Marasmius longipes*, Savannah, Aug., no. 40," a second internal packet labeled "*Marasmius longipes*, Bethlehem, Oct.," plus eight loose slips of paper with a single basidiome glued to each slip. The packet labeled "Savannah, Aug." was

designated by Gilliam (1976) as the lectotype. All material in the type assemblage is conspecific. I concur with Singer (1958) and Gilliam (1975b) that *M. longipes* Pk. is a synonym of *Marasmius pyrrhocephalus* Berkeley, a member of sect. *Alliacei*. Refer to the type study of the latter for comparison. An earlier type study of *M. longipes* was presented by Hesler (1957, as *M. elongatipes*).

It is interesting that around the time when Peck (1882) renamed his taxon *M. elongatipes*, he realized that the species was probably a form of *M. pyrrhocephalus*. On page 198 of Peck's notebook for 1881-1883 (archived at NYS), the following note was recorded: "#141. *M. pyrrhocephalus* B. - *M. longipes* Pk. is a form of this probably."

***MARASMIUS LONGISTRIATUS*** Peck, New York State Mus. Bull. 105: 25. Pl. S, figs. 1-4. 1906.

HOLOTYPE: United States, New York, Warren Co., Bolton Landing, 28 July 1905, C. H. Peck (NYS).

The collection consists of approximately 10 basidiomata, badly fragmented but otherwise in fair condition. **Pileus** 5-8 mm diam, plano-convex, depressed, striate, glabrous or suede-like, pale brown with paler disc and striae. **Lamellae** adnate, close, narrow, non-collariate, non-marginate, cream-colored. **Stipe** 20-25 X 1 mm, terete, enlarged slightly near the base, pubescent and beige above, tomentose and tawny below, non-insititious.

**Basidiospores** 6.4-8.8 X 3-3.8 µm [$\bar{x}$ = 7.6 ± 0.8 X 3.4 ± 0.3 µm, E = 2-2.6, Q = 2.3 ± 0.2, n = 15], elongate-ellipsoid or subfusiform, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 19-24 X

4-7.2 µm, 4-spored, clavate. **Basidioles** cylindric or subclavate. **Pleurocystidia** absent. **Cheilocystidia** numerous, 24-36 X 4-6.5 µm, irregularly cylindric, strangulate or contorted, seldom lobed, hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, formed of a cutis of radially arranged, repent hyphae; hyphae 2.5-8 µm diam, non-diverticulate or with scattered broad, knob-like branchlets or diverticula, with walls heavily incrusted with granular or amorphous, annular brown pigments, elsewhere walls subhyaline or pale greyish brown, inamyloid, clamped, non-gelatinous; terminal cells repent or suberect, cylindric or clavate. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-8 µm diam, cylindric, smooth or weakly incrusted, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-5 µm diam, parallel, cylindric, smooth or incrusted, subhyaline or pale ochraceous, inamyloid, clamped, with walls up to 1 µm thick; **medullary hyphae** 3.5-12 µm diam, similar but hyaline. **Stipe vesture** a layer of tangled **caulocystidia**, 16-50+ X 4.5-6.5 µm, suberect or erect, cylindric or irregular in outline, obtuse, hyaline or pale yellow, inamyloid, thin-walled or with walls up to 0.8 µm thick.

**Commentary**. Pileipellis morphology, inamyloid tramal tissues and non-insititious stipe of the holotype specimen indicate that *M. longistriatus* belongs in *Collybia* sect. *Subfumosae*. I concur with Gilliam (1976) and Halling (1983b) in accepting *M. longistriatus* as a synonym of *C. biformis* (Pk.) Singer. Refer to the type study of *Marasmius biformis* for comparison.

***GYMNOPUS LUDOVICIANUS*** Murrill, N. Amer. Fl. 9(5): 355. 1916.

≡ *Collybia ludoviciana* (Murr.) Murrill, Mycologia 8: 219. 1916.

≡ *Marasmius ludovicianus* (Murr.) Singer, Lilloa 22: 326. 1949 (1951).

HOLOTYPE: United States, Louisiana, New Orleans, City Park, 3 Sept. 1908, F. S. Earle no. 26 (NY).

The collection consists of 11 basidiomata in good condition, mostly with stipes broken. **Pileus** 5-13 mm diam, plano-convex and depressed, strongly rugulo-striate, glabrous, ochraceous or cream-colored. **Lamellae** adnate or subdecurrent, distant, narrow or moderately broad, intervenose, non-collariate, non-marginate, cinnamon-colored. **Stipe** 20-40 X ≈ 1 mm, terete, equal, glabrous or minutely pruinose, hollow, somewhat translucent, tawny, non-insititious, with buff-colored basal mycelium.

**Basidiospores** 6.4-7.6 X 3.4-4 µm [$\bar{x}$ = 6.9 ± 0.4 X 3.8 ± 0.2 µm, E = 1.7-2, Q = 1.8 ± 0.2, n = 20], ovate or ellipsoid, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 17-21 X 5-6.5 µm, 4-spored, clavate. **Basidioles** cylindric or clavate. **Pleurocystidia** absent. **Cheilocystidia** numerous, 17-24 X 7.5-11.5 µm, clavate, broadly clavate or sphaeropedunculate, hyaline, thin-walled, non-refractive. **Pileipellis** hymeniform, not mottled, of *Globulares*-type elements, 16-24 X 6.5-20 µm, clavate, vesiculose or sphaeropedunculate, not lobed, hyaline or pale yellow, inamyloid or weakly dextrinoid, thin-walled, basally clamped. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 4-13 µm diam, cylindric or inflated, smooth, non-gelatinous, hyaline, strongly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 3.5-8 µm diam,

parallel, cylindric, smooth, hyaline or pale ochraceous, strongly dextrinoid, thin-walled, clamped. **Stipe vesture** of scattered **caulocystidia** 15-26 X 9.5-12.5 µm, similar to cheilocystidia and pileipellis elements, clavate or sphaeropedunculate, hyaline, thin-walled.

**Commentary.** Holotype specimens of *Gymnopus ludovicianus* and *Marasmius alachuanus* Murr. are conspecific. Refer to the type study of the latter for comparison. As a consequence, *G. ludovicianus* is considered a synonym of *M. cohortalis* var. *alachuanus* (Murr.) Singer. Earlier type studies of *G. ludovicianus* were presented by Smith (1938a) and Hesler (1959a).

***MARASMIUS MACRORRHIZUS*** Montagne, Syll. Gen. Sp. Crypt. 142. 1856.

HOLOTYPE: United States, Ohio, Columbus, July, Sullivant no. 67 (PC).

The collection consists of one basidiome in poor condition, appearing somewhat plasticized from being dried poorly. **Pileus** 11 mm diam, plano-convex, depressed, striate, glabrous, dark ochraceous. **Lamellae** adnate, close, narrow, non-collariate, ochraceous. **Stipe** 65 X 1 mm, terete, radicating, pruinose above, tomentose below, dark brown.

**Basidiospores** 7.2-9.2 X 3.4-4.8 µm [$\bar{x}$ = 8 ± 0.6 X 4 ± 0.3 µm, E = 1.8-2.3, Q = 2 ± 0.1, n = 25], ellipsoid, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** not observed. **Basidioles** 15-20 X 4-5 µm, clavate. **Hymenial cystidia** numerous on lamellar faces and edges, 28-49 X 6.5-8 µm, fusoid or ventricose, capitulate, hyaline overall or often with contents of the capitellum golden-melleous and

resinous, thin-walled, inamyloid. **Pileipellis** hymeniform, not mottled, of *Globulares*-type elements, 16-24 X 8-20 µm, clavate, vesiculose or sphaeropedunculate, pale yellow or ochraceous, inamyloid, with walls 0.5-1.5 µm thick. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-6 µm diam, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-7 µm diam, parallel, cylindric, smooth, ochraceous, brownish orange or brown, inamyloid, clamped, with walls up to 2 µm thick; **medullary hyphae** 2.5-10 µm diam, hyaline or pale yellow, inamyloid, clamped, with walls <1 µm thick. **Stipe vesture** of numerous **caulocystidia**, 20-200+ X 8-12 µm, cylindric or flexuous, obtuse or subacute, hyaline or pale yellow, inamyloid, with walls up to 4.5 µm thick, thinning toward cell apex.

**Commentary.** Macromorphology of *M. macrorrhizus* in combination with spore size, pileipellis-type, hymenial cystidia and caulocystidial morphologies indicate that the species epithet is a synonym of *Marasmius pyrrhocephalus* Berk. as suggested by Gilliam (1975b).

***MARASMIUS MAGNISPORUS*** Murrill, Mycologia 4: 166. 1912.

HOLOTYPE: United States, New York, New York Botanical Garden, 28 Aug. 1911, W. A. Murrill (NY).

The collection consists of approximately 20 basidiomata in good condition. **Pileus** 8-15 mm diam, convex or plano-convex, wavy, even, rugolose or short-striate, glabrous or suede-like, dingy cream-colored. **Lamellae** adnexed or adnate, distant or remote, anastomosing and intervenose, narrow, non-collariate, non-marginate, concolorous with

the pileus. **Stipe** 5-12 X 1 mm, terete, equal or with slightly flared apex and swollen base, silky-pubescent, cream-colored overall or with brown base, subinsititious, lignicolous.

**Basidiospores** 12-16 X 4-5.6 µm [$\bar{x}$ = 13.6 ± 1.1 X 4.6 ± 0.5 µm, E = 2.6-3.4, Q = 3 ± 0.2, n = 20], broadly clavate or subfusiform, often curved and inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 34-40 X 7-9 µm, 4-spored, clavate. **Basidioles** subclavate or clavate. **Pleurocystidia** absent or rarely present near the lamellar edges, similar to the cheilocystidia. **Cheilocystidia** scattered, 50-60+ X 7-9 µm, flexuous or fusoid with an elongate neck 2.5-3.5 µm diam, arising from subhymenium and projecting well beyond basidioles, non-refractive, hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, composed of a cutis of interwoven, sparcely diverticulate or non-diverticulate hyphae; hyphae 3.5-10 µm diam, cylindric or irregular in outline, non-incrusted, non-gelatinous, hyaline, inamyloid, thin-walled, clamped; diverticula 2-10 X 2-6.5 µm, scattered, knob-like or rod-like, obtuse, hyaline, thin-walled; hyphae giving rise to scattered **pilocystidia**, 12-75 X 4-6.5 µm, similar to cheilocystidia but some subcapitate; setae absent. **Tramal hyphae** 3-10 µm diam, interwoven, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 3-8 µm diam, subparallel, hyaline or ochraceous (cortical hyphae of stipe base), inamyloid, clamped, with walls up to 1.5 µm thick. **Stipe vesture** of scattered **caulocystidia** similar in morphology to pilocystidia, hyaline, thin-walled.

**Commentary.** *Marasmius magnisporus* is considered by me and others (Josserand & Smith, 1933; Singer, 1973a; Noordeloos, 1983) to represent a synonym of *Marasmiellus candidus* (Bolt.) Singer. Refer to Noordeloos (1983) and Desjardin (1985a) for discussions on the taxonomy and nomenclature of *M. candidus*.

***MARASMIUS MAGNOLIAE*** Singer, Mycologia 37: 435. 1945.

LECTOTYPE: United States, Florida, Alachua Co., Gainesville, 11 May 1943, Singer no. F1906, *in petiolis foliorum delapsorum Magnoliae grandiflorae* (FH).

The lectotype specimen consists of several tiny basidiomata in good condition. **Pileus** 2 mm diam, convex or obtusely conic, striate, surface squamulose, furfuraceous or granulose, disc dark brown, margin reddish brown. **Lamellae** adnexed, distant, moderately broad, pallid. **Stipe** ≈ 15 X <0.5 mm, terete, equal, pruinose, dark brown, insititious on petioles of *Magnolia*.

**Basidiospores** 8-10.4 X 3.8-5 µm [$\bar{x}$ = 9.2 ± 0.6 X 4.3 ± 0.3 µm, E = 2-2.4, Q = 2.1 ± 0.1, n = 20], ellipsoid or broadly fusoid, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 18.5-22.5 X 6-7.5 µm, 4-spored, subclavate. **Basidioles** subclavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** of two types: 1) fusoid or ventricose-rostrate elements, 24-30 X 5-6.5 µm, obtuse or acute, arising from about the same level as basidioles but projecting beyond basidiole apices, non-refractive, hyaline, inamyloid, thin-walled; 2) *Rotalis*-type broom cells similar to those of the pileipellis, 5-12 µm diam, with hyaline, tawny or pale brown divergent

setulae 2-3.5 X 1-1.5 µm. **Pileipellis** for the most part hymeniform, plus scattered erect chains of cells forming surface squamules; hymeniform regions composed of *Rotalis*-type broom cells; main body 12-24 X 8-16 µm, broadly clavate or vesiculose, few hyaline and thin-walled, majority brown and thick-walled, upper half of cell covered with divergent setulae 1-3.5 X 1-1.5 µm, these knob-like or rod-like, obtuse, solid, ranging from subhyaline to reddish brown or dark brown; surface squamules formed of clusters of chains of cells, individual cells 12-32 X 6.5-14 µm, ranging from entirely smooth to weakly setulose, or covered overall with divergent setulae, elements typically reddish brown or dark brown with walls 1-3.5 µm thick, terminal cell of chain typically strongly setulose, penultimate and subpenultimate cells progressively less setulose; all pileipellis elements inamyloid, clamped. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-6.5 µm diam, cylindric, smooth, non-gelatinous, hyaline or pale brown, inamyloid, clamped, typically thin-walled but some elements thick-walled. **Stipe tissue** monomitic; **cortical hyphae** 3-5.5 µm diam, parallel, cylindric, smooth or in areas with heavy pigment incrustations, dark reddish brown, inamyloid, with walls up to 2 µm thick; **medullary hyphae** 1.5-6.5 µm diam, hyaline or pale yellow, inamyloid, clamped, with walls up to 0.5 µm thick. **Stipe vesture** composed of annular zones or isolated patches of pigment deposits, incrustations thick, angular or plaque-like, dark reddish brown, clustered into isolated groups or forming zones that circumscribe the stipe; no differentiated caulocystidia present.

**Commentary.** No specific specimen was designated as holotype in the protologue, although Singer (1945) noted that the type had been collected at Gainesville, Florida and was deposited at the Farlow Herbarium. Two potential lectotype specimens matching the protologue are at FH, one labeled "11 May 1943, Singer no. F1906," and one labeled "12 May 1943, Singer no. F1906a." In a subsequent publication, Singer (1976: 83) reported the 11 May 1943 specimen as "type," and this specimen is considered here to represent the lectotype. Because of non-collariate lamellae, insititious stipe, inamyloid tramal tissues and *Rotalis*-type pileipellis elements, *M. magnoliae* belongs in sect. *Hygrometrici*.

***MARASMIUS SALIGNUS*** var. ***MAJOR*** Peck, Annual Rep. New York State Mus. 41: 85. 1888.

HOLOTYPE: United States, New York, Saratoga Co., Gansevoort, July 1887, C. H. Peck, on *Salix nigra* (NYS).

The collection consists of more than 20 basidiomata in good condition, many intact and attached to a woody substrate, many fragmented. **Pileus** 5-17 mm diam, convex or plano-convex, often wavy, striate or rugulo-striate, glabrous or weakly suede-like, cream-colored or ochraceous. **Lamellae** adnate or subdecurrent, distant, moderately broad, intervenose, ochraceous, non-collariate, non-marginate. **Stipe** 5-10 X 1 mm, terete or compressed, apex flared, narrowed towards the base, insititious or subinsititious, pruinose, buff-colored or ochraceous.

**Basidiospores** 13.6-19.6 X 4.4-5.6 µm [$\bar{x}$ = 16.1 ± 1.4 X 5.3 ± 0.3 µm, E = 2.5-3.8, Q = 3 ± 0.3, n = 31], clavate or subfusiform, curved and inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 30-40 X 6.5-8.5 µm, 4-spored, clavate. **Basidioles** clavate. **Hymenial cystidia** common on lamellar faces and edges, 48-80 X 6.5-8 µm, flexuous or fusoid, seldom subcapitate, obtuse, hyaline, thin-walled, non-refractive, basally clamped. **Pileipellis** not hymeniform, composed of interwoven hyphae 4-8(-12) µm diam, typically non-diverticulate, sometimes with scattered hyaline and thin-walled diverticula, non-gelatinous, smooth, hyaline, inamyloid, thin-walled, clamped; with scattered **pilocystidia** similar in morphology to the hymenial cystidia, these often subcapitate; no pilosetae present. **Tramal hyphae** 3-12 µm diam, loosely interwoven, cylindric, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-6.5 µm, subparallel, cylindric, smooth, ochraceous or brown, inamyloid, clamped, with walls up to 1 µm thick; **medullary hyphae** similar but hyaline and thinner-walled. **Stipe vesture** of scattered **caulocystidia** similar to the cheilocystidia.

**Commentary.** The holotype specimen of *Marasmius salignus* var. *major* is conspecific with the holotype specimen of *M. magnisporus* Peck (refer to the type study) as suggested by Gilliam (1976), and consequently is considered here to represent a synonym of *Marasmiellus candidus* (Bolt.) Singer.

***MARASMIUS MELANOPUS*** Morgan, J. Cincinnati Soc. Nat. Hist. 18: 36. Pl. 1, fig. 2. 1895.

HOLOTYPE: United States, Ohio, Preston, 1890, A. P. & L. V. Morgan no. 108 (ISC).

The collection consists on several basidiomata in fair condition. **Pileus** 3-4 mm diam, convex, glabrous, even, dark brown. **Lamellae** adnate, subdistant, narrow or moderately broad, brown. **Stipe** ≈ 15 X <0.5 mm, terete, equal, glabrous, shiny, dark brown or black, insititious.

**Basidiospores** 6.4-9.2 X 3-4 µm [$\bar{x}$ = 8 ± 0.7 X 3.6 ± 0.3 µm, E = 2-2.5, Q = 2.2 ± 0.1, n = 30], elongate-ellipsoid, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 20-24 X 5-6.5 µm, 4-spored, clavate. **Basidioles** clavate or ventricose. **Pleurocystidia** absent. **Cheilocystidia** numerous, diverticulate; main body 10-16(-20) X 5.5-10 µm, cylindric or clavate, seldom lobed, hyaline, thin-walled; diverticula 2-4 X 1-2.5 µm, apical or subapical, cylindric or irregular in outline, obtuse, sometimes branched, hyaline, thin-walled. **Pileipellis** not hymeniform, composed of a poorly-developed *Rameales*-structure with repent or erect, broom cell-type terminal cells; hyphae interwoven, diverticulate or non-diverticulate, 3-6 µm diam, smooth or more commonly with pale brown, amorphous or annular pigment incrustations, non-incrusted areas hyaline or pale brown, thin-walled, inamyloid; terminal cells diverticulate, with main body 12-24 X 8-16 µm, subcylindric, clavate or irregular in outline, smooth or incrusted, thin-walled; diverticula 1-6.5 X 1-4 µm, rod-like or irregular in outline, often branched, hyaline or pale brown, thin-walled. **Tramal hyphae** 2.5-6.5 µm diam, interwoven, cylindric, typically smooth, seldom incrusted, non-gelatinous, hyaline, inamyloid, thin-walled, clamped.

**Stipe tissue** monomitic; **cortical hyphae** 3-6 µm diam, parallel, cylindric, smooth, brown or dark brown, dextrinoid, clamped, with walls up to 1 µm thick; **medullary hyphae** 2.5-8 µm diam, hyaline or pale yellow, inamyloid, thin-walled, clamped. **Stipe vesture** absent.

**Commentary**. Pileipellis and cheilocystidia morphology, spore size, absence of caulocystidia, and macromorphology of the holotype specimen of *M. melanopus* indicate the species is a synonym of *M. androsaceus* (L.: Fr.) Fries.

***MARASMIUS MINUTISSIMUS*** Peck, Annual Rep. New York State Mus. 27: 97. Pl. 2, figs 27-28. 1875.

HOLOTYPE: United States, New York, Forestburgh, Sept., C. H. Peck (NYS).

The collection consists of 4 or 5 mature basidiomata plus several immature ones. **Pileus** <1 mm diam, convex, hirsute, white. **Lamellae** few, remote, vein-like, white. **Stipe** ≈ 1 mm X 0.2 mm, pruinose, apex white, base brown, insititious.

**Basidiospores** 9.6-11.2 X 3.2-4 µm [$\bar{x}$ = 10.5 ± 0.6 X 3.7 ± 0.3 µm, E = 2.6-3.1, Q = 2.8 ± 0.2, n = 10], ventricose or subfusiform, seldom with an abaxial bulge, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 16-24 X 7-9.5 µm, 4-spored, clavate. **Basidioles** subcylindric or clavate. **Hymenial cystidia** scattered on lamellar edges, exceedingly rare on lamellar faces and interlamellar surfaces, commonest near pileus margin, 32-44 X 6.5-8 µm, fusoid-ventricose, ventricose-rostrate or lageniform with an elongate neck, non-refractive, typically thin-walled, seldom with basal portion of cell

firm-walled and apex thin-walled, hyaline, inamyloid, arising from the same level as basidioles. **Pileipellis** hymeniform, composed of variably-shaped elements plus scattered pilocystidia; elements 12-36 X 6.5-16 µm, clavate, ventricose, lageniform, vesiculose or sphaeropedunculate, mostly smooth but some roughened or incrusted apically or overall, non-gelatinous, hyaline, typically thin-walled, few with walls up to 0.8 µm thick, inamyloid, basally unclamped; **pilocystidia** 40-65+ X 5-10 µm (at broadest area), ventricose-rostrate or fusoid with a greatly elongated neck, hyaline, thick-walled. **Tramal hyphae** 1.5-6 µm diam, interwoven, cylindric, smooth or rarely weakly roughened, non-gelatinous, hyaline, inamyloid, unclamped. **Stipe tissue** monomitic; **cortical hyphae** 1.5-4 µm diam, parallel, cylindric, smooth, hyaline (at stipe apex) or pale brown (stipe base), inamyloid, unclamped, with walls up to 1 µm thick; **medullary hyphae** similar but hyaline throughout. **Stipe vesture** of scattered **caulocystidia** up to 50 X 4-6 µm (at base of cell), filiform, lanceolate or short-ventricose with a greatly elongated neck, thick-walled at base of cell, thinner towards cell apex, hyaline or pale ochraceous, inamyloid.

**Commentary.** *Marasmius minutissimus* forms the smallest basidiomata of any North American *Marasmius* known to date. Features of the holotype specimen that indicate placement in sect. *Epiphylli* include pileipellis composed of clavate, ventricose or vesiculose elements plus scattered pilocystidia, inamyloid tramal tissues, insititious stipe and pigmentless pileus. Although Gilliam (1976) considered *M. minutissimus* a synonym of *M. epiphyllus*, and Favre (1951) considered it a probable synonym of *M. tremulae*, I consider *M. minutissimus* a distinct species.

Diagnostic features of *M. minutissimus* include pilocystidia morphology, clampless hyphae, tetrasporic basidia and spore size. The species is currently known from the type specimen and from material recently collected in Nova Scotia (Redhead, pers. comm.). An earlier type study was presented by Hesler (1959b).

Singer (1943) provided a description of material collected in the Altai Mts. on leaves of *Betula* and *Populus* which he determined as *M. minutissimus*, but it is unclear whether the material was compared with the type of *M. minutissimus*. Several features of his description are not concordant with my observations of the holotype.

The label on the holotype specimen box reports the specimen as collected in September, 1874. The notation, however, is not in Peck's handwriting. A note on page 27 of Peck's notebook for 1873-1874 (archived at NYS) indicates that the Forestburgh specimen was collected in September, 1873.

***MARASMIUS MINUTUS*** Peck, Annual Rep. New York State Mus. 27: 97. 1875.

HOLOTYPE: United States, New York, Catskill Mts. and Sandlake, July, 1873, C. H. Peck (NYS).

The collection consists of several minute basidiomata in fair condition plus fragments of several others. **Pileus** <1 mm diam, convex, sulcate, granulose, pale reddish brown or brown. **Lamellae** adnate, remote, narrow, pallid, non-collariate, non-marginate. **Stipe** <10 X <0.2 mm, terete, equal, glabrous, ferruginous or reddish brown, insititious.

**Basidiospores** 6.2-8 X 2.6-3.6 µm [$\bar{x}$ = 6.8 ± 0.5 X 2.9 ± 0.3 µm, E = 2-2.6, Q = 2.4 ± 0.1, n = 20], ellipsoid or amygdaliform, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 15-18 X 5-6.5 µm, 4-spored, clavate. **Basidioles** clavate or ventricose. **Hymenial cystidia** numerous on lamellar faces and edges, 16-21 X 4-6 µm, lageniform, often capitulate, hyaline, thin-walled, inamyloid. **Pileipellis** hymeniform, of *Rotalis*-type broom cells plus interspersed pilocystidia; main body of broom cells 10-16 X 6-11 µm, clavate or vesiculose, basally thin-walled, apically thick-walled, ranging from subhyaline to ochraceous or reddish brown; divergent setulae 0.5-1.5 X 0.5-1 µm, rod-like, obtuse, solid, yellow, ochraceous or reddish brown; **pilocystidia** 14-21 X 4-6 µm, fusoid-ventricose or lageniform, often subcapitate, hyaline, thin-walled; some elements transitional between *Rotalis*-type elements and pilocystidia, *i.e.*, lageniform with the central inflated region covered with divergent setulae and apical neck smooth. **Tramal hyphae** 1.5-4 µm diam, interwoven, cylindric, smooth, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-5 µm diam, parallel, cylindric, non-incrusted, reddish brown, inamyloid, clamped, with walls up to 1.2 µm thick, exteriormost surface of outermost hyphae strongly diverticulate; diverticula 0.5-1.5 X 0.5-1 µm, rod-like; **medullary hyphae** 1.5-6 µm diam, hyaline, inamyloid, thin-walled, clamped. **Caulocystidia** absent.

**Commentary.** Although the holotype specimen was reported by Gilliam (1976) as collected in 1874, a note on page 5 of Peck's notebook for 1873-1874 (archived at NYS) indicates that the specimen was collected in July, 1873. Pileipellis morphology, inamyloid tramal

tissues, non-collariate lamellae and insititious stipe are features that indicate placement of *M. minutus* in sect. *Hygrometrici*. An earlier type study was presented by Hesler (1959b).

***MARASMIUS MULTIFOLIUS*** Peck *in* Pennington, N. Amer. Fl. 9(4): 270. 1915.

HOLOTYPE: United States, New York, Essex Co., Minerva, July, C. H. Peck (NYS).

The collection consists of approximately 20 basidiomata, mostly flattened but otherwise in good condition. **Pileus** 14-22 mm diam, plano-convex, glabrous, even, disc dark brown or reddish brown, margin ochraceous. **Lamellae** adnexed, crowded, narrow, non-collariate, non-marginate, ochraceous. **Stipe** 35-50 X 3-4 mm, terete or compressed, striate, pubescent above, tomentose below, buff-colored, non-insititious.

**Basidiospores** 5.6-7.2 X 2.4-3.2 µm [$\bar{x}$ = 6.4 ± 0.4 X 3 ± 0.2 µm, E = 1.8-2.7, Q = 2.2 ± 0.2, n = 20], ellipsoid or lacrymoid, hyaline, inamyloid, smooth. **Basidia** 16-19.5 X 4-5.5 µm, 4-spored, clavate. **Basidioles** subclavate or subfusoid. **Pleurocystidia** absent. **Cheilocystidia** numerous, 12-24+ X 3.5-5 µm, irregularly cylindric, strangulate or contorted, often apically lobed or diverticulate, hyaline, thin-walled. **Pileipellis** not hymeniform, composed of a cutis of radially arranged hyphae; hyphae 2.5-8 µm diam, non-diverticulate or with scattered diverticula, smooth or often with brown, granular, annular pigment incrustations, non-gelatinous, non-incrusted regions hyaline or yellow, inamyloid, thin-walled. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-15 µm diam, cylindric or slightly

inflated, non-gelatinous, hyaline, inamyloid, thin-walled, clamped; hyphae of hypodermial region sometimes incrusted. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 3-8 µm diam, cylindric, smooth, hyaline or pale yellow, inamyloid, thin-walled or with walls up to 1 µm thick, clamped. **Stipe vesture** a layer of interwoven hyphae 3-6.5 µm diam, with suberect or erect terminal cells, these cylindric, clavate or irregular in outline, hyaline or pale yellow, inamyloid, thin-walled.

**Commentary**. Gilliam (1976) reported the spores as amyloid. The spores tested consistently inamyloid during my observations on the holotype specimen. Pileipellis, cheilocystidial and caulocystidial morphologies, in combination with spore size and macromorphological characters indicate that *M. multifolius* is a synonym of *Collybia polyphylla* (Peck) Singer *ex* Halling. The holotype specimen of the latter species was collected during the same month at the same location as the holotype specimen of *M. multifolius* (during different years). Although Peck (*in* Pennington, 1915b) did not mention an alliaceous odor in *M. multifolius* (basidiomata of *C. polyphylla* produce alliaceous odors), revived portions of the holotype specimen and several authentic specimens (NYS!) have a weak alliaceous odor and a distinct alliaceous taste. Refer to the type study of *M. polyphyllus* Peck for a comparison.

***MARASMIUS MULTIVENOSUS*** Murrill, Lloydia 9(4): 320. 1946.

HOLOTYPE: United States, Florida, Alachua Co., Gainesville, in

leaf mold by road in high hammock, 3 Aug. 1944, W. A. Murrill no. F38930 (FLAS).

The collection consists of more than 30 basidiomata in good condition. Murrill's note on fresh basidiomata accompany the collection. Features of dried basidiomata: **Pileus** 8-18 mm diam, convex-depressed or plano-convex, rugulose, short-striate, glabrous, beige or ochraceous. **Lamellae** adnexed, distant, narrow, intervenose, non-collariate, non-marginate, pale fulvous. **Stipe** 35-45 X 1 mm, terete or compressed, equal, glabrous, fulvous, non-insititious, with buff-colored basal mycelium.

**Basidiospores** 5.6-7.4 X 3.2-4 µm [$\bar{x}$ = 6.5 ± 0.5 X 3.5 ± 0.3 µm, E = 1.7-2.1, Q = 1.8 ± 0.1, n = 20], ellipsoid in face view, lacrymoid in profile, hyaline, inamyloid, smooth. **Basidia** 17.5-23 X 5.5-7.5 µm, 4-spored, clavate. **Basidioles** subclavate or clavate. **Pleurocystidia** absent. **Cheilocystidia** scattered, repent, suberect or erect, 20-25 X 5.5-12 µm, clavate or sphaeropedunculate, rarely lobed, hyaline, thin-walled, non-refractive. **Pileipellis** hymeniform, of *Globulares*-type elements, 22-34 X 10-25(-32) µm, clavate, vesiculose or sphaeropedunculate, hyaline or pale ochraceous, typically thin-walled, rarely with walls up to 1 µm thick, inamyloid or weakly dextrinoid, non-gelatinous. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 4-13 µm diam, cylindric or inflated, smooth, non-gelatinous, hyaline, strongly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 3-12 µm diam, cylindric or seldom inflated up to 16 µm diam, hyaline or pale yellow, dextrinoid, clamped, with walls up to 1 µm thick. **Stipe vesture** of

scattered, repent or erect **caulocystidia**, 24-50 X 12-24 µm, clavate, ventricose, vesiculose or sphaeropedunculate, hyaline, inamyloid or weakly dextrinoid, thin-walled.

**Commentary.** The holotype specimen of *M. multivenosus* is conspecific with the holotype specimen of *M. alachuanus* Murr. [≡ *M. cohortalis* var. *alachuanus* (Murr.) Sing.], and the name is considered here a synonym of the latter. Refer to the type study of *M. alachuanus* for comparison.

***COLLYBIA NIGRODISCA*** Peck, Annual Rep. New York State Mus. 50: 98. 1896 (1897).

≡ *Gymnopus nigrodiscus* (Pk.) Murrill, N. Amer. Fl. 9(5): 356. 1916.

≡ *Marasmius nigrodiscus* (Pk.) Halling, Brittonia 35(4): 323. 1983.

HOLOTYPE: United States, New York, Suffolk Co., Wading River, July, C. H. Peck (NYS).

The holotype assemblage represents a mixed collection. Five basidiomata glued to three slips of paper match the protologue and are considered to represent the holotype specimen. In addition, two basidiomata are wrapped individually with a separate label annotated "*Collybia nigrodisca* Pk., W. R., Aug. 1906." The latter two basidiomata are not considered part of the type material. Features of the holotype specimen: **Pileus** 20-40 mm diam, plano-convex, umbonate, glabrous, even, disc brown, margin leather brown, tan or ochraceous. **Lamellae** adnexed, close or subdistant, broad, non-collariate, non-marginate, concolorous with pileus margin. **Stipe** 30-60 X 2-3 mm,

terete, equal, striate, pruinose, tan or buff-brown, non-insititious, basal mycelium cream-colored.

**Basidiospores** 6.4-8.8 X 4-5.2 µm [$\bar{x}$ = 7.7 ± 0.6 X 4.4 ± 0.4 µm, E = 1.6-2, Q = 1.8 ± 0.1, n = 25], ellipsoid in face view, lacrymoid in profile, hyaline, inamyloid, smooth. **Basidia** 22-26 X 5-6.5 µm, 4-spored, clavate. **Basidioles** subclavate or clavate. **Pleurocystidia** numerous, 50-85(-100+) X 8-14.5(-18) µm [$\bar{W}$ = 10.3 µm, n = 25], fusoid, ventricose or ventricose-rostrate, arising from lamellar trama and projecting well beyond basidioles, non-refractive, hyaline, inamyloid, thin-walled (many collapsed and poorly revived). **Cheilocystidia** numerous, 36-80 X 12-20 µm [$\bar{W}$ = 13.8 µm, n = 20], cylindric, clavate or seldom ventricose, otherwise similar to the pleurocystidia. **Pileipellis** hymeniform, not mottled, of *Globulares*-type elements, 10-20(-30) X 5.5-12 µm, cylindric, clavate, vesiculose or sphaeropedunculate, pale ochraceous or brown on pileus disc, subhyaline or hyaline on pileus margin, inamyloid or weakly dextrinoid, thin-walled. **Pileus** and **lamellar trama** interwoven; hyphae 3-16 µm diam, cylindric or inflated up to 20 µm diam, smooth, non-gelatinous, hyaline, strongly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, subparallel, 3-12 µm diam, cylindric or slightly inflated, hyaline or pale yellow, strongly dextrinoid, clamped, with walls up to 1.5 µm thick. **Stipe vesture** of scattered or clustered **caulocystidia** 13.5-32 X 6-10 µm, clavate, vesiculose, ventricose or sphaeropedunculate, hyaline, inamyloid or weakly dextrinoid, thin-walled.

**Commentary.** I concur with Halling's (1983b) diagnosis that the type assemblage is composed of two taxonomically distinct elements. The holotype element consists of five basidiomata glued to three slips of paper. Two additional basidiomata are wrapped separately in the type box and accompanied by a label annotated "Aug. 1906." The latter basidiomata are *Collybia maculata* (Alb. & Schw.: Fr.) Kummer, and were presumably incorporated into the type box at least ten years after publication of *C. nigrodisca*.

Pileipellis morphology, dextrinoid tramal tissues and non-insititious stipe are features that dictate placement of *C. nigrodisca* in sect. *Globulares* as transferred by Halling (1983b). A watercolor illustration of several basidiomata from the type specimen is archived at NYS.

***MARASMIUS RESINOSUS*** var. ***NIVEUS*** Peck, New York State Mus. Bull. 67: 38. 1903.

HOLOTYPE: United States, New York, Port Jefferson, 6 Aug., C. H. Peck (NYS).

The collection consists of more than 30 basidiomata in good condition, mostly loose, few attached to leafy substrate. **Pileus** 2-6 mm diam, convex or plano-convex, even, glabrous or granulose, deep golden yellow or orange overall. **Lamellae** adnate. close, very narrow, non-collariate, non-marginate, golden. **Stipe** 12-45 X <0.5 mm, terete, equal, granulose, golden or orange, non-insititious.

**Basidiospores** 5.6-8 X 2.8-3.8 µm [$\bar{x}$ = 6.7 ± 0.6 X 3.3 ± 0.3 µm, E = 1.8-2.4, Q = 2 ± 0.1, n = 30], ellipsoid, inequilateral in profile,

hyaline, amyloid, smooth, thin-walled. **Basidia** 17.5-21.5 X 4.5-6 µm, 4-spored, clavate. **Basidioles** cylindric or subclavate. **Pleurocystidia** absent or rare and similar to non-diverticulate cheilocystidia. **Cheilocystidia** numerous, lamellar edge sterile, (30-)40-50 X 5.5-8 µm, cylindric, clavate or irregular in outline, obtuse, refractive, hyaline or pale yellow; with rare, scattered, narrow, diverticulate (dendrophysoid) elements similar to those of the pileipellis. **Pileipellis** a subhymeniform layer of repent, suberect or erect pilocystidia, plus interspersed erect diverticulate (dendrophysoid) elements; **pilocystidia** 20-60+ X 5-11 µm, cylindric, flexuous or clavate, obtuse, thin-walled, hyaline or pale yellow, often capped with golden or tawny, amorphous adherent exudates; **diverticulate elements** irregularly cylindric, branched, narrow (2-5 µm diam), hyaline, non-refractive, thin-walled; diverticula 1.5-4 X 1-2 µm, rod-like or irregular in outline, hyaline, thin-walled. **Tramal hyphae** 3-15 µm diam, subparallel or interwoven, somewhat agglutinated, cylindric or inflated, short-celled nearest the pileipellis, elongated elsewhere, hyaline, dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2-4.5 µm diam, parallel, hyaline or pale yellow, dextrinoid, clamped, with walls up to 1 µm thick; **medullary hyphae** 2.5-8.5 µm diam, subparallel, hyaline, strongly dextrinoid, thin-walled, clamped. **Stipe vesture** of numerous **caulocystidia** 40-60 X 6-10 µm, similar to pilocystidia, some with golden, amorphous adherent exudates.

**Commentary.** The holotype specimen of *M. resinosus* var. *niveus* is indistinguishable from the holotype specimen of *M. decurrens* Pk. [≡ *M.*

*resinosus* Pk. *nom. nov.*], and as such represents a synonym of *Resinomycena rhododendri* (Pk.) Redhead & Sing. Refer to the type study of *M. decurrens* for comparison.

***MARASMIUS NOLANEIFORMIS*** Murrill, Bull. Torrey Bot. Club 67: 149. 1940.

HOLOTYPE: United States, Florida, Alachua Co., Gainesville, 31 May 1938, W. A. Murrill no. F18259, in an open lawn (FLAS).

The collection consists of approximately 20 basidiomata, some intact, many fragmented, otherwise in good condition. Murrill's notes on fresh material accompany the collection. Features of dried basidiomata: **Pileus** 3-10 mm diam, campanulate, short-sulcate, radially appressed-fibrillose, brown. **Lamellae** adnexed, subdistant or distant, broad, non-collariate, non-marginate, brown. **Stipe** 18-27 X <1 mm, terete, equal or slightly enlarged near the base, pubescent, brown, non-insititious.

**Basidiospores** 10.4-12.4 X 5-6.4 µm [$\bar{x}$ = 11.4 ± 0.7 X 5.7 ± 0.4 µm, E = 1.8-2.2, Q = 2 ± 0.1, n = 20], broadly ellipsoid or amygdaliform, hyaline, inamyloid, smooth. **Basidia** 28-32 X 8-9 µm, 4-spored, clavate. **Basidioles** clavate. **Pleurocystidia** absent. **Cheilocystidia** scattered, 20-25 X 7-10 µm, irregularly basidiomorphous, clavate, broadly strangulate or irregular in outline, rarely lobed, hyaline, thin-walled. **Pileipellis** not hymeniform, composed of a cutis of radially arranged hyphae that give rise terminally to repent or suberect thick-walled "hairs;" hyphae 3-7.5 µm diam, cylindric, typically brown pigment-incrusted, non-incrusted regions subhyaline or pale brown, inamyloid, clamped; pileus "hairs" up to $100^{+}$ X 5-8 µm, filiform or

lanceolate, subacute or acute, ochraceous, inamyloid, with walls up to 3 µm thick. **Tramal hyphae** 3-8 µm diam, interwoven, smooth or weakly incrusted nearest the pileipellis, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-5 µm diam, parallel, cylindric, smooth, ochraceous, inamyloid, clamped, with walls up to 1 µm thick; **medullary hyphae** 2.5-9 µm diam, similar but hyaline and thinner-walled. **Stipe vesture** of numerous repent or erect "hairs" similar to those of the pileipellis.

**Commentary.** I concur with Singer's (1976) diagnosis that *M. nolaneiformis* is a synonym of *Crinipellis subtomentosa* (Pk.) Singer. Refer to the type study of *M. subtomentosus* Peck for comparison. In the genus *Crinipellis*, the hair-like pileus elements and stipe surface elements are typically strongly dextrinoid. In the holotype specimens of both *M. nolaneiformis* and *M. subtomentosus* the pileus "hairs" did not react to Melzers reagent, and were scored as inamyloid. It is possible, albeit unlikely, that age of the specimens has affected the reaction. An earlier type study of *M. nolaneiformis* was presented by Hesler (1959b).

***MARASMIUS NUCICOLA*** McDougall, Trans. Illinois State Acad. Sci. 17: 84. fig. 1. 1925.

LECTOTYPE (*des mihi*): United States, Illinois, Urbana, University woods, 1924 (ILL no. 31106).

The lectotype specimen consists of approximately 12 basidiomata, some intact, some fragmented, otherwise in fair condition. **Pileus** 6-12 mm diam, bluntly conic, striate, translucent, yellowish brown.

**Lamellae** adnexed, close, narrow or moderately broad, non-collariate, non-marginate, pallid. **Stipe** 25-45 X 1 mm, terete, equal, reddish brown, pruinose above, base covered with pinkish-buff strigose mycelium, non-insititious.

**Basidiospores** 7.2-8.8 X 4.4-5 µm [$\bar{x}$ = 7.9 ± 0.4 X 4.8 ± 0.2 µm, E = 1.5-1.8, Q = 1.7 ± 0.1, n = 20], ovoid or short-ellipsoid, hyaline, mature spores inamyloid and smooth, immature spores appearing weakly roughened as if coated with small particles and weakly amyloid. **Basidia** 20-24 X 6-7.5 µm, 4-spored, clavate. **Basidioles** clavate. **Hymenial cystidia** numerous on lamellar faces and edges, 40-65 X 9.5-16 µm, lageniform or ventricose-rostrate, cheilocystidia typically shorter than pleurocystidia, non-refractive, hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, composed of a cutis of radially arranged hyphae; hyphae 4-10 µm diam, cylindric, non-diverticulate, smooth, non-gelatinous, hyaline or pale yellow, dextrinoid; terminal cells suberect or erect, 20-42 X 8-12 µm, clavate or ventricose, hyaline, thin-walled. **Hypodermium** pseudoparenchymatous; elements short, highly inflated (up to 30 µm diam), hyaline, strongly dextrinoid, thin-walled. **Pileus** and **lamellar trama** interwoven; hyphae 4-12 µm diam, cylindric or inflated, hyaline, dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-6 µm diam, parallel, cylindric, smooth, subhyaline or pale yellow, dextrinoid, thin-walled, clamped; **medullary hyphae** up to 15 µm diam, otherwise similar to cortical hyphae. **Stipe vesture** of numerous dendroid **caulocystidia**, 3.5-5 µm diam, frequently branched, hyaline, inamyloid, thin-walled.

**Commentary.** Contrary to the statement by Gilliam (1976: 133) that the type is "almost totally destroyed," I found the only extant collection made and determined by McDougall as *M. nucicola* (ILL) to contain over 12 basidiomata in good condition, albeit often fragmented. No specimens were cited in the protologue. A specimen labeled "*Marasmius nucicola*, University woods, Urbana, Illinois, McDougall, 1924" was presumably in the hands of the originating author at the time of publication of the epithet and is designated here as the lectotype.

*Marasmius nucicola* was considered a synonym of *Mycena luteopallens* (Pk.) Sacc. by Smith (1947). The lectotype specimen of *M. nucicola* clearly represents a species of *Mycena*, undoubtedly contaxic with *Mycena luteopallens sensu* Smith [material determined as such by Smith has been examined, *viz.*, TENN nos. 6512, 21031]. Maas Geesteranus (1985), however, indicated that the holotype specimen of *Agaricus luteopallens* Peck (basionym of *Mycena luteopallens*) represents a member of *Hygrophorus* subgen. *Hygrocybe* (Fr.) Fr. I have not examined the latter type specimen and cannot pass judgement on its correct taxonomic disposition. Micromorphological details of the holotype specimen of *A. luteopallens* as reported by Maas Geesteranus (1985) characterize a taxon distinct from *Marasmius nucicola*, differing in spore size, and morphology of pileipellis, stipitipellis and hymenial cystidia. If the holotype specimens of these two taxa are indeed distinct, the epithet *nucicola* is available in *Mycena* for the taxon determined by Smith (1947) as *M. luteopallens*. I will not formally transfer *M. nucicola* to *Mycena* until a comparison is made with the holotype specimen of *A. luteopallens*.

***MARASMIUS NUMMULARIUS*** Berkeley & Broome, J. Linn. Soc., Bot. 14: 33. 1875.

LECTOTYPE: Sri Lanka, Peradeniya, Dec. 1868, no. 102 (K - Berk. Herb.).

The lectotype collection consists of four basidiomata in good condition. **Pileus** 7-10 mm diam, convex, even (not striate), subvelutinous, deep reddish brown. **Lamellae** adnexed, close, narrow, non-collariate, non-marginate, brownish-cream colored. **Stipe** 20-40 X 1 mm, terete, equal, pruinose overall, dark ochraceous, non-insititious, with cream-colored basal strigose mycelium; on leafy debris.

**Basidiospores** 9.6-11.4 X 3.4-4 µm (7 measured), clavate in face view, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 19-23 X 5.5-7.2 µm, 4-spored, clavate. **Basidioles** subclavate, fusoid or ventricose, thin-walled. **Pleurocystidia** poorly differentiated, present as **setoid cystidioles** 20-24 X 5-6.5 µm, fusoid or ventricose-rostrate, sharply acute, arising from the same level as basidioles and projecting only slightly beyond, thick-walled at cell apex, thin-walled at cell base, hyaline, inamyloid. **Cheilocystidia** numerous, similar to *Siccus*-type pileipellis elements; main body 14.5-18 X 4.5-8 µm, cylindric or clavate, hyaline, thin-walled; apical setulae 3-10 X 1-2 µm, conic, acute, thick-walled, golden or ferruginous. **Pileipellis** hymeniform, not mottled, of *Siccus*-type broom cells; main body 12-20 X 5-10 µm, cylindric, clavate or irregular in outline, typically hyaline and thin-walled, rarely tawny or golden and firm-walled; apical setulae 2.5-6(-10) X 1-2 µm, conic, subacute or acute, thick-walled or solid, golden, tawny or ferruginous. **Pileus trama** interwoven;

**lamellar trama** regular; hyphae 3-7.5 µm diam, cylindric, smooth, non-gelatinous, hyaline, dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 4-12 µm diam, parallel, cylindric, smooth, brownish orange, dextrinoid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** similar but hyaline and thinner-walled. **Stipe vesture** of numerous **caulocystidia** 40-80 X 8-16(-22) µm, cylindric, subclavate, fusoid or irregular in outline, obtuse, seldom lobed, thick-walled (1-1.5 µm), hyaline or pale yellow, dextrinoid; plus rare *Siccus*-type broom cells scattered over stipe apex.

**Commentary**. The protologue cited three syntype specimens, *viz.*, Dec. 1864, Dec. 1868, and Jan. 1869, all collected presumably at Peradeniya. Because Pegler (1986: 169) reported the Dec. 1868 specimen as "type," that specimen is considered here to represent the lectotype. *Marasmius nummularius* belongs in sect. *Sicci* ser. *Atrorubenses* Desjardin, because of pileipellis morphology, dextrinoid tramal tissues, absence of setae, and presence of thick-walled caulocystidia. The hymenium contains fusoid or ventricose-rostrate elements with apically thickened walls, designated here as "setoid cystidioles." These elements are similar to poorly developed setae, albeit morphologically distinct, and suggest that *M. nummularius* represents a taxon transitional between ser. *Atrorubenses* and ser. *Spinulosi* (Clémençon) Desjardin.

***MARASMIUS NUPTIALIS*** Morgan, J. Mycol. 11: 238. 1905.

HOLOTYPE: Not located.

No material determined by Morgan as *M. nuptialis* exists in the Morgan Herbarium housed at ISC, or in any other major North American herbaria. As determined from extant type material, the new species described by Morgan in his series entitled *North American species of Marasmius* were all collected in the Miami Valley of Ohio, in the vicinity of Preston [*e.g.*, *M. bellipes, capillaris, delectans, fagineus, felix, melanopus*]. It is reasonable to assume that original material described by Morgan as *M. nuptialis* was also collected from the Miami Valley of Ohio. The protologue of *M. nuptialis* matches quite closely the protologue of *M. leighii* Smith [= *M. cystidiosus* (Smith & Hesler) Gilliam] described from southern Michigan. Both share the fasiculate habit on rotten wood, subumbonate pileus with wrinkled or pitted surface, crowded rather narrow lamellae, glabrous stipe with white basal mycelium, basidiomata coloration and spore size. It is quite possible that the material Morgan had in hand at the time he published *M. nuptialis* was conspecific with material currently determined as *M. cystidiosus*. Until additional material matching the protologue of *M. nuptialis* is collected in the Miami Valley of Ohio and designated the neotype, the epithet will remain a *nomen incertae sedis*. If material conspecific with *M. cystidiosus* is selected, the epithet *nuptialis* would have priority.

***MARASMIUS OCTIFOLIUS*** Murrill, Lloydia 8(4): 273. 1945 (1946).

HOLOTYPE: United States, Florida, Alachua Co., Gainesville, 19 Sept. 1942, G. F. Weber, F17859, on leaf-sheaths of dead sugarcane (FLAS).

The collection consists of approximately 20 basidiomata, some intact, the majority fragmented but otherwise in fair condition. **Pileus** 1.5-2 mm diam, convex, sulcate, distinctly papillate, subglabrous, brownish orange, reddish brown or brown, with a darker papilla. **Lamellae** obscurely collariate, broad, distant, non-marginate, pallid. **Stipe** 5-10 X <0.2 mm, terete, filiform, glabrous, black, insititious, rhizomorphs absent.

**Basidiospores** 7.6-9.8 X 4.2-5.6 µm [$\bar{x}$ = 8.8 ± 0.6 X 4.9 ± 0.4 µm, E = 1.6-2.1, Q = 1.8 ± 0.1, n = 30], ellipsoid or amygdaliform, hyaline, inamyloid, smooth; many mature spores secondarily once-septate. **Basidia** not observed. **Basidioles** 17.5-21 X 7-8.5 µm, clavate. **Pleurocystidia** absent. **Cheilocystidia** numerous, similar to the *Siccus*-type pileipellis elements, but apical setulae hyaline or pale yellow. **Pileipellis** hymeniform, weakly mottled, of *Siccus*-type broom cells; main body 9.5-16 X 4-10 µm, cylindric, clavate or subvesiculose, many hyaline and thin-walled, many pale tawny and thick-walled; apical setulae 1.5-3.5 X 0.5-1.5 µm, knob-like or rod-like, broadly obtuse, solid, ochraceous or tawny. **Tramal hyphae** 2.5-5 µm diam, interwoven, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-5 µm diam, parallel, cylindric, smooth, dark brown, dextrinoid, clamped, with walls up to 1.8 µm thick; **medullary hyphae**

3-6.5 µm diam, parallel, hyaline, inamyloid, thin-walled, clamped. **Stipe vesture** absent.

**Commentary.** *Marasmius octifolius* is a distinct species belonging in sect. *Marasmius* subsect. *Penicillati* Singer. The species is phenetically similar to *M. hiorami* Murr. and *M. graminum* (Lib.) Berk. & Br. *Marasmius hiorami* differs in forming longer and narrower spores (10-13.5 X 3.5-4.2 µm, *fide* Singer, 1976), and in growing on dicotyledonous debris. *Marasmius graminum* differs in forming basidiomata with typically larger pilei (3-8 mm diam v.s. 2-3 mm diam in *M. octifolius*) generally lacking a well-developed, black central papilla. An interesting feature of the holotype specimen is the abundance of mature spores with a central secondary septum. An earlier type study of *M. octifolius* was presented by Hesler (1959b).

***MARASMIUS OLIDUS*** Gilliam, Mycologia 67(4): 822. 1975.

≡ *Marasmius copelandii* var. *olidus* (Gilliam) Desjardin, Mycologia 79(1): 129. 1987.

HOLOTYPE: United States, Michigan, Oakland Co., Proud Lake, 1 Nov. 1970, leg. W. W. Patrick, Gilliam no. 997, gregarious on duff of *Pinus strobus* and *P. resinosus* and on midribs of hardwood leaves (MICH).

The portion of the holotype examined consisted of one basidiome in excellent condition; no substrate included. Refer to the protologue for details on macromorphology.

**Basidiospores** 12.8-17.2 X 2.8-3.8 µm [$\bar{x}$ = 14.9 ± 1.2 X 3.2 ± 0.3 µm, E = 3.8-5.2, Q = 4.7 ± 0.4, n = 42], clavate or subfusiform, curved

in profile, hyaline, inamyloid, smooth. **Basidia** 25-32 X 6-8 µm, 4-spored, subclavate. **Basidioles** subclavate or clavate. **Pleurocystidia** absent. **Cheilocystidia** numerous, 20-32 X 4-9(-11) µm, cylindric, clavate or more often irregular in outline, often lobed or with 1-4 broad diverticulate outgrowths, hyaline, inamyloid, thin-walled. **Pileipellis** hymeniform, weakly mottled, of *Globulares*-type elements, 16-36 X 8-22(-28) µm, clavate, obovate, vesiculose or sphaeropedunculate, broadly obtuse, very rarely lobed, many subhyaline or pale yellow and thin-walled, many ochraceous or brownish orange and thick-walled; all elements inamyloid, basally clamped. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-8 µm diam, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-10 µm diam, parallel, cylindric, smooth, pale ochraceous or brown, olivaceous in KOH, inamyloid, clamped, with walls up to 1 µm thick; **medullary hyphae** subparallel, hyaline, inamyloid, thin-walled, clamped. **Stipe vesture** a layer of tangled, suberect or erect **caulocystidia** 30-150 X 6.5-10 µm, cylindric, strangulate or irregular in outline, seldom lobed, hyaline, pale yellow or ochraceous, inamyloid, with walls up to 2 µm thick.

**Commentary.** As reported earlier (Desjardin, 1987a), the holotype specimen of *M. olidus* is micromorphologically indistinguishable from the holotype specimen of *M. copelandii* Peck. *Marasmius olidus* was reduced to a variety of *M. copelandii*, differing from the type variety in forming consistently smaller and more fragile basidiomata.

***MARASMIUS OLIVASCENTICEPS*** Singer, Fl. Neotrop. Monogr. 17: 180. 1976.

≡ *Marasmius leoninus* var. *olivascenticeps* Singer *nom. inval.*, Sydowia 12: 105. 1958. [no Latin description]

HOLOTYPE: United States, Florida, Highlands Co., Highlands Hammock State Park near Sebring, Aug. 1942, Singer no. F 596A (F).

The collection consists of one basidiome in good condition. **Pileus** 18 mm diam, plano-convex, sulcate, disc slightly depressed, subvelutinous, disc and striae olivaceous-fulvous, paler over the lamellae (*i.e.*, radially streaked). **Lamellae** adnexed, distant, narrow, cream-colored, olivaceous-marginate, non-collariate. **Stipe** 25 X 1 mm, terete, equal, glabrous, hollow, apex cream-colored, base reddish brown or black, stipe base broken off.

**Basidiospores** 10-12 X 3.6-4 µm [$\bar{x}$ = 11 ± 0.6 X 3.8 ± 0.2 µm, E = 2.6-3.2, Q = 2.9 ± 0.2, n = 15], subclavate or subfusiform, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** not observed. **Basidioles** 21.5-24 X 5-6 µm, cylindric, subclavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** numerous, similar to the *Siccus*-type pileipellis elements; main body 14-18 X 5.5-8 µm, cylindric or clavate, hyaline, thin-walled; apical setulae 2.5-5 X 1-1.5 µm, cylindric or conic, subacute, typically solid, ochraceous. **Pileipellis** hymeniform, weakly mottled, of *Siccus*-type broom cells; main body 12-21 X 5.5-10 µm, cylindric, clavate, or pyriform, many subhyaline or pale ochraceous and thin-walled, many ochraceous and thick-walled; apical setulae 2.5-6.5 X 1-1.5 µm, conic, subacute, solid, ochraceous or pale brown. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-6.5 µm diam, cylindric, smooth, non-

gelatinous, hyaline, dextrinoid, thin-walled or firm-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-7.5 µm diam, parallel, cylindric, smooth, subhyaline (at stipe apex) or brown (stipe base), strongly dextrinoid, clamped, with walls up to 1.2 µm thick; **medullary hyphae** 3-10 µm diam, similar but hyaline and thinner-walled. **Stipe vesture** absent.

**Commentary.** Singer (1958a: 105) originally described the Florida specimen cited above along with a Rick specimen from Brazil [Rio Grande do Sul, 1933 (FH)] as *M. leoninus* var. *olivascenticeps* Sing., but failed to include a Latin diagnosis. Subsequently, Singer (1976) redescribed the Florida specimen as *M. olivascenticeps* Sing., and coupled the species with *M. trinitatis* Dennis in the key. *Marasmius olivascenticeps* was reported to differ from *M. trinitatis* in forming "medium sized spores" and olivaceous-marginate lamellae. Singer (1976) reported the spores of *M. olivascenticeps* as 8.5 X 3.5-4.5 µm, and those of *M. trinitatis* as 8.3-12.5 X 2.7-4 µm. I measured the spores of the holotype specimen of *M. olivascenticeps* as 10-12 X 3.6-4 µm. I have not examined the holotype specimen of *M. trinitatis*, but in the protologue Dennis (1951a) reported the spores as 11-12 X 3-4 µm. I have examined a specimen determined by Singer as *M. trinitatis*, and the spores measured 10-12 X 3.2-4.2 µm [Singer no. F449 (F)]. There appears to be no significant difference in spore size between the species, leaving marginate versus non-marginate lamellae as the only distinguishing feature.

***MARASMIUS OLNEII*** Berkeley & Curtis, Ann. Mag. Nat. Hist. 3, 4: 294. 1859.

HOLOTYPE: United States, Rhode Island, leg. A. Metcalf, Misit Olney (155), Aug. 1848, Curtis no. 1821, *ad ramulos, deject.* (K!). [ISOTYPE: F!]

The holotype specimen consists of one basidiome pressed flat and glued to a card with lamellae unexposed, in fair condition. **Pileus** 6 mm diam, plano-convex, short-striate, glabrous, brown. **Lamellae** close. **Stipe** 30 X 1 mm, terete, equal, pruinose, tan or beige, insititious.

**Basidiospores** 7.2-11.2 X 3.2-4.2 µm [$\bar{x}$ = 8.7 ± 0.8 X 3.7 ± 0.3 µm, E = 2-2.8, Q = 2.4 ± 0.2, n = 30], elongate-ellipsoid in face view, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 20-26 X 5-8.5 µm, 4-spored, clavate. **Basidioles** subclavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** numerous, 16-24 X 5-10 µm, irregularly cylindric or clavate, typically lobed or with numerous broad, irregularly-shaped diverticula, hyaline, thin-walled; diverticula similar to those of the pileipellis elements. **Pileipellis** not hymeniform, composed of a poorly-developed *Rameales*-structure with repent, suberect or erect broom cell-like terminal cells; hyphae 3-7 µm diam, interwoven, diverticulate, thin-walled, inamyloid; walls smooth and hyaline, pale ochraceous or pale brown, or often with plaque-like, annular brown pigment- incrustations; diverticula 2.5-8 X 1.5-5 µm, irregularly cylindric or knob-like, broadly obtuse, sometimes branched, thin-walled; terminal cells 12-32 X 6-10 µm, cylindric, clavate, or more often irregular in outline, lobed and diverticulate. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-8 µm diam,

cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-6.5 µm diam, parallel, cylindric, smooth, hyaline or pale yellow, dextrinoid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** 2.5-8 µm diam, subparallel, hyaline, inamyloid, clamped, with walls up to 1 µm thick. **Stipe vesture** of numerous, erect **caulocystidia** 24-100+ X 5.5-9 µm, cylindric, fusoid or irregular in outline, seldom lobed, thick-walled (1-2 µm), hyaline or pale yellow, inamyloid or dextrinoid.

**Commentary**. Gilliam (1976) placed *M. olneii* in sect. *Marasmius* because of collariate lamellae, inamyloid tissues and hymeniform pileipellis of broom cells with broad blunt projections. Although in the protologue Berkeley and Curtis (1859) state "gills...forming by their junction a little collar round the top of the stem," no true collarium is present on basidiomata of the holotype or isotype specimens. In addition, the pileipellis is not hymeniform in arrangement, but rather is composed of densely interwoven, diverticulate hyphae with suberect or erect broom cell-like terminal cells. The "*stipe albo subtiliter pulverulento-tomentose insititio*" (Berkeley & Curtis, 1859), in combination with *Rameales*-type pileipellis are features that indicate *M. olneii* is best placed in the genus *Marasmiellus*. An anomalus feature of *M. olneii* is the distinctly dextrinoid stipe cortical hyphae and caulocystidia; all other tissues are inamyloid. Admittedly, inclusion of a species with dextrinoid tissue in *Marasmiellus* is unprecedented, because the presence of inamyloid tissue throughout basidiomata has been considered a generic character of *Marasmiellus*. When all features of *M. olneii* are

considered, however, the species seems more closely allied with species of *Marasmiellus* sect. *Rameales* (*e.g.*, *M. laurifoliae* Sing.) than with species of *Marasmius* sect. *Androsacei*, the only section of *Marasmius* with concordant pileipellis morphology. The species is transferred here as:

***Marasmiellus olneii*** (Berkeley & Curtis) Desjardin, ***comb. nov.*** [Bas.: *Marasmius olneii* Berkeley & Curtis, *ibid.*].

*Marasmiellus olneii* is a commonly collected litter decomposer in eastern North America, ranging in distribution from New York southward to Florida.

***MARASMIUS OPACUS*** Berkeley & Curtis, Hooker J. Bot. 1: 99. 1849.

≡ *Marasmiellus opacus* (Berk. & Curt.) Singer, Lilloa 22: 300. 1949 (1951).

HOLOTYPE: United States, South Carolina, Society Hill, June, 1847, Curtis no. 1241, *ad fol. & ramuli deject.* (K). [ISOTYPE: FH!]

The isotype specimen consists of 9 basidiomata in rather poor condition; most pilei are fragmented and most lamellae have been removed. **Basidiomata** beige or pale brown overall. **Pileus** ≈ 5 mm diam, convex or plano-convex, even, suede-like. **Lamellae** adnexed, subdistant, narrow, non-collariate, non-marginate. **Stipe** 20-30 X 1 mm, terete, equal, pubescent, insititious.

**Basidiospores** 7.4-8.8 X 3.2-4 µm [$\bar{x}$ = 8.1 ± 0.5 X 3.7 ± 0.2 µm, E = 1.9-2.6, Q = 2.2 ± 0.2, n = 25], ellipsoid or subfusiform in face view, amygdaliform in profile, hyaline, inamyloid, smooth. **Basidia** 22-26 X 5-8 µm, 4-spored, subclavate or clavate. **Basidioles** clavate or

fusoid. **Pleurocystidia** absent. **Cheilocystidia** numerous, 16-33.5 X 4.5-8.5 µm, irregularly cylindric or clavate, typically apically and/or laterally diverticulate or lobed; diverticula 1.5-5 X 1-3.5 µm, knob-like, rod-like or irregular in outline, broadly obtuse, sometimes branched; elements hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, composed of a poorly-developed *Rameales*-structure with swollen and often non-diverticulate terminal cells; intercalary hyphae 3-8 µm diam, intricately interwoven, sparcely diverticulate, smooth or coated with plaque-like, annular, subhyaline or pale greyish brown pigment incrustations, inamyloid, thin-walled, clamped; diverticula 1.5-5 X 1-3.5 µm, knob-like, cylindric or irregular in outline, broadly obtuse, thin-walled, hyaline; terminal cells 9.5-40 X 5.5-14 µm, repent, suberect or erect, clavate, vesiculose, sphaeropedunculate or irregular in outline, some lobed, many non-diverticulate, many with scattered apical and/or lateral diverticula, thin-walled or with walls up to 1 µm thick, hyaline, inamyloid; in the disc region the swollen terminal elements forming a subhymeniform layer. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-8 µm diam, cylindric, smooth or weakly incrusted nearest the pileipellis, non-diverticulate, hyaline, inamyloid, thin-walled or with walls up to 1 µm thick, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2-4.5 µm diam, parallel, cylindric, smooth, hyaline or pale yellow, inamyloid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** 3-6 µm diam, similar but thinner-walled. **Stipe vesture** a tangled layer of contorted hyphae with scattered diverticula, *i.e.*, a *Rameales*-structure that gives rise to clavate, sphaeropedunculate or subvesiculose

**caulocystidia**, 12-30 X 4-14 µm, these similar to the terminal cells of the pileipellis hyphae, with or without knob-like diverticula, hyaline, thin-walled or firm-walled.

**Commentary**. Diverticulate pileipellis elements, inamyloid tramal tissues, non-collariate lamellae and insititious stipe indicate that *M. opacus* belongs in the genus *Marasmiellus* as transferred by Singer (1949). A contemporary description of this taxon was presented by Singer (1973), but no mention was made of the distinctive terminal cells of the pileipellis. In basidiomata of *M. opacus* the majority of pileipellis hyphae have terminal cells that are broadly clavate, vesiculose or sphaeropedunculate. Many of these elements lack diverticula, while many other elements possess diverticula, especially on the proximal end of the cell. The morphology of these terminal cells is somewhat similar to that of members of *Marasmiellus* sect. *Tricolores* Sing., albeit in the latter group of species, pileipellis hyphae are more strongly diverticulate and spores are longer. *Marasmiellus opacus* would key to sect. *Rameales* subsect. *Opacini* Sing. in Singer (1973).

***AGARICUS OREADES*** Bolton: Fries, Syst. Mycol. 1: 127. 1821.

[*Agaricus oreades* Bolton, Hist. Fung. Halifax 3: 151. 1789.]

≡ *Marasmius oreades* (Bolt.: Fr.) Fries, Epicr. Syst. Mycol. 375. 1838.

≡ *Collybia oreades* (Bolt.: Fr.) Kummer, Führer Pilzk. 116. 1871.

≡ *Scorteus oreades* (Bolt.: Fr.) Earle, Bull. New York Bot. Gard. 5: 415. 1909.

REPRESENTATIVE MATERIAL: England, Surrey, Kew Gardens, 24 July 1899, G. Massee (FH). No holotype specimen exists.

The representative specimen consists of 7 intact basidiomata in fair condition, pressed flat, loose in the packet. **Pileus** 13-50 mm diam, plano-convex, glabrous, even, "clay color" or pale brown. **Lamellae** adnexed, broad, subdistant, pale brown, non-collariate, non-marginate. **Stipe** 40-65 X 2-4 mm, terete or compressed, equal or slightly enlarged towards the base, ribbed, pubescent above, tomentose below, tan or beige, non-insititious.

**Basidiospores** 7.6-10.4 X 4.4-6 µm [$\bar{x}$ = 8.8 ± 0.7 X 5.3 ± 0.4 µm, E = 1.6-1.9, Q = 1.7 ± 0.2, n = 30], ellipsoid, ovoid or lacrymoid, sometimes with an abaxial bulge, hyaline, inamyloid, smooth. **Basidia** 28-35 X 4.5-8 µm, 4-spored, clavate. **Basidioles** cylindric or subclavate. **Pleurocystidia** absent. **Cheilocystidia** absent or rarely with a few contorted, flexuous, lobed subhymenial hyphae intercalated between the basidiomorphous elements of the lamellar edge. **Pileipellis** hymeniform, not mottled, of *Globulares*-type elements, 12-20 X 4-12 µm, cylindric, clavate, broadly clavate or somewhat irregular in outline, often lobed, non-diverticulate, hyaline or pale yellow, dextrinoid, thin-walled or with walls up to 0.8 µm thick; elements becoming dispersed at maturity and pileipellis appearing subhymeniform. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 4-16 µm diam, cylindric, smooth, non-gelatinous, hyaline, strongly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** undifferentiated, subparallel, cylindric, smooth, hyaline, dextrinoid, thin-walled, clamped. **Stipe vesture** a layer up to 200 µm

thick of loosely interwoven hyphae 4-8(-10) µm diam, similar to medullary hyphae, with suberect or erect terminal cells (caulocystidia); **caulocystidia** 24-50 X 4-7(-10) µm, irregularly cylindric or strangulate, often lobed or with broad, obtuse outgrowths, hyaline, dextrinoid, thin-walled.

**Commentary.** No holotype specimen of *M. oreades* exists. Although the epithet was sanctioned by Fries (1821), he developed his concept of the species from Bolton (1789), the originating author of the epithet. A neotype specimen for *M. oreades* should be chosen from material collected in the vicinity of Halifax, England (Bolton's collecting area), and not from Upsala, Sweden (Fries' collecting area) as implied by Gilliam (1976). Until fresh material is collected and cultured from around Halifax, the Massee specimen described above will serve to represent my concept of *M. oreades*. It should be noted that macromorphological features of this specimen match those of the protologue, and macro- and micromorphological features are congruent with those observed on an E. P. Fries specimen collected from Upsala, Sweden (FH!). *Marasmius oreades* belongs in sect. *Globulares*.

***MARASMIUS OSTRYAE*** Berkeley & Curtis, *nomen herbariorum*.

*Marasmius ostryae* is an unpublished binomial. Material determined as such by Curtis was collected by Peters on *Ostrya* in Alabama (PH!). Micromorphological features of the basidiomata indicated the taxon belongs in the genus *Campanella*.

***MARASMIUS PALLIDICEPS*** Murrill, Lloydia 8(4): 274. 1945 (1946).

HOLOTYPE: United States, Florida, Alachua Co., 7 mi west of Gainesville, 26 Sept. 1943, W. A. Murrill no. F17771, on dead fallen moist oak leaves (FLAS).

The collection consists of approximately 30 basidiomata, many intact, many fragmented but otherwise in good condition. **Pileus** 4-8 mm diam, plano-convex, even, suede-like, "chamois." **Lamellae** adnate, close, narrow, non-collariate, non-marginate, concolorous with the pileus. **Stipe** 12-22 X 0.5 mm, terete, equal, pubescent, "chamois," insititious on oak leaves.

**Basidiospores** 7.2-9.2 X 3.2-4 µm [$\bar{x}$ = 8.1 ± 0.5 X 3.7 ± 0.3 µm, E = 2-2.6, Q = 2.2 ± 0.2, n = 25], ellipsoid or cylindric in face view, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 21.5-24 X 5-6.5 µm, 4-spored, clavate. **Basidioles** cylindric or fusoid. **Pleurocystidia** absent. **Cheilocystidia** numerous, 16-28 X 4-8 µm, irregularly cylindric or clavate, lobed and diverticulate, hyaline, inamyloid, thin-walled; diverticula 1.5-5 X 1-3.5 µm, knob-like, rod-like or irregular in outline, broadly obtuse, hyaline, thin-walled. **Pileipellis** not hymeniform, composed of a well-developed *Rameales*-structure plus repent, suberect or erect broom cell-like terminal cells; hyphae 4-6 µm diam, interwoven, diverticulate, thin-walled, inamyloid; walls smooth and hyaline, or with scattered plaque-like, pale greyish brown or olivaceous grey pigment incrustations; diverticula 1.5-6 X 1-3.5 µm, knob-like, rod-like or irregular in outline, broadly obtuse, seldom branched, hyaline, thin-walled; terminal cells 10-24 X 5-8 µm, cylindric, clavate or more often

irregular in outline, lobed and diverticulate. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-7 µm diam, cylindric, smooth or weakly incrusted nearest the pileipellis, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-6.5 µm diam, parallel, cylindric, smooth, subhyaline or pale brownish orange, dextrinoid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** 2.5-8 µm diam, subparallel, hyaline, inamyloid, clamped, with walls up to 1 µm thick. **Stipe vesture** of numerous **caulocystidia** 24-100+ X 4-6.5(-8) µm, cylindric, strangulate or irregular in outline, sometimes lobed, hyaline, ranging from inamyloid to strongly dextrinoid, with walls 0.5-1.5 µm thick.

**Commentary.** *Marasmius pallidiceps* is micromorphologically indistinguishable from *Marasmiellus olneii* (Berk. & Curt.) Desjardin, but the two taxa are macromorphologically distinct in pileus pigmentation. The pileus of *M. pallidiceps* was described by Murrill (1946a) as pallid to isabelline, whereas the pileus of *M. olneii* was described by Berkeley and Curtis (1859) as pale rufous [refer to Ridgway (1912) for color comparison], and by Gilliam (1975; as *M. insipidus* Gilliam) as moderately brown, fading to pale brown or brownish pink. Further collections of the pallid to isabelline-colored taxon from Florida may show a greater range in pileus coloration than that indicated in the protologue of *M. pallidiceps*. Until further material becomes available, however, I accept *M. pallidiceps* as a distinct color variant of *M. olneii*, and transfer the former as: ***Marasmiellus olneii*** var. ***pallidiceps*** (Murr.) Desjardin, ***stat. nov.*** [Bas.: *Marasmius pallidiceps* Murrill, *ibid.*].

An earlier type study of *M. pallidiceps* was presented by Hesler (1959b).

***MARASMIUS PALLIDOCEPHALUS*** Gilliam, Mycologia 67(4): 818. 1975.

HOLOTYPE: United States, Michigan, Chippewa Co., Tahquamenon Falls State Park, Lower Falls, 22 July 1971, M. S. Gilliam no. 1165, gregarious on debris and decayed needles under hemlock (MICH).

The portion of the holotype examined consisted of two basidiomata in good condition. **Pileus** 4 mm diam, convex, even, glabrous, disc brown, margin tan. **Lamellae** adnate, subdistant, narrow or moderately broad, non-collariate, non-marginate, cream-colored. **Stipe** ≈ 25 X <0.5 mm, terete, equal, glabrous, shiny, black, insititious.

**Basidiospores** 6.8-9.6 X 3.2-4.2 µm [$\bar{x}$ = 8.1 ± 0.6 X 3.7 ± 0.3 µm, E = 2-2.5, Q = 2.2 ± 0.1, n = 20], ellipsoid, hyaline, inamyloid, smooth. **Basidia** 21-24 X 5-7 µm, 4-spored, clavate. **Basidioles** subclavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** absent. **Pileipellis** not hymeniform, composed of a *Rameales*-structure with repent, suberect or erect, broom cell-like terminal cells; hyphae 3-6 µm diam, interwoven, diverticulate, few smooth, majority with plaque-like, annular, brown pigment-incrustations; walls subhyaline or pale brown, inamyloid, thin-walled or with walls up to 1 µm thick, unclamped; diverticula 1.5-6 X 1.5-3.5 µm, knob-like or irregular in outline, obtuse, sometimes branched; terminal cells 8-32 X 6-16 µm, clavate, subvesiculose or irregular in outline, lobed and diverticulate, thin-walled or thick-walled. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-8 µm diam, cylindric, smooth or

with granular brown pigment-incrustations in the hypodermial region, non-gelatinous, hyaline, inamyloid, thin-walled or firm-walled, unclamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-5 µm diam, parallel, cylindric, dark ochraceous or dark brown, incrusted with granular or annular pigment deposits, strongly dextrinoid, unclamped, with walls up to 1 µm thick; **medullary hyphae** 2-9.5 µm diam, parallel, hyaline or pale yellow, inamyloid or weakly dextrinoid, unclamped, with walls up to 1 µm thick. **Stipe vesture** absent.

**Commentary.** Although Gilliam (1975a) reported clamp connections on the holotype specimen, Redhead (1984) reported that clamp connections were absent. I concur with Redhead's diagnosis. *Marasmius pallidocephalus* belongs in sect. *Androsacei* where it is closely allied with *M. androsaceus* (L.: Fr.) Fr. and *M. straminipes* Pk.

***MARASMIUS PALUDIGENUS*** Desjardin *in* Desjardin & Petersen, Mycotaxon 34(1): 81. 1989.

HOLOTYPE: United States, New Jersey, Salem Co., Camp Edge Boy Scout Camp, 18 Aug. 1987, R. E. Halling (TENN no. 47622).

The collection consists of 9 basidiomata in excellent condition. **Pileus** 6-12 mm diam, convex, sulcate, subvelutinous, pale brown. **Lamellae** adnexed, remote, broad, non-collariate, non-marginate, greyish brown. **Stipe** 35-45 X <1 mm, terete, equal, glabrous, shiny, concolorous with the pileus, non-insititious, basal mycelium buff-colored.

**Basidiospores** 16-23.2 X 4.4-6 µm [$\bar{x}$ = 19.3 ± 1.7 X 5.2 ± 0.6 µm, E = 3.1-4.6, Q = 3.8 ± 0.3, n = 30], clavate or subfusiform, seldom

curved in profile, hyaline, inamyloid, smooth. Refer to the protologue for illustrations and details on other micromorphological features of the holotype specimen.

**Commentary.** *Marasmius paludigenus* belongs in sect. *Sicci* ser. *Leonini*.

***MARASMIUS PAPILLATUS*** Peck, Annual Rep. New York State Mus. 24: 76. 1872.

≡ *Marasmiellus papillatus* (Pk.) Redhead & Halling, Fungi Canadenses 215. 1982.

LECTOTYPE: United States, New York, Sand Lake, Aug. 1871, C. H. Peck (NYS).

The type assemblage represents a mixed collection. The majority of basidiomata match the protologue and were designated the lectotype by Redhead and Halling (1982). Four basidiomata represent *Collybia contraria* (Pk.) Halling, and these were segregated by me and placed in a separate packet, but included with the type assemblage. The lectotype material consists of approximately 20 basidiomata in good condition. **Pileus** 5-10 mm diam, plano-convex or plane, some with a shallow central depression, even, glabrous or suede-like, "chamois" or pale ochraceous. **Lamellae** adnate or subdecurrent, close or subdistant, narrow, non-marginate, concolorous with the pileus. **Stipe** 25-45 X <1 mm, terete, equal, pruinose and avellaneous cream-colored at the apex, pubescent or tomentose and greyish brown at the base, non-insititious, with buff or cream-colored, copious basal mycelium.

**Basidiospores** 9.2-13.2 X 3.8-5.2 µm [$\bar{x}$ = 11 ± 1.0 X 4.4 ± 0.4 µm, E = 2.1-3, Q = 2.5 ± 0.2, n = 30], elongate-ellipsoid, subcylindric or subfusiform, slightly inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 25-34 X 6-7.5 µm, 4-spored, subclavate. **Basidioles** subclavate or clavate. **Hymenial cystidia** numerous on lamellar edges, less common on lamellar faces, 36-60 X 5.5-8 µm, fusoid or fusoid-ventricose, arising from subhymenium and projecting well beyond basidioles, non-refractive, hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, not a true *Rameales*-structure, composed of a cutis of interwoven, flexuous hyphae; hyphae 1.5-3.5 µm diam, non-diverticulate or with scattered broad branchlets, smooth, hyaline or pale yellow, inamyloid, thin-walled, clamped; terminal cells repent, suberect or erect, 8-28 X 2.5-4 µm, cylindric or flexuous, often branched, typically non-diverticulate or with few knob-like branchlets, hyaline, thin-walled. **Pileus** and **lamellar trama** interwoven; hyphae 4-9.5 µm diam, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-6.5 µm diam, parallel, cylindric, smooth, hyaline or ochraceous, inamyloid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** 3-10 µm diam, similar but all hyaline and thinner-walled. **Stipe vesture** a thin layer of loosely interwoven hyphae 2-4.5 µm diam giving rise terminally and intercalarily to **caulocystidia**, 2-28 X 2.5-4(-5) µm, flexuous, cylindric or rarely fusoid, sometimes branched, obtuse, hyaline, inamyloid, thin-walled or with walls up to 1 µm thick.

**Commentary.** *Marasmius papillatus* was transferred to *Marasmiellus* by Redhead and Halling (1982), and *Marasmius alienus* Pk. and *M.*

*umbilicatus* Kauff. were included as synonyms. I concur with the synonymy of these three taxa. Several features of basidiomata of this organism indicate, however, that the species is best placed in the genus *Neoclitocybe* Singer. Singer (1973) pointed out the importance of an insititious stipe in the delimitation of *Marasmiellus*, and emphasized that this character was the primary distinction between phenetically similar *Marasmielli* and species of *Collybia* sect. *Subfumosae*. Although pileipellis and pleurocystidial morphologies of *M. papillatus* are vaguely similar to those of members of *Marasmiellus* sect. *Candidi*, the distinctly non-insititious stipe, absence of pilocystidia and basidiomata stature are unlike any known members of the section. Moreover, the subdecurrent lamellae and conspicuous pleurocystidia of *M. papillatus* exclude *Collybia* from consideration. Features of *M. papillatus*, concommitant with the circumscription of *Neoclitocybe* include: a) pileipellis morphology; b) monomitic, inamyloid and non-gelatinous tramal tissue; c) presence of pleurocystidia (present in some *Neoclitocybe, e.g., N. substenophylla* (Murr.) Sing.); d) clamp connections; e) spore morphology and microchemical reactions; f) omphalinoid stature (especially as exhibited by the holotype specimen of *M. umbilicatus*); g) non-insititious stipe; and h) lignicolous habit. When all features of *M. papillatus* are considered, the taxon best fits in *Neoclitocybe* and is transferred here as:

***Neoclitocybe papillata*** (Peck) Desjardin, ***comb. nov.*** [Bas.: *Marasmius papillatus* Peck, *ibid.*].

***MARASMIUS PAPILLOSUS*** Clements, Bot. Surv. Nebraska 4: 21. 1896.

LECTOTYPE (*des mihi*): United States, Nebraska, Beatrice, 24 July 1894, Pound & Clements no. 4273, on old stumps (NEB).

The lectotype specimen consists of two intact basidiomata plus numerous fragments, in fair condition. Refer to the protologue for details on macromorphology.

**Basidiospores** 6.4-8 X 3.8-4.8 µm [$\bar{x}$ = 6.9 ± 0.4 X 4.4 ± 0.3 µm, E = 1.4-1.8, Q = 1.6 ± 0.1, n = 31], ovoid or ellipsoid, hyaline, inamyloid, smooth. **Basidia** 17.5-23 X 6-7.5 µm, 4-spored, clavate. **Basidioles** clavate. **Pleurocystidia** absent. **Cheilocystidia** scattered, (25-)48-64 X 5.5-12 µm, clavate, fusoid, ventricose or irregular in outline, rarely with small irregularly-shaped lobes, arising from subhymenium and projecting beyond basidioles, non-refractive, hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, formed of a cutis of radially arranged hyphae; hyphae 2-7 µm diam, non-diverticulate or with scattered cylindric, obtuse diverticula, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Pileus trama** interwoven; hyphae 3-8 µm diam, not greatly differentiated from the pileipellis, not pseudoparenchymatous as in *Mycena*, hyphae cylindric or slightly inflated, hyaline, inamyloid, thin-walled, clamped; **lamellar trama** compactly interwoven or regular; hyphae 3-12 µm diam, similar to the pileus tramal hyphae. **Stipe tissue** monomitic; **cortical hyphae** 2-5 µm diam, parallel, cylindric, smooth or with scattered golden granular incrustations, some hyphae with golden, granular contents, these golden incrustations and contents turn olivaceous in 3% KOH; walls hyaline or pale yellow, inamyloid, thin; **medullary hyphae** 3-12 µm diam, hyaline,

inamyloid, thin-walled, clamped. **Stipe vesture** of scattered, repent or suberect **caulocystidia** 24-40 X 5-8 µm, irregular in outline, typically lobed or diverticulate, hyaline, pale olivaceous in KOH, inamyloid, thin-walled.

**Commentary**. No specimens were cited in the protologue, although Clements (1896) reported the species as growing on decaying logs in Beatrice, Nebraska. Although Gilliam (1976) was unable to locate the type specimen, two specimens in Clements' herbarium deposited at NEB are labeled "*Marasmius papillatus* Clements, 24 July 1894, Pound & Clements." One specimen is numbered "4273," and the second specimen is numbered "4337." Both specimens match the protologue of *M. papillosus* in all details and were undoubtedly in the hands of the originating author at the time of publication. I presume that Clements realized before publication that the epithet *papillatus* was unavailable (*cf.* Peck, 1872), and he changed the termination to *papillosus* for publication. The specimen numbered 4337 has the epithet *papillatus* crossed out and below this is written "*papillosus* Clements. Too much like *Mycena*. L. H. Pennington." Pennington (1915b) reported the taxon as belonging in *Mycena*. The specimen numbered 4273 is designated here the lectotype.

*Marasmius papillosus* is best placed in *Hemimycena* based on a pileipellis of repent, weakly diverticulate hyphae, non-pseudoparenchymatous hypodermial layer, inamyloid and non-gelatinous tramal tissue, inamyloid spores, mycenoid stature, nearly pigmentless basidiomata, and non-insititious stipe.

***MARASMIUS PARASITICUS*** Ellis & Everhart, *nomen herbariorum*.

*Marasmius parasiticus* E. & E. represents an unpublished binomial. Material determined as such by Ellis and Everhart was collected from Faulkland, Delaware on 27 July 1887 (PH!). The material is conspecific with *Marasmiellus tenerrimus* var. *setulosus* (Joss. & Smith) Sing. *apud* Desjardin.

***MARASMIUS PARASITICUS*** Stevens & Hawkes, *nomen herbariorum*.

*Marasmius parasiticus* Stevens & Hawkes represents an unpublished binomial. Five specimens determined as such by Stevens and Hawkes were collected in Panama from leaves of *Sida* spp. (ILL!). The material represents an undescribed species in sect. *Sicci* ser. *Leonini*, characterized by forming the smallest basidiomata of the section (pilei < 1 mm diam, ≈ 7 lamellae, stipes < 1 X < 0.1 mm), by growing on living leaves of *Sida*, and causing reddish brown-bordered leaf spots.

***MARASMIUS PETERSII*** Berkeley & Curtis, *nomen herbariorum*.

*Marasmius petersii* represents an unpublished binomial. Material determined as such by Curtis was collected by Peters in Alabama (FH!), and is conspecific with *Mycena albiceps* (Pk.) Gilliam.

***MARASMIUS PETIOLORUM*** Berkeley & Curtis, J. Linn. Soc., Bot. 10: 296. 1868 (1869).

≡ *Mycena petiolorum* (Berk. & Curt.) Dennis, Kew Bull. 6: 402. 1951.

≡ *Marasmiellus petiolorum* (Berk. & Curt.) Singer, Beih. Nova Hedwigia 44: 106. 1973.

HOLOTYPE: Cuba, Aug., C. Wright no. 140, *ad pet. foliorum* (K). [ISOTYPE: FH!]. Holotype not examined.

The isotype specimen consists of several basidiomata attached to the stem of an undetermined dicotyledonous plant. **Pileus** 1 mm diam, convex, even, suede-like, avellaneous. **Lamellae** adnate, distant, narrow, edges granulose, pallid overall. **Stipe** filiform, translucent, pruinose, avellaneous, insititious. Basidiomata with the stature and size of *Marasmiellus filopes* (Pk.) Redhead.

**Basidiospores** 6.4-8.6 X 2.8-3.6 µm [$\bar{x}$ = 7.5 ± 0.6 X 3.1 ± 0.2 µm, E = 2.2-2.6, Q = 2.4 ± 0.1, n = 25], elongate-ellipsoid, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 13.5-16 X 5-6 µm, 4-spored, clavate. **Basidioles** subclavate or ventricose. **Pleurocystidia** absent. **Cheilocystidia** numerous, 10-20 X 5-12 µm, cylindric, clavate or sphaeropedunculate, densely diverticulate, hyaline, thin-walled; diverticula 1-5 X 0.5-2 µm, apical and lateral, rod-like, obtuse, hyaline, thin-walled. **Pileipellis** not hymeniform, a well-developed *Rameales*-structure; hyphae 3-5.5 µm diam, cylindric, densely diverticulate, non-gelatinous, non-incrusted, hyaline, thin-walled, inamyloid, clamped; diverticula 1-4 X 0.5-1.5 µm, rod-like, obtuse, hyaline, thin-walled; terminal cells repent or suberect, cylindric or clavate, densely diverticulate. **Tramal hyphae** 3-9.5 µm diam, interwoven, cylindric or inflated, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-5.5 µm diam, parallel, cylindric, strongly diverticulate, similar to the pileipellis hyphae; **medullary hyphae** 3-10 µm diam, non-diverticulate, hyaline, inamyloid, clamped. **Caulocystidia** absent.

**Commentary**. The holotype specimen comprises tiny basidiomata of *Marasmiellus* as indicated by Singer (1973). The species appears allied with *M. filopes* (Pk.) Redhead of sect. *Rameales* subsect. *Ramealini*, although *M. petiolorum* would key to sect. *Rameales* subsect. *Opacini* because of pigmentless pileus.

***MARASMIUS PHYLLOPHILUS*** Peck, Bull. New York State Mus. 116: 26. 1907.

HOLOTYPE: United States, New York, Suffolk Co., Wading River, 21 Aug. 1906, C. H. Peck (NYS).

The collection consists of more than 30 basidiomata in excellent condition, some attached to hardwood leaves, others loose in the box. **Pileus** 4-12 mm diam, plano-convex, slightly rugulose, striate, suede-like, cream-colored overall. **Lamellae** adnate, close or subdistant, narrow, non-collariate, non-marginate, cream-colored. **Stipe** 12-35 X <1 mm, terete, equal, pruinose, tan or buff-colored, insititious.

**Basidiospores** 6.4-9.2 X 3.2-4 µm [$\bar{x}$ = 7.8 ± 0.6 X 3.6 ± 0.3 µm, E = 1.8-2.8, Q = 2.2 ± 0.2, n = 30], ellipsoid, elongate-ellipsoid or amygdaliform, hyaline, inamyloid, smooth. **Basidia** 22.5-26 X 5-6.5 µm, 4-spored, clavate. **Basidioles** cylindric, subclavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** numerous, 16-24 X 6-10 µm, cylindric, clavate or irregular in outline, sometimes lobed, with numerous irregularly-shaped, obtuse diverticula, hyaline, thin-walled; diverticula similar to those of the pileipellis elements. **Pileipellis** not hymeniform, composed of a well-developed *Rameales*-structure with repent, suberect or erect broom cell-like terminal cells; hyphae 3-11.5 µm diam, interwoven, irregularly cylindric, diverticulate, smooth

or very rarely roughened, hyaline, inamyloid, thin-walled, clamped; diverticula 2-6.5 X 1-5 µm, knob-like or irregular in outline, broadly obtuse, rarely branched, hyaline, thin-walled; terminal cells 16-30 X 6-12 µm, cylindric, clavate, subvesiculose or more often irregular in outline, lobed and diverticulate. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-10 µm diam, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-5 µm diam, parallel, cylindric, smooth, hyaline, dextrinoid, clamped, with walls up to 2 µm thick; **medullary hyphae** 2.5-9 µm diam, subparallel, hyaline, inamyloid, clamped, with walls up to 1 µm thick. **Stipe vesture** of numerous, erect **caulocystidia** 25-110+ X 6.5-10 µm, cylindric, flexuous, fusoid or irregular in outline, sometimes lobed, hyaline, thick-walled (1-2.8 µm), dextrinoid; with *Crinipellis*-like hairs at stipe base.

**Commentary.** Like *M. pallidiceps* Murr. described above, *M. phyllophilus* is micromorphologically indistinguishable from *Marasmiellus olneii* (Berk. & Curt.) Desjardin, but the latter taxa are macromorphologically distinct in pileus pigmentation. The pileus of *M. phyllophilus* was described by Peck (1907) as "whitish, with a faint pink tinge when dry," whereas the pileus of *M. olneii* ranges from pale rufous to brown, and that of *M. pallidiceps* was described as isabelline-colored. I accept *M. phyllophilus* as a pale color variant of *M. olneii* and transfer the taxon as:

***Marasmiellus olneii*** var. ***phyllophilus*** (Pk.) Desjardin, ***comb. et stat. nov.*** [Bas.: *Marasmius phyllophilus* Pk., *ibid.*].

***MARASMIUS PICEINA*** Kauffman, Pap. Michigan Acad. Sci. 1: 143. 1921.

HOLOTYPE: United States, Colorado, Gilpin Co., Tolland, 8 Sept. 1920, C. H. Kauffman, on spruce needles (MICH).

The portion of the holotype specimen loaned consisted of several minute basidiomata in fair condition. **Pileus** <1 mm diam, convex, even or striate, granulose, tan or pallid greyish. **Lamellae** subdistant or distant, narrow, non-collariate, pallid. **Stipe** ≈ 5 X <0.1 mm, filiform, pruinose, pinkish grey, insititious; numerous rhizomorphs present.

**Basidiospores** 8-10.8 X 3.6-4.2 µm [$\bar{x}$ = 9.3 ± 0.8 X 3.9 ± 0.2 µm, E = 2-2.7, Q = 2.4 ± 0.2, n = 20], elongate-ellipsoid or subfusiform, hyaline, inamyloid, smooth. **Basidia** 22.5-28 X 5.5-8 µm, 4-spored, clavate. **Basidioles** subclavate. **Pleurocystidia** absent. **Cheilocystidia** scattered, few observed because of scanty material, 20-25 X 5-8 µm, irregularly cylindric or clavate, densely diverticulate, often lobed, hyaline, thin-walled; diverticula similar to those on the pileipellis elements. **Pileipellis** not hymeniform, composed of a well-developed *Rameales*-structure; hyphae 2.5-5 µm diam, densely diverticulate, some areas less diverticulate and heavily incrusted with plaque-like, pale brown pigment deposits, smooth and hyaline or pale ochraceous elsewhere, inamyloid, non-gelatinous, thin-walled, clamped; diverticula 1.5-4 X 1-2 µm, rod-like or irregular in outline, obtuse, hyaline, thin-walled. **Tramal hyphae** 1.5-5.5 µm diam, interwoven, cylindric, weakly incrusted nearest the pileipellis, smooth elsewhere, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-4.5 µm diam, parallel, cylindric, non-

incrusted, densely diverticulate, hyaline, pale yellow or pale ochraceous, inamyloid, clamped, with walls up to 1.5 µm thick; diverticula 1-4 X 1-2 µm, similar to those on the pileipellis elements, projecting from exteriormost surface of outermost hyphae; **medullary hyphae** 2-6 µm diam, subparallel, non-diverticulate, hyaline, inamyloid, thin-walled, clamped. **Caulocystidia** absent.

**Commentary.** Gilliam (1976) included *M. piceina* as a synonym of *Marasmius thujinus* Pk., while Redhead (1980a) considered both *M. piceina* and *M. thujinus* as synonyms of *Marasmiellus filopes* (Pk.) Redhead. I concur with Redhead's diagnosis.

***MARASMIUS PINASTRIS*** Kauffman, Pap. Michigan Acad. Sci. 1: 144. 1921.

≡ *Collybia pinastris* (Kauff.) Mitchel & A. H. Smith, Mycologia 70(5): 1044. 1978.

HOLOTYPE: United States, Colorado, Gilpin Co., Tolland, 8 Sept. 1920, C. H. Kauffman (MICH).

The portion of the holotype examined consisted of four basidiomata in good condition. **Pileus** 6-16 mm diam, campanulate or expanded to plane with a shallow central depression or low umbo, even, glabrous or suede-like, brown. **Lamellae** subdecurrent, close or subdistant, narrow, non-collariate, non-marginate, cream-colored. **Stipe** 15-25 X 1 mm, terete or compressed, apex pruinose, base tomentose, brown, non-insititious.

**Basidiospores** 7.6-10.4 X 3.8-4.4 µm [$\bar{x}$ = 8.7 ± 0.8 X 4.1 ± 0.2 µm, E = 1.8-2.5, Q = 2.1 ± 0.2, n = 20], ellipsoid or lacrymoid, hyaline, inamyloid, smooth. **Basidia** 26-30 X 5.5-8 µm, 4-spored, clavate.

**Basidioles** clavate or rarely ventricose. **Pleurocystidia** absent. **Cheilocystidia** absent, lamellar edge fertile. **Pileipellis** not hymeniform, composed of a cutis of radially arranged hyphae; hyphae 3-8 µm diam, non-diverticulate or with scattered, broad rod-like diverticula, smooth or with thin, annular, brown pigment-incrustations, non-gelatinous, walls thin, subhyaline or pale brown, inamyloid, clamped. **Pileus trama** interwoven; **lamellar trama** interwoven; hyphae 3-10 µm diam, cylindric, smooth, hyaline, inamyloid, clamped, mostly thin-walled, rarely with walls up to 0.8 µm thick. **Stipe tissue** monomitic; **cortical hyphae** 2.5-5.5 µm diam, cylindric, smooth or weakly incrusted, subhyaline, yellowish brown or brown, inamyloid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** similar but hyaline and thinner-walled. **Stipe vesture** of numerous **caulocystidia,** up to 100+ X 5-10 µm, cylindric or flexuous, typically narrowed toward the apex, hyaline or pale yellow, inamyloid, thick-walled (1-2.5 µm), seldom secondarily septate.

**Commentary**. Pileipellis morphology, inamyloid tramal tissues, basidiomata stature and non-insititious stipe are features of *M. pinastris* indicating placement in *Collybia* sect. *Subfumosae*. Mitchel and Smith (1978) reported that basidiomata of *C. pinastris* formed thick-walled pileus tramal hyphae, and noted that this was an important character of the species. My observations on the holotype specimen indicated that the tramal hyphae were typically thin-walled and only rarely formed walls up to 0.8 µm thick. Halling (1983a) reported the pileus tramal hyphae as thin-walled. It should be noted that the

specimen described by Mitchel and Smith (1978) was not the holotype specimen, but an authentic specimen collected from Leal, Colorado.

The holotype specimens of *M. pinastris* and *M. contrarius* Pk. are micromorphologically indistinguishable, but the two taxa differ in odor and taste. *Marasmius pinastris* was described by Kauffman (1921) as having a strong, suballiaceous odor and disagreeable or subastringent taste. No such odor or taste were mentioned by Peck (1911) in his description of *M. contrarius*.

***MARASMIUS PITHYOPHILUS*** Berkeley & Curtis, Hooker J. Bot. 1: 100. 1849.

HOLOTYPE: United States, South Carolina, Society Hill, July 1847, Curtis no. 1327, *ad fol. Pinea dejecta* (K). [ISOTYPE: FH!]

The isotype specimen consists of five basidiomata in good condition attached to three pine needles and glued to a sheet. **Pileus** 4-6 mm diam, plano-convex, umbilicate, short-striate, suede-like, pale brown. **Lamellae** subdecurrent, close or subdistant, narrow, non-collariate, non-marginate, concolorous with the pileus. **Stipe** ≈ 10 X <1 mm, terete, equal, pubescent, pale brown, insititious.

**Basidiospores** 9.6-12.8 X 4-5 µm [$\bar{x}$ = 10.5 ± 0.8 X 4.5 ± 0.3 µm, E = 2-2.6, Q = 2.3 ± 0.2, n = 30], ellipsoid, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 17.5-24 X 5.5-8 µm, 4-spored, clavate. **Basidioles** clavate or ventricose. **Hymenial cystidia** absent. **Pileipellis** not hymeniform, composed of repent, interwoven hyphae; hyphae 2.5-4 µm diam, irregular in outline, diverticulate but not forming a true *Rameales*-structure, smooth or more commonly incrusted with granulose or plaque-like, pale brown pigment deposits, hyaline or

pale yellow elsewhere, non-gelatinous, clamped, with walls up to 1 µm thick; diverticula 1.5-4 X 1.5-3.5 µm, knob-like or rod-like, broadly obtuse, hyaline, thin-walled; terminal cells contorted or subcoralloid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-6 µm diam, cylindric, typically roughened, non-gelatinous, pale brown, inamyloid, clamped, thick-walled (0.5-1.2 µm). **Stipe tissue** monomitic; **cortical hyphae** 3-6.5 µm diam, parallel, cylindric, smooth or weakly incrusted, ochraceous, faintly olivaceous in 3% KOH, inamyloid, clamped, with walls up to 2 µm thick; **medullary hyphae** 2.5-7 µm diam, subparallel, hyaline or pale yellow, inamyloid, clamped, with walls up to 1.5 µm thick. **Stipe vesture** of numerous **caulocystidia** 12-60 X 5-6.5 µm, cylindric, obtuse, yellow or pale ochraceous, inamyloid, thick-walled (1-2 µm), some with lumen nearly occluded.

**Commentary.** *Marasmius pithyophilus* is similar in many respects to *Collybia contraria* (Pk.) Halling, and the two taxa might be confused in the field. *Collybia contraria* differs in forming basidiomata with convex pilei, tomentose and non-insititious stipe, shorter spores and thin-walled tramal hyphae. The insititious stipe of *M. pithyophilus*, in combination with weakly diverticulate pileipellis elements, inamyloid tramal tissues and spore size, are features indicating placement in *Marasmiellus* sect. *Dealbati* subsect. *Dealbatini*. It is transferred here as:

***Marasmiellus pithyophilus*** (Berk. & Curt.) Desjardin, ***comb. nov.*** [Bas.: *Marasmius pithyophilus* Berk. & Curt., *ibid.*].

*Marasmiellus pithyophilus* is similar to *M. subgraminis* (Murr.) Sing. and *M. stenophyllus* (Mont.) Sing. *Marasmiellus subgraminis*

differs in forming paler pilei, smaller spores, thin-walled caulocystidia and habit on grasses. *Marasmiellus stenophyllus* differs in forming less umbilicate pilei, adnate lamellae, smaller spores and thin-walled caulocystidia. In addition, both of the latter taxa form cheilocystidia.

***MARASMIUS PLICATULUS*** Peck, Bull. Torrey Bot. Club. 24: 142. 1897.

NEOTYPE: United States, California, Los Angeles Co., Placerita Canyon Park and Nature Center, 20 Feb. 1978, D. Reynolds (LAM no. 250131).

Nothing can be added to the redescription and illustrations presented earlier (Desjardin, 1987a). See there for details.

*Marasmius plicatulus* belongs in sect. *Sicci* ser. *Leonini*.

***MARASMIUS POLYCYSTIS*** Singer, Fl. Neotrop. Monogr. 17: 254. 1976.

HOLOTYPE: Bolivia, Prov. Nor-Yungas, La Paz, Carmen Pampa, 26 Feb. 1956, Singer B1499, on wood in upper zone Yungas forest, 2000 m (F).

The collection consists of two basidiomata attached to bark of undetermined dicot, plus two fragmented basidiomata loose in the packet. **Pileus** 2-3.5 µm diam, plane-undulate, even (not striate), granulose, reddish brown. **Lamellae** adnate, subdistant or distant, moderately broad, not intervenose, non-collariate, non-marginate, concolorous with the pileus. **Stipe** 1-2 X <0.5 mm, strongly eccentric but not lateral, terete, equal, pubescent, concolorous with the pileus, non-insititious, arising from a small, buff-colored pad of mycelium.

**Basidiospores** 8.5-10.1 X 4-5 µm [$\bar{x}$ = 9.3 ± 0.6 X 4.4 ± 0.4 µm, E = 2-2.3, Q = 2.2 ± 0.1, n = 6], ellipsoid or ventricose, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** not observed. **Basidioles** clavate or ventricose. **Pleurocystidia** abundant, 27-42 X 9-19 µm [$\bar{W}$ = 13.6 ± 2.1 µm, n = 45], broadly clavate, ventricose or irregularly saccate, broadly obtuse, refractive, arising from deep in subhymenium and projecting up to 16 µm beyond basidioles, hyaline, inamyloid, thin-walled or some elements with walls 0.5-2 µm thick. **Cheilocystidia** numerous, similar to *Siccus*-type pileipellis elements; main body 12-22.5 X 6-12 µm, cylindric, clavate or subvesiculose, rarely sphaeropedunculate, hyaline, thin-walled; apical setulae 0.5-3.5 X 0.5-1.5 µm, rod-like or irregular in outline, some branched, many verrucose, thick-walled, pale yellow or pale orange. **Pileipellis** hymeniform, not mottled, of *Siccus*-type broom cells; main body 9-14 X 4.5-13.5 µm, clavate or vesiculose, sometimes lobed, hyaline or pale yellow, inamyloid, thin-walled; setulae 0.5-3.5 X 0.5-1.5 µm, typically cluster in a dense group on the cells apex, rod-like or irregular in outline, often verrucose, solid, subhyaline, yellow or brownish orange. **Tramal hyphae** 3-7.5(-10) µm diam, interwoven, cylindric, smooth, non-gelatinous, hyaline, inamyloid or very weakly dextrinoid, thin-walled, clamps present but not at every septum. **Stipe tissue** not observed; material too scanty.

**Commentary.** Singer placed *M. polycystis* in sect. *Neosessiles* based on a short, eccentric stipe and pileipellis composed of broom cells. My observations on the holotype specimen of *M. polycystis* and an allied species *M. falcatipes* Desjardin, indicate that these species

are better placed in sect. *Sicci* ser. *Haematocephali*. Refer to Desjardin and Petersen (1989b) for a discussion of the reasons supporting this judgement.

***MARASMIUS POLYPHYLLA*** Peck, Annual Rep. New York State Mus. 51: 286. 1898.

≡ *Collybia polyphylla* (Pk.) Singer, *nom. inval., sine basionym*, Agaricales Mod. Taxon. 315. 1962.

≡ *Collybia polyphylla* (Pk.) Sing. *ex* Halling, Mycol. Mem. 8: 85. 1983.

HOLOTYPE: United States, New York, Essex Co., Minerva, July, C. H. Peck (NYS).

The collection consists of 11 slips of paper with 14 basidiomata glued on, plus 8 loose basidiomata, all in good condition. **Pileus** 15-30 mm diam, plano-convex, with or without a low umbo, even, suede-like, disc dark brown, margin ochraceous. **Lamellae** adnexed, close or crowded, narrow, non-collariate, non-marginate, dark cream-colored. **Stipe** 35-45 X 2-3 mm, terete, enlarged near the base, pubescent and greyish at apex, velutinous and buff or cream-colored at base, non-insititious.

**Basidiospores** 5-6.8 X 2.4-3.2 µm [$\bar{x}$ = 6 ± 0.5 X 2.9 ± 0.2 µm, E = 1.8-2.3, Q = 2.1 ± 0.2, n = 20], ellipsoid or lacrymoid, hyaline, inamyloid, smooth. **Basidia** 17.5-20 X 4-5.5 µm, 4-spored, clavate. **Basidioles** cylindric or subclavate. **Pleurocystidia** absent. **Cheilocystidia** numerous, 12-22.5 X 3-5 µm, cylindric, flexuous or more commonly irregular in outline, lobed or with scattered diverticula,

hyaline, thin-walled. **Pileipellis** not hymeniform, composed of a cutis of radially arranged hyphae; hyphae 2.5-6.5 µm diam, non-diverticulate or with scattered broad, rod-like, obtuse diverticula, smooth or weakly incrusted with granulose, brown pigment deposits, otherwise hyaline, pale yellow or pale ochraceous, inamyloid, thin-walled. **Pileus** and **lamellar trama** interwoven; hyphae 3-15 µm diam, cylindric or weakly inflated, smooth or weakly incrusted, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 4-10 µm diam, parallel or subparallel, cylindric, smooth, hyaline or pale yellow, inamyloid, clamped, with walls up to 1 µm thick. **Stipe vesture** a layer of loosely interwoven hyphae 2.5-5 µm diam, giving rise terminally to irregularly cylindric or flexuous, obtuse **caulocystidia**, these hyaline, inamyloid, thin-walled.

**Commentary.** Pileipellis morphology, inamyloid tramal tissues, basidiomata stature and non-insititious stipe of *M. polyphyllus* indicate that placement of the species in *Collybia* sect. *Subfumosae* as transferred by Halling (1983a).

***MARASMIUS PORPHYRETICUS*** Petch, Trans. Brit. Mycol. Soc. 31: 43. 1947.

HOLOTYPE: Sri Lanka, Hakgala, Sept. 1914, Petch no. 4126 (K!). [ISOTYPE: FH!]

Nothing can be added to the description and illustrations presented earlier (Desjardin & Petersen, 1989c).

*Marasmius porphyreticus* belongs in sect. *Rhizomorphigena*.

***MARASMIUS PRAEACUTUS*** Ellis, Bull. Torrey Bot. Club 6: 76. 1876.

≡ *Collybia praeacuta* (Ellis) Gilliam, Mycotaxon 4(1): 134. 1976.

≡ *Marasmiellus praeacutus* (Ellis) Halling, Syst. Bot. 12(3): 401. 1987.

LECTOTYPE [*des mihi*]: United States, New Jersey, Gloucester Co., Newfield, July & August, Ellis & Everhart, N. Amer. Fungi Exs. no. 402 (NY - Ellis Collection). [As holotype, Halling (1987)].

[ISOLECTOTYPES: BPI!, FH!, NY!, PENN! at PH, PH!]

The lectotype collection consists of six basidiomata in good condition. **Pileus** 3-5 mm diam, convex-depressed, even or short-striate, suede-like, dingy greyish buff. **Lamellae** subdecurrent, distant, moderately broad, non-collariate, non-marginate, pallid. **Stipe** ≈ 10 X 0.5-1 mm, terete, fusoid, tapering to a very narrow base at point of attachment to the substrate, silky, brownish above, attenuated base white, subinsititious, lignicolous.

**Basidiospores** 6.4-9 X 2.8-4 µm [$\bar{x}$ = 7.7 ± 0.7 X 3.4 ± 0.3 µm, E = 2-2.6, Q = 2.3 ± 0.2, n = 20], ellipsoid or subclavate in face viex, elongate-lacrymoid in profile, hyaline, inamyloid, smooth. **Basidia** 17.5-24 X 5-6.5 µm, 4-spored, subclavate. **Basidioles** cylindric, subclavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** absent; lamellar edge sterile, of basidiomorphous elements indistinguishable in shape and size from basidioles. **Pileipellis** not hymeniform, composed of a poorly-developed *Rameales*-structure; hyphae 3-6.5 µm diam, interwoven, non-diverticulate or more commonly sparcely diverticulate, hyaline, inamyloid, thin-walled; diverticula 2-4.5 X 1.5-4 µm, parabolic, knob-like or cylindric, broadly obtuse, hyaline, thin-

walled. **Tramal hyphae** 3-6.5 µm, interwoven, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled. **Stipe tissue** monomitic; **cortical hyphae** 3-7.5 µm diam, subparallel, cylindric, smooth or with tawny pigment incrustations; walls up to 1 µm thick, hyaline (at stipe apex) or brown (stipe median), inamyloid, clamped; **medullary hyphae** up to 10.5 µm diam, hyaline, inamyloid, thin-walled, clamped. **Stipe vesture** of scattered or clustered **caulocystidia** 12-45 X 4-6.5 µm, cylindric, acuminate or ventricose, obtuse, typically hyaline and thin-walled, few pale yellow and with walls up to 1 µm thick.

**Commentary.** Type material was distributed by Ellis and Everhart in their North American Fungi Exsiccati, as number 402. No specimens were cited in the protologue, and consequently all of the exsiccati duplicates represent potential lectotype material. The duplicate retained by Ellis in the Ellis Herbarium at NY is designated here as lectotype. I concur with Halling's (1987) diagnosis that *M. praeacutus* belongs in *Marasmiellus* sect. *Tetrachroi*. Refer to Halling (1983a, 1987) for contemporary descriptions of *M. praeacutus*.

***MARASMIUS PRUINATUS*** Berkeley & Curtis, Ann. Mag. Nat. Hist. 3, 4: 295. 1859. [*non Marasmius pruinatus* Rea, Trans. Brit. Mycol. Soc. 5: 435. 1916.]

HOLOTYPE: United States, New England, C. J. Sprague, Curtis no. 5064 (K).

The collection consists of five basidiomata pressed flat and glued to a sheet, in poor condition, infected with Deuteromycetous fungi. **Pileus** 2-4 mm diam, obtusely conic, convex or campanulate, striate,

brown. **Lamellae** adnexed, non-collariate, subdistant or distant, narrow, non-marginate. **Stipe** 20-33 X <0.5 mm, terete, equal, glabrous, shiny, brown, non-insititious; attached to fragments of undetermined debris.

**Basidiospores** 11.2-14.4 X 3.2-4 µm [$\bar{x}$ = 12.6 ± 0.9 X 3.7 ± 0.3 µm, E = 3.1-3.8, Q = 3.4 ± 0.2, n = 15], clavate, sometimes curved in profile, hyaline, inamyloid, smooth. **Basidia** not observed. **Basidioles** 21.5-24 X 6-8 µm, clavate or subfusoid. **Pleurocystidia** absent. **Cheilocystidia** not examined; lamellar edge in poor condition, material too scanty. **Pileipellis** hymeniform, weakly mottled, of *Siccus*-type broom cells; main body 8-14 X 4-9 µm, cylindric, clavate or irregular in outline, sometimes lobed, many hyaline and thin-walled, many others golden and with walls up to 2 µm thick; apical setulae 1-3.2 X 0.5-1.2 µm, irregular in outline, verrucose, numerous and crowded on thin-walled elements, few and more widely spaced on thick-walled elements, typically solid, golden or brownish orange. **Tramal hyphae** 3-7.5 µm diam, interwoven, cylindric, non-gelatinous, smooth, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-6 µm diam, parallel, cylindric, smooth, brownish orange or brown, dextrinoid, with walls up to 1.5 µm thick, clamped; **medullary hyphae** 3-6.5 µm diam, parallel, hyaline, weakly dextrinoid or inamyloid, thin-walled, clamped. **Stipe vesture** absent.

**Commentary.** Dennis (1951a) noted the following features of the holotype specimen: "ten gills, not attached to a collar, brown cystidia with short processes ... its spores have not been identified." He accepted it as a distinct species and cited additional collections

from Trinidad. Singer (1958a) reported that on the holotype specimen "the collarium is definitely present although not fully formed and easy to overlook." In addition, Singer (1958a) indicated that the stipe was insititious, and that he was also unable to recover spores. Singer placed *M. pruinatus* in synonymy with *M. graminum* (Lib.) Berk. & Broome. My observations on the holotype specimen are concordant with those reported by Dennis (1951a), and somewhat contrary to those reported by Singer (1958). A collarium or any structure approximating a collarium was not observed. The stipe base of one basidiome arose from a small, buff-colored ring of strigose mycelium, and must be considered non-insititious. I was able to recover 15 spores (measurements recorded above). These data indicate that *M. pruinatus* is distinct from *M. graminum*, and should be placed in sect. *Sicci* ser. *Leonini*. *Marasmius pruinatus* is allied with *M. similis* Berk. & Curt.

Putative isotype material deposited in the Farlow Herbarium (FH!) labeled "Curtis no. 5064, Society Hill, South Carolina," is conspecific with the holotype. Although the FH specimen was numbered the same as the holotype specimen, it was collected at a different locality and cannot be conferred type status. The FH specimen should be considered only as authentic conspecific material. Curtis often gave a specific number to a "taxon" and used this number for various specimens collected at different locations (see Desjardin & Petersen, 1989c).

***MARASMIUS PRUINOSIPES*** Murrill, Lloydia 8(4): 274. 1945 (1946).

HOLOTYPE: United States, Florida, Alachua Co., Gainesville, 17

July 1938, W. A. Murrill no. F8346, small dead root on an exposed bank (FLAS).

The collection consists of one basidiome in fair condition. **Pileus** 3 mm diam, convex-depressed, even, suede-like, pale cream-colored. **Lamellae** adnateto subdecurrent, distant, broad, non-collariate, non-marginate, pallid. **Stipe** 18 X <0.5 mm, terete, pruinose, insititious, cream-colored.

**Basidiospores** 10-12 X 4.5-5.4 µm (4 measured), ellipsoid or lacrymoid in profile, hyaline, inamyloid, smooth. **Basidia** not observed. **Basidioles** 24-32 X 6-8 µm, clavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** numerous, 20-32 X 4-8 µm, irregular in outline, often lobed, densely diverticulate over apical portion or with apex bulbous and non-diverticulate; diverticula similar to those on pileipellis elements. **Pileipellis** not hymeniform, composed of a well-developed *Rameales*-structure; hyphae 3-4.5 µm diam, interwoven, densely diverticulate, hyaline, inamyloid, thin-walled; terminal cells 20-32 X 3.2-6 µm, repent or suberect, irregular in outline, often lobed, densely diverticulate or often with bulbous, smooth apices; diverticula 1.5-4.5 X 0.5-1.5 µm, knob-like, rod-like, strangulate or contorted, sometimes verrucose, hyaline, thin-walled. **Pileus** and **lamellar tramas** interwoven; hyphae 2.5-6.5 µm diam, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 3-6.5 µm diam, parallel or subparallel, cylindric, smooth, ranging from ochraceous to hyaline, inamyloid, with walls up to 0.8 µm

thick, clamped. **Stipe vesture** a well-deveolped *Rameales*-structure, similar in arrangement and cell-type to the pileipellis.

**Commentary.** A distinct *Rameales*-type pileipellis with apically bulbous terminal cells, spore size and stipitipellis morphology are features that indicate *M. pruinosipes* is a synonym of *Marasmiellus tricolor* (Alb. & Schwein.: Fr.) Singer. An earlier type study of *M. pruinosipes* was provided by Hesler (1959b).

***MARASMIUS PSEUDIMPUDICUS*** Murrill, Lloydia 9(4): 320. 1946.

HOLOTYPE: United States, Florida, Alachua Co., Gainesville, 8 Aug. 1944, W. A. Murrill no. F38951, open lawn (FLAS).

The collection consists of approximately 20 basidiomata in good condition. **Pileus** 6-17 mm diam, convex, even, glabrous, dark brown. **Lamellae** adnate, close, moderately broad, non-collariate, non-marginate, pale brown. **Stipe** 20-30 X 1-1.5 mm, terete or compressed, equal, pubescent overall, ranging from cream-colored to greyish, non-insititious, basal mycelium buff or cream-colored.

**Basidiospores** 6-8 X 3.2-4 µm [$\bar{x}$ = 6.9 ± 0.6 X 3.4 ± 0.2 µm, E = 1.9-2.4, Q = 2 ± 0.1, n = 20], ellipsoid, lacrymoid or amygdaliform in profile, hyaline, inamyloid, smooth. **Basidia** 17.5-22.5 X 5-6.5 µm, 4-spored, clavate. **Basidioles** clavate or fusoid. **Hymenial cystidia** absent. **Pileipellis** not hymeniform, composed of a cutis of radially arranged hyphae; hyphae 3.5-7.5 µm diam, cylindric, non-gelatinous, thin-walled, clamped, non-diverticulate or with scattered, rare, knob-like or rod-like diverticula; walls subhyaline or brown, typically covered with brown, granular or annular pigment incrustations,

inamyloid; terminal cells repent, often slightly swollen, non-diverticulate. **Pileus** and **lamellar trama** interwoven; hyphae 3.5-7.5 µm diam, cylindric, non-diverticulate, non-gelatinous, smooth or weakly incrusted nearest the pileipellis, hyaline or pale brownish yellow, inamyloid, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-7 µm diam, subparallel, cylindric, weakly incrusted, pale brown, inamyloid, clamped, with walls up to 1 µm thick; **medullary hyphae** similar but smooth, hyaline and thinner-walled. **Stipe vesture** a layer of loosely interwoven hyphae 4-6.5 µm diam, smooth or weakly incrusted, giving rise to repent, suberect or erect **caulocystidia**, 16-40+ X 4-6 µm, flexuous, subclavate or irregularly cylindric, obtuse, smooth, subhyaline or pale yellow, inamyloid, thin-walled.

**Commentary**. *Marasmius pseudimpudicus* belongs in *Collybia* sect. *Subfumosae*. The species is similar to *C. impudica* (Fr.) Sing. and *C. putilla* (Fr.) Sing. *Collybia impudica* differs in substrate and presence of a strong alliaceous odor, while *C. putilla* differs in substrate and in forming smaller spores. An earlier type study of *M. pseudimpudicus* was presented by Hesler (1957).

***MARASMIUS PULCHERRIPES*** Peck, Annual Rep. New York State Mus. 24: 77. 1871 (1872).

HOLOTYPE: United States, New York, Garrisons, June, C. H. Peck (NYS).

The type packet contains two internal packets. One is labeled "Garrison specimens. Types," and is considered here to represent the holotype specimen. The second internal packet is labeled "W. Shokan

specimens, not types, Aug." and is considered here to represent authentic material. The holotype specimen consists of 10 basidiomata in good condition glued to 4 slips of paper. **Pileus** 3-4 mm diam, campanulate or bullet-shaped, striate, ferruginous. **Lamellae** subdistant, narrow, non-collariate, non-marginate, pallid. **Stipe** 30-40 X <1 mm, terete, equal, glabrous, shiny, apex reddish, base greyish brown, non-insititious.

**Basidiospores** 12-16 X 3.6-4.4 µm [$\bar{x}$ = 14.4 ± 1.0 X 3.9 ± 0.2 µm, E = 3.1-4.2, Q = 3.6 ± 0.3, n = 30], clavate, slightly inequilateral or curved in profile, hyaline, inamyloid, smooth. **Basidia** 25-30 X 5.5-7.5 µm, 4-spored, clavate. **Basidioles** cylindric or subfusoid. **Pleurocystidia** 32-44 X 5-8 µm, fusoid or flexuous, often apically once-constricted, some appendiculate, arising from about the same level as basidioles but projecting up to 14 µm beyond, non-refractive, hyaline, thin-walled. **Cheilocystidia** numerous, similar to *Siccus*-type pileipellis elements; main body thin-walled; apical setulae hyaline, pale yellow or pale orange, thick-walled or solid. **Pileipellis** hymeniform, mottled, of *Siccus*-type broom cells; main body 10-18 X 5-8 µm, cylindric, clavate or subvesiculose, sometimes lobed, majority of elements hyaline and thin-walled, with pale setulae, some elements with orange or ochraceous walls up to 1.5 µm thick and darker setulae; apical setulae 1.5-5 X 0.5-2 µm, cylindric, conic or slightly irregular in outline, obtuse or subacute, thick-walled or solid, ranging from subhyaline or pale yellow to orange or dark ochraceous. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-5.5 µm diam, cylindric, smooth, non-gelatinous, hyaline, weakly dextrinoid, thin-

walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 1.5-4 µm diam, parallel, cylindric, smooth, hyaline and thin-walled at apex, brown or olivaceous brown and thick-walled (up to 1.5 µm) at base, dextrinoid; **medullary hyphae** 3-7.5 µm diam, subparallel, hyaline or pale yellow, inamyloid or weakly dextrinoid, thin-walled, clamped. **Stipe vesture** absent, or with scattered *Siccus*-type broom cells on stipe apex, similar to those of the pileipellis.

**Commentary.** Gilliam (1976) was unable to locate the holotype specimen and consequently designated an authentic specimen as lectotype [*viz.*, W. Shokan, 9 Aug. (NYS!)]. I was able to locate the holotype (as reported above) in the Peck Herbarium (NYS) and the lectotype designation is therefore superfluous.

There is no entry annotated as *Marasmius pulcherripes* in Peck's notebooks (archived at NYS) prior to the date of publication of the epithet. There is, however, an entry in Peck's notebook for 1870 listed as "#14. *Marasmius bryophilus* n. sp." with a description matching nearly word for word that of the protologue of *M. pulcherripes*, including the location cited as "Garrisons, June." In addition, there is a watercolor illustration labeled "#14. *Marasmius pulcherripes*, Garrisons, June." It appears that Peck had originally intended to name the species *bryophilus*, but later changed the epithet to *pulcherripes* for publication.

*Marasmius pulcherripes* belongs in sect. *Sicci* ser. *Haematocephali*. An earlier type study was presented by Hesler (1959b).

***MARASMIUS PUNICEUS*** Thiers, Mycologia 50: 514. 1958.

HOLOTYPE: United States, Texas, Brazos Co., near Millican, 16 May 1943, H. D. Thiers no. 4846, on dung in oak hardwoods (MICH).

The portion of the holotype specimen examined consisted of several basidiomata in good condition attached to dung fragments. **Pileus** 1-3 mm diam, campanulate or subconic, sulcate, subvelutinous, reddish or burgandy-colored. **Lamellae** adnexed, non-collariate, distant, narrow, non-marginate, pallid. **Stipe** ≈ 20 X <0.2 mm, terete, equal, glabrous, shiny, brown, non-insititious, coprophilus.

**Basidiospores** (13.6-)14.8-19.6 X 3.2-4.4 µm [$\bar{x}$ = 16.6 ± 1.3 X 3.8 ± 0.3 µm, E = 3.7-5, Q = 4.4 ± 0.3, n = 25], clavate, often curved in profile, hyaline, inamyloid, smooth. **Basidia** 20-24 X 6.5-9 µm, clavate, 4-spored. **Basidioles** clavate or ventricose. **Pleurocystidia** numerous, 32-45 X 8-11.5 µm, clavate or ventricose, rarely apically constricted, arising from deep in subhymenium and projecting well beyond basidioles, refractive, hyaline, thin-walled. **Cheilocystidia** numerous, similar to *Siccus*-type pileipellis elements; main body 12-17.5 X 5-7.5 µm, cylindric or clavate, hyaline, thin-walled; apical setulae 1.5-4 X 0.5-1.5 µm, densely crowded, irregularly cylindric, strangulate or contorted, often verrucose, obtuse or subacute, hyaline or pale yellow, thin-walled. **Pileipellis** hymeniform, not mottled, of *Siccus*-type broom cells; main body 6.5-15 X 5-10 µm, clavate or subvesiculose, seldom lobed, typically hyaline and thin-walled, few pale red and firm-walled; apical setulae 2-5 X 1-2 µm, crowded, conic, irregularly cylindric or strangulate, sometimes verrucose, obtuse or subacute, red, thick-walled or solid; red pigment soluble in 3% KOH

and elements becoming greyish yellow or pale olivaceous; pigmented areas dextrinoid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-4 µm diam, cylindric, smooth, non-gelatinous, hyaline, dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-5 µm diam, parallel, cylindric, smooth, hyaline (at stipe apex) or brown (stipe base), dextrinoid, with walls up to 1 µm thick; **medullary hyphae** 3-6.5 µm diam, similar but hyaline and thinner-walled; scattered oleiferous hyphae present. **Stipe vesture** absent.

**Commentary.** *Marasmius puniceus* belongs in sect. *Sicci* ser. *Haematocephali*, and is allied with *M. haematocephalus* (Mont.) Fr. and *M. pseudobambusinus* Desjardin. *Marasmius haematocephalus* differs in forming larger pilei with purple tones, broader lamellae, and in habit on debris of various dicotyledonous plants (never on old cow dung). *Marasmius pseudobambusinus* differs in forming smooth, reddish orange or brownish orange pilei, orange-marginate lamellae, appendiculate pleurocystidia, and habit on decayed grasses.

***MARASMIUS PUSIO*** Berkeley & Curtis, Ann. Mag. Nat. Hist. 2, 12: 426. 1853.

HOLOTYPE: United States, South Carolina, Santee Canal, Aug. 1848, H. W. Ravenel no. 816, Curtis no. 2043, *Aest. ad corticum arborum* (K!). [ISOTYPE: FH!]

The holotype specimen consists of 7 basidiomata pressed flat and glued to two slips of paper, all in fair condition. **Pileus** 2-3 mm diam, convex, weakly striate, glabrous, brownish orange or brown. **Lamellae** adnexed, non-collariate, close, narrow or moderately broad,

non-marginate, pallid. **Stipe** 5-8 X <0.2 mm, terete, equal, pruinose, dingy buff-colored, non-insititious.

**Basidiospores** 8-10 X 3.4-4 µm [$\bar{x}$ = 9 ± 0.7 X 3.7 ± 0.2 µm, E = 2.1-2.7, Q = 2.4 ± 0.2, n = 13], ellipsoid in face view, inequilateral and sometimes with an adaxial bulge in profile, hyaline, inamyloid, smooth. **Basidia** not observed. **Basidioles** 14-19 X 5.5-6.5 µm, clavate or broadly ventricose. **Pleurocystidia** absent. **Cheilocystidia** common, similar to *Siccus*-type pileipellis elements, but apical setulae all hyaline. **Pileipellis** hymeniform, not mottled, of *Siccus*-type broom cells; main body 10-20 X 4-10 µm, cylindric, clavate or pyriform, sometimes lobed, typically hyaline and thin-walled, seldom pale tawny and firm-walled; apical setulae 1.5-3.5 X 0.5-1.5 µm, crowded, rod-like or irregular in outline, obtuse or subacute, ranging from subhyaline to ferruginous, thin-walled or thick-walled; pigmented areas weakly dextrinoid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2-7.5 µm diam, cylindric or weakly inflated, smooth, non-gelatinous, hyaline, inamyloid or weakly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-6 µm diam, parallel, cylindric, smooth, pale ochraceous, strongly dextrinoid, with walls up to 2 µm thick; **medullary hyphae** similar but hyaline and thinner-walled. **Stipe vesture** of two types of **caulocystidia**: 1) numerous *Siccus*-type elements similar to those of the pileipellis, arising as terminal cells or as lateral outgrowths, with hyaline setulae; 2) rare setoid "hairs" or dendrotrichomoid elements with 2-5,

thick-walled, lanceolate "arms" 16-70 X 1.5-4 μm, the latter more common at the stipe base.

**Commentary.** *Marasmius pusio* belongs in sect. *Sicci* ser. *Leonini*.

***MARASMIUS PYRINUS*** Ellis, Bull. Torrey Bot. Club 8: 64. 1881.

LECTOTYPE: United States, New Jersey, Newfield, 4 June 1880, Ellis North American Fungi Exs. no. 401, on fallen leaves of *Pyrus communis* (NY - Ellis Collection).

The lectotype specimen consists of approximately 10 basidiomata in fair condition attached to leaves of *Pyrus*. **Pileus** 1-2 mm diam, convex, umbilicate, sulcate, granulose, brown. **Lamellae** adnate, non-collariate, distant, narrow, brown. **Stipe** filiform, glabrous, shiny, reddish brown, insititious; with very thin, reddish brown rhizomorphs appressed to leaf surface.

**Basidiospores** (6.4-)7.8-10 X 3-3.8 μm [$\bar{x}$ = 9 ± 0.7 X 3.3 ± 0.2 μm, E = 2.4-3.1, Q = 2.7 ± 0.2, n = 20], elongate-ellipsoid, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 20-24 X 6-10 μm, clavate, 4-spored. **Basidioles** clavate or ventricose. **Hymenial cystidia** scattered on lamellar faces and edges, more common on lamellar edges, 20-26 X 5-6.5 μm, lageniform, often subcapitate, arising from about the same level as basidioles and projecting very little or not at all, non-refractive, hyaline, inamyloid, thin-walled. **Pileipellis** hymeniform, of *Rotalis*-type broom cells, pilocystidia and elements intermediate in morphology; main body of broom cells 11-20 X 5-12 μm, clavate, pyriform, turbinate or subvesiculose, ranging from hyaline and thin-walled to brown and thick-walled; divergent setulae 0.5-1.5 X

0.5-1 µm, knob-like or rod-like, obtuse, densely crowded, solid, dark ochraceous or brown; **pilocystidia** uncommon, 17.5-24 X 4.5-7.5 µm, lageniform, similar to hymenial cystidia; intermediate elements lageniform with smooth apices and bases and densely setulose central portions. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 1.5-5 µm diam, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-5 µm diam, parallel, cylindric, smooth, dark reddish brown, inamyloid, with walls up to 1.2 µm thick, clamped; **medullary hyphae** 2.5-6.5 µm diam, subparallel, hyaline, inamyloid, thin-walled, clamped. **Stipe vesture** composed of a thin layer of parallel hyphae 2.5-4 µm diam, with the exteriormost surface densely diverticulate; walls hyaline or pale yellow, inamyloid, thin; diverticula 1-3.5 X 0.5-0.8 µm, rod-like, obtuse, hyaline or pale yellow, thick-walled.

**Commentary**. Type material of *Marasmius pyrinus* was distributed as no. 401 in Ellis' North American Fungi Exsiccati, issued January 1881. Gilliam (1976) noted that a duplicate retained by Ellis in his private herbarium (NY) could be considered the holotype. Ellis' original handwritten notes on the specimen from which duplicates were made and distributed are deposited at BPI along with a portion of the material. One could easily argue that the latter specimen represents the holotype. However, because a single specimen was not cited by Ellis in the protologue (a series of duplicates was reported), one duplicate must be designated the lectotype (Art. 7.5, ICBN). The duplicate retained in the Ellis Herbarium at NY contains ample material in fair

condition and is considered here to represent the lectotype specimen. *Marasmius pyrinus* is a synonym of *M. minutus* Peck.

***MARASMIUS PYRRHOCEPHALUS*** Berkeley, London J. Bot. 6: 316. 1847.

HOLOTYPE: United States, Ohio, Wayne Co., Waynesville, 23 Aug. 1844, Thos. G. Lea (K).

The collection consists of four basidiomata in fair condition pressed flat and attached to one slip of paper. **Pileus** 6-8 mm diam, plano-convex, even or short-striate, glabrous, brown. **Lamellae** adnate, non-collariate, close, moderately broad, non-marginate, pale brown. **Stipe** 35-60 X <1 mm, terete, pubescent and greyish ochraceous at apex, tomentose and brownish grey at base, non-insititious.

**Basidiospores** 7.2-9.2 X 3.4-4 µm [$\bar{x}$ = 8.2 ± 0.5 X 3.7 ± 0.2 µm, E = 2.1-2.6, Q = 2.2 ± 0.1, n = 20], ellipsoid, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 24-29 X 6-7.5 µm, clavate, 4-spored. **Basidioles** subclavate. **Hymenial cystidia** common on lamellar faces and edges, 32-40 X 6.5-10 µm, capitulate or lageniform-capitate, arising from about the same level as basidioles but projecting well beyond, non-refractive, hyaline, inamyloid, thin-walled. **Pileipellis** hymeniform, not mottled, of *Globularis*-type elements, 24-32 X 8.5-20.5 µm, subcylindric, clavate, turbinate or sphaeropedunculate, broadly obtuse, non-gelatinous, thick-walled (0.5-1.5 µm), subhyaline, pale yellow or ochraceous, inamyloid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3.5-6 µm diam, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3.5-6 µm diam, parallel, cylindric, smooth,

yellow or ochraceous, inamyloid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** 2.5-8 µm diam, similar but hyaline and thin-walled. **Stipe vesture** of numerous suberect or erect **caulocystidia** 40-150+ X 6.5-10 µm, cylindric or subacuminate, rarely lobed, hyaline or pale yellow, inamyloid, with walls 1-4 µm thick..

**Commentary.** A hymeniform pileipellis composed of clavate to sphaeropedunculate cells, inamyloid tramal tissues and non-insititious stipe indicate placement of *M. pyrrhocephalus* in sect. *Alliacei*.

***MARASMIUS QUERCOPHILUS*** Pouzar, Ceská Mykol. 36: 1. 1982.

≡ *Setulipes quercophilus* (Pouzar) Antonin, Ceská Mykol. 41: 86. 1987.

HOLOTYPE: Czechoslovakia, Bohemia, "Roztocky háj" ap. Roztocky prope Praha, 25 Aug. 1981, Z. Pouzar (PRM no. 825281).

Nothing can be added to the redescription and illustrations presented earlier (Desjardin, 1987a). See there for details. Refer also to Pouzar (1982) for a discussion of allied taxa.

*Marasmius quercophilus* belongs in sect. *Androsacei*.

***MARASMIUS QUERCUUM*** Murrill, Lloydia 9: 321. 1946.

HOLOTYPE: United States, Florida, Alachua Co., Gainesville, 23 July 1944, W. A. Murrill no. F38924, trash under a laurel oak (FLAS).

The collection consists of three fragmented basidiomata in fair condition. **Pileus** ≈ 10 mm diam, plano-convex with a shallow central depression, appressed radially fibrillose, brownish-streaked. **Lamellae** adnate, non-collariate, close or crowded, narrow, pale brownish orange.

**Stipe** ≈ 35 X 1 mm, terete, equal, with buff or cream-colored pubescence overlaying pale greyish brown hyphae, non-insititious.

**Basidiospores** 6.6-8.4 X 3.4-4 µm (5 measured), ellipsoid or lacrymoid, hyaline, inamyloid, smooth. **Basidia** 16.5-22.5 X 4.5-6 µm, clavate, 4-spored. **Basidioles** cylindric or fusoid. **Pleurocystidia** absent. **Cheilocystidia** numerous, 21-36 X 5-10 µm, irregular in outline, often contorted or strangulate, often lobed, broadly obtuse, non-refractive, hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, composed of a cutis of radially arranged, repent hyphae; hyphae 3-8 µm diam, heavily incrusted with brown, annular or helical pigment deposits, non-diverticulate or sparcely diverticulate, diverticula knob-like or rod-like; walls thin, subhyaline or pale brown, inamyloid, non-gelatinous. **Tramal hyphae** 2.5-8 µm diam, interwoven, cylindric, smooth or weakly incrusted, non-gelatinous, hyaline or pale brown, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-10 µm diam, subparallel, cylindric, smooth, subhyaline, yellow or pale ochraceous, inamyloid, clamped, with walls up to 2 µm thick; **medullary hyphae** up to 13.5 µm diam, similar but hyaline and thinner-walled. **Stipe vesture** a thin layer of loosely interwoven hyphae 3-6 µm diam, cylindric, smooth, non-diverticulate, hyaline, inamyloid, giving rise to suberect or erect **caulocystidia**, 22-40+ X 4.5-7 µm, similar to the cheilocystidia, *i.e.*, irregular in outline, contorted or strangulate, often lobed, obtuse, thin-walled.

**Commentary.** A non-hymeniform pileipellis of radially arranged, sparcely diverticulate hyphae, inamyloid tramal tissues and non-insititious stipe are features indicating placement of *Marasmius*

*quercuum* in *Collybia* sect. *Subfumosae*, where it is similar to, if not conspecific with, *C. jamaicensis* (Murr.) Murrill. An earlier type study of *M. quercuum* was presented by Hesler (1959b).

***MARASMIUS RAMULINUS*** Peck, Annual Rep. New Tork State Mus. 51: 286. 1897 (1899).

HOLOTYPE: United States, New York, Albany Co., Delmar, Aug., C. H. Peck (NYS).

The collection consists of fragments of several basidiomata glued to five slips of paper, only five fragmented pilei in poor condition present. **Pileus** 4-7 mm diam, plano-convex, surface features not observable, *i.e.*, glued to paper. **Lamellae** adnate, non-collariate, close, narrow, non-marginate, cream-ochraceous. **Stipe** 10-15 X <0.5 mm, terete, pruinose, pale brown, insititious on undetermined twigs.

**Basidiospores** 7.2-10.4 X 3.8-4.8 µm [$\bar{x}$ = 8.7 ± 0.9 X 4.2 ± 0.3 µm, E = 1.9-2.3, Q = 2.1 ± 0.1, n = 25], ellipsoid or sublacrymoid, hyaline, inamyloid, smooth. **Basidia** 16-20.5 X 5-8 µm, clavate, 4-spored. **Basidioles** subclavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** common, irregularly lobed or diverticulate; main body 17-24 X 5-8 µm, irregular in outline; diverticula 2-8 X 1.5-5 µm, rod-like, strangulate or somewhat contorted, obtuse; hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, composed of a poorly-developed *Rameales*-structure; hyphae 3.5-7.5 µm diam, interwoven, diverticulate, non-gelatinous, hyaline, inamyloid, thin-walled; diverticula 2-5.5 X 1.5-5 µm, broadly cylindric or somewhat contorted, obtuse, hyaline, thin-walled; terminal cells repent or suberect,

cylindric or clavate, typically sparcely diverticulate. **Pileus trama** interwoven; hyphae 4-9.5 µm diam, cylindric, non-gelatinous, smooth or often with annular, yellow pigment incrustations; walls thin, hyaline or pale yellow, inamyloid; **lamellar trama** regular; hyphae similar but hyaline and non-incrusted, few inflated up to 12 µm diam. **Stipe tissue** monomitic; **cortical hyphae** 3-8 µm diam, parallel, cylindric, smooth or pigment-incrusted, hyaline or pale yellow at stipe apex, ochraceous or pale brown at stipe base, inamyloid, clamped, with walls up to 2 µm thick; **medullary hyphae** 3-10 µm diam, subparallel, similar but hyaline and thinner-walled. **Stipe vesture** of abundant, scattered or clustered **caulocystidia** 16-50 X 5.5-8 µm, irregularly cylindric or subclavate, sometimes lobed, obtuse, hyaline, inamyloid, thick-walled.

**Commentary.** Pileipellis, stipitipellis and cheilocystidia morphologies, in combination with spore size and macromorphological features of basidiomata indicate that *M. ramulinus* is a synonym of *Marasmiellus vaillantii* (Pers.: Fr.) Singer, *sensu* Singer (1973), Redhead (1981) and Noordeloos (1983).

***MARASMIUS RESINOSUS*** Peck, Bull. Buffalo Soc. Nat. Sci. 4: 181. 1883.

≡ *Marasmius decurrens* Peck, Annual Rep. New York State Mus. 24: 77. 1872 [*non Marasmius decurrens* Montagne, Ann Sci. Nat. Bot. ser. 4, 1: 118. 1854].

***MARASMIUS RIGIDUS*** Montagne, Syll. Gen. Sp. Crypt. 143. 1856.

LECTOTYPE (*des mihi*): United States, Ohio, Columbus, Sullivant no. 144 (PC).

The lectotype specimen consists of one fragmented basidiome in poor condition, plus fragments of a woody substrate. **Pileus** plano-convex, weakly short-striate, glabrous, dark brown. **Lamellae** adnate, non-collariate, subdistant, narrow, ochraceous, non-marginate. **Stipe** equal above a slightly enlarged or subbulbous base, pubescent, brown, non-insititious.

**Basidiospores** 8.4-11.2 X 3.2-4.2 µm [$\bar{x}$ = 9.9 ± 0.7 X 3.7 ± 0.3 µm, E = 2.4-3.4, Q = 2.7 ± 0.2, n = 30], elongate-ellipsoid, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 20-25 X 5.5-7 µm, clavate, 4-spored. **Basidioles** cylindric or subclavate. **Pleurocystidia** absent. **Cheilocystidia** scattered, common, 28-44 X 9.5-17.5 µm, broadly clavate or sphaeropedunculate, often voluminous, non-refractive, hyaline, thin-walled. **Pileipellis** not hymeniform, composed of a cutis of radially arranged hyphae; hyphae 4-18 µm diam, cylindric, typically with annular, helical or amorphous, brown pigment-incrustations, non-diverticulate or with rare, broad branchlets, non-gelatinous, hyaline, inamyloid, thin-walled, clamped; terminal cells repent or suberect, clavate, non-diverticulate. **Tramal hyphae** 2-10 µm diam, interwoven, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 2.5-8 µm diam, subparallel, cylindric, smooth, ranging from subhyaline to ochraceous or pale brown, clamped, with walls up to 1 µm thick. **Stipe vesture** a layer of loosely interwoven hyphae 2.5-5 µm diam, giving rise to suberect or erect **caulocystidia**, these cylindric or clavate, hyaline or pale yellow, inamyloid, with walls up to 1 µm thick.

**Commentary.** Two syntype specimens were reported in the protologue, *viz.* "Sullivant nos. 150 et 144." The description presented above is of Sullivant no. 144, designated here as lectotype. I have not examined Sullivant no. 150. A pileipellis composed of radially arranged, brownish-incrusted hyphae, sphaeropedunculate cheilocystidia, and narrowly ellipsoid spores, in combination with basidiomata morphology and lignicolous habit, are features of the lectotype specimen that indicate *M. rigidus* is a synonym of *Collybia dichrous* (Berk. & Curt.) Gilliam.

***MARASMIUS ROBINIANUS*** Gilliam, Mycotaxon 4: 103. 1976.

HOLOTYPE: United States, Michigan, Livingston Co., Oak Grove State Game Preserve, 18 July 1972, M. S. Gilliam no. 1511, on debris under *Robinia* and *Prunus* (MICH).

The portion of the holotype specimen examined consisted of four basidiomata in good but fragmented condition. **Pileus** 7-10 mm diam, conic or campanulate, striate, weakly granulose, pale yellow or ochraceous with a slightly darker disc. **Lamellae** adnate or adnexed, non-collariate, subdistant or distant, narrow, cream-colored, non-marginate. **Stipe** 30-40 X <1 mm, terete, equal, minutely pruinose at apex, glabrous elsewhere, shiny, brown, non-insititious.

**Basidiospores** 11.6-15.2 X 3.2-4.8 µm [$\bar{x}$ = 12.9 ± 0.9 X 3.6 ± 0.4 µm, E = 3.2-4.3, Q = 3.6 ± 0.2, n = 32], clavate, seldom slightly curved in profile, hyaline, inamyloid, smooth. **Basidia** 18.5-26 X 6-7.5 µm, clavate, 4-spored. **Basidioles** subclavate or ventricose. **Pleurocystidia** scattered, sometimes inconspicuous, 28-36 X 5-8 µm,

clavate, fusoid or strangulate, sometimes apically constricted or appendiculate, weakly refractive, arising from deep in subhymenium and projecting beyond basidioles, hyaline, inamyloid, thin-walled. **Cheilocystidia** numerous on lamellar edges, rare on lamellar face, similar to *Siccus*-type pileipellis elements; main body 12-17.5 X 5-7.5 µm, cylindric, clavate or irregular in outline, seldom lobed, hyaline, thin-walled; apical setulae 1.5-5 X 0.5-1.5 µm, rod-like or conic, obtuse or subacute, thick-walled, hyaline or pale yellow. **Pileipellis** hymeniform, mottled, of *Siccus*-type broom cells; main body 8-14 X 5-8 µm, cylindric, clavate, pyriform or irregular in outline, many hyaline or pale yellow and thin-walled, many others ochraceous or orange and thick-walled; apical setulae 1.5-4 X 0.5-1.5 µm, rod-like or conic, few knob-like, obtuse or subacute, thick-walled or solid, ranging from subhyaline to yellow, orange or ochraceous; pigmented areas weakly dextrinoid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-7 µm diam, cylindric, smooth, non-gelatinous, hyaline, weakly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2-4 µm diam, parallel, cylindric, smooth, pale yellow at stipe apex, ochraceous, olivaceous-ochraceous or brown at stipe base, dextrinoid, with walls up to 1.5 µm thick; **medullary hyphae** 2-8 µm diam, subparallel, hyaline, inamyloid or dextrinoid, thin-walled or firm-walled, clamped; with scattered, refractive oleiferous hyphae interspersed. **Stipe vesture** absent or consisting of a few, hyaline or pale ochraceous *Siccus*-type broom cells on stipe apex.

**Commentary.** *Marasmius robinianus* belongs in sect. *Sicci* ser. *Haematocephali*. The holotype specimen of *M. robinianus* is nearly

indistinguishable from that of *M. pulcherripes* Peck (refer to the type study of the latter for comparison). *Marasmius pulcherripes* differs in forming more deeply pigmented pilei, more closely spaced lamellae, and habit on leaves of various deciduous trees (not restricted to *Robinia*).

***AGARICUS ROTULA*** Scopoli: Fries, Syst. Mycol. 1: 136. 1821.

[*Agaricus rotula* Scopoli, Fl. Carniol. 2: 456. 1772.]

≡ *Marasmius rotula* (Scop.: Fr.) Fries, Epicr. Syst. Mycol. 385. 1838.

≡ *Androsaceus rotula* (Scop.: Fr.) Patouillard, Essai Tax. Hymenomyc. 141. 1900.

REPRESENTATIVE MATERIAL: France, Laye, Rhône, 30 June 1937, Josserand (MICH). No holotype specimen exists.

The representative material consists of 9 basidiomata in good condition. **Pileus** 3-7 mm diam, convex with a depressed disc, sulcate to edge of depression, glabrous, buff or cream-colored. **Lamellae** adnate to a well-developed collarium, distant, moderately broad, buff-colored, edges granulose. **Stipe** 25-30 X 0.5-1 mm, terete, equal, shiny, glabrous, dark brown or black, insititious, lignicolous; with numerous wiry, brown rhizomorphs.

**Basidiospores** 7.2-9.6 X 3.4-4.2 µm [$\bar{x}$ = 8.5 ± 0.6 X 3.9 ± 0.2 µm, E = 2-2.4, Q = 2.2 ± 0.1, n = 25], ellipsoid or amygdaliform, hyaline, inamyloid, smooth. **Basidia** 20-32 X 6.5-8 µm, clavate, 4-spored. **Basidioles** fusoid. **Pleurocystidia** absent. **Cheilocystidia** common, similar to the *Rotalis*-type pileipellis elements; main body 20-32 X 8-16(-20) µm, broadly clavate or sphaeropedunculate, hyaline, thin-walled; divergent setulae similar to those on pileipellis elements.

**Pileipellis** hymeniform, not mottled, of *Rotalis*-type broom cells; main body 16-25 X 8-20 µm, broadly clavate or sphaeropedunculate, apical region thick-walled, basal region thin-walled, hyaline, inamyloid; divergent setulae 0.5-1.5 X 0.5-1 µm, knob-like or rod-like, obtuse, thick-walled or solid, hyaline. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-8(-10) µm, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-5.5 µm diam, parallel, cylindric, smooth, brownish orange, brown or olivaceous-brown, inamyloid, clamped, with walls up to 1.2 µm thick; **medullary hyphae** 2.5-6.5 µm diam, parallel, similar but hyaline and thinner-walled. **Stipe vesture** absent.

**Commentary**. In the sanctioning publication of *Agaricus rotula*, Fries (1821) cited Micheli (1729; Tab. 74, fig. 5), and described a fungus concordant with the plate and description provided by Micheli, *viz.*, with a white, striate pileus, collariate lamellae and black stipe. Fries (1821) listed as a synonym *Agaricus rotula* Scopoli (1772: 456) [the epithet originated with Scopoli], but explicitly excluded Scopoli's reference to Micheli, *i.e.*, Micheli (1729), Tab. 29, fig. 7. The latter plate and description referred to a species with white stipe. No holotype specimen of *A. rotula* exists. Because Fries explicitly indicated Micheli as the source of his concept of the species, a neotype specimen should be selected from material collected in Tuscany, Italy, Micheli's collecting area. Until adequate fresh material is collected and cultured from this region, the specimen

described above, typical of European material, will serve to represent my concept of *Marasmius rotula*.

Smith and Singer (1946) proposed conservation of the genus *Marasmius* over *Micromphale* which had nomenclatorial priority, with *M. rotula* as lectotype. The genus *Marasmius* with *M. rotula* as lectotype was later conserved by the Paris Congress on Botanical Nomenclature (see Taxon 2: 29-30, 1953; Taxon 3: 233, 1954).

***MARASMIUS RUBROPHYLLUS*** Pennington, N. Amer. Fl. 9(4): 271. 1915.

HOLOTYPE: United States, Michigan, near Ann Arbor, Sept. 1907, L. H. Pennington, upon bark at base of white oak tree in the forest.

No holotype specimen or original material of *M. rubrophyllus* was located during an extensive search of herbaria likely to house Pennington collections (*e.g.*, MICH, NY, NYS, SYRF). One specimen deposited at NYS (!) was annotated by Pennington as "close to *M. rubrophyllus*." The latter specimen (New York, W. Albany, C. H. Peck) is conspecific with *Collybia subnuda* (Ellis *ex* Peck) Gilliam. Both Gilliam (1976) and Halling (1983a) list *M. rubrophyllus* as a synonym of *C. subnuda*. Until further material matching the protologue is collected from near Ann Arbor, Michigan, and designated the neotype of *M. rubrophyllus*, the epithet will remain a *nomen incertae sedis*.

***MARASMIUS RUFOROTULA*** Singer, Sydowia 2: 34. 1948.

HOLOTYPE: United States, Florida, Dade Co., Matheson Hammock, 3 Nov. 1942, Singer no. F1456 (FH).

The collection consists of several basidiomata in good condition. **Pileus** convex-umbilicate with a small central papilla, striate or sulcate to the central depression, glabrous, deep ferruginous overall (lacking a pale zone surrounding a dark central spot). **Lamellae** adnate to a well-developed collarium, subdistant, broad, pallid, non-marginate. **Stipe** filiform, glabrous, shiny, upper half stramineous, base ochraceous or brown, insititious, lignicolous.

**Basidiospores** 7.6-9.6 X 4-4.8 µm [$\bar{x}$ = 8.6 ± 0.5 X 4.3 ± 0.3 µm, E = 1.8-2.2, Q = 2 ± 0.1, n = 20], ellipsoid or sublacrymoid, hyaline, inamyloid, smooth. **Basidia** 20-26 X 5.5-7.5 µm, clavate, 4-spored. **Basidioles** cylindric or fusoid. **Pleurocystidia** absent. **Cheilocystidia** numerous, similar to the *Siccus*-type pileipellis elements; main body 12-16 X 6.5-10 µm, clavate, hyaline, thin-walled; apical setulae 2-5 X 1-2 µm, cylindric or subconic, obtuse, thick-walled, hyaline or pale yellow. **Pileipellis** hymeniform, weakly mottled, of *Siccus*-type broom cells; main body 12-20 X 7-12 µm, cylindric, clavate or turbinate, seldom lobed, many pale yellow or pale orange and thin-walled, many orange or orange-tawny and thick-walled; apical setulae 2-5 X 1-2 µm, rod-like, conic or irregular in outline, obtuse, thick-walled and yellowish orange, or solid and orange-tawny or ferruginous. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-10 µm diam, cylindric, smooth, non-gelatinous, hyaline, inamyloid or weakly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-5.5 µm diam, parallel, cylindric, smooth, stramineous or tawny, dextrinoid, with walls up to 1.2 µm thick, clamped; **medullary**

**hyphae** similar but hyaline, inamyloid and thinner-walled. **Stipe vesture** absent.

**Commentary.** *Marasmius ruforotula* belongs in sect. *Marasmius* subsect. *Penicillati* because of collariate lamellae, insititious stipe and *Siccus*-type pileipellis elements. As noted by Singer (1976), *M. ruforotula* is similar to *M. praecox* Singer, but the latter differs in forming consistently broader spores.

***MARASMIUS SALALIS*** Desjardin & Redhead, Mycotaxon 29: 308. 1987.

HOLOTYPE: Canada, British Columbia, Vancouver Island, Lake Cowichan, Gordon Bay, 4 Oct. 1979, S. A. Redhead no. 3343, *in foliis et ramis senescentibus Gaultheris shallis et Mahoniis nervosis* (DAOM no. 175254).

Nothing can be added to the description and discussion presented in the originating publication (Desjardin & Redhead, 1987). Refer to Redhead (1982a; *ut Marasmius copelandi* Pk.) for illustrations of salient details.

***MARASMIUS SALIGNUS*** Peck, Annual Rep. New York State Mus. 35: 135. 1884.

HOLOTYPE: United States, New York, Bethlehem, Sept. 1881, C. H. Peck, on willow trunks (NYS).

The collection consists of approximately 20 basidiomata in fair condition, many fragmented. **Pileus** 3-5 mm diam, plane, even, glabrous or suede-like, pale tan. **Lamellae** adnate, non-collariate, close, narrow, concolorous with the pileus, non-marginate, edges crystalline.

**Stipe** 8-12 X <1 mm, terete, equal, pruinose, tawny or brown, insititious, lignicolous.

**Basidiospores** 7.2-9.6 X 3.8-4.8 µm [$\bar{x}$ = 8.4 ± 0.7 X 4.2 ± 0.3 µm, E = 1.8-2.3, Q = 2 ± 0.1, n = 30], ellipsoid or subamygdaliform, hyaline, inamyloid, smooth. **Basidia** not observed. **Basidioles** 20-24 X 6.5-8 µm, clavate or ventricose. **Pleurocystidia** absent. **Cheilocystidia** numerous, irregularly lobed or diverticulate; main body 16-26 X 4.5-7.5 µm, irregular in outline; lobes or diverticula 2-6 X 1-4 µm, broadly cylindric or knob-like, obtuse; elements hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, composed of a poorly-developed *Rameales*-structure; hyphae 3-8 µm diam, interwoven, sparcely diverticulate, irregular in outline, non-gelatinous, hyaline, pale yellow or pale ochraceous, inamyloid, thin-walled; diverticula 2.5-8 X 2-5 µm, broadly cylindric, knob-like or irregular in outline, obtuse, hyaline, thin-walled. **Pileus trama** interwoven; hyphae 4-10 µm diam, cylindric, smooth or with pale ochraceous, annular pigment incrustations, non-gelatinous, hyaline or pale ochraceous, inamyloid, thin-walled, clamped; **lamellar trama** regular; hyphae similar to those of the pileus trama but smooth and hyaline throughout. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 3.5-8 µm diam, parallel, cylindric, smooth, hyaline or ochraceous, inamyloid, with walls up to 1 µm thick, clamped. **Stipe vesture** of numerous, scattered or clustered **caulocystidia** 24-48+ X 5.5-8 µm, flexuous, strangulate or irregularly cylindric, sometimes lobed, obtuse, hyaline, inamyloid, with walls up to 1 µm thick.

**Commentary.** *Marasmius salignus* is a synonym of *Marasmiellus vaillantii* (Pers.: Fr.) Singer *sensu* Singer (1973), Redhead (1981) and Noordeloos (1983). Compare with the type study of *Marasmius ramulinus* Peck.

*Marasmius salignus* is not conspecific with *M. salignus* var. *major* Peck. The latter variety represents *Marasmiellus candidus* (Bolt.) Singer.

***AGARICUS SCABELLUS*** Albertini & Schweinitz: Fries, Syst. Mycol. 1: 259. 1821.

[*Agaricus scabellus* Albertini & Schweinitz, Consp. Fung. Lusat. 189. 1805.]

≡ *Marasmius scabellus* (Alb. & Schw.: Fr.) Morgan, J. Mycol. 11: 202. 1905.

HOLOTYPE: Poland, northern Galicia, Nisko (?). Type unknown.

Gilliam (1976: 136) reported that Morgan (1905) established the name *Marasmius scabellus* based on a type specimen collected from Preston, Ohio. In actuality, Morgan indicated the epithet was derived from Albertini and Schweinitz (1805; *ut Agaricus scabellus*), and Morgan considered *Agaricus stipitarius* Fr. as a synonym. Fries (1821) sanctioned *A. scabellus* Alb. & Schw., but placed it in tribe *Inocybe*. If the taxon is considered to belong in *Marasmius*, the correct citation is *Marasmius scabellus* (Alb. & Schw.: Fr.) Morgan.

No holotype specimen or original material of *A. scabellus* exists. The taxon determined by Morgan as *M. scabellus*, based on several

collections deposited in Morgan's herbarium (ISC!), represents *Crinipellis setipes* (Pk.) Singer.

***AGARICUS SCORODONIUS*** Fries, Syst. Mycol. 1: 130. 1821.

[*Agaricus scorodonius* Fries, Observ. Mycol. 1: 29. 1815.]

≡ *Marasmius scorodonius* (Fr.) Fries, Epicr. Syst. Mycol. 379. 1838.

REPRESENTATIVE MATERIAL: Sweden, Upsala, Kungsparken, 1853, E. P. Fries (FH).

The represenatative material consists of four basidiomata in fair condition, pressed flat and glued to a slip of paper. **Pileus** 10-20 mm diam, plano-convex, even or rarely short-striate, glabrous, "chamois" or "clay color." **Lamellae** adnexed, non-collariate, close, narrow, pale-concolorous with the pileus, non-marginate, non-intervenose. **Stipe** 35-40 X 1 mm, terete, equal, glabrous, dull, brown, insititious; one basidiome attached to a rootlet.

**Basidiospores** 7.6-10.4 X 3.6-5.2 µm [$\bar{x}$ = 9.1 ± 0.9 X 4.3 ± 0.4 µm, E = 2-2.5, Q = 2.2 ± 0.1, n = 25], ellipsoid, slightly inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 22.5-28 X 5.5-7.5 µm, clavate, 4-spored. **Basidioles** cylindric, subclavate or subfusoid. **Pleurocystidia** absent. **Cheilocystidia** abundant, lamellar edge sterile, elements diverticulate or irregularly lobed; main body 20-25 X 4-8 µm, cylindric or irregular in outline; lobes or diverticula 1.5-4.5 X 1-3.5 µm, broadly cylindric, knob-like or irregular in outline, obtuse; elements hyaline, inamyloid, thin-walled. **Pileipellis** hymeniform, evenly pigmented or weakly mottled, of *Globulares*-type elements plus rare, scattered broom cell-type elements; majority of cells 20-28 X 7-

17.5 µm, clavate, broadly clavate or sphaeropedunculate, non-diverticulate or non-setulose, many hyaline or pale yellow and thin-walled, many others ochraceous and thick-walled (up to 2 µm), inamyloid; rare *Siccus*-type broom cells with few, apical setulae 4-8 X 1.5-2.5 µm, these thick-walled and ochraceous. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-10.5 µm diam, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3.5-6.5 µm diam, parallel, cylindric, smooth, brownish orange, inamyloid, clamped, with walls up to 1.8 µm; **medullary hyphae** 3.5-13 µm diam, similar but hyaline and thinner-walled. **Stipe vesture** absent.

**Commentary.** No holotype specimen or original material exists for *M. scorodonius*. Until a neotype specimen is selected from material collected by E. M. Fries, or from material collected and cultured by others from Fries' collecting area, the specimen cited above will serve to represent my concept of the species. This specimen, collected in Upsala, Sweden, and determined by E. P. Fries, matches quite well the Friesian protologue (1821) and watercolor painting of *M. scorodonius* sanctioned by E. M. Fries (1862, Plate 32).

*Marasmius scorodonius* belongs in sect. *Alliacei*.

***MARASMIUS SCOTOTEPHRODES*** Singer, Fl. Neotrop. Monogr. 17: 105. 1976.

HOLOTYPE: Mexico, Oaxaca, Sierra Mazateca, Rancho del Cura cerca de Huautla de Jiménez, 7 July 1969, Singer no. M8299, *ad folia stipulasque minutas Dicotyledonum in silva mixta frondosa tropicali, montana gregatim*, 1580 m (F).

The collection consists of three basidiomata in good condition. **Pileus** ≈ 5 mm diam, convex-umbilicate, sulcate to center, glabrous, dark greyish brown overall (lacking a pallid zone surrounding a dark central spot). **Lamellae** adnate to a well-developed collarium, distant or remote, broad, pallid, greyish-marginate. **Stipe** ≈ 25 X <0.2 mm, filiform, glabrous, shiny, black, insititious on undetermined leaves.

**Basidiospores** 8-10 X 4-4.8 µm [$\bar{x}$ = 9 ± 0.5 X 4.5 ± 0.3 µm, E = 1.8-2.3, Q = 2 ± 0.1, n = 20], ellipsoid or subamygdaliform, hyaline, inamyloid, smooth. **Basidia** 20.5-24 X 6-8 µm, clavate, 4-spored. **Basidioles** clavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** numerous, similar to the *Rotalis*-type pileipellis elements, apical region of cell and divergent setulae subhyaline or pale brown. **Pileipellis** hymeniform, weakly mottled, of *Rotalis*-type broom cells; main body 17.5-24 X 8-27 µm, broadly clavate, subvesiculose or sphaeropedunculate, many elements hyaline or pale brown and thin-walled, many other elements with dark brown, thick-walled apical regions and paler, thinner-walled basal regions; divergent setulae 1-3.5 X 0.5-1.5 µm, knob-like or rod-like, obtuse, thick-walled or solid, ranging from subhyaline to dark brown. **Tramal hyphae** 3-13 µm diam, interwoven, cylindric or inflated, smooth, non-gelatinous, hyaline, inamyloid or very weakly dextrinoid, thin-walled or with walls up to 1 µm thick, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-5 µm diam, parallel, cylindric, smooth, dark brown, weakly dextrinoid, clamped, with walls up to 1.2 µm thick; **medullary hyphae** 2.5-7 µm diam, similar but hyaline, inamyloid and thinner-walled. **Stipe vesture** absent.

**Commentary.** *Marasmius scototephrodes* belongs in sect. *Marasmius* subsect. *Marasmius* because of collariate lamellae, insititious stipe and *Rotalis*-type pileipellis elements.

***MARASMIUS SEMIHIRTIPES*** Peck, Bull. Buffalo Soc. Nat. Sci. 1: 57. 1873 (1874).

≡ *Collybia semihirtipes* (Pk.) Halling, Mycologia 73: 637. 1981.

HOLOTYPE: United States, New York, June 1872, C. H. Peck (NYS).

The collection consists of four basidiomata glued to four slips of paper, plus 10 loose basidiomata; all in good condition; plus a pencil and watercolor illustration. **Pileus** 5-10 mm diam, convex, even, glabrous, disc dark brown, margin beige-brown. **Lamellae** adnate, non-collariate, close, narrow, cream-colored, non-marginate. **Stipe** 15-30 X 1-1.5 mm, equal or with a slightly enlarged base, pruinose at apex, base velutinous or tomentose, dark brown overall, non-insititious.

**Basidiospores** 6.6-9.6 X 3.2-4.8 µm [$\bar{x}$ = 7.9 ± 0.7 X 3.9 ± 0.4 µm, E = 1.8-2.4, Q = 2.1 ± 0.1, n = 25], ellipsoid or lacrymoid, hyaline, inamyloid, smooth. **Basidia** 19-24 X 5.5-7.5 µm, clavate, 4-spored. **Basidioles** subclavate or fusoid. **Hymenial cystidia** absent. **Pileipellis** not hymeniform, composed of a cutis of interwoven, short-celled, frequently-branched hyphae, *i.e.*, a *Levipedes*-type arrangement; hyphae 4-10 µm diam, irregular in outline, non-gelatinous, clamped, smooth or with scattered yellowish brown pigment incrustations, these soluble in 3% KOH; walls thin, greyish brown or yellowish brown, inamyloid. **Tramal hyphae** 3-8 µm diam, interwoven, cylindric, smooth or weakly incrusted nearest the pileipellis, non-gelatinous, hyaline,

inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-6 µm diam, parallel, cylindric, brown in water, incrusted with numerous, granular, brown, KOH-soluble pigment deposits, hyphae becoming olivaceous in KOH, inamyloid, clamped, with walls up to 1.5 µm diam; **medullary hyphae** 3-10 µm diam, subparallel, similar but paler and thinner-walled. **Stipe vesture** of numerous, suberect or erect **caulocystidia,** 24-50+ X 5-7.5 µm, flexuous, strangulate or irregular in outline, obtuse, hyaline or pale brown, inamyloid, with walls up to 1.5 µm thick.

**Commentary.** I concur with Halling's (1981) diagnosis that *M. semihirtipes* represents a distinct species of *Collybia* belonging in sect. *Levipedes*. This position is contrary to the suggestions of Singer (1951, 1975b) and Gilliam (1976) that *M. semihirtipes* represents a synonym of *Collybia spongiosa* (Berk. & Curt.) Singer.

An earlier type study of *M. semihirtipes* was presented by Hesler (1959b). Refer to Halling (1981, 1983a) for contemporary descriptions of *Collybia semihirtipes* (Pk.) Halling.

***MARASMIUS SEMISQUARROSUS*** Berkeley & Cooke *in* Cooke, Grevillea 6: 129. 1878.

HOLOTYPE: United States, Florida, Gainesville, H. W. Ravenel, Fungi Americani Exsiccati no. 106, *intra foliis delapsis* (K). [ISOTYPES: BPI!, FH!, PH!]

The isotype specimens each consist of a single basidiome in fair condition. **Pileus** plano-convex, even, glabrous, disc region pale brown, margin ochraceous. **Lamellae** adnexed, non-collariate, close,

moderately broad, pale brown, non-marginate. **Stipe** pubescent at apex, tomentose at base, brownish orange or brown, non-insititious.

**Basidiospores** 6.4-8 X 3.6-4.4 µm [$\bar{x}$ = 7.3 ± 0.6 X 4 ± 0.3 µm, E = 1.6-2, Q = 1.8 ± 0.1, n = 20], ellipsoid or lacrymoid, hyaline, inamyloid, smooth. **Basidia** 20-26.5 X 6-7.5 µm, clavate, 4-spored. **Basidioles** cylindric or subclavate. **Pleurocystidia** absent. **Cheilocystidia** scattered, 18-22.5 X 4-6.5 µm, irregular in outline, apically lobed or contorted, hyaline, thin-walled. **Pileipellis** not hymeniform, composed of a cutis of interwoven, short-celled, frequently-branched hyphae, *i.e.*, a *Levipedes*-type arrangement; hyphae 3.5-6.5 µm diam, cylindric or irregular in outline, non-gelatinous, clamped, smooth or with granular or helical, pale brown or ochraceous pigment incrustations, these not soluble in KOH; walls thin, hyaline or pale yellow, inamyloid. **Stipe tissue** monomitic; **cortical hyphae** 4-8 µm diam, subparallel, cylindric, smooth, brownish orange or brown (pigment intraparietal) in water, olivaceous in 3% KOH, inamyloid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** similar but paler and thinner-walled. **Stipe vesture** of numerous, suberect or erect **caulocystidia**, 20-40+ X 4-8 µm, flexuous or irregularly cylindric, obtuse, ochraceous, inamyloid, with walls up to 1.5 µm thick.

**Commentary.** *Marasmius semisquarrosus* represents a synonym of *Collybia spongiosa* (Berk. & Curt.) Singer, as suggested by Singer (1949), Gilliam (1976) and Halling (1981, 1983a).

***MARASMIUS SENESCENS*** Petch, Trans. Brit. Mycol. Soc. 31: 41. 1947.

≡ *Marasmiellus senescens* (Petch) Pegler, Kew Bull. Addit. Ser. 12. 111. 1986.

HOLOTYPE: Sri Lanka, Peradeniya, Royal Botanical Garden, 15 Nov. 1914, Petch no. 4306 (K).

The collection consists of several basidiomata in poor condition, badly infected with a *Penicillium* species. **Pileus** ≈ 10 mm diam, plano-convex with a low umbo, radially streaked-fibrillose, pale grey. **Lamellae** subdecurrent, non-collariate, distant, broad, concolorous with the pileus. **Stipe** ≈ 18 X <1 mm, terete, equal, silky, dark grey or nearly black, subinsititious on a small piece of bark.

**Basidiospores** 10-14.8 X 4.2-5.6 µm [$\bar{x}$ = 12.4 ± 1.2 X 5 ± 0.5 µm, E = 1.8-3.2, Q = 2.5 ± 0.3, n = 20], broadly clavate, inequilateral or slightly curved in profile, hyaline, inamyloid, smooth. **Basidia** not observed. **Basidioles** 26-32 X 5.5-9.5 µm, versiform, cylindric, subclavate, ventricose or lageniform, hyaline, thin-walled, non-refractive. **Hymenial cystidia** absent. **Pileipellis** not hymeniform, composed of a cutis of interwoven hyphae with scattered pilosetae; hyphae 4-10 µm diam, few inflated up to 16 µm diam, cylindric, smooth, non-gelatinous, non-diverticulate, hyaline, inamyloid, clamped; **pilosetae** scattered, 50-120$^{+}$ X 5.5-8 µm, lanceolate or cylindric, obtuse or subacute, brownish orange, with walls 1-2.5 µm thick; setae arising from thin-walled, hyaline hyphae; no thin-walled pilocystidia observed. **Tramal hyphae** interwoven, undifferentiated from the pileipellis hyphae. **Stipe tissue** monomitic; **cortical hyphae** 4-12.5 µm, subparallel, cylindric, smooth, brownish orange or brown,

inamyloid, clamped, with walls up to 2.5 µm thick; **medullary hyphae** similar but hyaline and thinner-walled. **Stipe vesture** undeterminable; surface badly infected with a *Penicillium* species.

**Commentary.** *Marasmius senescens* belongs in *Marasmiellus* sect. *Stenophylloides* as transferred by Pegler (1986). I was unable to detect hymenial cystidia on the holotype specimen, in contradiction to Pegler's (1986) observations. The hymenium is composed of basidia and versiform basidioles, the latter ranging in shape from cylindric to subclavate, ventricose or lageniform. All hymenial elements arise from about the same level in the subhymenium, and grow to about the same length. No differentiated elements of the size reported by Pegler (1986) [*i.e.*, 50-60 X 8-10 µm] were observed by me in a total of four mounts from two basidiomata. Absence of hymenial cystidia would suggest that *Marasmiellus senescens* is allied with *M. peckii* (Murr.) Sing. and *M. atrosetosus* Dennis.

***MARASMIUS SESSILIAFFINIS*** Singer, Sydowia 12: 82. 1958.

≡ *Marasmius spaniophyllus* var. *sessiliaffinis* (Sing.) Singer, Sydowia 18: 211. 1965.

HOLOTYPE: Canal Zone, Barro Colorado, 11 July 1952, G. W. Martin & A. L. Welden no. 7607, on forest litter, stems, branchlets and dead branches (ISC). [ISOTYPE: F!]

The collection consists of 13 basidiomata in good condition attached to a woody substrate. **Pileus** 1-2.5 mm diam, plano-convex or reniform, weakly striate, granulose, light yellowish brown or brownish orange. **Lamellae** adnate, non-collariate, distant or remote, narrow,

pale yellow or cream-colored, edges white-crystalline. **Stipe** <0.5 X <0.2 mm, strongly eccentric but not lateral, curved and appressed to the hymenium, glabrous or minutely silky, brown; spore print on black paper pale cream-colored.

**Basidiospores** 8.3-9.9 X 4-5.4 µm [$\bar{x}$ = 9.1 ± 0.4 X 4.7 ± 0.3 µm, E = 1.8-2.2, Q = 2 ± 0.2, n = 30], clavate, slightly curved in profile, hyaline, inamyloid, smooth. **Basidia** 20-29 X 4.5-7 µm, clavate, 4-spored. **Basidioles** subclavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** numerous (lamellar edge sterile), similar to *Siccus*-type pileipellis elements; main body 12-25 X 6-12 µm, cylindric, clavate, subvesiculose or irregular in outline, often lobed, hyaline, thin-walled; apical setulae 1-4 X 0.5-1.5 µm, rod-like or irregular in outline, obtuse, hyaline, thin-walled. **Pileipellis** hymeniform, mottled, of *Siccus*-type broom cells; main body 13.5-21 X 8-13.5(-18) µm, broadly clavate, vesiculose or sphaeropedunculate, majority of elements hyaline and thin-walled with hyaline or subhyaline setulae, some elements thick-walled and melleous with brownish orange setulae; setulae 1-4 X 0.5-2 µm, knob-like, rod-like or irregular in outline, obtuse, ranging from hyaline to brownish orange, subdivergent on some cells, strictly apical on others, sometimes in small clusters over disc region of cell or in a ring of clusters circumscribing the cell apex. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-7 µm diam, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3.5-9 µm diam, parallel, cylindric, smooth, ochraceous or brown, dextrinoid,

clamped, with walls up to 4 μm thick; **medullary hyphae** similar but hyaline. **Stipe vesture** absent.

**Commentary.** *Marasmius sessiliaffinis* was placed by Singer (1976) in sect. *Neosessiles* because of strongly eccentric or lateral stipe, and broom cell-type pilepiellis elements. If less taxonomic emphasis is placed on the presence of a short, strongly eccentric stipe, other features of *M. sessiliaffinis* indicate the species is closely allied with members of sect. *Sicci* ser. *Leonini*.

Singer (1958a) initially described *M. sessiliaffinis* as a distinct species, later (Singer, 1965) reduced the taxon to a variety of *M. spaniophyllus* (Berk.) Sacc., and recently (Singer, 1976) recognized it once again as a distinct species. Data from my examination of the holotype specimen of *Agaricus spaniophyllus* Berk. are in agreement with Singer's (1965) report that *M. sessiliaffinis* and *M. spaniophyllus* differ microscopically only in spore size. It is quite probable, as suggested by Singer (1965), that these two taxa represent geographical races, and that *M. sessiliaffinis* is best considered a variety of *M. spaniophyllus*. Compare with the type study of *Agaricus spaniophyllus* presented below.

The holotype and isotype specimens were erroneously cited in the protologue (Singer, 1958a) and subsequent publications (Singer, 1965, 1976) as "Martin & Welden no. 7606." Both the holotype specimen at ISC (formerly at IA), and the isotype at F are annotated "Martin & Welden no. 7607." The published collection number "7606" must be considered a typographical error, perpetuated from the protologue.

***GYMNOPUS SETULOSUS*** Murrill, N. Amer. Fl. 9: 373. 1916.

≡ *Collybia setulosa* (Murr.) Murrill, Mycologia 8: 219. 1916.

≡ *Marasmius setulosus* (Murr.) Singer, Lilloa 22: 326. 1949 (1951), *nom. illeg.* [*non Marasmius setulosus* Murrill, Bull. Torrey Bot. Club 67: 150. 1940].

≡ *Marasmius murrillianus* Singer, *nom. nov.* Lilloa 25: 488. 1952.

HOLOTYPE: Jamaica, Cinchona, 25 Dec. - 8 Jan. 1908-1909, Murrill no. 632, in clay on wet mossy bank, about 1500 m (NY).

The collection consists of one fragmented basidiome, *i.e.*, one third of a pileus plus various other fragments. **Pileus** ≈ 10 mm diam, plano-convex, even, hispid, erect hairs tawny, surface dark brown. **Lamellae** adnate or slightly adnexed, non-collariate, subdistant, moderately broad, pruinose, pallid, non-marginate. **Stipe** ≈ 24 X 1 mm, equal above, base fusoid, hispid with tawny hairs, surface pale reddish brown, non-insititious.

**Basidiospores** not observed in four mounts. **Basidia** not observed. **Basidioles** subclavate or ventricose, hyaline, thin-walled. **Hymenial cystidia** numerous on lamellar sides and edges, 60-95 X 18-28 µm [$\bar{W}$ = 23.5 µm, n = 10], ventricose or broadly lageniform, some long-pedicellate, arising from deep in lamellar trama and projecting well beyond basidioles, non-refractive, hyaline, thin-walled or few firm-walled, basally unclamped. **Pileipellis** hymeniform, not mottled, composed of clavate, fusoid, ventricose or lageniform elements, 28-70 X 10-17.5 µm; walls hyaline, inamyloid, thin or up to 1 µm thick; cell contents brown; plus scattered **pilosetae** 100-550(-800) X 8-25 µm, cylindric-acuminate or lanceolate, obtuse, subacute or acute, melleous,

tawny or ferruginous, with walls 3-8 µm thick. **Pileus trama** interwoven; subgelatinous, sarcodimitic; **lamellar trama** bilateral, subgelatinous, with a broad mediostratum of sarcodimitic hyphae, plus a narrow lateral stratum of divergent, monomitic hyphae; sarcodimitic tissue composed of cylindric or inflated, infrequently-branched hyphae 4-12 µm diam, plus frequently-branched, non-inflated hyphae 2-4 µm diam; all hyphae hyaline, thin-walled, inamyloid, unclamped. **Stipe tissue** sarcodimitic; **cortical hyphae** 3-8 µm diam, parallel, cylindric, smooth, hyaline or ochraceous, inamyloid, unclamped, with walls up to 1 µm thick; **medullary hyphae** of two types, inflated, unbranched elements 5-16 µm diam, plus non-inflated, infrequently-branched elements 1.5-4 µm diam, all hyaline, inamyloid, thin-walled, unclamped. **Stipe vesture** of numerous caulocystidia and caulosetae; **caulocystidia** 10-32 X 5.5-8 µm, cylindric or subclavate, obtuse, rarely lobed, hyaline or yellowish, inamyloid, with walls up to 1 µm thick; **caulosetae** similar to the pilosetae, 100-350 X 10-20 µm, lanceolate, melleous or deep brownish orange, with walls 1-7 µm thick.

**Commentary**. Smith (1938a) was the first (after Murrill, 1916) to treat *Gymnopus setulosus*, providing a description and illustrations of the micromorphology of the holotype specimen. Smith accepted the species in *Collybia*. Subsequently, Singer (1951) transferred the species to *Marasmius*, based on details provided by Murrill (1916), Smith (1938a) and Joanne Williams (Singer, 1976), but apparently Singer did not examine the holotype specimen. Singer placed *G. setulosus* in sect. *Alliacei*. None of the above accounts mentioned details of the organization of the hymenophoral trama, sarcodimitic condition of the

tramal tissues, or the presence or absence of clamp connections. Distinctive features of the holotype specimen of *G. setulosus* include: 1) hymeniform pileipellis of ventricose or lageniform elements with brown vacuolar pigments and thin or thick walls; 2) numerous, melleous or brownish orange pilosetae with walls up to 8 µm thick; 3) sarcodimitic tissues in pileus, lamellae and stipe; 4) inamyloid hyphae lacking clamp connections; 5) bilateral, subgelatinous hymenophoral trama; 6) lageniform, thin-walled, non-refractive, hyaline hymenial cystidia; 7) cylindric or subclavate caulocystidia; and 8) brownish orange, caulosetae with walls up to 7 µm thick. In combination, these features indicate that the correct disposition of *G. setulosus* is in the genus *Pseudohiatula*, and the taxon is transferred here as:

***Pseudohiatula setulosa*** (Murr.) Desjardin ***comb. nov.*** [Bas.: *Gymnopus setulosus* Murrill, *ibid.*].

The thick-walled, darkly pigmented pilosetae of *P. setulosa* are unique to the genus. The majority of species of *Pseudohiatula* form pilocystidia, but they are typically thin or only moderately thick-walled (up to 1.5 µm) and consistently hyaline. In addition, in all other known species of *Pseudohiatula*, the pileipellis is formed of thin-walled, subglobose, vesiculose or rarely pyriform elements, whereas in *P. setulosa* the pileipellis elements are mostly thick-walled and distinctly ventricose or lageniform.

I was unable to recover spores from the single basidiome comprising the holotype, and was also unable to detect sterigmata on

any of the hymenial elements. Presumably the material was immature when collected.

Because all known species of *Pseudohiatula* are lignicolous (or on the trunks of tree ferns), the potential substrate of *P. setulosa* requires clarification. The stipe was described as "radicating at the base as in *Gymnopus radicatus*, and the substrate as "in clay on a wet mossy bank" (Murrill, 1916). The base of the stipe of the holotype basidiome has been broken off and it was impossible to diagnosis its mode of attachment to the substrate. It is possible, however, that the basidiome was attached to buried woody debris or possibly to roots. Until more material is available for examination, the spore size and exact nature of the stipe attachment will remain uncertain.

*Pseudohiatula setulosa* differs from *P. dorotheae* (Berk.) Dennis *ex* Singer and *P. irrorata* (Pat. *in* Duss) Sing., in pileus and stipe coloration, presence of pilosetae, and shape of elements comprising the hymeniform pileipellis.

***MARASMIUS SETULOSUS*** Murrill, Bull. Torrey Bot. Club 67: 150. 1940. [*non Marasmius setulosus* (Murr.) Singer, Lilloa 22: 326. 1951].

HOLOTYPE: United States, Florida, Alachua Co., Arredonda, 29 July 1938, West & Murrill no. F18267, under oaks (FLAS).

The collection consists of portions of four basidiomata in good condition, somewhat fragmented. **Pileus** 7-12 mm diam, convex, even, subvelutinous, disc brown, margin ferruginous. **Lamellae** adnexed, non-collariate, subdistant or close, moderately broad, pruinose,

ferruginous. **Stipe** terete, pruinose or subvelutinous, dull, hollow, reddish brown; length and attachment undeterminable.

**Basidiospores** 6.8-8.8 X 3.2-4.2 µm [$\bar{x}$ = 7.5 ± 0.5 X 3.7 ± 0.3 µm, E = 1.8-2.3, Q = 2 ± 0.2, n = 20], ellipsoid or amygdaliform, hyaline, inamyloid, smooth. **Basidia** 17.5-20 X 4.5-6 µm, clavate, 4-spored. **Basidioles** subclavate or clavate. **Hymenial setae** common on lamellar sides and edges, 55-110 X 6.5-12 µm [$\bar{L}$ ≈ 70-80 µm], acuminate or lanceolate, sharply acute, arising from deep in lamellar trama and projecting well beyond basidioles, subhyaline, melleous, golden or ferruginous, dextrinoid, with walls 1.5-3.5 µm thick. **Cheilocystidia** numerous, similar to the *Siccus*-type pileipellis elements and intermediate-type elements. **Pileipellis** hymeniform, not mottled, composed of *Siccus*-type broom cells, pilosetae and elements transitional in morphology: 1) ***Siccus*-type broom cells** with main body 9.5-14.5 X 4-6.5 µm, cylindric, clavate or irregular in outline, rarely lobed, thin-walled or firm-walled, hyaline or pale tawny; apical setulae 2.5-10 X 0.5-1.5 µm, conic, subacute or acute, solid, melleous or tawny; 2) **pilosetae** 60-120+ X 6-8 µm, similar to hymenial setae, thick-walled, ferruginous; 3) **transitional elements** similar to *Siccus*-type broom cells but typically larger and with fewer and longer apical setulae; main body 12-20 X 6.5-10 µm; setulae up to 28 X 2-4 µm, acuminate, acute, 3-10 per cell, ferruginous, solid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 4-10.5 µm diam, cylindric or inflated, smooth, non-gelatinous, hyaline, strongly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-6.5 µm diam, parallel, cylindric, smooth, tawny, strongly dextrinoid, with

walls up to 1 µm diam; **medullary hyphae** 3-10 µm diam, hyaline or pale yellow, dextrinoid, clamped, with walls up to 0.5 µm thick. **Stipe vesture** of numerous *Siccus*-type broom cells, caulosetae and elements transitional in morphology, *i.e.*, of elements similar to those of the pileipellis but not organized in a hymeniform layer.

**Commentary.** Singer (1951, 1952, 1965) and Hesler (1959b) suggested that *M. setulosus* might be a synonym of *M. cohaerens* (Alb. & Schw.: Fr.) Cooke & Quél., whereas Gilliam (1976) indicated the two taxa were not conspecific. Features of the holotype specimen of *M. setulosus* indicate that the latter species is indeed conspecific with *M. cohaerens*. The numerous caulosetae and relatively short and narrow spores suggest that *M. setulosus* is contaxic with *M. cohaerens* var. *lachnophyllus* (Berk.) Gilliam. For a comparison, refer to the type study of *Agaricus lachnophyllus* Berk. presented above.

***MARASMIUS CANDIDUS* var. *SETULOSUS*** Josserand & Smith, Mycologia 33: 496. 1941.

≡ *Marasmiellus setulosus* (Joss. & Smith) Singer, Agar. Mod. Taxon. 319. 1975. *nom. inval.*

HOLOTYPE: United States, Tennessee, Sevier Co., Gatlinburg, Keener House, 8 Aug. 1938, A. H. Smith no. 9943 (MICH).

The portion of the holotype examined consisted of several basidiomata in good condition attached to hardwood twigs. **Pileus** 3-10 mm diam, convex or campanulate, even, suede-like or pruinose, beige-colored. **Lamellae** non-collariate, distant, narrow, forked, pruinose, concolorous with the pileus. **Stipe** 5-13 X 1 mm, terete, pruinose or

pubescent, ochraceous above, brownish below, insititious, lignicolous; with few reddish brown rhizomorphic strands adherent to the substrate.

**Basidiospores** 13.2-17.8 X 3.4-4.8 µm [$\bar{x}$ = 14.8 ± 1.1 X 4.2 ± 0.3 µm, E = 3.1-4.2, Q = 3.6 ± 0.3, n = 30], clavate or subfusiform, sometimes curved in profile, hyaline, inamyloid, smooth. **Basidia** 35-42 X 8-10 µm, clavate, 4-spored. **Basidioles** clavate. **Hymenial cystidia** common on lamellar sides and edges, 48-60 X 8-17.5 µm, lageniform or ventricose-rostrate, often subcapitate, arising from subhymenium and projecting well beyond basidioles, non-refractive, hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, composed of a cutis of interwoven hyphae giving rise to pilocystidia and pilosetae; hyphae 2.5-10 µm diam, cylindric or weakly inflated, smooth, non-gelatinous, clamped, hyaline, inamyloid, thin-walled; **pilocystidia** scattered, suberect, 48-72 X 7-9.5 µm, cylindric or capitulate, hyaline, thin-walled or rarely with lower half of cell with wall up to 0.5 µm thick; **pilosetae** scattered, common or uncommon, 60-115+ X 5.5-8 µm, acuminate or lanceolate, sharply acute, golden-melleous or brownish orange, with walls 1-3.5 µm thick; setae arising as terminal cells from hyaline, thin-walled pileipellis hyphae. **Tramal hyphae** 3-13.5 µm diam, interwoven, cylindric or inflated, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae**, 2.5-11.5 µm diam, subparallel, cylindric, smooth, pale ochraceous or brown, inamyloid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** similar but hyaline and thinner-walled; with rare, oleiferous hyphae interspersed. **Stipe vesture** of numerous, scattered **caulocystidia** similar to the pilocystidia, 50-100+ X 9-14.5 µm,

cylindric or ventricose-rostrate, hyaline, thin-walled; no caulosetae observed.

**Commentary.** *Marasmius candidus* var. *setulosus* belongs in *Marasmiellus* sect. *Stenophylloides* because of pileipellis morphology, pigmented pilosetae, insititious stipe and spore morphology. Singer (1973) noted the similarity of var. *setulosus* to *Marasmiellus tenerrimus* (Berk. & Curt.) Sing., and stated that if var. *setulosus* were to be retained at varietal rank, it would represent a variety of *M. tenerrimus* rather than a variety of *M. candidus* (Bolt.) Sing. Several years later, Singer (1975) accepted var. *setulosus* as a distinct species, but invalidly transferred the epithet [he failed to cite a basionym and give a direct reference to place of valid publication (Art. 33.2, ICBN)]. My examinations of two isotype specimens of *M. tenerrimus* (both at FH!) indicate that *M. candidus* var. *setulosus* is indeed closely allied with *M. tenerrimus* and should be considered a distinct variety of the latter, transferred here as:

***Marasmiellus tenerrimus*** var. ***setulosus*** (Joss. & Smith) Desjardin, ***comb. nov.*** [Bas.: *Marasmius candidus* var. *setulosus* Josserand & Smith, *ibid.*].

*Marasmiellus tenerrimus* var. *tenerrimus* and var. *setulosus* share the uncommon feature of possessing darkly pigmented rhizomorphs. To date, no *Marasmielli* have been reported to form dark rhizomorphs. In addition, both varieties are similar in spore size, substrate, and in forming thin-walled, hyaline pilocystidia as well as pigmented, thick-walled pilosetae. Variety *tenerrimus* differs from var. *setulosus* in forming much thinner, almost papery pilei, fewer lamellae, and a more

filiform stipe. In addition, pilei of var. *setulosus* typically develop pale orange tones at maturity, whereas such a color-change phenomenon has not been reported for var. *tenerrimus*.

***MARASMIUS SICCIFORMIS*** Murrill, Bull. Torrey Bot. Club 67: 150. 1940.

HOLOTYPE: United States, Florida, Alachua Co., Gainesville, 8 Mar. 1938, W. A. Murrill no. 16179, on ground, probably attached to buried wood (FLAS).

The collection consists of one fragmented basidiome in poor condition. **Pileus** 6 mm diam, obtusely conic, striate, subvelutinous, dark purplish brown. **Lamellae** adnexed, non-collariate, subdistant, broad, pallid. **Stipe** terete, glabrous, dark reddish brown, basal attachment and length undeterminable.

**Basidiospores** 7.6-9.6 X 5.2-6.4 µm [$\bar{x}$ = 8.4 ± 0.5 X 5.6 ± 0.3 µm, E = 1.3-1.7, Q = 1.5 ± 0.1, n = 20], subglobose or broadly ellipsoid, slightly inequilateral in profile, hyaline, strongly amyloid, smooth, thin-walled. **Basidia** 24-30.5 X 10.5-13 µm, broadly clavate, 4-spored. **Basidioles** broadly clavate. **Pleurocystidia** absent. **Cheilocystidia** common, 40-48 X 6-8 µm, subfusoid, fusoid or narrowly lageniform, obtuse or subacute, non-refractive, arising from subhymenium and projecting well beyond basidioles, hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, composed of a thin *Rameales*-structure; hyphae 2-8 µm diam, repent, interwoven, densely diverticulate, non-gelatinous, subhyaline, pale reddish brown or pale brown (pigment soluble in 3% KOH), inamyloid, thin-walled, clamped; diverticula 1.5-6 X 1-2.5 µm, rod-like, obtuse. **Hypodermial hyphae** strongly inflated (up

to 14 µm diam), hyaline, dextrinoid. **Pileus trama** interwoven; **lamellar trama** interwoven; hyphae 3-8 µm diam, cylindric (non-inflated), non-gelatinous, hyaline, weakly dextrinoid or inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-8 µm diam, parallel, cylindric, smooth, non-diverticulate, non-gelatinous, dark ochraceous or pale brown, inamyloid, thin-walled, clamped; **medullary hyphae** similar but hyaline. **Stipe vesture** absent.

**Commentary.** The diverticulate and non-gelatinous pileipellis elements, inflated and dextrinoid hypodermial hyphae, presence of clamp connections and amyloid spores indicate that *Marasmius sicciformis* is best placed in *Mycena* sect. *Fragilipedes sensu* Maas Geesteranus (1980, 1988). The non-viscid, pale vinose pileus, non-marginate lamellae, and absence of odor (Murrill, 1940), in combination with absence of pleurocystidia and non-diverticulate stipitipellis elements, suggest that *M. sicciformis* may represent a distinct species of *Mycena*. A formal transfer will not be proposed until further contaxic material from Florida is examined. An earlier type study of *M. sicciformis* was presented by Hesler (1959b).

***AGARICUS SICCUS*** Schweinitz, Schr. Naturf. Ges. Leipzig 1: 84. 1822.

≡ *Marasmius siccus* (Schw.) Fries, Epicr. Syst. Mycol. 382. 1838.

HOLOTYPE: United States, North Carolina (Salem) or Pennsylvania (Bethlehem), "Salem - Beth.," Schweinitz, no date (PH).

The type assemblage consists of four basidiomata in fair condition, pressed flat and glued to a slip of paper. **Pileus** convex, sulcate, subvelutinous, brownish orange or ferruginous. **Lamellae**

adnexed, non-collariate, distant, narrow, orange-cream-colored, non-marginate. **Stipe** terete, equal, glabrous, shiny, brown, non-insititious, basal mycelium buff-colored, foliicolous.

**Basidiospores** 16-20.4 X 3.4-4 µm [$\bar{x}$ = 18.2 ± 1.5 X 3.8 ± 0.2 µm, E = 4.2-5.3, Q = 4.8 ± 0.4, n = 13], narrowly clavate, often curved in profile, hyaline, inamyloid, smooth. **Basidia** not observed. **Basidioles** 20-26 X 6-7.5 µm, clavate or ventricose. **Pleurocystidia** numerous, 32-56 X 5.5-8 µm, cylindric, subclavate or fusoid, often once-constricted at the apex, arising from lamellar trama and projecting well beyond basidioles, straight or basally curved, refractive, hyaline or pale yellow, inamyloid, thin-walled. **Cheilocystidia** numerous, similar to pileipellis broom cells; main body 10-15 X 4-8 µm, cylindric or clavate, seldom lobed, thin-walled, hyaline; apical setulae 1.5-6.5 X 0.5-1.5 µm, cylindric or conic, obtuse or subacute, hyaline or pale yellow, thin-walled or thick-walled. **Pileipellis** hymeniform, not mottled or only weakly mottled, composed of broom cells; main body 8-15 X 4-9 µm, cylindric, clavate or irregular in outline, sometimes lobed, majority of elements hyaline or pale yellow and thin-walled, scattered elements orange or pale brownish orange and thick-walled; apical setulae 1.5-5 X 0.5-1.5 µm, cylindric or conic, obtuse or subacute, yellow, orange or pale brownish orange, thick-walled or solid; broom cells of this general morphology have been designated as *Siccus*-type elements. **Pileus trama** interwoven; hyphae 3-6.5 µm diam, cylindric, smooth, non-gelatinous, hyaline, dextrinoid, thin-walled, clamped; **lamellar trama** regular; hyphae 3-10 µm diam, otherwise similar to pileus tramal hyphae. **Stipe tissue** monomitic; **cortical**

**hyphae** 3-10 µm diam, parallel, cylindric, smooth, ochraceous or brownish orange, dextrinoid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** 3-12 µm diam, similar but hyaline and thinner-walled. **Stipe vesture** absent.

**Commentary.** The type assemblage of *Agaricus siccus*, deposited in the Schweinitz Herbarium at PH, consists of a single slip of paper with four attached basidiomata. The material was annotated as being collected from "Salem - Beth." According to Schallert (1934), Lewis David von Schweinitz collected in the Salem community of North Carolina (currently Winston-Salem) between 1812 and 1821. Schweinitz' record books from the period indicated that the designation "Salem" covered a radius of 30 miles around the town (Pennell, 1931). Schweinitz returned to Bethlehem, Pennsylvania in 1821 (he was born there in 1780), where he lived and collected in the vicinity until his death in 1834 (Pennell, 1934, 1942). It is impossible to diagnose whether the basidiomata comprising the type assemblage were collected from Salem, Bethlehem, or from both localities, or when the material was collected. It is reasonable to assume, however, that part or possibly all of the collection was in the hands of Schweinitz at the time of publication of the epithet (Schweinitz, 1822); *e.g.*, because Schweinitz cited the locale as "Salem - Beth.," at least the Salem portion was collected prior to 1822. Likewise, it is impossible to segregate the basidiomata according to locale collected. Although no specific specimen was cited in the protologue, the entire type assemblage is considered by me to

represent an implicit holotype specimen. An isotype specimen is deposited in the Curtis Herbarium at FH.

*Marasmius siccus* is the type species of sect. *Sicci*.

***MARASMIUS SIMILIS*** Berkeley & Curtis, Hooker's J. Bot. Kew Gard. Misc. 1: 100. 1849.

HOLOTYPE: United States, South Carolina, Curtis no. 1319 (K). [ISOTYPE: South Carolina, Society Hill, Aug. 1848, Curtis no. 1319 (FH! - Curtis Herb.)]

The holotype collection consists of three basidiomata in fair condition, pressed flat and glued to a slip of paper. **Pileus** 5-6 mm diam, convex, sulcate, pale yellowish brown. **Lamellae** adnexed, non-collariate, distant, broad, concolorous with the pileus. **Stipe** ≈ 35 X 0.5 mm, terete, equal, glabrous, shiny, brown, non-insititious; no substrate present.

**Basidiospores** 10.4-14 X 3.4-4.4 µm [$\bar{x}$ = 12.3 ± 0.9 X 3.9 ± 0.3 µm, E = 2.8-3.6, Q = 3.2 ± 0.2, n = 30], clavate or subfusoid, seldom slightly curved in profile, hyaline, inamyloid, smooth. **Basidia** not observed. **Basidioles** 18-23 X 5.5-8 µm, clavate or ventricose. **Pleurocystidia** absent. **Cheilocystidia** common, similar to *Siccus*-type pileipellis elements; main body 12-17.5 X 5-7.5 µm, cylindric or clavate, seldom lobed, hyaline, thin-walled; apical setulae 1-6 X 0.5-1.5 µm, irregular in outline, obtuse, strongly verrucose or nodulose, hyaline, thin-walled. **Pileipellis** hymeniform, not mottled, of *Siccus*-type broom cells; main body 6.5-15 X 6-11 µm, cylindric, clavate or subvesiculose, seldom lobed, typically hyaline and thin-walled, rarely

pale ochraceous and firm-walled; apical setulae 2-6.5 X 0.5-2.5 µm, irregular in outline, obtuse, strongly verrucose or nodulose, thick-walled or solid, ranging from hyaline to pale ochraceous. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-8 µm diam, cylindric, smooth, non-gelatinous, hyaline, weakly dextrinoid or inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-6 µm diam, parallel, cylindric, smooth, ochraceous or brownish orange, dextrinoid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** 2-8 µm diam, similar but hyaline and thinner-walled. **Stipe vesture** absent.

**Commentary**. *Marasmius similis* belongs in sect. *Sicci* ser. *Leonini*. The species is distinct because of the formation of white pilei, non-collariate lamellae, lignicolous habit, and *Siccus*-type broom cells with strongly verrucose setulae.

***MARASMIUS SPADICEUS*** Gilliam, Mycologia 67: 840. 1975.

HOLOTYPE: United States, Michigan, Washtenaw Co., Sharon Hollow northwest of Manchester, 19 July 1937, A. H. Smith no. 6591 (MICH).

The portion of the holotype specimen examined consisted of two basidiomata in excellent condition. **Pileus** 12-14 mm diam, campanulate, even or weakly short-striate, subvelutinous, brown or dark "cinnamon brown." **Lamellae** adnexed or free, non-collariate, close, moderately broad, pale reddish brown, non-marginate. **Stipe** 30-45 X 1 mm, terete, equal, glabrous, shiny, ochraceous or dark brownish yellow, non-insititious, basal mycelium pale orange buff.

**Basidiospores** 7.2-10.8 X 2.8-4 µm [$\bar{x}$ = 9 ± 1.0 X 3.4 ± 0.4 µm, E = 2.2-3, Q = 2.7 ± 0.2, n = 30], elongate-ellipsoid, slightly

inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 21.5-24 X 5.5-6.5 µm, clavate, 4-spored. **Basidioles** clavate or fusoid. **Pleurocystidia** numerous, 32-44(-50) X 7.5-10 µm, fusoid, ventricose or lageniform, apically strangulate or appendiculate, arising from deep in subhymenium and projecting up to 12 µm beyond basidioles, refractive, hyaline, inamyloid, thin-walled. **Cheilocystidia** common, similar to *Siccus*-type pileipellis elements; main body 8-13 X 5-8 µm, cylindric, clavate, obclavate or irregular in outline, seldom lobed, hyaline, thin-walled; apical setulae 3-12(-17.5) X 0.5-2.5 µm, cylindric or conic, obtuse, subacute or acute, thick-walled or solid, hyaline or pale ochraceous. **Pileipellis** hymeniform, mottled, of *Siccus*-type broom cells; main body 8-18 X 5.5-10 µm, cylindric, clavate, turbinate, pyriform or irregular in outline, often lobed, many pale yellow or brownish orange and firm-walled, many others brownish orange or pale brown and thick-walled; apical setulae 3-12 X 1-2.5 µm, cylindric or conic, subacute or acute, thick-walled or solid, brownish orange or tawny. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-10(-15) µm diam, cylindric or inflated, smooth, non-gelatinous, hyaline, dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-8 µm diam, parallel, cylindric, smooth, yellow or ochraceous, strongly dextrinoid, clamped, with walls up to 1.2 µm thick; **medullary hyphae** 3-10 µm diam, similar but hyaline and thinner-walled. **Stipe vesture** absent.

**Commentary.** *Marasmius spadiceus* differs subtly from *M. floridanus* Murr. in pileus and stipe coloration and substrate. *Marasmius spadiceus* was described as forming basidiomata with moderate brown or

brownish orange pilei, stipes colored pale orange-yellow at the apex and deep brown at the base, and habit on decayed leaves in oak woods. In comparison, *M. floridanus* forms fulvous pilei, stipes colored white at the apex and fulvous at the base, and basidiomata form on decayed hardwood logs (Murrill, 1940). Micromorphologically, the holotype specimens of these two taxa are indistinguishable. After studying numerous collections determined by me as *M. floridanus*, ranging in distribution from Florida to Michigan, I conclude that pileus and stipe coloration and substrate are variable in this taxon, and I consider *M. spadiceus* a synonym of *M. floridanus*. For a further discussion, refer to the commentary on *M. floridanus* in Chapter IV. Also compare with the type study of *M. floridanus* presented above.

***AGARICUS SPANIOPHYLLUS*** Berkeley, London J. Bot. 2: 631. 1843.

≡ *Marasmius spaniophyllus* (Berk.) Saccardo, Syll. Fung. 5: 568. 1887.

HOLOTYPE: Brazil, Goyaz, Natividade, Nov. 1839, Gardner (K).

The collection consists of several basidiomata in poor condition, pressed flat on several decorticated sticks and glued to a small slip of paper. **Pileus** ≈ 4 mm diam, plano-convex, granulose, brown. **Lamellae** adnexed, non-collariate, distant, narrow or moderately broad, not intervenose, pallid. **Stipe** ≈ 1 X 0.5 mm, strongly eccentric or nearly lateral, buff-colored, insititious, lignicolous.

**Basidiospores** 9.6-12 X 4.8-6.6 µm [$\bar{x}$ = 10.9 ± 0.7 X 5.7 ± 0.5 µm, E = 1.6-2.2, Q = 1.9 ± 0.1, n = 30], broadly ellipsoid or amygdaliform, hyaline, inamyloid, smooth. **Basidia** not onserved. **Basidioles** 20-25 X 6.5-10 µm, clavate or subventricose. **Pleurocystidia** absent.

**Cheilocystidia** common, similar to *Siccus*-type pileipellis elements; main body 12-20 X 7.5-10 µm, cylindric or clavate, hyaline, thin-walled; apical setulae 1.5-3.5 X 0.5-1.5 µm, knob-like or rod-like, obtuse, thin-walled or thick-walled, hyaline. **Pileipellis** hymeniform, mottled, of *Siccus*-type broom cells; main body 12-22.5 X 8-14 µm, cylindric, clavate, subvesiculose or irregular in outline, seldom lobed, many subhyaline or pale ochraceous and thin- or firm-walled, many others ochraceous or ferruginous and thick-walled; apical setulae 1.5-3.5 X 0.5-2.5 µm, knob-like, rod-like or irregular in outline, obtuse, thick-walled or solid, yellow, ochraceous or ferruginous. **Tramal hyphae** 3.5-8 µm diam, interwoven, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-5 µm diam, parallel, cylindric, smooth, hyaline or yellow, dextrinoid, clamped, with walls up to 1 µm thick; **medullary hyphae** 2.5-8 µm diam, similar to cortical hyphae. **Stipe vesture** present but difficult to diagnose the morphology because of poor revivability.

**Commentary.** *Marasmius spaniophyllus* was placed by Singer (1976) in sect. *Neosessiles*; however, many features of the holotype specimen suggest affinities with species in sect. *Sicci* ser. *Leonini* (*viz.*, *M. pusio* Berk. & Curt.).

***AGARICUS SPINULIFER*** Peck, Annual Rep. New York State Mus. 24: 62. 1871.

≡ *Collybia spinulifera* (Pk.) Peck, Annual Rep. New York State Mus. 49: 62. 1895 (1896).

≡ *Marasmius spinulifer* (Pk.) Morgan, J. Mycol. 11: 238. 1906.

HOLOTYPE: United States, New York, Greig, Sept., C. H. Peck (NYS).

The collection consists of 17 basidiomata in good condition glued in varied numbers to 7 slips of paper, plus 20 individual basidiomata wrapped loose in tissue paper. **Pileus** 10-25 mm diam, campanulate or plano-convex, even, subvelutinous, disc reddish brown, margin ranging from ochraceous to brown or reddish brown. **Lamellae** adnexed, non-collariate, close or crowded, narrow, pruinose, pale ferruginous. **Stipe** 40-60 X 1-2 mm, terete, equal above, slightly enlarged near the base, pruinose or hispid, somewhat glabrescent centrally, reddish brown or brown, non-insititious, basal mycelium white or buff-colored.

**Basidiospores** 6.8-8.2 X 3.6-4.2 µm [$\bar{x}$ = 7.5 ± 0.4 X 3.9 ± 0.2 µm, E = 1.7-2.2, Q = 2 ± 0.1, n = 30], ellipsoid or amygdaliform, hyaline, inamyloid, smooth. **Basidia** 22-28 X 6-8 µm, clavate, 4-spored. **Basidioles** subclavate or clavate. **Hymenial setae** numerous on lamellar sides and edges, 80-130+ X 10-20 µm, ventricose-acuminate or lanceolate, sharply acute, arising from deep in subhymenium or lamellar trama and projecting well beyond basidioles, ochraceous or pale reddish brown, dextrinoid, with walls 1-3.5 µm thick. **Pileipellis** hymeniform, weakly mottled, of *Siccus*-type broom cells, pilosetae, and elements transitional in morphology; 1) ***Siccus*-type broom cells** with main body 10-16 X 4-8 µm, cylindric, clavate, turbinate or irregular in outline, seldom lobed, ochraceous or pale reddish brown, with walls 0.5-1.5 µm thick; apical setulae 3-10 X 0.5-2 µm, cylindric or conic, subacute or acute, thick-walled or solid, subhyaline, ochraceous or reddish brown; 2) **pilosetae** numerous, 45-110+ X 5.5-14 µm, similar to hymenial setae,

irregularly lanceolate, acute, dark brownish orange, brown or reddish brown, dextrinoid, with walls up to 5 µm thick; 3) **transitional elements** similar to *Siccus*-type broom cells but with fewer and longer apical setulae; main body 12.5-18 X 6-9 µm, brownish orange or reddish brown, with walls up to 3 µm thick; setulae up to 24 X 2-3 µm, conic, sharply acute, 3-8 per cell, solid, brownish orange or reddish brown. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-10(-12) µm diam, cylindric or inflated, smooth, non-gelatinous, hyaline, dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-6 µm diam, parallel, cylindric, smooth, yellow, ochraceous or pale brown, strongly dextrinoid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** 3-16 µm diam, similar but hyaline and thinner-walled. **Stipe vesture** of numerous, erect **caulosetae**, 40-80 X 8-12 µm, conic or lanceolate, sharply acute, ochraceous, dextrinoid, with walls up to 3 µm thick.

**Commentary**. Peck (1896) speculated on the similarities between *C. spinulifera* and *Collybia lachnophylla* (Berk.) Pk., but noted that the two taxa should be kept distinct until "they can more clearly be shown to be specifically the same." A comparison of the holotype specimens of *Agaricus lachnophyllus* Berk. and *A. spinulifer* revealed that the two taxa are indeed conspecific. Consequently, *A. spinulifer* is considered here to represent a synonym of *Marasmius cohaerens* var. *lachnophyllus* (Berk.) Gilliam. A watercolor illustration of the holotype specimen of *A. spinulifer* is archived at NYS.

***MARASMIUS SPISSUS*** Gilliam, Mycologia 67: 834. 1975.

HOLOTYPE: United States, Michigan, Washtenaw Co., Sharon Hollow northwest of Manchester, 2 July 1960, A. H. Smith no. 62486, on leaf mold (MICH).

The portion of the holotype examined consisted of three basidiomata in excellent condition. **Pileus** 10-28 mm diam, plano-convex or plane, even, subvelutinous, disc tawny-brown, margin cream-colored. **Lamellae** adnexed or nearly free, non-collariate, crowded, narrow, cream-colored, non-marginate. **Stipe** 35-55 X 1-1.5 mm, terete, equal above a slightly enlarged base, glabrous over upper half, pruinose to tomentose over lower portion, reddish brown, non-insititious, basal mycelium orange-white.

**Basidiospores** 5.8-7.6 X 2.8-3.4 µm [$\bar{x}$ = 6.6 ± 0.5 X 3.1 ± 0.2 µm, E = 1.9-2.4, Q = 2.1 ± 0.1, n = 30], ellipsoid, slightly inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 20-24 X 4.5-6 µm, clavate, 4-spored. **Basidioles** clavate or fusoid. **Pleurocystidia** common, 24-36 X 3.5-5 µm, narrowly cylindric, flexuous or ventricose with a long, narrow rostrum, obtuse or subacute, arising from about the same level as basidioles and projecting up to 12 µm beyond, non-refractive, sometimes inconspicuous, hyaline, inamyloid, thin-walled. **Cheilocystidia** of two types: 1) ***Siccus*-type broom cells** with main body 10-14 X 5-10 µm, cylindric, clavate or turbinate, thin-walled or with walls up to 1 µm thick, hyaline or pale yellow; apical setulae 2.5-6.5 X 1-2 µm, conic, obtuse, subacute or acute, thick-walled, hyaline or yellow; 2) **versiform, non-setulose elements** 28-36 X 5-10.5 µm, clavate or irregular in outline, often bifid or lobed, refractive, hyaline,

thin-walled. **Pileipellis** hymeniform, weakly mottled, of *Siccus*-type broom cells; main body 8-18 X 5-12 µm, cylindric, clavate, turbinate or irregular in outline, majority hyaline or pale yellow and thin-walled, scattered cells orange or pale brownish orange and thick-walled; apical setulae 2.5-8 X 0.5-2.5 µm, cylindric or conic, obtuse, subacute or acute, thick-walled or solid, ranging from subhyaline to yellow, orange or brownish orange; pigmented areas weakly dextrinoid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3.5-10.5 µm diam, cylindric or slightly inflated, smooth, non-gelatinous, hyaline, strongly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-8 µm diam, parallel, cylindric, smooth, hyaline (at stipe apex) or ochraceous to brownish orange (stipe base), strongly dextrinoid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** 3-10 µm diam, similar but hyaline and thinner-walled. **Stipe vesture** absent at stipe apex, composed of numerous **dendrotrichomoid elements** at stipe base, these with poorly-developed basal regions giving rise to 4-8 divergent setulae; setulae up to 24+ X 1.5-2.5 µm, cylindric-acuminate or conic, sometimes branched, subacute or acute, thick-walled or solid, hyaline or ochraceous, dextrinoid.

**Commentary.** *Marasmius spissus* belongs in sect. *Sicci* ser. *Haematocephali*, because of *Siccus*-type pileipellis elements, presence of pleurocystidia, dextrinoid tramal tissues, and non-insititious stipe. The species is distinct because of flexuous, non-refractive pleurocystidia, two types of cheilocystidia, dendrotrichomoid stipitipellis elements, and crowded, narrow lamellae.

***MARASMIUS SPONGIOSUS*** Berkeley & Curtis, Hooker's J. Bot. Kew Gard. Misc. 1: 100. 1849.

≡ *Collybia spongiosa* (Berk. & Curt.) Singer, Lilloa 22: 201. 1949 (1951).

HOLOTYPE: United States, South Carolina, Society Hill, June 1847, Curtis no. 1257, *ad fol. putresc. in sylvis* (K). [ISOTYPE: FH!].

The isotype specimen consists of three basidiomata in poor condition, pressed flat and glued to a slip of paper. **Pileus** 7-11 mm diam, plano-convex, even, glabrous, disc brown, margin pale brown or dark ochraceous. **Lamellae** adnexed, non-collariate, close, narrow or moderately broad, pale brown, non-marginate. **Stipe** ≈ 30 X 1.5-2 mm, terete, gradually enlarged downward, apex pubescent, base tomentose, brownish orange or brown with brownish orange tomentum, non-insititious, foliicolous.

**Basidiospores** 6.4-9.2 X 3-4.2 µm [$\bar{x}$ = 7.8 ± 0.6 X 3.6 ± 0.3 µm, E = 1.9-2.8, Q = 2.2 ± 0.2, n = 30], ellipsoid, hyaline, inamyloid, smooth. **Basidia** 18.5-24 X 5.5-7.5 µm, clavate, 4-spored. **Basidioles** cylindric, subclavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** absent or rare (lamellar edges in poor condition, cellular morphology difficult to diagnose), irregularly cylindric or contorted, hyaline, thin-walled. **Pileipellis** not hymeniform, composed of a cutis of interwoven, frequently-branched, short-celled hyphae, *i.e.*, a *Levipedes*-type arrangement; hyphae 4-8 µm diam, smooth or with ochraceous or pale brown, amorphous pigment incrustations (not soluble in 3% KOH), non-diverticulate, non-gelatinous, inamyloid, thin-walled, clamped. **Tramal hyphae** interwoven, cylindric, non-incrusted, hyaline,

inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-5 µm diam, parallel, cylindric, non-incrusted, ochraceous or pale brown in water, olivaceous in KOH, inamyloid, clamped, with walls up to 1 µm thick; **medullary hyphae** 3-6.5 µm diam, similar but hyaline and thinner-walled. **Stipe vesture** a layer of loosely interwoven hyphae 2-6.5 µm diam, ochraceous in water, olivaceous in KOH, inamyloid, with walls up to 1.2 µm thick, giving rise to repent or suberect **caulocystidia**, these cylindric or flexuous, sometimes branched or lobed, obtuse, thick-walled, inamyloid.

**Commentary.** I concur with the findings of Singer (1949), Gilliam (1976) and Halling (1981, 1983a) that *Marasmius spongiosus* represents a distinct species of *Collybia* belonging in sect. *Levipedes*.

***MARASMIUS SQUAMOSIDISCUS*** Murrill, Bull. Torrey Bot. Club 67: 151. 1940.

≡ *Armillaria squamosidisca* (Murr.) Murrill, Mycologia 36: 122. 1944.

[≡ *Ripartitella squamosidisca* (Murr.) Singer, Lloydia 9: 128. 1946. *nom. illeg.*]

≡ *Ripartitella squamosidisca* (Murr.) Singer, Mycologia 39: 85. 1947.

HOLOTYPE: United States, Florida, Grove Park, 15 July, 1938, West, Arnold & Murrill no. F18262, on a much-decayed hardwood log in dry oak-pine woods (FLAS).

The collection consists of approximately 20 fragmented basidiomata in fair condition, with some insect damage. **Pileus** 8-20 mm diam, convex with a shallow central depression, even, disc minutely squamulose and fulvous, margin glabrous and dark ochraceous. **Lamellae** adnate with a short decurrent tooth, non-collariate, close, moderately

broad, ochraceous, non-marginate. **Stipe** 20-40 X 1.5-2 mm, terete, equal above an enlarged base, striate, pruinose at apex, downy at base, yellowish tan-colored, non-insititious, lignicolous.

**Basidiospores** 4.6-5.6 X 3.2-3.8 µm [$\bar{x}$ = 5.2 ± 0.3 X 3.5 ± 0.2 µm, E = 1.4-1.7, Q = 1.5 ± 0.1, n = 20], ellipsoid or lacrymoid, hyaline, inamyloid, with walls up to 0.3 µm thick, echinulate; echinulae acute, up to 0.4 µm long. **Basidia** 14.5-20.5 X 5.5-6.5 µm, cylindric or clavate, 4-spored. **Basidioles** cylindric or clavate. **Hymenial cystidia** scattered, uncommon on lamellar sides, 36-45 X 6-8 µm, fusoid or ventricose with a long, narrow rostrum, arising from subhymenium and projecting well beyond basidioles, non-refractive, hyaline, inamyloid, thin-walled; few capped with thin, hyaline, crystalline incrustations, these soluble in 3% KOH. **Pileipellis** not hymeniform, composed of a cutis of weakly interwoven, somewhat radially arranged hyphae; hyphae 4-6.5 µm diam, cylindric, smooth or weakly roughened, non-diverticulate or with rare branchlets, non-gelatinous, hyaline or pale yellow, inamyloid, thin-walled; squamules over disc composed of chains of short-celled hyphae, these inflated, 6-8.5 µm diam, ochraceous or tawny, smooth or weakly roughened, clamped. **Tramal hyphae** 4-12 µm diam, interwoven, cylindric or inflated, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 2.5-10 µm diam (up to 15 µm diam in medulla), subparallel, cylindric, smooth, hyaline or pale yellow, inamyloid, thin-walled, clamped. **Stipe vesture** a loosely interwoven layer of hyphae 2.5-5 µm diam, cylindric, smooth, hyaline, inamyloid, with or without scattered knob-like outgrowths; terminal cells

suberect or erect, 6-24 X 2.5-5 µm, cylindric or subclavate, obtuse, hyaline, thin-walled.

**Commentary.** *Marasmius squamosidiscus* is considered a synonym of *Ripartitella brasiliensis* (Speg.) Singer. Refer to Singer (1946) and Ovrebo (1988) for contemporary descriptions of this taxon.

***MARASMIUS STENOPHYLLOIDES*** Murrill, Lloydia 8: 274. 1945 (1946).

HOLOTYPE: United States, Florida, Gainesville, 6 Sept. 1939, W. A. Murrill no. F9920, on a fallen frondose stick in dry woods (FLAS).

The collection consists of one basidiome in good condition, attached to a woody stick. **Pileus** 12 mm diam, convex, even, suede-like, beige or cream-colored. **Lamellae** subdecurrent, non-collariate, close, narrow, pale brownish orange, non-marginate. **Stipe** 10 X 1 mm, terete, equal, pubescent, beige-brown, non-insititious, arising from a ring of cream-colored mycelium, lignicolous.

**Basidiospores** 6.2-8.6 X 3.6-4.4 µm [$\bar{x}$ = 7.2 ± 0.7 X 3.9 ± 0.3 µm, E = 1.6-2.2, Q = 1.8 ± 0.1, n = 20], ellipsoid or amygdaliform, hyaline, inamyloid, smooth. **Basidia** 20-24 X 5-6 µm, clavate, 4-spored. **Basidioles** cylindric or subclavate. **Hymenial cystidia** common on lamellar sides and edges, 36-48 X 5.5-9 µm, cylindric or subclavate, rarely slightly fusoid, obtuse, arising from deep in subhymenium and projecting up to 16 µm beyond basidioles, non-refractive, hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, composed of a well-developed *Rameales*-structure; hyphae 2-4.5 µm diam, interwoven, diverticulate, non-gelatinous, hyaline, inamyloid, thin-walled or with walls up to 0.6 µm thick; diverticula 2-5 X 1-3.5 µm, knob-like or

rod-like, obtuse, hyaline, thin-walled. **Tramal hyphae** 2.5-6.5 µm diam, interwoven, cylindric, smooth, non-gelatinous, hyaline, inamyloid, clamped, with walls up to 1 µm thick. **Stipe tissue** monomitic; **cortical hyphae** 3-10 µm diam, subparallel, cylindric, smooth, yellow, inamyloid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** 3-16 µm diam, similar but hyaline and thinner-walled. **Stipe vesture** a well-developed *Rameales*-structure, similar to the pileipellis.

**Commentary.** The holotype specimen of *M. stenophylloides* is microscopically indistinguishable from the holotype specimen of *M. substenophyllus* Murr. [≡ *Neoclitocybe substenophylla* (Murr.) Sing.]. Macromorphologically, *M. stenophylloides* differs in forming adnate to subdecurrent or arcuate lamellae. In *N. substenophylla* the lamellae are strongly decurrent resulting in basidiomata with clitocyboid stature. *Marasmius stenophylloides* is accepted here as a distinct form of *N. substenophylla*, and is transferred as:

***Neoclitocybe substenophylla*** forma ***stenophylloides*** (Murr.) Desjardin ***comb. et stat. nov.*** [Bas.: *Marasmius stenophylloides* Murrill, *ibid.*].

Compare the description presented above with the type study of *M. substenophyllus*. An earlier type study of *M. stenophylloides* was presented by Hesler (1959b). *Marasmius stenophylloides* Murr. should not be confused with *Marasmiellus stenophylloides* (Dennis) Dennis (1970).

***MARASMIUS STRAMINIPES*** Peck, Bull. Buffalo Soc. Nat. Sci. 1: 59. 1873.

HOLOTYPE: United States, New York, Albany Co., Center (= Karner), Oct. 1872, C. H. Peck (NYS).

The collection consists of seven basidiomata glued to separate slips of paper, plus approximately 20 loose basidiomata wrapped in newspaper, all in good condition. **Pileus** 2-5 mm diam, convex, short-striate, granulose, cream-colored. **Lamellae** adnate, non-collariate, subdistant, moderately broad, buff-colored, edges granulose, non-marginate. **Stipe** 20-30 X 0.2 mm, terete, equal, glabrous, shiny, melleous or orangish, insititious on pine needles.

**Basidiospores** 6.8-9.5 X 3.6-4.4 µm [$\bar{x}$ = 8 ± 0.8 X 4 ± 0.2 µm, E = 1.7-2.2, Q = 2 ± 0.2, n = 23]. Nothing can be added to the redescription and illustrations presented earlier (Desjardin & Petersen, 1989a). See there for details.

**Commentary**. *Marasmius straminipes* belongs in sect. *Androsacei*.

***MARASMIUS STRIATIPES*** Peck, Annual Rep. New York State Mus. 24: 76. 1871 (1872).

HOLOTYPE: United States, New York, Adirondack Mts., Lewis Co., Greig, Sept. 1870, C. H. Peck no. 108 (NYS).

The collection consists of 20 basidiomata in good condition contained in two separate boxes; some glued to slips of paper, others loose. **Pileus** 12-40 mm diam, convex, even, glabrous, yellowish brown. **Lamellae** adnate, non-collariate, close or subdistant, narrow or moderately broad, cream-colored, non-marginate. **Stipe** 50-70 X 2-5 mm,

terete, striate, pruinose at apex, tomentose at base, dingy buff-colored overall, non-insititious.

**Basidiospores** 5.2-7.4 X 2.2-3.2 µm [$\bar{x}$ = 6.1 ± 0.6 X 2.7 ± 0.3 µm, E = 2-2.6, Q = 2.3 ± 0.2, n = 15], subcylindric or narrowly ellipsoid, slightly inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 16-20 X 4-6 µm, clavate, 4-spored. **Basidioles** subclavate. **Pleurocystidia** absent. **Cheilocystidia** scattered, interspersed among basidioles, 12-16 X 3.5-5 µm, irregular in outline, often lobed or contorted, hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, composed of a cutis of radially arranged, repent hyphae; hyphae 2.5-5 µm diam, cylindric, smooth, non-diverticulate, non-gelatinous, subhyaline or pale ochraceous, inamyloid, clamped, with walls up to 0.6 µm thick. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 4.5-15 µm diam, cylindric or weakly inflated, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 4-8 µm diam, subparallel, cylindric, smooth, hyaline or pale yellow, inamyloid, clamped, with walls up to 1.2 µm diam. **Stipe vesture** of loosely interwoven hyphae giving rise to suberect or erect, often tangled **caulocystidia** 30-55+ X 5-8 µm, cylindric, flexuous or strangulate, obtuse, hyaline, thin-walled or firm-walled.

**Commentary.** A pileipellis composed of radially arranged, repent, non-diverticulate hyphae, in combination with inamyloid tramal tissues, spore morphology and non-insititious stipe together that indicate *M. striatipes* belongs in *Collybia* sect. *Vestipedes*. The epithet is preempted in *Collybia* by *C. striatipes* Velenovsky [České Houby 2: 329.

1920]. According to Halling (1983a), the holotype specimens of *M. striatipes* and *Collybia cylindrospora* Kauffman are conspecific. Consequently, when regarded in *Collybia*, the organism described above is correctly named *C. cylindrospora*.

***COLLYBIA STRICTIPES*** Peck, Annual Rep. New York State Mus. 41: 62. 1887 (1888).

≡ *Gymnopus strictipes* (Pk.) Murrill, N. Amer. Fl. 9: 357. 1916.

≡ *Marasmius strictipes* (Pk.) Singer, Ann. Mycol. 41: 130. 1943.

LECTOTYPE (*des mihi*): United States, New York, Catskill Mts., Sept., C. H. Peck (NYS).

The type assemblage is a mixed collection consisting of six basidiomata glued to separate slips of paper, plus six loose basidiomata, all in fair condition. The lectotype portion consists of five basidiomata glued to separate slips. **Pileus** 20-30 mm diam, convex, even, glabrous, dark ochraceous, brownish orange or brown. **Lamellae** adnexed, non-collariate, close, moderately broad, pale brownish orange, non-marginate. **Stipe** 45-90 X 4-5 mm, terete, equal, hollow, pruinose, centrally glabrescent, greyish or greyish brown, non-insititious.

**Basidiospores** 6.8-10 X 3.6-4.4 µm [$\bar{x}$ = 8.5 ± 0.8 X 3.9 ± 0.2 µm, E = 1.8-2.7, Q = 2.2 ± 0.2, n = 40], ellipsoid or elongate-lacrymoid, hyaline, inamyloid (few spores appearing weakly dextrinoid with inamyloid hilar appendix), smooth. **Basidia** 24-28 X 5.5-7.5 µm, clavate, 4-spored. **Basidioles** subclavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** numerous, lamellar edge sterile, elements 16.5-

34 X 3-6.5 µm, versiform, cylindric, ventricose, clavate, bifid or variously lobed, broadly obtuse, non-refractive, hyaline, inamyloid, thin-walled. **Pileipellis** hymeniform, not mottled, of *Globulares*-type elements, 12-25 X 8-13 µm, cylindric, clavate, vesiculose or sphaeropedunculate, hyaline or pale yellow, dextrinoid, thin-walled, basally clamped. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-12.5 µm diam, cylindric or inflated, smooth, non-gelatinous, hyaline, strongly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 3-12(-18) µm diam, cylindric, smooth, hyaline or pale yellow, strongly dextrinoid, clamped, with walls up to 1 µm thick. **Stipe vesture** of numerous, often clustered, suberect or erect **caulocystidia**, 20-45 X 5-8 µm, similar to the cheilocystidia, cylindric, clavate, fusoid or irregular in outline, often lobed, hyaline, inamyloid or weakly dextrinoid, thin-walled.

**Commentary.** The type assemblage is a mixed collection. Five basidiomata glued to separate slips of paper match the protologue and our current concept of *M. strictipes*, and are designated here as lectotype. One basidiome glued to a slip of paper possesses conspicuous, refractive, fusoid pleurocystidia, and is conspecific with *M. cystidiosus* (Smith & Hesler) Gilliam. In addition, six loose basidiomata have non-hymeniform pileipelli composed of interwoven, sparcely diverticulate hyphae plus inamyloid tramal tissues, and represent a species of *Collybia* sect. *Subfumosae*.

*Marasmius strictipes* belongs in sect. *Globulares*. Refer to Bigelow & Barr (1963), Gilliam (1976) and Singer (1976) for contemporary descriptions.

***GYMNOPUS SUBAGRICOLA*** Murrill, Mycologia 33: 439. 1941.

≡ *Collybia subagricola* (Murr.) Murrill, Mycologia 33: 448. 1941.

≡ *Marasmius subagricola* (Murr.) Singer, Fl. Neotrop. Monogr. 17: 269. 1976.

HOLOTYPE: United States, Florida, Gainesville, 24 June 1938, W. A. Murrill no. F16323, on a road through oak woods (FLAS).

The collection consists of five fragmented basidiomata in fair condition. **Pileus** 5-7 mm diam, convex, even, glabrous, brown. **Lamellae** adnate, non-collariate, subdistant, moderately broad, pale brown, non-marginate. **Stipe** 15-23 X 1 mm, terete or compressed, equal or with a slightly flared apex, glabrous, brown, non-insititious, basal mycelium tawny.

**Basidiospores** 5.4-6.4 X 2.4-3.2 µm [$\bar{x}$ = 5.8 ± 0.3 X 2.8 ± 0.2 µm, E = 1.8-2.3, Q = 2.1 ± 0.2, n = 11], ellipsoid, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 14.5-18 X 5-6.5 µm, clavate, 4-spored. **Basidioles** clavate. **Pleurocystidia** absent. **Cheilocystidia** numerous, 19-28 X 5-10 µm, cylindric, clavate or irregular in outline, rarely lobed, obtuse, hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, composed of a cutis of interwoven, repent, frequently-branched, short-celled hyphae, *i.e.*, a *Levipedes*-type arrangement; hyphae 4-16 µm diam, smooth or weakly roughened, non-gelatinous, ochraceous or pale brown, inamyloid, thin-walled, clamped. **Tramal hyphae** 3-12 µm diam, interwoven, cylindric or inflated, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 3-8.5 µm diam, parallel or subparallel, cylindric, smooth,

yellow or pale tawny, inamyloid, clamped, with walls up to 1.2 µm thick. **Stipe vesture** absent.

**Commentary.** Pileipellis morphology of the holotype specimen is similar in structure to that formed by members of *Collybia* sect. *Levipedes*. This feature, in combination with inamyloid tramal tissues, spore size, cheilocystidial morphology and non-insititious stipe indicate that *G. subagricola* is best placed in *Collybia*, not *Marasmius* sect. *Alliacei* as suggested by Singer (1976). Comparison with the holotype specimen of *Gymnopus agricola* Murrill (NY!) [≡ *Collybia agricola* (Murr.) Murr.] indicates that *G. subagricola* represents a synonym of *C. agricola*.

***MARASMIUS SUBALBICEPS*** Murrill, Lloydia 9: 321. 1946.

HOLOTYPE: United States, Florida, Alachua Co., Gainesville, 2 July 1944, W. A. Murrill no. F38916, on dead leaves under a laurel oak (FLAS).

The collection consists of approximately 20 basidiomata in good condition, plus numerous oak leaves. **Pileus** 2-4 mm diam, convex, short-striate, glabrous or weakly granulose, tan-colored. **Lamellae** adnexed, non-collariate, distant, moderately broad, tan, non-marginate. **Stipe** 10-12 X <0.2 mm, terete, equal, pruinose, brown, insititious, foliicolous; with numerous dark brown rhizomorphs.

**Basidiospores** 6.4-8.8 X 3.2-4.4 µm [$\bar{x}$ = 7.6 ± 0.6 X 3.8 ± 0.3 µm, E = 1.8-2.3, Q = 2 ± 0.1, n = 30], ellipsoid or amygdaliform, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 20.5-24 X 5.5-7.5 µm, clavate, 4-spored. **Basidioles** subclavate or fusoid.

**Hymenial cystidia** absent. **Pileipellis** not hymeniform, composed of a well-developed *Rameales*-structure with broom cell-like terminal cells; hyphae 3-8 µm diam, irregular in outline, densely diverticulate, smooth or weakly incrusted, non-gelatinous, hyaline or pale yellow, inamyloid, thin-walled, clamped; diverticula 1.5-6.5 X 1-2.5 µm, knob-like, rod-like or irregular in outline, obtuse, sometimes branched, hyaline, thin-walled; terminal cells suberect or erect, cylindric or clavate, seldom lobed, densely diverticulate. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2-8 µm diam, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-6 µm diam, parallel, cylindric, smooth, melleous or tawny, dextrinoid, clamped, with walls up to 2 µm thick; **medullary hyphae** 2.5-8 µm diam, hyaline, inamyloid, thin-walled. **Stipe vesture** of two types of **caulocystidia**: 1) cylindric or broadly clavate elements 12-30 X 5.5-11 µm, scattered along entire length of stipe, broadly obtuse, sometimes with one or several knob-like outgrowths, thin-walled or with walls up to 1.2 µm thick, hyaline, inamyloid; 2) acuminate or lanceolate elements up to 50+ X 4-7.5 µm, common on central and basal portion of stipe surface, subacute or acute, thick-walled (1-1.5 µm), subhyaline or pale melleous, inamyloid.

**Commentary.** *Marasmius subalbiceps* represents a distinct species in sect. *Androsacei* because of the following combination of characters: 1) densely diverticulate pileipellis elements; 2) absence of cheilocystidia; 3) clamp connections; 4) dimorphic caulocystidia; 5) pilei with rosy-isabelline disc and white margin; and 6) habit on oak leaves. *Marasmius subalbiceps* is similar to *M. quercophilus* Pouzar and

*M. liquidambari* Singer. *Marasmius quercophilus* differs in forming numerous cheilocystidia and monomorphic caulocystidia, while *M. liquidambari* differs in forming predominantly 2-spored basidia and monomorphic caulocystidia. An earlier type study of *M. subalbiceps* was presented by Hesler (1959b).

***MARASMIUS SUBARCHYROPUS*** Murrill, Bull. Torrey Bot. Club 67: 151. 1940.

HOLOTYPE: United States, Florida, Alachua Co., Planera Hammock, 20 July 1938, West & Murrill no. F18264, on much-decayed hardwood (FLAS).

The collection consists of five basidiomata in fair condition, with some insect damage. **Pileus** 22-38 mm diam, obtusely conic or plano-convex, sometimes with a shallow central depression, even, radially appressed-fibrillose, yellowish brown. **Lamellae** adnexed, non-collariate, crowded, narrow, concolorous with the pileus, non-marginate. **Stipe** 50-65 X 3-5 mm, terete or compressed, equal, striate, twisted, hollow, pruinose, pale brown, non-insititious.

**Basidiospores** 5.6-8 X 3.2-4.2 µm [$\bar{x}$ = 6.6 ± 0.6 X 3.8 ± 0.3 µm, E = 1.7-2, Q = 1.8 ± 0.1, n = 20], ellipsoid or sublacrymoid, hyaline, inamyloid, smooth. **Basidia** 14-16 X 5-6 µm, clavate, 4-spored. **Basidioles** cylindric, clavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** numerous, 17.5-30 X 5.5-9.5 µm, clavate, ventricose or irregular in outline, some contorted, some with one or several knob-like outgrowths, hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, composed of a cutis of radially arranged, repent hyphae; hyphae 3-6.5 µm diam, cylindric, smooth or seldom roughened, non-

diverticulate, non-gelatinous, ochraceous or pale brown (pigment intraparietal), inamyloid, thin-walled, clamped. **Tramal hyphae** 3-8 µm diam, interwoven, similar to pileipellis hyphae but hyaline. **Stipe tissue** monomitic; **cortical hyphae** 2.5-12 µm diam, parallel, cylindric, smooth, ochraceous or pale brown, inamyloid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** similar but hyaline and thinner-walled. **Stipe vesture** of numerous, suberect or erect **caulocystidia** 20-40 X 6.5-10 µm, similar to the cheilocystidia, clavate, lageniform, or more commonly irregular in outline, sometimes with several knob-like outgrowths, hyaline, thin-walled.

**Commentary.** The holotype specimen of *M. subarchyropus* belongs in *Collybia* sect. *Vestipedes*, and probably represents a synonym of *C. luxurians* Peck. According to Halling (1983a), *C. luxurians* forms slightly longer spores [6.4-9(-10.2) µm], longer basidia (18.2-27 µm), and narrower caulocystidia (2.2-4.2 µm diam). An earlier type study of *M. subarchyropus* was presented by Hesler (1959b).

***MARASMIUS SUBCRETACEUS*** Berkeley & Curtis, *nomen herbariorum*

*Marasmius subcretaceus* represents an unpublished binomial. Material determined as such by Berkeley and Curtis was collected by Peters on pine needles in Alabama (FH!). This material is conspecific with *Marasmius straminipes* Peck. Refer to Desjardin and Petersen (1989a) for a further discussion of *M. subcretaceus*.

***MARASMIUS SUBGRAMINIS*** Murrill, Bull. Torrey Bot. Club 67: 151. 1940.

≡ *Marasmiellus subgraminis* (Murr.) Singer, Beih. Nova Hedwigia 44: 36. 1973.

HOLOTYPE: United States, Florida, Alachua Co., Gainesville, 5 Oct. 1938, G. F. Weber, Murrill no. F18361, on dead centipede grass on a lawn (FLAS).

The collection consists of approximately 20 basidiomata in fair but fragmented condition, many attached to grass leaves. **Pileus** 3-5 mm diam, convex or plano-convex, even or short-striate, suede-like, buff-colored; context thick, spongy. **Lamellae** adnate, non-collariate, subdistant or distant, narrow or moderately broad, buff-colored. **Stipe** 8-10 X <1 mm, terete, apex flared, narrowed downward, pubescent, buff-colored, insititious, foliicolous.

**Basidiospores** 6.8-8.2 X 3-4 µm [$\bar{x}$ = 7.5 ± 0.5 X 3.5 ± 0.3 µm, E = 1.9-2.7, Q = 2.2 ± 0.2, n = 20], ellipsoid or amygdaliform, hyaline, inamyloid, smooth. **Basidia** 16-22 X 5.5-7.2 µm, clavate, 2- or 4-spored. **Basidioles** ventricose or fusoid. **Hymenial cystidia** absent; lamellar edge composed of numerous fusoid basidioles plus a few basidia. **Pileipellis** not hymeniform, composed of a cutis of interwoven hyphae; hyphae 2-3.5 µm diam, irregular in outline, knobby or contorted (not a *Rameales*-structure), smooth or with granular or annular hyaline incrustations, non-diverticulate or with scattered knob-like diverticula, clamped; walls hyaline, inamyloid, thin or up to 1 µm thick; terminal cells repent or suberect, cylindric or contorted, sometimes branched. **Pileus trama** interwoven; hyphae 2-6.5 µm diam, cylindric, smooth or roughened with hyaline incrustations,

non-gelatinous, hyaline, inamyloid, clamped, walls up to 1 µm thick. **Stipe tissue** monomitic; **cortical hyphae** 2-3.5 µm diam, subparallel, cylindric, smooth or more often with hyaline incrustations, clamped; walls hyaline, inamyloid, up to 1 µm thick; **medullary hyphae** 3-8 µm diam, similar but non-incrusted and thinner-walled. **Stipe vesture** a thick layer of interwoven hyphae similar in arrangement to the pileipellis, giving rise to suberect or erect **caulocystidia** 16-30 X 3.5-5 µm, cylindric, strangulate or contorted, obtuse, sometimes with few knobby outgrowths, hyaline, inamyloid, thin-walled.

**Commentary**. *Marasmius subgraminis* belongs in *Marasmiellus* sect. *Dealbati* subsect. *Dealbatini* as indicated by Singer (1973a), because of sparcely diverticulate pileipellis elements, inamyloid tramal tissues, small spores, absence of pilosetae, pigmentless pilei, and insititious stipe. Singer (1973a) reported formation of flexuous, often forked or nodose cheilocystidia in this species, but I was unable to demonstrate the presence of such structures on basidiomata of the holotype specimen.

The holotype specimen was collected by Dr. George F. Weber, and included with the collection are his detailed notes on the ecology of the species. Two hundred thirty seven basidiomata were collected by him from an area of less than one square yard. Apparently the species is parasitic on centipede grass, entering healthy host plants through older, senescent leaf sheaths and eventually attacking most of the living leaves and shoots.

***MARASMIUS SUBNIGRICANS*** Murrill, Bull. Torrey Bot. Club 67: 152. 1940.

≡ *Hemimycena subnigricans* (Murr.) Singer, Sydowia 15: 61. 1961.

≡ *Marasmiellus subnigricans* (Murr.) Singer, Beih. Nova Hedwigia 44: 26. 1973.

HOLOTYPE: United States, Florida, Alachua Co., Gainesville, 1 July 1938, W. A. Murrill no. F17358, on hardwood sticks in a high hammock (FLAS).

The collection consists of three basidiomata in fair condition. **Pileus** 12-18 mm diam, plane-undulate, striate, pruinose, dark brown; tissue thin. **Lamellae** adnate, non-collariate, distant, narrow or moderately broad, intervenose, dark brown. **Stipe** 22-25 X 1 mm, terete, equal, pruinose, brownish, insititious, lignicolous.

**Basidiospores** 10.6-14.4 X 3.6-4.8 µm [$\bar{x}$ = 12.2 ± 1.0 X 4.1 ± 0.3 µm, E = 2.5-3.4, Q = 3 ± 0.2, n = 20], clavate or subfusoid, often curved in profile, hyaline, inamyloid, smooth. **Basidia** 24-28 X 6-8 µm, clavate, 4-spored. **Basidioles** cylindric or clavate. **Hymenial cystidia** numerous on lamellar sides and edges, 44-72 X 8-13.5 µm, lageniform, obtuse, arising from subhymenium and projecting well beyond basidioles, non-refractive, hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, composed of a cutis of radially arranged hyphae, with numerous suberect or erect pilocystidia; hyphae 3-10(-12) µm diam, cylindric, smooth, subgelatinous, non-diverticulate, hyaline, inamyloid, thin-walled, clamped; **pilocystidia** 32-56 X 6-8 µm, cylindric or elongate-clavate, broadly obtuse, hyaline, thin-walled. **Pileus trama** interwoven; **lamellar trama** regular; hyphae cylindric, smooth, pale ochraceous or brown in water, hyaline in 3% KOH

(necropigment soluble in KOH), inamyloid, thin-walled, clamped; with scattered, refractive oleiferous hyphae interspersed. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 2.5-8 µm diam, subparallel, cylindric, smooth, ochraceous or pale brown from presence of necropigments, hyaline in KOH, inamyloid, clamped, with walls up to 1 µm thick. **Stipe vesture** of scattered, suberect or erect **caulocystidia**, 52-100 X 9-13 µm, similar to hymenial cystidia.

**Commentary**. A pileipellis composed of non-diverticulate, hyaline hyphae with elongate-clavate, thin-walled pilocystidia, inamyloid tramal tissues, long spores and insititious stipe are features which in combination indicate that *Marasmius subnigricans* belongs in *Marasmiellus* sect. *Candidi* as indicated by Singer (1973a). An interesting feature of this species is the development of dark brown necropigments upon drying.

***MARASMIUS SUBNUDUS*** Ellis *ex* Peck, Annual Rep. New York State Mus. 51: 287. 1898.

[≡ *Marasmius peronatus* var. *subnudus* Ellis, N. Amer. Fungi Exs. no. 909. 1883, *nom. nud.*]

≡ *Collybia subnuda* (Ellis *ex* Pk.) Gilliam, Mycotaxon 4: 136. 1976.

LECTOTYPE (*des mihi*): United States, New Jersey, Newfield, Sept. to Oct. 1882, Ellis, N. Amer. Fungi Exs. no. 909 (NY - Ellis Collection).

**Pileus** convex-depressed, radially streaked, appressed-fibrillose, striate, brown. **Lamellae** adnate, non-collariate, close, narrow,

ochraceous, non-marginate. **Stipe** terete, apex flared, equal below, pubescent, greyish brown, non-insititious.

**Basidiospores** 7.2-11.2 X 3.6-4.8 µm [$\bar{x}$ = 8.9 ± 1.0 X 4.2 ± 0.4 µm, E = 1.9-2.4, Q = 2.1 ± 0.1, n = 20], ellipsoid or amygdaliform, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 23-28 X 5.5-7 µm, clavate, 4-spored. **Basidioles** cylindric or fusoid. **Pleurocystidia** absent. **Cheilocystidia** scattered, 25-32 X 5-9.5 µm, clavate, fusoid or irregular in outline, sometimes apically constricted or lobed, hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, composed of a cutis of radially arranged hyphae; hyphae 4.5-10 µm diam, cylindric, usually incrusted with annular or helical, brown pigment deposits, few smooth, non-gelatinous, clamped; walls subhyaline or pale brown, inamyloid, thin; terminal cells repent, cylindric or clavate, obtuse, smooth or incrusted. **Tramal hyphae** 2.5-6.5 µm diam, interwoven, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-6.5 µm diam, subparallel, cylindric, smooth or incrusted, yellow or pale ochraceous, inamyloid, clamped, with walls up to 1 µm thick; **medullary hyphae** similar but hyaline and thinner-walled. **Stipe vesture** of numerous, clustered, erect **caulocystidia** 40-70 X 4-6.5 µm, flexuous, strangulate or irregularly cylindric, obtuse, hyaline or pale yellow, inamyloid, thin-walled.

**Commentary.** Type material of *M. subnudus* was distributed by Ellis in his North American Fungi Exsiccati as no. 909, *Marasmius peronatus* var. *subnudus* (epithet a *nomen nudum*). When the epithet was validly published, Peck (1898) cited Ellis' exsiccati duplicates as the

material on which the epithet was based, but he did not designate a particular specimen as the holotype. The exsiccata specimen retained in the Ellis Collections at NY is designated here as lectotype.

I concur with Gilliam (1976) and Halling (1983a) and accept *M. subnudus* as a distinct species of *Collybia* belonging in sect. *Vestipedes*.

***MARASMIUS SUBPILOSUS*** Peck, Bull. Torrey Bot. Club 30: 95. 1903.

HOLOTYPE: United States, Idaho, near Moscow Mountains, L. F. Henderson no. 5313 (NYS).

The collection consists of nine basidiomata in fair condition. **Pileus** 4-10 mm diam, convex or plano-convex, even, glabrous, ochraceous. **Lamellae** adnexed, non-collariate, close, broad, pruinose, pale ochraceous. **Stipe** 30-60 X 1 mm, terete, equal and pruinose at the apex, downy or tomentose and narrowed downward at the base, subradicating, non-insititious, pale orange or ochraceous.

**Basidiospores** 4.4-6 X 2.6-3.4 µm [$\bar{x}$ = 5 ± 0.5 X 3 ± 0.3 µm, E = 1.5-1.9, Q = 1.7 ± 0.1, n = 20], ellipsoid or lacrymoid, hyaline, inamyloid, smooth. **Basidia** 14-18 X 5-7 µm, clavate, 4-spored. **Basidioles** clavate. **Hymenial cystidia** numerous on lamellar sides and edges, 44-56 X 8.5-12 µm, ventricose or lageniform, rarely subcapitate, arising from subhymenium and projecting well beyond basidioles, thin-walled or with central portion of cells thick-walled (up to 1 µm), hyaline, inamyloid. **Pileipellis** hymeniform, not mottled, composed of broadly clavate, subvesiculose or sphaeropedunculate elements, 16-28 X 7-15(-24) µm, non-gelatinous or imbedded in a thin gelatinous matrix;

walls hyaline, inamyloid, thin; basally unclamped; plus scattered **pilocystidia** similar to the hymenial cystidia. **Tramal hyphae** 3-8 µm diam, interwoven, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, unclamped. **Stipe tissue** inconspicuously sarcodimitic; **cortical hyphae** 3-6(-10) µm diam, parallel, cylindric, smooth, hyaline, inamyloid, with walls up to 1.5 µm thick; **medullary hyphae** of two types: 1) inflated hyphae up to 16 µm diam, unbranched, hyaline, inamyloid, thin-walled; 2) non-inflated, branched hyphae 3-8 µm diam, otherwise similar. **Stipe vesture** of scattered, erect **caulocystidia** 50-120 X 10-20 µm, fusoid, or acuminate, obtuse, apically thin-walled, basally thick-walled (up to 2.5 µm), hyaline, inamyloid.

**Commentary.** Features that indicate *M. subpilosus* represents a synonym of *Strobilurus albipilatus* (Pk.) Wells & Kempton include: 1) hymeniform pileipellis of broadly clavate to sphaeropedunculate elements with scattered narrowly lageniform pilocystidia; 2) inamyloid tramal hyphae lacking clamp connections; 3) ventricose or lageniform hymenial cystidia; 4) small spores; 5) sarcodimitic stipe medullary tissue; and 6) subradicating, non-insititious stipe. Refer to Redhead (1980b) and Desjardin (1987b) for descriptions of *S. albipilatus*.

***MARASMIUS SUBPRASIOSMUS*** Murrill, Bull. Torrey Bot. Club 67: 153. 1940.

HOLOTYPE: United States, Florida, Alachua Co., Gainesville, 31 May 1938, W. A. Murrill no. F18362, on a lawn (FLAS).

The collection consists of approximately 18 basidiomata in good condition, some fragmented. **Pileus** 5-15 mm diam, convex or campanulate, striate or sulcate, glabrous, disc and striae brown,

ochraceous elsewhere. **Lamellae** adnexed or nearly free, non-collariate, subdistant or distant, narrow, pale ochraceous, non-marginate. **Stipe** 25-35 X 1 mm, terete or compressed, equal or with a slightly enlarged base, apex pruinose, base pubescent, greyish brown with paler pubescence, non-insititious.

**Basidiospores** 6.6-9.2 X 3.4-4.4 µm [$\bar{x}$ = 7.6 ± 0.6 X 3.9 ± 0.2 µm, E = 1.8-2.3, Q = 1.9 ± 0.1, n = 30], ellipsoid or amygdaliform, hyaline, inamyloid, smooth. **Basidia** 20-23 X 5-6 µm, 2- or 4-spored, clavate. **Basidioles** subclavate or fusoid. **Hymenial cystidia** absent; lamellar edge fertile or with regions of repent, interwoven, somewhat contorted hyphae. **Pileipellis** not hymeniform, composed of a cutis of radially arranged, repent hyphae; hyphae 3-8 µm diam, cylindric, non-incrusted, non-diverticulate, non-gelatinous but some hyphae agglutinated, subhyaline or pale greyish brown, inamyloid, thin-walled, clamped. **Tramal hyphae** 3-10 µm diam, interwoven, similar to the pileipellis hyphae. **Stipe tissue** monomitic; **cortical hyphae** 2.5-5 µm diam, subparallel, cylindric, smooth, subhyaline or pale yellow, inamyloid, clamped, with walls up to 1 µm thick; **medullary hyphae** 2.5-10 µm diam, otherwise similar. **Stipe vesture** of numerous, erect **caulocystidia**, 16-40 X 6.5-12 µm, cylindric, clavate, ventricose or irregular in outline, obtuse, hyaline, inamyloid, thin-walled.

**Commentary**. A pileipellis of radially arranged, non-diverticulate hyphae, inamyloid tramal tissues, adnexed lamellae and non-insititious stipe indicate that *M. subprasiosmus* belongs in *Collybia*. The taxon is transferred here as:

***Collybia subprasiosma*** (Murr.) Desjardin, ***comb. nov.*** [Bas.: *Marasmius subprasiosmus* Murrill, *ibid.*].

Furthermore, pileipellis morphology suggests the taxon is best placed in sect. *Vestipedes*. There are, however, numerous features of *M. subprasiosmus* that suggest affinities with *Collybia iocephala* (Berk. & Curt.) Sing., type species of sect. *Iocephalae*. Both species are nearly indistinguishable micromorphologically. *Collybia iocephala* differs only in forming interwoven pileipellis hyphae compared with radially arranged pileipellis hyphae in *C. subprasiosma*. In addition, basidiomata of both species have the same stature, pileus shape, lamellar features and alliaceous odor. *Collybia subprasiosma* differs in lacking violet pigments and in forming less ornamented stipes.

*Collybia subprasiosma* is also similar to *C. dysodes* Halling, but the latter differs by forming diverticulate pileipellis elements and flexuous cheilocystidia. An earlier type study of *M. subprasiosmus* was presented by Hesler (1959b).

***MARASMIUS SUBSTENOPHYLLUS*** Murrill, Bull. Torrey Bot. Club 67: 153. 1940.

≡ *Neoclitocybe substenophylla* (Murr.) Singer, Sydowia 15: 56. 1961.

HOLOTYPE: United States, Florida, Alachua Co., Planera Hammock, 21 July 1938, West, Arnold & Murrill no. F18268, on dead hardwood (FLAS).

The collection consists of approximately 20 basidiomata in fair condition, many infected by deuteromycetous fungi. **Pileus** 5-20 mm diam, convex or expanded-campanulate, even, suede-like, cream-colored.

**Lamellae** strongly decurrent, close or subdistant, narrow, ochraceous. **Stipe** 5-15 X 1 mm, terete, narrowed downward, pruinose, pale brown or ochraceous, subinsititious, base with cream-colored pubescence.

**Basidiospores** 6.6-8.2 X 3.4-4.4 µm [$\bar{x}$ = 7.4 ± 0.5 X 3.9 ± 0.3 µm, E = 1.8-2.1, Q = 1.9 ± 0.1, n = 20], ellipsoid or subamygdaliform, hyaline, inamyloid, smooth. **Basidia** 23-27 X 6-8 µm, cylindric or clavate, 4-spored. **Basidioles** clavate. **Hymenial cystidia** numerous on lamellar sides and edges, 40-55 X 6-8 µm, cylindric or elongate-clavate, broadly obtuse, arising from subhymenium and projecting well beyond basidioles, non-refractive, hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, composed of a well-developed *Rameales*-structure; hyphae 2.5-4 µm diam, irregular in outline, diverticulate, non-gelatinous, hyaline, inamyloid, clamped, with walls up to 0.5 µm thick; diverticula 1.5-4 X 1-2.5 µm, knob-like or rod-like, obtuse, hyaline, thin-walled; terminal cells repent or suberect, often branched, diverticulate. **Tramal hyphae** 3.2-7.2 µm diam, interwoven, cylindric, smooth, non-gelatinous, hyaline, inamyloid, clamped, with walls up to 1 µm thick. **Stipe tissue** monomitic; **cortical hyphae** 3-10 µm diam, parallel, cylindric, smooth, yellow, inamyloid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** 3-14 µm diam, similar but hyaline and thinner-walled. **Stipe vesture** a thin *Rameales*-structure similar to the pileipellis.

**Commentary.** Singer (1961b) transferred *M. substenophyllus* to *Neoclitocybe* because of a *Rameales*-type pileipellis, inamyloid tramal tissues, long-decurrent lamellae (*i.e.*, clitocyboid stature) and

subinsititious stipe. I concur with this disposition. An earlier type study of *M. substenophyllus* was presented by Hesler (1959b).

***MARASMIUS SUBSYNODICUS*** Murrill, Bull. Torrey Bot. Club 67: 154. 1940.

HOLOTYPE: United States, Florida, Alachua Co., Gainesville, 21 Oct. 1932, W. A. Murrill no. F9932, on chips in a pine grove (FLAS).

The collection consists of approximately 50 basidiomata in fair condition, mostly fragmented. **Pileus** 3-6 mm diam, convex, even or short-striate, suede-like, tan or buff-brown. **Lamellae** adnate or subdecurrent, non-collariate, subdistant, narrow or moderately broad, pale ochraceous. **Stipe** 5-8 X 0.5 mm, terete, equal, pruinose, concolorous with the pileus, insititious on pine needles and wood chips.

**Basidiospores** 6.4-8.8 X 3.2-3.6 µm $\bar{x}$ = 7.7 ± 0.6 X 3.4 ± 0.2 µm, E = 1.9-2.5, Q = 2.3 ± 0.2, n = 20], elongate-ellipsoid or subfusoid, hyaline, inamyloid, smooth. **Basidia** 16-19 X 5.5-7 µm, clavate, 4-spored. **Basidioles** clavate or ventricose. **Hymenial cystidia** usually absent; lamellar edge basidiomorphous, rarely with a few, scattered **cheilocystidia,** 24-29 X 5-7 µm, clavate or ventricose, typically with one or several broad, knob-like outgrowths, hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, composed of a cutis of weakly interwoven, slightly radially arranged hyphae; hyphae 2.5-5 µm diam, cylindric or irregular in outline, non-diverticulate or sparcely diverticulate (not a *Rameales*-structure), smooth or with granulose, hyaline incrustations, non-gelatinous, clamped; walls hyaline or pale yellow, inamyloid, thin; terminal cells repent or suberect, irregular

in outline, contorted, often lobed. **Tramal hyphae** 3-5.5 µm diam, interwoven, cylindric, smooth, non-gelatinous, hyaline, inamyloid, clamped, with walls up to 1 µm thick. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 3-8 µm diam, subparallel, cylindric, smooth or weakly roughened, subhyaline, inamyloid, clamped, with walls up to 1.2 µm thick. **Stipe vesture** a thin layer of loosely interwoven hyphae similar in morphology to the pileipellis.

**Commentary.** *Marasmius subsynodicus* belongs in *Marasmiellus* sect. *Dealbati* subsect. *Dealbatini* because of pileipellis morphology, spore size and macromorphological features. Singer (1973a) considered *M. subsynodicus* a synonym of *Marasmiellus stenophyllus* (Mont.) Singer. I have not examined the holotype specimen of *M. stenophyllus* and cannot comment on the conspecificity with *M. subsynodicus*. For a comparison of taxa allied with *M. stenophyllus* refer to the commentary following the type study of *M. pithyophilus* Berk. & Curt. presented above. An earlier type study of *M. subsynodicus* was presented by Hesler (1959b).

***MARASMIUS SUBTOMENTOSUS*** Peck, Bull. Torrey Bot. Club 22: 487. 1895.

≡ *Crinipellis subtomentosa* (Pk.) Singer, Lilloa 8: 463. 1942.

HOLOTYPE: United States, Kansas, Rooks Co., 1 July 1895, E. Bartholomew no. 1735; on sandy ground, parasitic on dead grass roots, abundant (NYS).

The collection consists of approximately 10 basidiomata in fair to poor condition. **Pileus** 8-14 mm diam, convex, even, zonate, furfuraceous, tan-brown. **Lamellae** adnate, non-collariate, subdistant, broad, pale brown. **Stipe** 20-30 X 1.5-2 µm, terete, enlarged downward,

pubescent or velutinous, concolorous with the pileus, subinsititious or insititious, attached to roots.

**Basidiospores** 10-13.2 X 4.8-6 µm [$\bar{x}$ = 11.7 ± 0.9 X 5.4 ± 0.4 µm, E = 1.9-2.8, Q = 2.2 ± 0.2, n = 20], ellipsoid or broadly amygdaliform, hyaline, inamyloid, smooth. **Basidia** 26-36 X 7-9 µm, clavate, 2- or 4-spored. **Basidioles** cylindric, clavate or ventricose. **Pleurocystidia** absent. **Cheilocystidia** scattered, few observed, 24-35 X 7.5-10 µm, irregularly clavate, sometimes lobed, hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, composed of a cutis of interwoven, repent hyphae with suberect or erect, setoid terminal cells ("hairs"); hyphae 3-8 µm diam, cylindric, smooth or incrusted, non-gelatinous, hyaline, inamyloid, with walls up to 1.5 µm thick; **setoid hairs** up to 100 X 5.5-10 µm, cylindric-acuminate, acute, subhyaline or pale yellow, inamyloid or weakly dextrinoid, with walls 1-3 µm thick. **Tramal hyphae** 3-8 µm diam, interwoven, cylindric, smooth or weakly incrusted, non-gelatinous, hyaline, inamyloid, thick-walled, clamped. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 4-10 µm diam, subparallel, cylindric, smooth, ochraceous, inamyloid or weakly dextrinoid, clamped, with walls up to 1 µm thick. **Stipe vesture** of numerous setoid hairs similar to those of the pileipellis.

**Commentary.** Although the holotype specimen of *M. subtomentosus* was collected by E. Bartholomew, and original material is deposited in the Bartholomew Collections at FH (!), the portion retained by Peck (NYS) is considered by me to represent the holotype specimen. I concur with Singer's (1942a) diagnosis that *M. subtomentosus* belongs in *Crinipellis*. It should be noted that the setoid pileipellis "hairs"

were typically unreactive to Melzers reagent or were only weakly dextrinoid, not strongly dextrinoid as reported by Singer (1976).

***MARASMIUS SUBVENOSUS*** Peck, Annual Rep. New York State Mus. 23: 125. 1869 (1872).

HOLOTYPE: United States, New York, Center, Oct. 1869, C. H. Peck (NYS).

The collection consists of 15 basidiomata pressed flat and glued in various numbers to 5 slips of paper, plus more than 30 intact basidiomata loose or attached to leaves, most basidiomata in good condition. **Pileus** 2-4 mm diam, convex or plano-convex, even or short-striate, glabrous or minutely pruinose, pale yellow. **Lamellae** well-developed, adnate, non-collariate, remote, narrow, some intervenose, pale yellow. **Stipe** 8-20 X <0.5 mm, terete, equal, glabrous at the apex, pruinose at the base, pale brown, insititious; attached to grass debris or *Populus* leaves.

**Basidiospores** 8.8-11.2 X 3.6-4.4 µm [$\bar{x}$ = 10.2 ± 0.6 X 3.9 ± 0.2 µm, E = 2.4-3, Q = 2.6 ± 0.1, n = 30], elongate-ellipsoid, subclavate or ventricose, hyaline, inamyloid, smooth. **Basidia** 20-28 X 7-9.5 µm, clavate, 4-spored. **Basidioles** cylindric or clavate. **Hymenial cystidia** common on lamellar sides and edges, 36-48 X 6-9 µm, fusoid-ventricose or narrowly lageniform, obtuse, arising from subhymenium and projecting well beyond basidioles, non-refractive, hyaline; cells thin-walled on lamellar sides, thin-walled or slightly thick-walled on lamellar edges. **Pileipellis** hymeniform, not mottled, of versiform elements plus scattered pilocystidia; **versiform elements** 12-20 X 8-20 µm, cylindric,

clavate, subvesiculose, broadly lageniform, turbinate or sphaeropedunculate, hyaline, inamyloid; on some basidiomata cells mostly thin-walled with thick-walled elements interspersed, on other basidiomata cells mostly thick-walled (0.5-1 µm) with thin-walled elements interspersed; **pilocystidia** 24-36 X 7-9 µm, ventricose or narrowly lageniform, obtuse, thin-walled or with walls up to 0.5 µm thick, hyaline, inamyloid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2-7.5 µm diam, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-6.5 µm diam, parallel, cylindric, smooth, hyaline or pale yellow at stipe apex, ochraceous or pale brown at stipe base, inamyloid, clamped, with walls up to 2 µm thick; **medullary hyphae** 2.5-8 µm diam, subparallel, similar but hyaline and thinner-walled. **Stipe vesture** of scattered **caulocystidia**, 8-28 X 4-8 µm, cylindric or ventricose, broadly obtuse, hyaline, inamyloid, with walls 0.5-1.5 µm thick.

**Commentary**. Pileipellis and hymenial cystidia morphologies, coupled with spore size, tetrasporic basidia and presence of clamp connections together indicate that *M. subvenosus* is a synonym of *M. epiphyllus* (Pers.: Fr.) Fr., as suggested by Gilliam (1976). Cells comprising the pileipellis of the holotype basidiomata ranged from thin-walled to thick-walled, with some basidiomata exhibiting mostly thin-walled elements with interspersed thick-walled cells, while other basidiomata showed mostly thick-walled elements. This infrapopulation phenomenon must be considered when evaluating the taxonomic disposition of *M. tenuiparietalis* Singer, a species segregated from *M. epiphyllus*

on presence of thin-walled pileipellis elements. According to Singer (1969), *M. epiphyllus* is characterized by thick-walled pileipellis elements. Refer to Singer (1969) for a comparison of *M. epiphyllus* and *M. tenuiparietalis*.

***MARASMIUS SULLIVANTII*** Montagne, Syll. Crypt. 143. 1856.

HOLOTYPE: United States, Ohio, Sullivant no. 174, *ad terram inter muscos* (PC).

The collection consists of one badly fragmented basidiome in poor condition. **Pileus** convex, even, subvelutinous, red to reddish brown. **Lamellae** adnexed, non-collariate, subdistant, moderately broad. **Stipe** terete, equal, minutely pruinose, brown, non-insititious.

**Basidiospores** 6.4-9.6 X 3.2-4.2 µm [$\bar{x}$ = 8.1 ± 0.8 X 3.7 ± 0.2 µm, E = 1.9-2.7, Q = 2.2 ± 0.2, n = 35], ellipsoid or subamygdaliform, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** not observed. **Basidioles** 17.5-21 X 5-6.5 µm, clavate or ventricose. **Pleurocystidia** uncommon, 25-32 X 4.5-6.5 µm, fusoid or irregularly cylindric, often abruptly attenuated at the apex, some appendiculate, arising from deep in subhymenium and projecting little beyond basidioles, weakly refractive, sometimes inconspicuous, hyaline, inamyloid, thin-walled. **Cheilocystidia** common, similar to the *Siccus*-type pileipellis elements; main body 9.5-12 X 4-7.5 µm, cylindric or clavate, seldom lobed, thin-walled or firm-walled, hyaline; apical setulae 2.5-6.5 X 0.5-1.5 µm, cylindric or conic, obtuse or subacute, thick-walled, hyaline. **Pileipellis** hymeniform, not mottled, of *Siccus*-type broom cells; main body 8-13 X 4.5-8 µm, cylindric, clavate or

turbinate, thin-walled or firm-walled, hyaline or pale orange; apical setulae 2.5-8 X 0.5-1.5 µm, cylindric or conic, obtuse or subacute, thick-walled or solid, subhyaline or tawny, dextrinoid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-10 µm diam, cylindric or slightly inflated, smooth, non-gelatinous, hyaline, dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 4-12 µm diam, parallel, cylindric, smooth, dark ochraceous or brown (olivaceous brown in KOH), dextrinoid, clamped, with walls up to 2 µm thick; **medullary hyphae** similar but hyaline and thinner-walled. **Stipe vesture** of numerous *Siccus*-type broom cells plus non-setulose elements; ***Siccus*-type elements** similar to those of the pileipellis; **non-setulose elements** 8-40 X 6-10 µm, fusoid, ventricose or irregular in outline, sometimes lobed or with knob-like outgrowths, hyaline, thick-walled.

**Commentary.** Gilliam (1976) reported that the holotype specimen was no longer available, and based her concept of the species on a Lloyd specimen (Ohio, Lloyd no. 27933) deposited at BPI (!). The holotype specimen has been located and is described above. Lloyd's material is conspecific with the holotype, and Gilliam's (1976) circumscription of the species is accurate. *Marasmius sullivantii* belongs in sect. *Sicci* ser. *Haematocephali*.

***MARASMIUS SUPERABUNDANS*** Murrill, Quart. J. Florida Acad. Sci. 8: 180. 1945.

HOLOTYPE: United States, Florida, Alachua Co., Gainesville, 11 Aug. 1944, W. A. Murrill no. F32713, on an open grassy lawn (FLAS).

The collection consists of more than 40 basidiomata in good condition, some fragmented, some infected with deuteromycetous fungi. **Pileus** 5-22 mm diam, convex or plano-convex, even, glabrous, "buckthorn brown." **Lamellae** adnexed, non-collariate, close or subdistant, narrow, concolorous with the pileus. **Stipe** 30-60 X 1.5-2.5 mm, terete, equal above a slightly enlarged base, apex pruinose, base downy-pubescent, tan or cream-brown, non-insititious.

**Basidiospores** 8.4-11.2 X 4.2-5.8 µm [$\bar{x}$ = 9.6 ± 0.7 X 5.2 ± 0.4 µm, E = 1.6-2.2, Q = 1.9 ± 0.2, n = 20], ellipsoid or lacrymoid, hyaline, inamyloid, smooth. **Basidia** 18.5-23 X 5.5-8 µm, clavate, 4-spored. **Basidioles** cylindric or clavate. **Pleurocystidia** absent. **Cheilocystidia** numerous, 24-36 X 8-12 µm, broadly clavate, rarely with a small, knob-like outgrowth, hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, composed of a cutis of radially arranged hyphae; hyphae 3-8 µm diam, cylindric, non-diverticulate or with scattered, knob-like diverticula, non-gelatinous, smooth (non-incrusted), ochraceous or pale brown, inamyloid, thin-walled, clamped. **Tramal hyphae** interwoven, undifferentiated from the pileipellis hyphae. **Stipe tissue** monomitic; **cortical hyphae** 3-9 µm diam, subparallel, cylindric, smooth, ochraceous or tawny, inamyloid, clamped, with walls up to 1 µm thick; **medullary hyphae** similar but hyaline and thinner-walled. **Stipe vesture** of numerous, clustered, suberect or erect **caulocystidia** cylindric, clavate, ventricose or lageniform, broadly obtuse, typically thin-walled, rarely firm-walled, hyaline, inamyloid.

**Commentary**. *Marasmius superabundans* belongs in *Collybia* sect. *Subfumosae* because of pileipellis morphology, inamyloid tramal tissues

and non-insititious stipe. As suggested by Murrill (1945b), *M. superabundans* is similar to *Collybia domestica* (Murr.) Sing. [*non C. domestica* (Murr.) Murr.], although the two taxa appear to be distinct. Murrill (1945b) reported the lamellae of *M. superabundans* as adnexed, narrow and usually close. In comparison, the lamellae of *M. domesticus* Murrill (1939 - basionym of *C. domestica* (Murr.) Sing.) were described as squarely adnate, rather broad and medium distant. A comparison of the holotype specimens of these two taxa indicated that *M. superabundans* formed clavate or ventricose, thin-walled caulocystidia and spores 8.4-11.2 µm long ($\bar{L}$ = 9.6 µm), whereas *M. domesticus* formed irregularly cylindric or contorted, thick-walled caulocystidia and slightly shorter spores (7.6-9.2 µm long; $\bar{L}$ = 8.3 µm). A formal transfer of *M. superabundans* to *Collybia* will not be proposed until more material is available and examined to evaluate the degree of variability in the features mentioned above. An earlier type study of *M. superabundans* was presented by Hesler (1959b).

***MARASMIUS SUTLIFFAE*** Peck, Bull. Torrey Bot. Club 32: 78. 1905.

HOLOTYPE: United States, California, Sacramento, Nov. 1904, Miss Mary L. Sutliff (NYS).

The collection consists of 10 fragmented basidiomata in fair condition, plus buff-colored spore prints of three pilei on black glossy paper. **Pileus** 7-17 mm diam, obtusely conic or convex, even or short-striate, glabrous, dark brown. **Lamellae** adnate, non-collariate, close or subdistant, broad, pale brown. **Stipe** terete, equal above a

slightly enlarged base, apex glabrous, base tomentose, greyish brown with cream-colored tomentum, non-insititious.

**Basidiospores** 8.8-12 X 5-6.4 µm [$\bar{x}$ = 10.3 ± 0.8 X 5.6 ± 0.4 µm, E = 1.4-1.9, Q = 1.8 ± 0.1, n = 25], broadly ellipsoid or lacrymoid, hyaline, strongly amyloid, smooth. **Basidia** 33.5-44 X 7-9 µm, cylindric or clavate, 4-spored. **Basidioles** cylindric or subclavate. **Hymenial cystidia** common on lamellar sides and edges, 60-90 X 10-18 µm, fusoid or ventricose with a long, narrow rostrum, arising from lamellar trama and projecting well beyond basidioles, non-refractive, hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, composed of a thin cutis of nearly radially arranged hyphae; hyphae 2.5-8 µm diam, cylindric, non-diverticulate, smooth, non-gelatinous, ranging from hyaline to pale brown (olivaceous grey in 3% KOH), dextrinoid, thin-walled, clamped. **Subcutis** of highly inflated hyphae up to 18.5 µm diam, many short-celled, non-gelatinous, hyaline, strongly dextrinoid, thin-walled, clamped. **Tramal hyphae** 3-15 µm diam, interwoven, cylindric or slightly inflated, typically longer-celled than hyphae of subcutis, hyaline, dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 3-8 µm diam, parallel, cylindric, smooth, non-gelatinous, hyaline or yellow, strongly dextrinoid, thin-walled, clamped. **Stipe vesture** of scattered or clustered **caulocystidia**, 12-40 X 5.5-8 µm, cylindric or irregular in outline, broadly obtuse, rarely lobed, hyaline, thin-walled.

**Commentary.** As previously indicated (Desjardin, 1987b), *M. sutliffae* belongs in *Mycena*. A re-evaluation of the holotype specimen resulted in my accepting the taxon as a distinct species belonging in

sect. *Calodontes* subsect. *Purae* (Konr. & Maubl.) Maas Geesteranus (*sensu* Maas Geesteranus, 1980). The epithet is transferred here as:

***Mycena sutliffae*** (Pk.) Desjardin ***comb. nov.*** [Bas.: *Marasmius sutliffae* Peck, *ibid.*].

*Mycena sutliffae* differs from all other taxa considered by Maas Geesteranus (1980) to belong to this subsection [*viz.*, *M. pura* (Pers.: Fr.) Kummer, *M. kuehneriana* A. H. Smith, and *M. subaquosa* A. H. Smith], in pileus coloration, spore size and possibly habitat. The type specimen of *M. sutliffae* was described as forming reddish brown, subcampanulate or convex pilei 10-20 mm diam, and fruiting on lawns in shaded places (Peck, 1905). In addition, the spores of *M. sutliffae* are much larger than those of other members of the subsection. *Mycena sutliffae* seems closest to *M. rutilantiformis* (Murr.) Murr. (of subsect. *Marginatae*) in pileus coloration and spore size, but the latter species differs in forming conspicuously purple-marginate lamellae.

***MARASMIUS TENEBRARUM*** Berkeley & Curtis, J. Linn. Soc., Bot. 10: 294. 1868.

ISOTYPE: Cuba, Dec. 29, C. Wright no. 108, Fungi Cubenses Exs. no. 95; *ad ramul. dej.* (FH). Holotype not examined.

The isotype specimen described below consisted of one basidiome in poor condition. **Pileus** 9 mm diam, plano-convex with a shallow central depression, even, glabrous, reddish brown. **Lamellae** adnate, non-collariate, close, narrow, reddish brown. **Stipe** 10 X 1 mm, terete,

base slightly enlarged, apex glabrous, base pubescent, pale brown, non-insititious, basal mycelium buff-colored, lignicolous.

Notes with a second isotype specimen at FH read: "Pileus sulcate, striate, thin, smooth, light brown, margin recurved, umbo depressed. Gills numerous, approximate narrow, unequal, adnate, light brown. Stipe rather stout, smooth, solid, white or nearly so. On sticks in woods. M. V. Dec. 29. Spore white. no. 108."

**Basidiospores** 5.2-6.8 X 2.8-3.4 µm (10 recovered), ellipsoid, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** not observed. **Basidioles** cylindric or clavate. **Pleurocystidia** absent. **Cheilocystidia** common, 14.5-20 X 3-4 µm, flexuous or cylindric, hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, composed of a cutis of repent, nearly radially arranged hyphae; hyphae 3-5 µm diam, cylindric, non-diverticulate, smooth or weakly roughened, non-gelatinous, pale ochraceous (pigment intraparietal), inamyloid, thin-walled, clamped. **Tramal hyphae** undifferentiated from the pileipellis hyphae, but hyaline. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 2.5-5 µm diam, parallel, cylindric, smooth, hyaline or pale yellow, inamyloid, thin-walled, clamped. **Stipe vesture** of scattered, erect **caulocystidia**, 16-32 X 3-5.5 µm, flexuous or cylindric, obtuse, hyaline, thin-walled.

**Commentary.** Pileipellis morphology and macromorphological features indicate that *M. tenebrarum* is allied with species of *Collybia* sect. *Vestipedes*. I cannot agree with Pegler's (1987) suggestion that *M. tenebrarum* might be close to *M. brevipes* Berk. & Rav. *in* Berk. & Curt. The latter species differs in forming diverticulate pileipellis

elements, black, glabrous stipes, black rhizomorphs, and distinctive stipe medullary tissue. Refer to Desjardin and Petersen (1989c) for a description and discussion of *M. brevipes*.

***MARASMIUS TENERRIMUS*** Berkeley & Curtis, J. Linn. Soc., Bot. 10: 296. 1868.

≡ *Marasmiellus tenerrimus* (Berk. & Curt.) Singer, Beih. Nova Hedwigia 44: 80. 1973.

ISOTYPE: Cuba, Aug. 6, C. Wright no. 139, Fungi Cubenses Exs. no. 110; *ramul. deject.* (FH). Holotype not examined.

The isotype specimen consists of five basidiomata in poor condition, pressed flat, badly infected by *Aspergillus* spp. **Pileus** plano-convex, very thin, papery, tan-colored. **Lamellae** remote, narrow, intervenose. **Stipe** filiform, narrow, dark brown, insititious, lignicolous; with a few dark reddish brown rhizomorphs on the woody substrate. Notes with the collection read: "Pileus flattish, thin, subpellucid, umbo depressed, whitish, fibrous. Stipe slender, solid, pubescent, light brownish. Gills few, distant, adnate, unequal, broad, whitish. On rotten sticks in woods. M. V. Aug. 6. no. 139."

**Basidiospores** (10.8)12-14.4 X 4.4-5.6 µm (7 recovered), subfusoid, inequilateral in profile, hyaline, inamyloid, smooth. **Hymenial elements** not observed; material too badly infected and hyphae revived poorly. **Pileipellis** not hymeniform, composed of a cutis of repent, non-diverticulate hyphae with scattered pilocystidia and pilosetae; hyphae 4-10 µm diam, cylindric or weakly inflated, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped; **pilocystidia**

rare, cylindric, subcapitate, hyaline, thin-walled; **pilosetae** 75-100 X 6-8 µm, cylindric-acuminate or lanceolate, sharply acute, brownish orange, inamyloid, with walls 1-2.5 µm thick, arising as terminal cells from hyaline, thin-walled pileipellis hyphae. **Tramal hyphae** 4-10 µm diam, interwoven, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** not examined; material too badly infected.

**Commentary**. Two conspecific isotype specimens are deposited at FH. Basidiomata of both specimens are so badly infected with *Aspergillus* that it was difficult to recover details of all essential features. A total of seven spores were observed, measuring 12-14.4 X 4.4-5.6 µm. In comparison, Pegler (1987) reported spores from the holotype specimen (K) as 14-19 X 4.5-5.7 µm. Pileipellis morphology indicates that *M. tenerrimus* belongs in *Marasmiellus* sect. *Stenophylloides*.

***GYMNOPUS TENUIFOLIUS*** Murrill, N. Amer. Fl. 9: 358. 1916.

≡ *Collybia tenuifolia* (Murr.) Murrill, Mycologia 8: 219. 1916.

≡ *Marasmius tenuifolius* (Murr.) Singer, Ann Mycol. 41: 130. 1943.

HOLOTYPE: United States, New York, Bronx Co., New York Botanical Garden, 29 July 1915 (NY).

The collection consists of three basidiomata in good condition. **Pileus** 22-60 mm diam, plano-convex, glabrous, even or concentrically wrinkled, disc dark brown (caused by poor drying conditions), margin buff-brown. **Lamellae** adnexed, non-collariate, close, very broad, buff-brown, non-marginate. **Stipe** 70-80 X 5-9 mm, terete, equal above a

subbulbous base, hollow, striate, pulverulent, base tomentose, cream-buff overall, non-insititious.

**Basidiospores** 6.6-8.4 X 4-4.8 µm [$\bar{x}$ = 7.4 ± 0.4 X 4.3 ± 0.3 µm, E = 1.6-1.9, Q = 1.7 ± 0.1, n = 20], ellipsoid or sublacrymoid, hyaline, inamyloid, smooth. **Basidia** 21-29 X 5.5-7.5 µm, clavate, 4-spored. **Basidioles** cylindric or subclavate. **Hymenial cystidia** numerous on lamellar sides and edges, 45-60 X 11-15 µm, irregularly fusoid or ventricose-rostrate, arising from deep in subhymenium or lamellar trama and projecting well beyond basidioles, non-refractive, hyaline, inamyloid, thin-walled (many collapsed). **Pileipellis** hymeniform, not mottled, of *Globulares*-type elements, 20-28 X 8-28 µm, broadly clavate, vesiculose, turbinate or sphaeropedunculate, non-gelatinous, hyaline or pale yellow, dextrinoid, thin-walled. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3.5-20 µm diam, cylindric or inflated, smooth, non-gelatinous, hyaline, strongly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 4-15 µm diam, subparallel, cylindric, smooth, hyaline or pale yellow, strongly dextrinoid, clamped, with walls up to 2.5 µm thick. **Stipe vesture** a layer of loosely interwoven hyphae similar to stipe cortical hyphae, giving rise to repent, suberect or erect, clavate, thin-walled terminal cells.

**Commentary.** *Gymnopus tenuifolius* represents a synonym of *Marasmius nigrodiscus* (Pk.) Halling, as suggested by Halling (1983b), The species belongs in sect. *Globulares* because of hymeniform pileipellis of broadly clavate elements and strongly dextrinoid tramal

tissues. An earlier type study of *G. tenuifolius* was presented by Smith (1938a).

***MARASMIUS TESTACEICEPS*** Murrill, Lloydia 9: 321. 1946.

HOLOTYPE: United States, Florida, Alachua Co., Gainesville, 11 Aug. 1944, W. A. Murrill no. F38912, in grass under a red maple (FLAS).

The collection consists of approximately 20 basidiomata in good condition, some fragmented. **Pileus** 4-6 mm diam, plano-convex, even or short-striate, subvelutinous, orange-ferruginous. **Lamellae** adnexed, non-collariate, subdistant, narrow or moderately broad, pale ferruginous, margins white-crystalline. **Stipe** 20-35 X <0.5 mm, terete, equal, pruinose or hispid, pale orange-white, non-insititious, foliicolous.

**Basidiospores** 9.6-12 X 3.6-4.8 µm [$\bar{x}$ = 10.8 ± 0.6 X 4.2 ± 0.3 µm, E = 2.3-3, Q = 2.6 ± 0.2, n = 20], broadly clavate or subfusoid, often with an abaxial bulge, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** not observed. **Basidioles** 20-24 X 5-7 µm, fusoid or ventricose-mucronate. **Pleurocystidia** absent. **Cheilocystidia** numerous, similar to the *Siccus*-type pileipellis elements; main body 11-20 X 4.5-7 µm, cylindric or clavate, sometimes wavy in outline, hyaline, thin-walled; apical setulae 2-12 X 1-2 µm, flexuous or irregularly cylindric, obtuse, often nodulose, thin-walled or thick-walled, hyaline. **Pileipellis** hymeniform, not mottled, of *Siccus*-type broom cells; main body 10.5-16 X 5-10 µm, cylindric, clavate, turbinate or irregular in outline, often lobed, hyaline or pale orange, thin-walled, inamyloid; apical setulae 2-12 X 1-2 µm, conic or irregularly

cylindric, obtuse or subacute, sometimes nodulose, thick-walled or solid, pale yellow or orange, dextrinoid. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2-6.5 µm diam, cylindric, smooth, non-gelatinous, hyaline, strongly dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2-8 µm diam, parallel, cylindric, smooth, hyaline or pale yellow, strongly dextrinoid, thick-walled, clamped; **medullary hyphae** 2.5-10 µm diam, similar but thinner-walled. **Stipe vesture** of numerous, erect, setoid **caulocystidia**, 40-130 X 5-10 µm, lanceolate, filiform-acuminate or narrowly fusiform, apex acute, basal region inflated, strangulate or rarely lobed, aseptate or rarely secondarily septate; walls 1-2 µm thick, hyaline or pale yellow, weakly dextrinoid.

**Commentary.** *Marasmius testaceiceps* represents a distinct species in sect. *Sicci* ser. *Atrorubenses*. As suggested by Murrill (1946b), *M. testaceiceps* is similar to *M. bahamensis* Murr. The latter species differs, however, in forming isabelline-colored pilei (*vs.* testaceous pilei in *M. testaceiceps*), and longer spores, *viz.*, 12-16 µm ($\bar{L}$ = 13.9 µm). Compare with the type study of *M. bahamensis*. An earlier type study of *M. testaceiceps* was presented by Hesler (1959b).

***MARASMIUS THIERSII*** Desjardin, Mycologia 79: 123. 1987.

HOLOTYPE: United States, California, Amador Co., Irishtown Road, off Hwy 88 near Pine Grove, 25 Oct. 1983, D. E. Desjardin no. 2611 (SFSU).

Nothing can be added to the description and illustrations presented in the originating publication (Desjardin, 1987a). See there for details.

***MARASMIUS THUJINUS*** Peck, New York State Mus. Bull. 67: 26. 1903.

HOLOTYPE: United States, New York, North Elba, 19 Sept. 1902, C. H. Peck; on fallen twigs of arbor vitae (NYS).

The collection consists of more than 20 basidiomata in good condition, attached to leaves of *Thuja occidentalis*. **Pileus** 1-1.5 mm diam, convex, even or weakly striate, glabrous, greyish buff. **Lamellae** adnate, non-collariate, subdistant, narrow, pallid. **Stipe** 10-15 X <0.2 mm, terete, equal, glabrous, tan or pale reddish brown, insititious; with scattered sterile stipes.

**Basidiospores** 7.8-10.4 X 3.2-4.2 µm [$\bar{x}$ = 8.9 ± 0.7 X 3.7 ± 0.3 µm, E = 2.1-2.8, Q = 2.4 ± 0.2, n = 20], elongate-ellipsoid or subcylindric, hyaline, inamyloid, smooth. **Basidia** 19-24 X 6.5-8 µm, clavate, 4-spored. **Basidioles** clavate. **Pleurocystidia** absent. **Cheilocystidia** numerous, 12-25 X 4-6.5, cylindric, clavate or irregular in outline, seldom lobed, apically diverticulate, hyaline, thin-walled; diverticula similar to those of the pileipellis elements. **Pileipellis** not hymeniform, composed of a well-developed *Rameales*-structure; hyphae 2-5.5 µm diam, interwoven, densely diverticulate, non-incrusted, non-gelatinous, hyaline or pale greyish brown, inamyloid, thin-walled; diverticula 2-6.5 X 1-2.5 µm, knob-like or rod-like, obtuse, seldom lobed, thin-walled, hyaline. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-6.5 µm diam, cylindric, smooth or weakly incrusted

with pale greyish brown pigment deposits, non-gelatinous, clamped; walls thin, hyaline, inamyloid. **Stipe tissue** monomitic; **cortical hyphae** 1.5-4 µm diam, parallel, hyaline, pale yellow or pale brown, inamyloid, thin-walled, clamped; exterior most hyphae densely diverticulate; diverticula 2-5 X 0.5-2 µm, rod-like or irregular in outline, obtuse, hyaline, thin-walled; **medullary hyphae** 2-8 µm diam, subparallel, cylindric, hyaline, inamyloid, thin-walled, clamped.

**Commentary.** Gilliam (1976) treated *M. thujinus* as a distinct species of *Marasmius* in sect. *Androsacei*. The *Rameales*-type pileipellis and stipitipellis in conjunction with inamyloid tramal tissues and absence of rhizomorphs are features of the holotype specimen that indicate *M. thujinus* is best placed in *Marasmiellus*. I concur with Redhead's (1980a) diagnosis that *M. thujinus* represents a synonym of *Marasmiellus filopes* (Pk.) Redhead. For further discussions of *M. filopes* see Redhead (1980a) and Desjardin (1987b). An earlier type study of *M. thujinus* was presented by Hesler (1959b).

***MARASMIUS TOMENTELLUS*** Berkeley & Curtis, J. Linn. Soc., Bot. 10: 298. 1868.

HOLOTYPE: Cuba, C. Wright no. 22 (K).

The collection consists of several coarse, black rhizomorphs with white pubescence. The rhizomorphs give rise along their length to numerous, short stipes, most of which lack pilei. One stipe has a flattened, badly parasitized, dark brown pileus less than 2 mm diam.

Microscopic features of the pileus undeterminable. **Stipe tissue** and **rhizomorph tissue** similar, monomitic; **cortical hyphae** 4-6.5 µm

diam, parallel, cylindric, incrusted with granulose or amorphous, brown pigment deposits, unclamped; walls up to 1.5 µm thick, brown (pigment intraparietal as well as incrusting), dextrinoid; **medullary hyphae** 4-8 µm diam, subparallel, cylindric, smooth, hyaline, weakly dextrinoid, thin-walled, unclamped. **Rhizomorph vesture** of numerous, erect **rhizocystidia**, 45-120 X (6-)8-12 µm, cylindric or lanceolate, obtuse or subacute, aseptate or with one or several secondary septa, apex of cell hyaline, base of cell hyaline, pale ochraceous or pale brown, weakly dextrinoid.

**Commentary**. Very little taxonomic information was retrievable from the holotype specimen. Because only one, tiny, badly infected pileus remains, I was unable to obtain details on pileal micromorphology and must rely on earlier type studies for essential data. Pegler (1987) reported the pileipellis as composed of irregular, diverticulate, hyaline elements, 10-17 X 4-12 µm, and he recovered one spore that measured 10 X 3.5 µm. Dennis (1951d) reported the pileus trama as very thin, of non-gelatinized, inamyloid hyphae, and indicated that pleurocystidia were absent. These features in combination with details on stipe and rhizomorph tissues presented above, indicate that *M. tomentellus* belongs in sect. *Androsacei*. The absence of clamp connections and presence of numerous rhizocystidia are distinctive.

***MARASMIUS TOMENTOSIPES*** Peck, Bull. Torrey Bot. Club 29: 71. 1902.

HOLOTYPE: United States, Idaho, Moscow Mts., L. F. Henderson no. 5243 (NYS).

The collection consists of 13 basidiomata in good condition, some fragmented. **Pileus** 6-15 mm diam, convex, some shallowly umbilicate, even, glabrous, brownish orange. **Lamellae** subdecurrent or decurrent, non-collariate, close, moderately broad, orange-white, non-marginate. **Stipe** 17-20 X 1 mm, apex flared, central region equal, base slightly enlarged, upper half pubescent and dark brown, lower half tomentose and brownish orange, non-insititious.

**Basidiospores** 5.2-6.6 X 2.8-3.6 µm [$\bar{x}$ = 5.7 ± 0.4 X 3.1 ± 0.2 µm, E = 1.7-2.1, Q = 1.8 ± 0.1, n = 21], ellipsoid, hyaline, amyloid, smooth. **Basidia** 18-27 X 5-6 µm, clavate, 4-spored. **Basidioles** cylindric or subclavate. **Pleurocystidia** absent. **Cheilocystidia** common, 24-36 X 4-9 µm, cylindric, clavate or more commonly highly irregular in outline, contorted and lobed, hyaline, inamyloid, thin-walled or firm-walled. **Pileipellis** not hymeniform, composed of a cutis of radially arranged, repent hyphae; hyphae 2.5-8 µm diam, cylindric or irregular in outline, incrusted with granulose, brownish orange pigment deposits, non-gelatinous, ochraceous in water, red in KOH, thin-walled, inamyloid; giving rise to scattered **pilocystidia**, 16-36 X 4-13 µm, similar to the cheilocystidia. **Pileus trama** sarcodimitic; hyphae interwoven, non-gelatinous, some inflated up to 12 µm diam, with walls up to 1.5 µm thick, other hyphae non-inflated, 4-8 µm diam, thin-walled; all hyphae smooth or weakly incrusted, subhyaline or pale yellowish orange in water, red in KOH, inamyloid, clamped. **Stipe tissue** monomitic or subtly sarcodimitic; **cortical hyphae** 3-5 µm diam, parallel, cylindric, incrusted, ochraceous or pale brown in water, red in KOH, dextrinoid, clamped, with walls up to 1.5 µm thick; **medullary**

**hyphae** 3-8 µm diam, cylindric or slightly inflated, hyaline, inamyloid, thin-walled, with a few narrower, branched hyphae interspersed. **Stipe vesture** of numerous, suberect or erect **caulocystidia** 25-80+ X 4-7 µm, highly irregular in outline, flexuous, often lobed, obtuse or acute, hyaline or pale yellow in water, deep red in KOH, inamyloid or weakly dextrinoid, with walls up to 1.5 µm thick.

**Commentary.** I concur with the diagnoses of Gilliam (1976) and Redhead (1988) that *M. tomentosipes* represents a synonym of *Xeromphalina cauticinalis* (Fr.) Kühner & Maire.

***MARASMIUS TOMENTOSUS*** Peck, N. Amer. Fungi Exs. 2. 3403. 1896. *nom. nud.* [*non Marasmius tomentosus* Quélet, C. R. Assoc. France Av. Sci. Paris 18(2): 511. 1890].

The material distributed by Ellis and Everhart in their North American Fungi Exsiccati as "no. 3403. *Marasmius tomentosus* Pk." constituted duplicates of a specimen collected by E. Bartholomew and annotated "on dead grass roots, July 1895, Rockport, Rook Co., Kansas." It is probable that the exsiccati duplicates were once part of a collection that constituted the holotype specimen of *M. subtomentosus* Pk. (NYS!). All label data from the holotype specimen of *M. subtomentosus* match exactly the label data on the Ellis and Everhart exsiccati specimens. Moreover, the exsiccati duplicates determined as *M. tomentosus* are conspecific with the holotype of *M. subtomentosus*. It can be concluded that the epithet *tomentosus* represents an orthographic error that was originally intended to be printed

*subtomentosus*. Consequently, the exsiccati specimens cited above may be regarded as isotype specimens of *M. subtomentosus*.

***MARASMIUS TRITICI*** Young, Phytopath. 15: 118. 1925.

HOLOTYPE: United States, Illinois, Abingdon, 12 July 1924, P. A. Young; on *Triticum aestivum* L., culms of ripening wheat in a field (BPI). [ISOTYPES: BPI!, ILL!].

Very little material is left of the holotype specimen. No pilei are present and only a few fragmented stipes remain. An isotype specimen at ILL consists of several basidiomata in fair condition. Data on micromorphological features were obtained from an ILL isotype specimen.

**Basidiospores** 7.2-8.8 X 3.6-4.8 µm [$\bar{x}$ = 7.9 ± 0.5 X 4.1 ± 0.4 µm, E = 1.6-2.1, Q = 1.9 ± 0.1, n = 15], ellipsoid, hyaline, inamyloid, smooth. **Basidia** 15-18.5 X 5.5-7 µm, clavate, 4-spored. **Basidioles** clavate or ventricose. **Pleurocystidia** absent. **Cheilocystidia** numerous, similar to the *Siccus*-type pileipellis elements, with hyaline apical setulae. **Pileipellis** hymeniform, mottled, of *Siccus*-type broom cells; main body 9.5-13 X 5-10 µm, cylindric or broadly clavate, seldom lobed, mostly hyaline and thin-walled, some elements pale orange and thick-walled; apical setulae 1-3.5 X 1-2 µm, knob-like or rod-like, obtuse, thick-walled or solid, yellow or orange. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-8 µm diam, cylindric or slightly inflated, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3.5-7.5 µm diam, parallel, cylindric, smooth, brownish orange or brown,

dextrinoid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** 3-10 µm diam, hyaline, inamyloid, thin-walled. **Stipe vesture** absent.

**Commentary.** Because no pilei remain on the holotype specimen, the description presented above was derived from examination of an isotype specimen deposited at ILL. The specimen labeled "type" deposited at BPI reported the substrate as *Triticum aestivum*. In contrast, two additional specimens at BPI and two specimens at ILL report the substrate as *Triticum vulgare*. In all other details, label data from the latter four specimens match the data from the holotype specimen. The specimen examined is conspecific with *M. graminum* (Lib.) Berk. & Broome.

***MARASMIUS TRULLISATIPES*** Peck, Annual Rep. New York State Mus. 167: 44. 1913.

≡ *Caulorhiza trullisatipes* (Pk.) Halling, Mycol. Mem. 8: 104. 1983.

LECTOTYPE (*des mihi*): United States, Minnesota, near Minneapolis, May, Mrs. M. S. Whetstone (NYS).

The collection consists of four fragmented basidiomata in good condition. **Pileus** 8-16 mm, campanulate or convex-umbonate, margin incurved, even, glabrous, dark ochraceous. **Lamellae** adnate, non-collariate, close, broad, greyish tan, non-marginate. **Stipe** ≈ 35-55 X 1-1.5 mm, terete, equal above, enlarged near the base then radicating, pruinose at apex, pubescent at base, tan or buff-brown overall, non-insititious.

**Basidiospores** 5.6-8 X 3-4 µm [$\bar{x}$ = 6.9 ± 0.8 X 3.6 ± 0.3 µm, E = 1.7-2.4, Q = 1.9 ± 0.2, n = 25], ellipsoid or subamygdaliform, hyaline,

strongly amyloid, smooth. **Basidia** not observed. **Basidioles** 16-18.5 X 4-6 µm, clavate. **Hymenial cystidia** common on lamellar sides and edges, 36-60 X 6-9.5 µm, fusoid or ventricose, obtuse, arising from deep in subhymenium and projecting well beyond basidioles, non-refractive, hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, composed of a cutis of radially arranged hyphae; hyphae 3-8 µm diam, cylindric, smooth or weakly incrusted, non-diverticulate, non-gelatinous, ochraceous or pale brown (pigment intraparietal), inamyloid, thin-walled, clamped. **Tramal hyphae** undifferentiated from pileipellis hyphae, or some inflated up to 10.5 µm diam. **Stipe tissue** monomitic; **cortical** and **medullary hyphae** similar, 2.5-6.5 µm diam, subparallel, cylindric, smooth, hyaline or pale yellow, inamyloid, clamped, with walls up to 1 µm thick. **Stipe vesture** of numerous **caulocystidia** similar to the hymenial cystidia, with walls up to 1 µm thick.

**Commentary.** Two specimens were cited by Peck (1913) in the protologue, *viz.*, "near Minneapolis, Minnesota. May. Mrs. M. S. Whetstone," and "Cedar Point, Ohio. July. C. K. Brain." Because no single specimen was specified as the holotype, the specimen collected near Minneapolis, Minnesota is designated here as lectotype. I concur with Halling's (1983a) transfer of *M. trullisatipes* to the genus *Caulorhiza*. Contrary to Singer (1982), I do not consider *Caulorhiza* a synonym of *Hydropus*. Refer to Halling (1983a) for further details on the lectotype specimen.

***MARASMIUS UMBILICATUS*** Kauffman, Pap. Michigan Acad. Sci. 5: 137. 1925.

HOLOTYPE: United States, Oregon, Clackamas Co., Mt. Hood, 5 Oct. 1922, C. H. Kauffman; in an alder and conifer swamp (MICH).

The portion of the holotype examined consisted of three basidiomata in good condition. **Pileus** 12-20 mm diam, convex-umbilicate, even, glabrous, cream-colored. **Lamellae** subdecurrent or decurrent, close, narrow, golden, non-marginate. **Stipe** ≈ 30-40 X 1-2 mm, terete or compressed, apex flared or equal, narrowed downward, pruinose above, pubescent below, brown, non-insititious.

**Basidiospores** 8.4-12 X 3.6-4.4 µm [$\bar{x}$ = 10.5 ± 1.0 X 4 ± 0.2 µm, E = 2.3-3, Q = 2.7 ± 0.2, n = 20], elongate-ellipsoid or subcylindric, slightly inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 24-28 X 5-7 µm, clavate, 4-spored. **Basidioles** cylindric or csubclavate. **Hymenial cystidia** abundant on lamellar sides and edges, 30-56 X 5-7.5 µm, irregularly cylindric, fusoid, or narrowly lageniform, sometimes subcapitate, obtuse, arising from deep in subhymenium and projecting well beyond basidioles, non-refractive, hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, a very poorly developed *Rameales*-structure; hyphae 1.5-5 µm diam, interwoven, flexuous, diverticulate, non-gelatinous, hyaline or pale yellow, inamyloid, thin-walled, clamped; diverticula 2-8 X 1.5-3.5 µm, knob-like or cylindric, obtuse; terminal cells repent or suberect, flexuous, often lobed or diverticulate. **Tramal hyphae** 3-8 µm diam, interwoven, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 4-8 µm diam, parallel, cylindric, smooth, hyaline or pale ochraceous,

inamyloid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** 3-14.5 µm diam, similar but hyaline and thinner-walled. **Stipe vesture** a thin layer of loosely interwoven hyphae giving rise terminally and intercalarily to suberect or erect **caulocystidia,** 16-50 X 4-6 µm, flexuous or cylindric, often subcapitate, obtuse, hyaline, inamyloid, thin-walled.

**Commentary.** Redhead and Halling (1982) included *M. umbilicatus* as a synonym of *Marasmiellus papillatus* (Pk.) Redhead & Halling. I agree that these two taxa are conspecific but consider the organism to belong in *Neoclitocybe*. Macromorphologically, the holotype basidiomata of *M. umbilicatus* are larger, more conspicuously umbilicate and have lamellae more strongly decurrent than basidiomata of the holotype specimen of *M. papillatus*. Compare with the type study of *M. papillatus* Pk.

***MARASMIUS UMBONATUS*** Peck, Bull. Buffalo Soc. Nat. Sci. 1: 58. 1873 (1874).

≡ *Collybia umbonatella* Singer, Mycologia 35: 156. 1943. *nom. nov.*

[*non Collybia umbonatus* Peck, Bull. Torrey Bot. Club 31: 178. 1904]

HOLOTYPE: United States, New York, North Elba, July, C. H. Peck; under balsam (NYS).

The collection consists of more than 20 basidiomata in good condition. **Pileus** 4-10 mm diam, plano-umbonate or plano-convex, even or short-striate, suede-like, ochraceous with a slightly darker disc. **Lamellae** adnate or subdecurrent, non-collariate, close or subdistant, narrow, pale golden, non-marginate. **Stipe** 20-30 X 1 mm, terete, equal, apex pubescent, base tomentose, tawny-brown, non-insititious.

**Basidiospores** 8-11.2 X 3.8-5.2 µm [$\bar{x}$ = 9.5 ± 0.9 X 4.5 ± 0.4 µm, E = 1.9-2.5, Q = 2.1 ± 0.2, n = 30], ellipsoid, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 30-43 X 5.5-7.5 µm, clavate, 4-spored. **Basidioles** cylindric or clavate. **Hymenial cystidia** absent. **Pileipellis** not hymeniform, composed of a cutis of slightly interwoven but radially arranged, repent hyphae; hyphae 3-6.5 µm diam, cylindric, smooth or roughened, non-diverticulate or with scattered, broad, knob-like diverticula or branchlets, non-gelatinous, clamped; walls thin, pale yellow or pale ochraceous, inamyloid. **Tramal hyphae** 3-10 µm diam, interwoven, cylindric or weakly inflated, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-6 µm diam, parallel, cylindric, smooth or roughened, ochraceous in water, olivaceous in 3% KOH, inamyloid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** 3-8.5 µm diam, similar but hyaline and thinner-walled. **Stipe vesture** of numerous **caulocystidia** up to $150^{+}$ X 6-8 µm, irregularly cylindric, flexuous or strangulate, obtuse, yellow or ochraceous, inamyloid, thick-walled (1-2.5 µm).

**Commentary.** Pileipellis morphology, inamyloid and non-gelatinous tramal tissue, and non-insititious stipe are features that indicate *M. umbonatus* belongs in *Collybia* sect. *Subfumosae*. I concur with Halling's (1983a) diagnosis that *M. umbonatus* is conspecific with *M. contrarius* Pk., and when included in *Collybia*, the correct name for this taxon is *C. contraria* (Pk.) Halling.

***MARASMIUS VELUTIPES*** Berkeley & Curtis, Ann. Mag. Nat. Hist. ser. 3, 4: 294. 1859.

ISOTYPE: United States, South Carolina, Society Hill, Aug. 1849, Curtis no. 2548; *ad fol. putresc. in paludosi exsiccatis* (FH). Holotype (K) not examined.

The isotype specimen consists of five basidiomata in fair condition, pressed flat and glued to a slip of paper; one attached to a woody substrate, three attached to leafy debris, one lacking a stipe base. **Pileus** 12-18 mm diam, plano-convex, even, radially appressed-fibrillose, brown or dark brown. **Lamellae** adnate, non-collariate, close or crowded, narrow, cream-ochraceous. **Stipe** 35-55 X 1-1.5 mm, terete, equal above a slightly enlarged base, apex pubescent and greyish brown, base tomentose and tawny or ferrugineous, non-insititious. Notes with the collection match those reported in the protologue.

**Basidiospores** 6.4-8 X 3.2-4 µm [$\bar{x}$ = 7.1 ± 0.5 X 3.6 ± 0.2 µm, E = 1.8-2.4, Q = 2 ± 0.1, n = 25], ellipsoid or lacrymoid, hyaline, inamyloid, smooth. **Basidia** 18-23 X 4-6 µm, clavate, 4-spored. **Basidioles** subclavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** abundant, lamellar edge sterile, 16-33.5 X 5.5-8 µm, irregularly cylindric, ventricose or clavate, often lobed or with a few, broad diverticula, hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, composed of a cutis of radially arranged, repent hyphae; hyphae 3-8 µm diam, cylindric or irregular in outline, typically incrusted with granular, amorphous or annular, brown pigment deposits, non-diverticulate or with scattered, broad, knob-like diverticula, non-gelatinous, clamped; walls hyaline, ochraceous or pale brown, inamyloid, less than 0.5 µm thick. **Tramal hyphae** 2.5-8 µm

diam, interwoven, cylindric, smooth or weakly incrusted, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-6 µm diam, parallel, cylindric, smooth, ochraceous, inamyloid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** similar but hyaline and thinner-walled. **Stipe vesture** of abundant, often clustered **caulocystidia** 30-100 X 3-6 µm, flexuous or cylindric, sometimes wavy in outline, obtuse, rarely with a few knob-like outgrowths, hyaline, ochraceous or pale tawny, inamyloid, walls 0.5-1 µm thick.

**Commentary.** *Marasmius velutipes* belongs in *Collybia* sect. *Subfumosae*. Although the epithet *velutipes* is the oldest known name for this taxon, a transfer to *Collybia* is preempted by *C. velutipes* (W. Curtis: Fr.) Kummer (1871). I concur with Gilliam (1976) and Halling (1983a) that the next available epithet for this taxon is *C. biformis* (Pk.) Sing. [Bas.: *Marasmius biformis* Pk.]. Compare with the type study of *M. biformis*.

***MARASMIUS VIALIS*** Peck, Annual Rep. New York State Mus. 51: 287. 1897 (1899).

≡ *Marasmiellus tricolor* var. *vialis* (Pk.) Singer, Beih. Nova Hedwigia 44: 96. 1973.

HOLOTYPE: United States, New York, Saratoga Co., Gansevoort, July 1897, C. H. Peck (NYS).

The collection consists of approximately 10 badly fragmented basidiomata in poor condition. **Pileus** 1.5-2.5 mm diam, convex, some slightly centrally depressed, even, suede-like, dingy cream-colored. **Lamellae** decurrent, non-collariate, distant, narrow, concolorous with

the pileus. **Stipe** 5-12 X <0.5 mm, terete, apex equal and pruinose, base swollen and tomentose, ochraceous, subinsititious, arising from soil but attached to roots.

**Basidiospores** 8.8-12.4 X 4-4.8 µm [$\bar{x}$ = 10.6 ± 1.0 X 4.6 ± 0.3 µm, E = 1.8-2.8, Q = 2.3 ± 0.3, n = 13], elongate-ellipsoid or subfusoid, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** not observed. **Basidioles** 29-35 X 6.5-8 µm, clavate or ventricose. **Pleurocystidia** absent. **Cheilocystidia** 16-40 X 5-8 µm, highly irregular in outline, densely diverticulate laterally and apically, or with a smooth, bulbous apex, hyaline, inamyloid, thin-walled; diverticula similar to those on the pileipellis elements. **Pileipellis** not hymeniform, composed of a well-developed *Rameales*-structure; hyphae 2-6 µm diam, interwoven, highly irregular in outline, densely diverticulate, non-gelatinous, hyaline, inamyloid, thin-walled; diverticula 1.5-6 X 0.5-2.5 µm, knob-like or rod-like, obtuse, sometimes lobed, thin-walled; terminal cells densely diverticulate, often lobed, somewhat coralloid, sometimes with smooth, bulbous apices. **Tramal hyphae** 2-9.5 µm diam, interwoven, cylindric or weakly inflated, smooth or slightly roughened, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2-4 µm diam, parallel, cylindric, smooth, hyaline or pale yellow, inamyloid, clamped, with walls up to 1 µm thick; **medullary hyphae** 2-8 µm diam, similar but hyaline throughout. **Stipe vesture** a well-developed *Rameales*-structure, similar to the pileipellis.

**Commentary.** I concur with Singer (1973a) that *M. vialis* is closely allied to *Marasmiellus tricolor* (Alb. & Schw.: Fr.) Singer,

*sensu* Singer (1973a), Kühner (1933) and Noordeloos (1987). Because no type material of the latter species exists, it is currently impossible to determine whether *M. vialis* represents a distinct variety of *M. tricolor* (as suggested by Singer), or whether it is convarietal with var. *tricolor*. Data from the type study of *M. vialis* presented above match nearly exactly those reported by Noordeloos (1987a) on European specimens of *M. tricolor*. Moreover, the character Singer (1973a) utilized to separate *M. tricolor* var. *vialis* (Pk.) Sing. from var. *graminis* (Murr.) Sing., *viz.*, spore size, is untenable. Spores from the holotype specimen of *M. vialis* measured 8.8-12.4 X 4-4.8 µm, whereas Singer (1973a) reported spores of var. *graminis* as (7.5-)9-11.3(-13.7) X 3.5-5.5(-5.7) µm. *Marasmiellus tricolor* must be neotypified before an accurate assessment of the disposition of infraspecific taxa can be formulated. An earlier type study of *M. vialis* was presented by Hesler (1959b).

***MARASMIUS VIRGINIANUS*** Singer, Sydowia 12: 112. 1958. *nom. inval.*

This taxon was published as "*ad. int.*," without a Latin diagnosis. I accept the taxon as a distinct variety of *M. floridanus* Murr., and present a formal proposal and description elsewhere in this manuscript (Chapter IV). See there for details on the holotype specimen.

***MARASMIUS VITICOLA*** Berkeley & Curtis, Ann. Mag. Nat. Hist. ser. 3, 4: 295. 1859.

ISOTYPE: United States, Alabama, 1854, J. M. Peters, Curtis no. 4604 (FH). Holotype (K) not examined.

The isotype assemblage consists of two separate slips of paper: 1) one slip contains three basidiomata in fair condition pressed flat and glued; annotated "Alabama superiore, Peters no. 637 & 846, Curtis no. 4604, *ram. mort. deject.*"; 2) the second slip contains four basidiomata in very poor condition, badly eaten by larvae; annotated "Alabama, Peters no. 637, Aest. 1854, Curtis no. 4604, *cort. Vitis in humidis.*" Features of dried basidiomata of slip no. 1 are as follows: **Pileus** 16-27 mm diam, plano-convex with a shallow central depression, short-striate, glabrous, brown. **Lamellae** adnate, non-collariate, close or subdistant, narrow, pale brown. **Stipe** 10-17 X 1.5-2 mm, terete, pruinose or pubescent, dark brown, subinsititious, lignicolous.

**Basidiospores** 7.6-8 X 3.6-3.8 µm (only 2 recovered), ellipsoid, hyaline, inamyloid. **Basidia** 20-24 X 5-6.5 µm, clavate, 4-spored. **Basidioles** cylindric or subclavate. **Hymenial cystidia** absent. **Pileipellis** not hymeniform, composed of a cutis of radially arranged, repent hyphae; hyphae 3-7 µm diam, cylindric, typically incrusted with granulose, brown pigment deposits, non-diverticulate, non-gelatinous, clamped; walls subhyaline or pale brown, inamyloid, up to 1 µm thick. **Pileus trama** interwoven, conspicuously gelatinous; hyphae 3-10 µm diam, cylindric, infrequently-branched, hyaline, inamyloid, clamped, thick-walled (1-1.5 µm); hyphae of **lamellar trama** similar, gelatinous. **Stipe tissue** monomitic; **cortical hyphae** 3-6.5 µm diam, parallel, cylindric, incrusted with granular, brown pigment deposit, clamped; walls pale brown, inamyloid, up to 1 µm thick; **medullary hyphae** 4-8 µm diam, weakly gelatinous, smooth, hyaline, inamyloid, with walls up to 1.5 µm thick. **Stipe vesture** of numerous, clustered **caulocystidia** 20-50

X 4-6.5 µm, cylindric, obtuse, hyaline or pale yellow, inamyloid, with walls 0.5-1 µm thick.

**Commentary**. Characters which in combination indicate that *M. viticola* is a synonym of *Micromphale foetidum* (Sow.: Fr.) Sing. include: a) pileipellis of repent, non-diverticulate, non-gelatinous, brownish-incrusted hyphae; b) thick-walled, inamyloid tramal hyphae imbedded in a gelatinous matrix; c) absence of hymenial cystidia; and d) small spores. Although only 2 spores were observed on the isotype specimen, authentic material distributed by Ravenel [Ravenel Fasc. 5, no. 8, 1860 (PH!)] yielded numerous spores that measured 7.2-8.8 X 3.6-4.2 µm [$\bar{x}$ = 7.9 ± 0.5 X 3.9 ± 0.2 µm, Q = 2 ± 0.1, n = 10].

***MARASMIUS WASHINGTONENSIS*** Pennington, N. Amer. Fl. 9: 270. 1915.

HOLOTYPE: United States, Washington, near Seattle, 20 Oct. - 1 Nov. 1911, W. A. Murrill no. 335, upon decaying wood (NY).

No notes taken on aspects of the dried basidiomata. Refer to the protologue for details on macromorphological features.

**Basidiospores** 5-6.4 X 2.5-3 µm [$\bar{x}$ = 5.8 ± 0.4 X 2.7 ± 0.1 µm, E = 2-2.5, Q = 2.2 ± 0.2, n = 20], ellipsoid or lacrymoid, hyaline, inamyloid, smooth. **Basidia** 24-30 X 5-6 µm, clavate, 4-spored, rarely 2-spored. **Basidioles** clavate. **Pleurocystidia** absent. **Cheilocystidia** scattered, inconspicuous, apparently absent on some lamellae, 22-28 X 3-5 µm, flexuous, irregularly cylindric or strangulate, sometimes lobed, hyaline, inamyloid, thin-walled. **Pileipellis** not hymeniform, composed of a poorly-developed trichodermium of suberect or erect, tangled hyphae; older region composed of repent, interwoven hyphae;

hyphae 2-5 µm diam, cylindric or flexuous, smooth, non-gelatinous, hyaline or pale ochraceous, inamyloid, clamped, thin-walled. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 2.5-10 µm diam, cylindric, smooth, non-gelatinous, hyaline or pale yellow, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2-6 µm diam, parallel, cylindric, smooth, ochraceous or brown, inamyloid, thin-walled, clamped; **medullary hyphae** similar but hyaline. **Stipe vesture** absent at stipe apex; at stipe base composed of a layer of loosely interwoven hyphae giving rise to thin-walled, cylindric **caulocystidia** similar to the terminal cells of the pileipellis elements.

**Commentary.** Pileipellis, stipitipellis and cheilocystidial morphologies, inamyloid tramal tissues, and spore size, coupled with macromorphological features indicate that *M. washingtonensis* is a synonym of *Collybia acervata* (Fr.) Kummer. Refer to Halling (1983a) for a contemporary description of North American specimens of *C. acervata*.

***MARASMIUS WESTII*** Murrill, Proc. Florida Acad. Sci. 7: 110. 1945.

≡ *Micromphale westii* (Murr.) Singer, Sydowia 2: 32. 1948.

HOLOTYPE: United States, Florida, Swan Lake, 26 July 1938, E. West, Murrill no. F17211, on dead sticks of laurel oak (FLAS). [ISOTYPE: NY!]

The holotype specimen consists of more than 20 basidiomata in good condition, lignicolous or arising directly from coarse, black rhizomorphs. **Pileus** 2-4.5 mm diam, convex, even or striate, granulose,

pale brown, brown or greyish brown. **Lamellae** adnate, non-collariate, subdistant or distant, narrow or moderately broad, pale brown, non-marginate. **Stipe** central or slightly eccentric, 1-3 X <0.5 mm, terete, equal, glabrous, solid, black, context white, insititious; rhizomorphs copious, black, glabrous, wiry, solid.

**Basidiospores** 8.2-10.8 X 3.8-5 µm [$\bar{x}$ = 9.2 ± 0.6 X 4.4 ± 0.3 µm, E = 1.9-2.6, Q = 2.1 ± 0.2, n = 40], ellipsoid, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 18-24 X 5.4-7 µm, clavate, 4-spored. **Basidioles** clavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** absent on some lamellae, scattered on others, inconspicuous, 15-20 X 4-6 µm, irregularly cylindric, lobed or diverticulate, hyaline, thin-walled. **Pileipellis** not hymeniform, composed of interwoven, repent hyphae; hyphae 2.5-5.5 µm diam, irregular in outline, sparcely or densely diverticulate, non-gelatinous, smooth or more commonly with granular, amorphous or annular, brownish pigment deposits; walls hyaline, yellow or pale brown, inamyloid, 0.5-2 µm thick; diverticula 1.5-5.5 X 0.5-2 µm, knob-like, rod-like or irregular in outline, obtuse, smooth or incrusted, thin-walled or thick-walled, hyaline or pale brown; terminal cells irregular in outline, often coralloid, densely diverticulate. **Hypodermium** of cylindric, heavily incrusted hyphae 3-6 µm diam, non-diverticulate, non-gelatinous. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-9 µm diam, cylindric, smooth, non-gelatinous, hyaline or pale yellow, inamyloid, clamped, with walls up to 2 µm thick. **Stipe tissue** monomitic; **cortical hyphae** 2.5-7 µm diam. parallel, cylindric, smooth or with granular, brown pigment

incrustations, dark brown, dextrinoid, with walls up to 2 µm thick; **medullary hyphae** of two types: 1) somewhat interwoven, frequently-branched hyphae 2.5-4.5 µm diam, cylindric (non-inflated), hyaline, inamyloid, thin-walled; 2) parallel, unbranched, heavily skeletalized hyphae 5-11 µm diam, long-celled, somewhat inflated, hyaline, inamyloid, with walls 2-4.5 µm thick. **Stipe vesture** absent.

**Commentary.** *Marasmius westii* represents a synonym of *Marasmius brevipes* Berk. & Rav. *in* Berk. & Curt., and is the type species of sect. *Rhizomorphigena*. Refer to Desjardin and Petersen (1989c) for a comprehensive discussion of this species. An earlier type study was presented by Hesler (1959b).

***MARASMIUS WETTSTEINII*** Saccardo & Sydow, Syll. Fung. 14: 117. 1899.

≡ *Marasmius tenerrimus* Wettstein, Sitzungsber. Kaiserl. Akad. Wiss., Math.-Naturwiss. Cl., Abt. 1, 94: 66. 1886 [*non Marasmius tenerrimus* Berkeley & Curt., J. Linn. Soc., Bot. 10: 296. 1869].

REPRESENTATIVE MATERIAL: Austria, prope Rossatz, June, C. Rechinger, Bresadola Kryptogamae Exs. no. 1809 (*ut Marasmius rotula*); *ad acus Abietis excelsae* (NY). No holotype specimen exists.

The representative material consists of approximately 10 basidiomata in fair condition. **Pileus** 1.5-3 mm diam, campanulate with a central depression surrounding a small, obtuse papilla, glabrous, sulcate; colored beige or pale brown overall or with a slightly paler zone surrounding the papilla, but no dark central spot. **Lamellae** adnate to a well-developed, free collarium, subdistant or distant, broad, pallid, non-marginate. **Stipe** 15-23 X 0.2-0.4 mm, terete, equal,

glabrous, shiny, brown, insititious, lacking lateral sterile stipes; with scattered dark brown rhizomorphs; on fir needles.

**Basidiospores** 8.4-10.8 X 3.8-4.8 µm [$\bar{x}$ = 9.4 ± 0.7 X 4.2 ± 0.3 µm, E = 1.9-2.6, Q = 2.3 ± 0.2, n = 30], ellipsoid or subamygdaliform, inequilateral in profile, hyaline, inamyloid, smooth. **Basidia** 20-26.5 X 4.5-7 µm, clavate, 4-spored. **Basidioles** cylindric, clavate or fusoid. **Pleurocystidia** absent. **Cheilocystidia** common, similar to the *Rotalis*-type pileipellis elements except all setulae hyaline. **Pileipellis** hymeniform, not mottled, of *Rotalis*-type broom cells; main body 14.5-20 X 6.5-13.5 µm, cylindric or broadly clavate, apical portion of cells thick-walled, subhyaline or pale yellow, basal portion of cells thin-walled, hyaline, inamyloid; divergent setulae 0.5-3 X 0.5-2 µm, knob-like or rod-like, obtuse, solid, hyaline, pale yellow or pale ochraceous. **Tramal hyphae** 2.5-8 µm diam, interwoven, cylindric, smooth, non-gelatinous, hyaline, inamyloid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 3-6 µm diam, parallel, cylindric, smooth, brown, inamyloid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** similar but hyaline and thinner-walled. **Stipe vesture** absent.

**Commentary**. No holotype specimen of *M. tenerrimus* Wett. (basionym of *M. wettsteinii*) exists, and consequently the identity of this taxon is somewhat obscure. Wettstein (1886) described a species that formed basidiomata with the following features: a) small (2-4 mm diam), umbilicate, plicate, ochraceous pilei; b) collariate, distant, broad, pallid lamellae; and c) brownish black, glabrous stipe accompanied by black rhizomorphs. In addition, the species was said to form globose

or ellipsoid spores 5-7 µm diam, and fruit on cones of *Abies pectinata* in Austria. I have examined numerous European collections of a species growing on debris of various conifers with features that match Wettstein's description except for spore diameter. Favre (1952) redescribed *M. wettsteinii* from material collected on needles of *Picea* and *Pinus*, and Lundell (1957) described it from needles of *Picea* but considered it a form of *M. rotula* (Scop.: Fr.) Fr. [= *M. rotula forma acicola* Lundell]. Recently, Noordeloos (1987) considered the taxon as more similar to *M. bulliardii* Quél., and transferred Lundell's epithet as *M. bulliardii forma acicola* (Lundell) Noordeloos. Noordeloos (1987) emphasized that the only differences between f. *acicola* and f. *bulliardii* were substrate and the absence of sterile side-branches on the stipe of f. *acicola*. *Marasmius bulliardii* fruits on hardwood leaves and forms basidiomata with stipes possessing small side-branches bearing terminal sterile pilei. Although I concur with Noordeloos' observations, I believe the differences between f. *acicola* and f. *bulliardii* are significant enough to retain the former as a distinct species. Noordeloos chose not to accept the earlier epithet *M. wettsteinii* for the coniferophilous taxon (*i.e.*, f. *acicola*) because of incongruous spore measurements [*viz*, Wettstein (1886) reported the spores as 5-7 µm diam, whereas Noordeloos (1987) reported the spores of f. *acicola* as 3.5-5.5(-6.5) µm diam]. My experience with extant agaric holotype specimens indicates that oftentimes spore measurements published in early literature are erroneous, due in part to the poor optical resolution of microscopes of the period, or to the measurement of contaminant spores. I choose to follow Favre (1952) and accept *M.*

*wettsteinii* as the correct name for f. *acicola sensu* Lundell (1957) and Noordeloos (1987). The Bresadola exsiccata specimen from Austria (Wettstein's collecting region) cited above will serve as representative material of *M. wettsteinii sensu* Favre. This specimen is conspecific with several French specimens (PC!) determined by Favre as *M. wettsteinii*.

*Marasmius wettsteinii* belongs in sect. *Marasmius* subsect. *Marasmius*.

***MARASMIUS WILSONII*** Murrill *in* Pennington, N. Amer. Flora 9: 261. 1915.

HOLOTYPE: Puerto Rico, Luquillo Mts., July 1902, Percy Wilson no. 297 (NY).

The collection consists of approximately 10 basidiomata in fair condition, pressed flat, attached to leafy debris. **Pileus** ≈ 10 mm diam, campanulate or convex, sulcate, subvelutinous, dark ferruginous. **Lamellae** adnexed, non-collariate, distant, moderately broad, pale ferruginous, non-marginate. **Stipe** 40-50 X 1 mm, terete, equal, glabrous, golden-tawny, non-insititious, with coarse, strigose basal mycelium.

**Basidiospores** 11.2-16 X 3.4-4.4 µm [$\bar{x}$ = 13.6 ± 1.3 X 3.9 ± 0.3 µm, E = 3.1-4, Q = 3.5 ± 0.3, n = 20], subclavate or subfusoid, hyaline, inamyloid, smooth. **Basidia** 17.5-24 X 6.5-8 µm, clavate, 4-spored. **Basidioles** clavate or fusoid. **Pleurocystidia** numerous, 30-40 X 7-10.5 µm, clavate, fusoid or ventricose, sometimes apically constricted once or several times, sometimes appendiculate, refractive, arising from deep in subhymenium and projecting up to 8 µm beyond basidioles,

hyaline or pale golden, inamyloid, thin-walled. **Cheilocystidia** numerous, similar to the *Siccus*-type pileipellis elements; main body 12-16 X 5-8 µm, cylindric or clavate, hyaline, thin-walled; apical setulae 2-7 X 0.5-2 µm, conic, thick-walled, hyaline or pale yellow. **Pileipellis** hymeniform, not mottled, of *Siccus*-type broom cells; main body 10-17.5 X 5-9 µm, cylindric, clavate, turbinate or irregular in outline, often lobed, thin-walled or firm-walled, hyaline or pale orange; apical setulae 2.5-6.5(-9) X 0.5-2 µm, conic, subacute or acute, thick-walled or solid, dark brownish orange or ferruginous. **Pileus trama** interwoven; **lamellar trama** regular; hyphae 3-8(-10.5) µm diam, cylindric or weakly inflated, smooth, non-gelatinous, hyaline, dextrinoid, thin-walled, clamped. **Stipe tissue** monomitic; **cortical hyphae** 2.5-5 µm diam, parallel, cylindric, smooth, yellow or brownish orange, dextrinoid, clamped, with walls up to 1.5 µm thick; **medullary hyphae** 3-8 µm diam, similar but hyaline and thinner-walled. **Stipe vesture** absent.

**Commentary**. *Marasmius wilsonii* represents a distinct species in sect. *Sicci* ser. *Haematocephali*.

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# APPENDICES

# APPENDIX A

## SPECIMENS EXAMINED

### 1. *MARASMIUS BREVIPES*

**Trinidad**

Naranja, 2.x.49, Dennis no. 114 (K)

**United States**

**Alabama**. Monroe Co.: Little River State park, near Uriah, 11.vii.59, Thiers no. 6821 (SFSU).

**Florida**. Alachua Co.: Archer, 21.vii.84, Cullen, F53847 (FLAS); Gainesville, 1.ix.38, Murrill no. F18296 [as *Marasmius muscadincae nom. herb.*, published as a paratype of *Marasmiellus oligocinsulae* Murr.] (FLAS); Kelly's Hammock, Gainesville, 25.v.43, Singer no. F2118 [as *Marasmius westii*] (FH); Swan Lake, 26.vii.38, E. West, F17211 [Holotype of *Marasmius westii*: FLAS; Isotype: NY].

**Louisiana**. Evangeline Co.: Chicot State Park, 18.vii.60, Thiers no. 7728 (SFSU). St. Tammany Co.: Covington, Primate Research Center, 5.vi.76, Thiers no. 36004 (SFSU); Honey Island Swamp, 6.vi.76, Cooke no. 52125 (DAOM 193773).

**Mississippi**. Jackson Co.: Pascagoula River, Parker Lake area, 17.vii.87, Desjardin no. 4367 (TENN 47662).

**North Carolina**. Macon Co.: Highlands, Chattooga Loop trail, 13.vi.87, Desjardin no. 4279 (TENN 47665), 13.vii.88, Desjardin no. 4586 (TENN 47682); Coweeta Hydrologic Lab, Ball Creek, 14.vii.86, Desjardin no. 3813 (TENN 47663), 13.vi.87, Desjardin no. 4282 (TENN

47664). County unknown: Sulphur Springs, winter 1852, Ravenel no. 1527 (Authentic: BPI, FH).

**South Carolina**. Orangeburg Co.: Santee Canal, June, Ravenel no. 1527 [also numbered 1922] (Holotype: K).

**Texas**. No locality given, Ravenel, iv.1869, Billings no. 55 (Authentic: FH). Harris Co.: Houston, 1869, Ravenel no. 309 (Authentic: BPI). Orange Co.: Vidor, Virginia Lane, 26.vi.76, Lewis no. 276 (TENN 47666).

### 2. *MARASMIUS STRAMINIPES* var. *STRAMINIPES*

**United States**

**Alabama**. viii-ix.1864, Peters no. 13, Curtis no. 6442 [as *Marasmius subcretaceus nom. herb.*] (FH).

**North Carolina**. Buncombe Co.: Lake Powatah, near Asheville, 5.ix.87, Desjardin no. 4476 (TENN 47643). Macon Co.: Coweeta Hydrologic Lab, Ball Creek, 23.vii.86, Desjardin 3931 (TENN 47640), 13.viii.87, Desjardin no. 4458 (TENN 47642); Highlands, Horse Cove Rd., 2.viii.88, Desjardin no. 4690 (TENN). Orange Co.: Chapel Hill, by Meeting of the Waters, 25.vi.19, Coker no. 3368 (NCU); Chapel Hill, 7.viii.19, Coker no. 3417 (NCU).

**New Jersey**. Gloucester Co.: Newfield, vii.1876, Ellis, N. Amer. Fungi. no. 701 (BPI, FH, MICH, NY, NYS, PENN at PH, PH).

**New York**. Albany Co.: x.1872, Peck (Holotype: NYS); no date, Peck (Authentic: BPI).

**Ohio**. Hocking Co.: Long Hollow, 1.ix.68, Cooke no. 39910 (BPI).

**Tennessee**. Blount Co.: Great Smoky Mts, Natl. Park (GSMNP), near Cades Cove, 7.vii.87, Desjardin no. 4325 (TENN 47641). Sevier Co.: GSMNP, Old Indian Gap Rd., 11.vi.86, Desjardin no. 3578 (TENN 47638), 28.vi.86, Desjardin no. 3687 (TENN 47639), 19.vii.88, Desjardin no. 4614 (TENN); GSMNP, Grassy Patch, 16.vi.46, Hesler (MICH, TENN 17628).

**Virginia**. Giles Co.: Jefferson Natl. Forest, 2.x.83, Miller no. 20806 (VPI); Mt. Lake, 22.vii-25.viii.46, Singer no. V157 (FH).

### 3. *MARASMIUS STRAMINIPES* var. *FIBULATUS*

**United States**

**North Carolina**. Buncombe Co.: Lake Powatah, near Asheville, 5.ix.87, Desjardin no. 4474 (TENN 47647). Transylvania Co.: Pisgah Natl. Forest, Black Mt. trail N of Brevard, 24.vii.86, Desjardin no. 3948 (Holotype: TENN 47644).

**South Carolina**. Oconee Co.: Ellicott Wilderness Area, Chattooga Picnic Area, 12.viii.87, Desjardin no. 4447 (TENN 47646).

**Tennessee**. Knox Co.: Knoxville, 7.ix.86, Desjardin no. 4162 (TENN 47645).

### 4. *MARASMIUS PALLIDOCEPHALUS*

**Canada**

**Quebec**. 28.vi.68, J. W. Groves (DAOM 124613).

**Nova Scotia**

Kings Co.: Kentville, 5.vii.72, Harrison nos. 11516, 11519 (both

MICH), 15.vii.72, Harrison no. 11580 (MICH); Scotts Bay, 16.vii.72, Harrison nos. 11596, 11598, 11600, 11601, 11602A (all MICH); West Halls Harbor, 21.vii.72, Harrison nos. 11632, 11634, 11637 (all MICH).

**United States**

**Colorado**. Gilpin Co.: Tolland, 5.ix.20, Kauffman (MICH).

**Maine**. Aroostook Co.: 7.vii.56, Bigelow no. 3086 (MICH). Hancock Co.: Lamoine, 26.vi.73, Smith no. 84100 (MICH), 27.vi.73, Smith no. 84116 (MICH).

**Michigan**. Alger Co.: Chatham, 7.vi.33, Smith no. 33-185 (MICH). Baraga Co.: Parent Lake, 10.vii.69, Ammirati no. 3056 (MICH). Cheboygan Co.: Reese's Bog, 21.vi.71, Gilliam no. 1110 (MICH); Univ. Michigan Biological Station, 26.vi.57, Shaffer no. 1291 (MICH), 4.vii.57, Smith no. 57160 (MICH); Wolf Bog, 30.vi.47, Smith no. 25365, 17.vii.47, Smith no. 25778, 21.vi.49, Smith no. 32244 (all MICH). Chippewa Co.: Roxbury Creek, 28.vii.71, Gilliam no. 1170 (MICH); Tahquamenon Falls State Park, Lower Falls, 22.vii.71, Gilliam no. 1165 (Holotype: MICH). Emmet Co.: Wilderness State Park, 7.x.55, Smith no. 50912, 1.vii.68, Patrick no. 268, 21.x.71, Weber no. 2570 (all MICH). Keweenaw Co.: Moose Lake, 20.vii.30, Povah no. Fp231 (MICH); Ryan Island, 11.ix.30, Povah no. Fp751. Mackinac Co.: Bois Blanc Lake, 27.vii.47, Smith no. 26067 (MICH); Cut River, 25.vi.51, Smith no. 36435 (MICH). Marquette Co.: Conway Creek, 13.vii.70, Ammirati no. 4374 (MICH); Pine Lake, Huron Mts., 14.vi.63, Smith no. 66360 (MICH); Salmon-Trout River, 24.vi.68, Ammirati no. 1616 (MICH).

**Minnesota**. Clearwater Co.: Itasca State Park, 9.viii.68, Weaver no. 1621 (MICH).

**Montana**. Flathead Co.: Echo Lake, 30.vi.28, Kauffman (MICH). County unknown, Jewell Basin, Rock Creek, 25.vi.69, Miller no. 7356 (VPI)

**New York**. Albany Co.: Loudinville, 17.vi.45, H. D. House (MICH). Essex Co.: North Elba, 9.ix.19, Kauffman (MICH).

**North Carolina**. Swain Co.: GSMNP, Deep Creek, 1.ix.71, Harrison no. 10976 (MICH).

**Tennessee**. Sevier Co.: GSMNP, Old Indian Gap Rd., 2.viii.36, Hesler [as *Marasmius albiceps*] (FLAS 33098, FH, TENN 9108), 30.vi.51, Hesler [as *Marasmius androsaceus*] (TENN 2836), 21.vi.52, Hesler (TENN 20486), 27.iv.54, Hesler (TENN 21343), 10.ix.85, Desjardin no. 3412 (TENN), 11.vi.86, Desjardin no. 3581 (TENN), 28.vi.86, Desjardin no. 3691 (TENN), 19.vii.88, Desjardin no. 4615 (TENN).

**Washington**. Clallam Co.: Joyce, 29.ix.41, Smith no. 17427 (MICH).

**West Virginia**. Pocohontas Co.: Black Mt., 20.vi.83, Bills no. 586 (VPI).

## 5. *MARASMIUS ANDROSACEUS*

**Austria**

Tirol, 20.ix.60, Singer no. C2363 (MICH).

**Canada**

**Ontario**. Lake Timagami, 22.viii.36, Smith no. 4075 (MICH); Mer

Bleue Bog E of Ottawa, 21.vi.87, Desjardin no. 4292 (TENN); East Gate, 5.viii.62, Petersen (TENN 27584).

**England**

Somerset, Newcombe, 15.ix.60, Smith no. 63164 (MICH). Newcastle, Ross Links, 22.ix.71, Smith no. 80748 (MICH).

**Finland**

Mustiala a. Okt., Finland Fungi Exs. no. 233, Karsten (NY). Pohjois-Häme, Toivakka, Huikko, 7.vii.79, Ohenoja (NY).

**France**

Vise, Forêt de Compiègne, 18.viii.65, Shaffer no. 4647 (MICH). Haut-Rhin, Lac Blanc, 10.ix.65, Shaffer no. 4911 (MICH).

**Germany**

Harz, in Wäldern bei Braunlage, 23.viii.04, P. Sydow, Mycotheca Germanica (MICH).

**Nova Scotia**

Kings Co.: Kentville, 5.vii.72, Harrison nos. 11512, 11513, 11514, 11515, 11517, 11521 (all MICH); West Halls Harbor, 21.vii.72, Harrison nos. 11625, 11630 (both MICH). Colchester Co.: 27.vi.31, Smith no. 506 (MICH).

**Scotland**

Alurdunshire, Caimuell, 12.ix.78, Miller no. 17831 (VPI).

**Sweden**

Femsjö, 2.ix.1899, Burt Herbarium (FH); Fensjö, 4.ix.1899, Burt Herbarium (FH).

**Switzerland**

Alpes Cernoises, pr. de la Lenk, Bord de la Viviére, 29.vi.48, Favre (MICH).

**United States**

**California**. Alameda Co.: Oakland, 31.x.37, Bonar, California Fungi Exs. no. 468 (MICH, UC). Numerous other specimens cited in Desjardin (1985a).

**Colorado**. Larimer Co.: Estes Park, 24.viii.40, Mains no. 5189 (MICH).

**Conneticut**. no locale given, Underwood, F19801 (FLAS).

**Delaware**. Faulkland, 11.ix.1885, Ellis no. 205 (PH).

**Idaho**. Boise Co.: Banks, 17.ix.46, Smith no. 23595 (MICH); Boise Natl. Forest, 22.vi.84, Miller no. 20151 (VPI). Bonner Co.: Priest Lake Exp. Forest, 4.vii.39, Slipp no. 103, 6.x.39, Slipp no. 559, 7.vi.40, Slipp no. 674, 20.vi.41, Slipp no. 1090, 30.vi.41, Slipp no. 1113, 3.vi.42, slipp no. 1344 (all MICH). Custer Co.: Stanley Lake, 21.vii.58, Smith no. 58991 (MICH). Idaho Co.: Burgdorf Hot Springs, 20.vii.54, Smith no. 45254 (MICH). Valley Co.: Payette Lakes, 29.vii.41, Smith no. 15805 (MICH), 15.vii.54, Smith no. 44975 (MICH), 29.vii.58, Smith no. 59214 (MICH).

**Maine**. Aroostook Co.: Madawaska Lake, 10.vii.65, Bigelow no. 3157 (MICH); Sinclair, 8.vii.56, Bigelow no. 3096 (MICH), 9.vii.56,

Bigelow no. 3104 (MICH). Hancock Co.: Lamoine, 26.vi.73, Smith no. 84102, 27.vi.73, Smith nos. 84114, 84128 (all MICH).

**Maryland**. Cabin John, 20.vii.19, Kauffman (MICH). Fredrick Co.: 20.vi.73, McKnight no. 13603 (BPI).

**Massachusetts**. Berkshire Co.: near North Adams, 16.viii.86, Desjardin no. 4068 (TENN). Worchester Co.: Petersham, Federation of Womens Clubs State Forest, 9.viii.86, Desjardin no. 4041 (TENN).

**Michigan**. Alger Co.: Munising, 25.viii.32, Mains no. 32-320 (MICH); Rock River, 14.ix.27, Kauffman (MICH), 16.ix.29, Smith (MICH), 29.viii.32, Mains no. 32-418 (MICH). Allegan Co.: New Richmond, 19.ix.11, Kauffman (MICH). Barry Co.: Yankee Springs Rec. Area, 12.vi.68, Patrick no. 226 (MICH). Cheboygan Co.: Burt Lake, 4.vii.49, Harding no. 133 (MICH); Reese's Bog, 19.ix.71, Gilliam no. 1239 (MICH); Stevens Bay, 1.vii.47, Smith no. 25370 (MICH); Univ. Michigan Biol. Sta., 13.vii.57, Shaffer no. 1482 (MICH). Chippewa Co.: Eckerman, 22.vii.71, Gilliam no. 1166 (MICH), 28.vii.71, Gilliam no. 1172 (MICH); Raber Fossil Beds, 27.viii.65, Smith no. 72457 (MICH). Emmet Co.: Wilderness State Park, 21.x.71, Weber no. 2569 (MICH). Jackson Co.: Big Portage Lake, 10.x.71, Gilliam no. 1455 (MICH). Marquette Co.: Marquette, 29.viii.39, Mains no. 5035 (MICH). Midland Co.: Midland City Forest, 13.x.71, Gilliam no. 1475 (MICH). Oakland Co.: Proud Lake, 21.vii.70, Gilliam no. 778 (MICH). Presque Isle Co.: Onaway, 22.vi.61, Smith 62A (MICH), 22.vii.61, Miller no. 1096 (VPI). Washtenaw Co.: Ann Arbor, 15.vi.70, Gilliam nos. 528, 529 (both MICH), 20.vii.70, Gilliam no. 736 (MICH); Stinchfield Woods, 17.vi.60, Smith no. 62447 (MICH), 10.vi.61, Smith no. 63434 (MICH), 17.vi.64, Homola

no. 815 (MICH), 16.vi.70, Gilliam no. 540 (MICH), 9.viii.72, Hoseney no. 2189 (MICH).

**Minnesota**. Clearwater Co.: Itasca State Park, 21.vii.65, Weaver no. 1194 (MICH), 27,vii.70, Weaver no. 2085 (MICH). Isanti Co.: Cedar Creek Nat. Hist. area, 29.ix.69, Weaver no. 1958 (MICH).

**Montana**. Flathead Co.: Echo Lake, 6.vii.28, Kauffman (MICH).

**New Hampshire**. Hillsboro Co.: Fox Forest, 28.vi.59, Miller no. 105 (MICH).

**New York**. Warren Co.: Warrensburg, 9.ix.34, Smith (MICH); same location, 25.ix.71, Gilliam no. 1284 (MICH). County unknown, Mt. Marcy, 16.viii.34, Smith (MICH).

**North Carolina**. Buncombe Co.: Lake Powatah, near Asheville, 5.ix.87, Desjardin no. 4475 (TENN). Haywood Co.: GSMNP, Cataloochee, 5.ix.87, Desjardin no. 4481 (TENN), 9.ix.87, Desjardin no. 4491 (TENN), 11.vii.88, Desjardin no. 4570 (TENN). Macon Co.: Coweeta Hydrologic Lab, Ball Creek, 14.vii.86, Desjardin no. 3806 (TENN), 23.vii.86, Desjardin no. 3935 (TENN); Coweeta Hydrologic Lab, Shope Fork Creek, 8.vii.86, Desjardin no. 3766 (TENN); Glenn Falls area, SW of Highlands, 7.vii.86, Desjardin no. 3726 (TENN); Highlands, 4.vii.37, Hesler, (FH, MICH, TENN 10453), 22.vii.86, Desjardin no. 3917 (TENN), 1.vii.85, Methven no. 3780 (TENN); Highlands, Cliffside Lake Cmpgrd., 3.ix.86, Desjardin no. 4107 (TENN); Rustic Falls Rd. off Horse Cove Rd., 10.viii.87, Desjardin no. 4430 (TENN); Slick Rock Vista area, off Horse Cove Rd., 28.v.87, Petersen no. 56879 (TENN). Orange Co.: Chapel Hill, 19.vii.17, Coker no. 2721 (NCU). Transylvania Co.: Pisgah Natl. Forest, Black Mt. trail, N. of Brevard, 24.vii.86,

Desjardin no. 3955 (TENN); Pisgah Natl. Forest, near Slide Rock, N or Brevard, 24.vii.86, Desjardin no. 3937 (TENN). Watauga Co.: Blowing Rock, 25.viii.22, Coker no. 5800 (NCU).

**Ohio**. Montgomery Co.: Preston, 1890, Morgan no. 108 (Holotype of *Marasmius melanopus*: ISC). Portage Co.: West Branch State Park, 23.vi.72, Mazzer no. 7589 (MICH), 8.vii.72, Gilliam no. 1504 (MICH).

**Oregon**. Crook Co.: Ochoco Natl. Forest, 7.xi.41, Smith (MICH). Josephine Co.: Grants Pass, 10.xi.56, Smith no. 55396 (MICH), 17.xi.56, Smith no. 55757 (MICH).

**South Carolina**. Oconee Co.: Ellicott Wliderness Area, Chattooga Picnic Area, 12.viii.87, Desjardin no. 4450 (TENN).

**Tennessee**. Blount Co.: GSMNP, Cades Cove, 2.vi.46, Hesler (TENN 17472), 20.vii.86, Desjardin no. 3878 (TENN), 7.vii.87, Desjardin no. 4328 (TENN). Carter Co.: Roan Mt., 22.viii.37, Hesler (FH, MICH, TENN 10856). Sevier Co.: GSMNP, Elkmont, 9.viii.36, Hesler (TENN 9177), 1.vii.87, Desjardin no. 4308 (TENN); GSMNP, Old Indian Gap Rd., 11.vi.86, Desjardin nos. 3579, 3580 (both TENN), 28.vi.86, Desjardin no. 3694 (TENN).

**Vermont**. Windham Co.: Newfane-Wardsboro Rd., 21.viii.61, Shaffer no. 3370 (MICH).

**Virginia**. Floyd Co.: Bearson Creek, 8.ix.87, Baldwin (TENN). Montgomery Co.: Blacksburg, 20.xi.82, Vilgalys no. 82/367 (MICH).

**Washington**. Clallam Co.: Olympic Mts., 22.vi.39, Smith no. 14541 (MICH). Pierce Co.: Longmire, 19.vii.48, Smith no. 29172 (MICH), 11.x.54, Smith no. 48818. Spokan Co.: Valley Ford, 2.xi.46, Cooke nos. 18667, 18679 (both MICH). Stevens Co.: Springdale, 2.xi.46,

Cooke no. 18678 (MICH). Whatcom Co.: Mt. Baker, 23.viii.41, Smith no. 16316 (MICH), 31.viii.41, Smith no. 16524 (MICH).

**West Virginia**. Pocohontas Co.: Rocky Knob, 19.vi.83, Bills no. 587 (BPI).

**Wisconsin**. Forest Co.: Alvin, 13.ix.71, Gilliam no. 1231 (MICH). Locale unknown, 1971, Mazzer (MICH).

**Wyoming**. Grand Teton Natl. Park, 25.vii.55, Solheim no. 4122 (MICH). Sublette Co.: Hoback Canyon, 14.viii.57, Solheim no. 5361.

### 6. *MARASMIUS GRAMINUM*

**Belgium**

Arduenna, Autumn 1832, Libert, Plantae Cryptogamicae in Arduenna Exs. no. 119 (Lectotype: FH; Isotype: BPI). Tervueren, Lez-Brux., 26.vi.58, Heinemann (BPI).

**England**

Surrey, Kew, ix.50, Dennis (MICH).

**United States**

**California**. Orange Co.: 15.vii.41, C. O. Smith (UC).

**Delaware**. New Castle Co.: Wilmington, 4.vi.1889, Commons no. 913 (PH).

**Indiana**. Monroe Co., Victor, Cedar Bluffs, 23.viii.70, Gilliam no. 933a (MICH).

**Kansas**. Rooks Co.: Stockton, 10.vii.1896, Bartholomew, Kansas Fungi Exs. no. 2181 (FH).

**Illinois**. Knox Co.: Abingdon, 12.vii.24, Illinois Natural History Specimen no. 18116 (Isotype of *Marasmius tritici*: BPI, ILL).

**Michigan**. Marquette Co.: Huron Mt. Club, Howe Lake, 18.viii.70, Ammirati no. 4970 (MICH); Huron Mt. Club, Ives Lake, 14.vii.70, Ammirati no. 4438 (MICH). Washtenaw Co.: Ann Arbor, 18.vii.72, Hoseney no. 2133 (MICH); Hankerd Rd., 24.vii.70, Gilliam no. 799 (MICH), 30.vii.70, Gilliam no. 862 (MICH).

**Missouri**. St. Louis Co.: St. Louis, Missouri Bot. Gard., vi.28, Linder (BPI); Valley Park, 16.viii.28, Linder (BPI). County unknown, Emma, vii.1889, Ellis & Everhart, N. Amer. Fungi Exs. no. 2301 (NY, PH).

**New York**. 29.vii.15, Murrill (NY). Albany Co.: Loudonville, 18.vii.31, House (NYS).

**North Carolina**. Buncombe Co.: Asheville, 1911, Beardslee no. 11041 (MICH). Gaston Co.: Lowell, 3.vii.41, Coker no. 12340 (NCU). Macon Co.: Highlands, 2.viii.88, Desjardin no. 4680 (TENN); Highlands, Turtle Pond Creek Rd. near Cliffside Lake Cmpgrd., 16.vii.86, Desjardin no. 3838 (TENN), 23.vii.87, Desjardin no. 4386 (TENN). Orange Co.: Chapel Hill, 14.v.22, Coker no. 5112 (NCU). Swain Co.: GSMNP, Indian Creek, 10.ix.86, Desjardin no. 4169 (TENN).

**Ohio**. Hamilton Co.: Anderson Twp., 21.vi.56, Cooke no. 30275 (MICH). Portage Co.: Kent, 8.vii.72, Gilliam no. 1492 (MICH).

**Pennsylvania**. Alleghany Co.: Pittsburgh, 18.viii.46, Sumstine (NY); Schenly Park, 22.vi.40, Sumstine (NY), 24.vi.40, Sumstine (NY); Wilkensburg, 3.vii.06, Sumstine (NY), 4.vii.12, Sumstine (NY). Butler Co.: Uplands, E of Yellow Creek, 18.vii.37, Henry no. 1176 (NY).

Westmoreland Co.: Loyalhanna Creek, 12.vi.40, Henry (NY); E of Mt. Pleasant, 18.vi.40, Henry (NY).

**South Carolina**. Aiken Co.: Aiken, Ravenel, Fungi Americani Exs. no. 105 (BPI, ISC, PH). Darlington Co.: Society Hill, 26.vi.1847, Curtis no. 1249 (FH). Oconee Co.: Ellicott Wilderness Area, Chattooga Picnic Area, 12.viii.87, Desjardin no. 4442 (TENN).

**Tennessee**. County unknown: Wolf Creek, 10.vi.34, Hesler (TENN 3784). Knox Co.: Knoxville, 10.vii.34, Hesler (TENN 3783), 3.vi.50, Hesler (TENN 19648), 24.vi.56, Hesler (TENN 22308).

**Vermont**. Addison Co.: Middlebury, 19.vi.1898, Burt Herbarium (FH).

**Virginia**. Augusta Co.: Stuart's Draft, 8.vii.83, Bills no. 611 (VPI). Montgomery Co.: Blacksburg, Vilgalys no. 250 (VPI), 19.vii.82, Vilgalys no. 82/267 (BPI).

**Washington**. Pierce Co.: Mt. Rainier Natl. Park, viii.45, Gruber no. 630 (MICH).

### 7. *MARASMIUS CAPILLARIS*

**Nova Scotia**

Kings Co.: Scotts Bay, 16.vii.72, Harrison no. 11595 (MICH).

**United States**

**Illinois**. Clarke Co.: Clarkesville, Rocky Branch, 28.ix.87, Methven (TENN).

**Indiana**. Monroe Co.: Cedar Bluffs, 23.viii.70, Gilliam no. 936 (MICH).

**Massachusetts**. Barnstable Co.: Woods Hole, 4.viii.1898, Moore no. 50 [as *Marasmius rotula*] (FH).

**Michigan**. Alger Co.: Rock River, 6.ix.27, Kauffman (MICH). Branch Co.: Algansee Twp., 20.ix.45, Kanouse no. 623 (MICH). Emmet Co.: Pellston Hills, 20.vii.61, Smith no. 63551 (MICH). Gratiot Co.: Ithaca, 28.vi.48, Potter no. 5231 (MICH). Jackson Co.: Big Portage Lake, 10.x.71, Gilliam no. 1448 (MICH); Waterloo Rec. Area, 3.viii.72, Hoseney no. 2163 (MICH). Livingston Co.: George Reserve, 4.x.71, Gilliam no. 1315 (MICH); Oak Grove State Game Area, 26.viii.72, Gilliam no. 1548 (MICH); Pickney, 10.x.31, Smith (MICH), 11.viii.42, Smith no. 18634 (MICH). Montcalm Co.: Crystal, 14.ix.49, Potter no. 8765 (MICH). Oakland Co.: Haven Hill, 17.ix.37, Smith no. 7593 (MICH), 20.vii.70, Gilliam no. 729 (MICH); Kent Lake, 26.viii.37, Smith no. 7317 (MICH); Milford, 15.ix.38, Smith no. 10923 (MICH), 30.viii.40, Smith no. 15212 (MICH); Pontiac, 24.viii.37, Smith no. 7252 (MICH). Washtenaw Co.: Ann Arbor, 20.x.26, Kauffman (MICH); Cassidy Rd., 8.viii.72, Gilliam no. 1525 (MICH); Crooked Lane, 26.vii.70, Nimke no. 36 (MICH); Gorman Lake, 19.viii.72, Smith no. 81590 (MICH); Hankerd Rd., 24.vii.70, Gilliam no. 817 (MICH), 30.vii.70, Gilliam no. 880 (MICH); Pond Lily Lookout, 17.x.71, Gilliam no. 1477 (MICH); Pickney Rec. Area, 10.viii.60, Shaffer no. 2568 (MICH); Sharon Hollow, 4.viii.60, Shaffer no. 2512 (MICH), 4.ix.61, Smith no. 64074 (MICH), 19.viii.70, Gilliam no. 925 (MICH); South Lake, 31.vii.71, Gilliam no. 891 (MICH).

**Minnesota**. Isanti Co.: Cedar Creek Nat. Hist. Area, 14.ix.68, Weaver no. 1735 (MICH). Rice Co.: Wheeling Township, 29.viii.65, Weaver no. 1246 (MICH).

**North Carolina**. Haywood Co.: Cataloochee, 5.ix.87, Desjardin no. 4482 (TENN), 9.ix.87, Desjardin no. 4493 (TENN), 11.vii.88, Desjardin no. 4571 (TENN). Swain Co.: Indian Creek, 16.viii.47, Hesler (TENN 17983).

**Ohio**. Highland Co.: Fort Hill St. Memorial, 4.ix.65, Cooke no. 35612 (MICH). Montgomery Co.: Preston, x.1890, Morgan (Neotype: ISC; Isoneotype: ISC); 14.vi.1891, Morgan (Authentic: ISC).

**Michigan**. Dexter Co.: Silver Lake, 18.x.40, Springer (ISC).

**Missouri**. County unknown, Emma, vii.1889, Ellis & Everhart, No. Amer. Fungi Exs. no. 2501 [as *Marasmius rotula*] (PH).

**North Carolina**. Haywood Co.: Waynesville, Eagles Nest, 12.ix.10, Standley no. 5792 (BPI). Macon Co.: Glenn Falls area, near Highlands, 1.x.71, Harrison no. 11429 (MICH). Orange Co.: Chapel Hill, 6.vi.22, Coker no. 5177 (NCU). Swain Co.: GSMNP, Deep Creek, 1.ix.71, Harrison no. 10968 (MICH).

**Tennessee**. Blount Co.: GSMNP, Bote Mt. trail near Crib Gap, 31.viii.86, Desjardin no. 4077 (TENN); GSMNP, Crib Gap, 18.vii.86, Desjardin no. 3855 (TENN), 10.ix.87, Desjardin no. 4508 (TENN); GSMNP, Cades Cove, 11.ix.85, Desjardin no. 3416 (TENN). Campbell Co.: Norris Dam, 20.vii.58, Hesler (TENN 23067); Knox Co.: Knoxville, Cherokee Dr., 7.ix.86, Desjardin no. 4159 (TENN); Knoxville, Timberlake Rd., 14.ix.57, Hesler (TENN 22651). Sevier Co.: GSMNP, Chimney Tops trail, 28.v.87, Desjardin no. 4239 (TENN); GSMNP, Elkmont, 17.viii.35, Hesler

(TENN 8215), 1.vii.87, Desjardin no. 4307 (TENN); GSMNP, Grassy Patch, 1.ix.38, Smith nos. 10796, 10797 (both MICH); GSMNP, Husky Gap trail, 4.viii.38, Smith no. 9721 (MICH); GSMNP, Mt. Le Conte, 5.vii.34, Hesler (TENN 3776), 12.viii.38, Smith no. 10081 (MICH); GSMNP, Roaring Fork, 9.vii.87, Desjardin no. 4345 (TENN). Unaka Springs, Murrill F19788 (FLAS).

**Virginia**. Giles Co.: Mt. Lake Biol. Sta., 10.x.78, Miller no. 17901 (VPI); Pembroke, trail to Cascades, 10.ix.70, Miller no. 8711 (VPI), 30.ix.76, Miller no. 15876 (VPI). Montgomery Co.: Blacksburg, 14.ix.83, Bills no. 677 (VPI), 18.viii.87, Desjardin no. 4465 (TENN), 23.viii.70, Miller no. 8645 (VPI), 17.ix.77, Miller no. 16229 (VPI); Pandapus Pond, 2.x.83, Miller no. 20805 (VPI).

## 8. *MARASMIUS ROTULA*

**Canada**

**Ontario**. Magnetawan, 8.viii.21, Kelly no. 956 (MICH); Mer Bleue Bog E of Ottawa, 21.vi.87, Desjardin no. 4294 (TENN); London, viii.1895, Ellis & Everhart, Fungi Columbiani Exs. no. 801 (PH).

**Czechoslovakia**

Trebusany, viii.38, Pilat (NCU).

**England**

Highgate, ix.1866, M. C. Cooke, Fungi Britannici Exs. no. 302 (NY).

**France**

Rhône, Laye, 30.vi.37, Josserand (MICH). Toulouse, ix.1891, Roumeguère, Fungi Selecti Exs. no. 5902 (NY).

**Germany**

Berlin, viii.1882, Sydow, Mycotheca Marchica Exs. no. 303 (NY). Brandenburg, 2.vii.10, Sydow, Mycotheca Germanica Exs. no. 851 (MICH). Saxony, Brettern von Frühbeetkästen, viii.1879, Krieger, Fungi Saxonici Exs. no. 225 (MICH, NY).

**Nova Scotia**

Colchester Co.: Brookside, 16.vii.29, Wehmeyer no. 56 (MICH).

**Sweden**

Hammersby, 8.viii.78, Miller no. 17997 (VPI). Lindingö, 21.vii.1898, Romell (NY).

**United States**

**Illinois**. Cook Co.: Paddock Woods Forest Preserve, 22.vi.56, Shaffer no. 789 (MICH).

**Indiana**. Jefferson Co.: near Kent, 21.viii.34, S.L.W. (TENN 7167). Montgomery Co.: Pine Hills, 25.viii.61, Cooke no. 32806 (MICH).

**Louisiana**. West Feliciana Co.: Tunica, 4.v.57, Lowy (TENN 5038).

**Maine**. Aroostook Co.: Guerette, 25.viii.56, Bigelow no. 4383 (MICH).

**Massachusetts**. Barnstable Co.: Woods Hole, vii.04, Davis (MICH).

**Michigan**. Cheboygan Co.: Colonial Pt., 16.vii.61, Smith no. 63567 (MICH). Emmet Co.: Wilderness State Park, 6.vii.71, Gilliam no. 1125 (MICH). Gratiot Co.: Ithaca, 14.vi.48, Potter no. 4784 (MICH). Livingston Co.: George Reserve, 15.vi.64, Homola no. 804 (MICH). Luce Co.: Tahquamenon Falls State Park, 28.vi.71, Gilliam no. 1116 (MICH). Marquette Co.: Ives Lake, 25.viii.71, Petersen (TENN 36161), 13.vii.71, Harrison no. 10379 (MICH). Oakland Co.: Haven Hill, 15.vi.70, Gilliam no. 530 (MICH). Oceana Co.: Shelby, 7.viii.72, Smith no. 81358 (MICH). Washtenaw Co.: Waterloo Rec. Area, 22.vi.70, Gilliam no. 559 (MICH). County unknown, Sawmill, 17.viii.60, Miller no. 735 (VPI).

**Minnesota**. Anoka Co.: East Bethel Village, 8.vii.67, Weaver no. 1403 (MICH).

**Missouri**. Boone Co.: Ashland, 16.vi.40, Routien (TENN 13292).

**New Hampshire**. Carroll Co.: Chatham, 12.viii.40, Rea no. 587 (MICH).

**New York**. Allegany Co.: 25.vi.64, Petersen (TENN 27549). Essex Co.: Keene Valley, 24.viii.54, Shaffer no. 495 (MICH). County unknown: Hillsboro Pt., 9.viii.1898, C. O. Smith (FH).

**North Carolina**. Macon Co.: Blue Valley, 3.vii.85, Methven no. 3819 (TENN); Cashiers, 19.vi.63, Hesler (TENN 25581); Coweeta Hydrologic Lab, Ball Creek, 14.vii.86, Desjardin no. 3818 (TENN), 4.ix.86, Desjardin no. 4132 (TENN), 13.viii.87, Desjardin no. 4461 (TENN); Coweeta Hydrologic Lab, Shope Fork Creek, 23.vii.86, Desjardin no. 3921 (TENN); Highlands, 12.vi.34, Hesler (TENN 4343). Orange Co.: Chapel Hill, 7.vii.17, Coker nos. 2601, 2615 (both NCU), 22.v.18, Coker

& Couch no. 3060 (NCU), 1.vii.19, Coker no. 3391 (NCU); Hillsborough, vi-vii, Curtis no. 503 (FH). Swain Co.: GSMNP, Cataloochee Divide trail, 20.vii.70, Shaffer no. 6258 (MICH); GSMNP, Indian Creek, 18.vii.70, Shaffer no. 6246 (MICH); GSMNP, Kephart Prong, 14.vi.87, Desjardin no. 4274 (TENN).

**North Dakota**. Kulm, x.11, Brenckle, Fungi Dakotensis Exs. no. 173 (BPI, MICH).

**Ohio**. Coshocton Co.: Coshocton, 17.vi.42, Moldenke, F16072 (FLAS). Hamilton Co.: Miami-Whitewater forest Park, 2.vii.60, Cooke no. 31922 (MICH). Locale unknown: Legit Lea, Misit Berk., Curtis (FH).

**Pennsylvania**. Monroe Co.: Pocono Manor, viii.34, Stifler (BPI).

**Tennessee**. Blount Co.: GSMNP, Cades Cove, 11.ix.85, Desjardin no. 3417 (TENN), 2.vii.34, Hesler (TENN 3794). Carter Co.: Roan Mt., 10.viii.34, Hesler (TENN 5323). Davidson Co.: Nashville, v.55, Hesler (TENN 21698). Knox Co.: Ball Camp Pike, 21.vii.36, Hesler (FH, TENN 8922); Knoxville, 19.vi.34, Hesler (TENN 3791), 22.vi.34, Hesler (TENN 3792), 13.vii.34, Hesler (TENN 4133), 22.vi.37, Hesler (MICH); Roaring Springs, 8.vii.34, Hesler (TENN 3790); Tobler Rd., 12.v.64, Hesler (TENN 26210). Sevier Co.: GSMNP, Alum Cave, 27.vi.34, Hesler (TENN 3793); GSMNP, Chimney Tops, 28.v.87, Desjardin no. 4241 (TENN), 1.vii.88, Desjardin no. 4555 (TENN); GSMNP, Greenbrier, 2.vi.86, Desjardin no. 3544 (TENN), 5.vi.86, Desjardin nos. 3546, 3547, 3550 (TENN), 5.vii.34, Hesler (TENN 3795); GSMNP, Mt. Le Conte, 10.viii.34, Hesler (TENN 5323); GSMNP, Newfound Gap, 13.viii.68, Harrison (MICH);

GSMNP, Old Indian Gap Rd., 2.viii.36, Hesler (FH, TENN 9114), 26.vi.49, Hesler (TENN 18995), 11.vi.86, Desjardin no. 3583 (TENN).

**Texas**. Brazos Co.: College Station, 4.ix.53, Thiers no. 1915 (MICH).

**Vermont**. Addison Co.: Middlebury, 7.viii.1896, Burt (FH, PH), summer, 1896, Burt (FH), 13.vii.1900, Burt (FH). Windham Co.: Newfane-Wardsboro Rd., 21.viii.61, Shaffer no. 3369 (MICH).

**Virginia**. Giles Co.: Cascades, 26.vi.76, Benny, F53295 (FLAS), 16.vii.76, Benny, F53380 (FLAS); Horton Center off Mt. Lake Rd., 18.viii.87, Desjardin no. 4466 (TENN); Mt. Lake, 25.vii.58, Hesler (TENN 21999). Smyth Co.: Mt. Rogers Rec. Area, 19.vi.86, Desjardin no. 3634 (TENN). County unknown: Strong Man Mt., 20.vii.35, Stevenson (BPI).

**West Virginia**. County unknown: Hunting Ridge, 13.viii.60, Stevenson (BPI).

**Wisconsin**. Vilas Co.: Anvil Lake, 12.ix.71, Gilliam no. 1189 (MICH).

### 9. *MARASMIUS EPIFAGUS*

**United States**

**Michigan**. Washtenaw Co.: Ann Arbor, 5.x.12, Kauffman (MICH); Sharon Hollow, NE of Manchester, 1.x.71, Smith no. 80656 (Holotype: MICH).

**Ohio**. Lake Co.: Painesville, viii.25, Beardslee (MICH).

**Virginia**. Botecourt Co.: 10.x.82, Vilgalys no. 82/342 (VPI).

**West Virginia**. Fayette Co.: 15.vi.1893, Nuttall no. 60 (MICH); Nuttallburg, vi.1893, Ellis & Everhart, N. Amer. Fungi Exs. no. 2901 [as *Marasmius ramealis*] (MICH).

## 10. *MARASMIUS EPIPHYLLUS*

**Austria**

Bohemia, Teplitz, ix.1872, de Thümen, Fungi Austriaci Exs. no. 609 (NY). Prope Vindobonam, Bisamberg, Wettstein, Flora Exs. Austro-Hungarica no. 1957 (NY).

**Finland**

Kintakongas Falls, south side of the Oulonkajaki, 22.viii.78, Miller no. 17475 (VPI).

**France**

Dauphineé, Gillet (NY)

**Sweden**

Femsjö, 30.vi.1899, Romell (NY); Femsjö, 1911, Romell (NY).

**United States**

**California**. El Dorado Co.: Fallen Leaf Lake, 2.x.76, Thiers no. 36533 (SFSU).

**Colorado**. Huerfano Co.: Pass Creek Pass, 22.viii.63, Simons no. Sf-37 (BPI).

**Michigan**. Cheboygan Co.: Burt Lake, Reese's Bog, 7.x.88, Methven no. 5314 (EIU).

**New York**. Albany Co.: Alcove, ix.1893, Shear, New York Fungi Exs. no. 304 [as *Marasmius subvenosus*] (BPI); Center, x.1869, Peck (Holotype of *Marasmius subvenosus*: NYS). Warren Co.: Warrensburg, 9.ix.34, Smith no. 695 (TENN 10220).

**Wyoming**. County unknown: Medicine Bow Mts., N fork of Laramie River, 8.viii.50, Henry (NY).

## 11. *MARASMIUS FELIX*

**United States**

**Florida**. Alachua Co.: San Felasco Hammock State Park, Planera Hammock, near Gainesville, 12.xii.87, Desjardin no. 4528 (TENN); Univ. Florida Horticultural Farm, Hwy 232, near Gainesville, 15.xii.87, Desjardin no. 4544 (TENN).

**North Carolina**. Buncombe Co.: Lake Powatah, near Asheville, 5.ix.87, Desjardin no. 4471 (TENN). Haywood Co.: GSMNP, Cataloochee, 9.ix.87, Desjardin no. 4486 (TENN), 11.vii.88, Desjardin no. 4566 (TENN).

**Ohio**. Montgomery Co.: Preston, 1906, Morgan no. 129 (Lectotype: ISC).

**Tennessee**. Knox Co.: Knoxville, Dean's Woods, 9.xi.86, Desjardin no. 4208 (TENN), 29.xi.86, Desjardin no. 4219 (TENN), 21.xi.87, Methven (TENN).

**Virginia**. Appomattox Co.: Fish Pond Creek, 23.x.83, Vilgalys no. 83/227 (BPI). Montgomery Co.: Shawsville, Kawanianna Scout Camp,

29.x.72, Miller no. 9348 [as *Marasmius calopus*] (VPI). Washington Co.: 17.ix.83, Vilgalys no. 83/201 (BPI).

## 12. *MARASMIUS DECIPIENS*

**United States**

**North Carolina**. Haywood Co.: GSMNP, Cataloochee, 5.ix.87, Desjardin no. 4480 (TENN), 30.vi.89, Desjardin no. 4930 (TENN). Swain Co.: Cherokee, 7.vi.58, Hesler [as *Marasmius epodius*] (TENN 3654); GSMNP, Kepart Prong, 7.vi.63, Hesler [as *Marasmius epodius*] (TENN 25530), 14.vi.87, Desjardin no. 4272 (TENN), 19.vii.88, Desjardin no. 4608 (TENN). Transylvania Co.: Cedar Mt. near Brevard, Sherwood Forest, 19.vi.80, Tish no. 1602-F (Holotype: NY); same location, 2.vi.82, Tish no. 9503 (Paratype: NY), 25.vi.84, Tish (Paratype: NY).

**Tennessee**. Blount Co.: GSMNP, Cades Cove, 19.vi.70, Hesler [as *Marasmius epodius*] (TENN 35579), 24.v.65, Petersen [as *Marasmius prasiosmus*] (TENN 27961); GSMNP, Elkmont, 6.vi.87, Desjardin no. 4266 (TENN); GSMNP, Gregory Bald trail off Parsons Branch Rd, near Cades Cove, 13.vi.86, Desjardin no. 3612 (TENN). Sevier Co.: GSMNP, Chimneys, 27.vi.34, Hesler (TENN 3796), 26.vi.38, Hesler (BPI, FLAS, TENN 11513) [both as *Marasmius siccus*]; GSMNP, Husky Gap trail, 4.viii.35, Smith no. 9709 [as *Marasmius epodius*] (MICH); GSMNP, Mt. Le Conte, 4.vi.57, Hesler [as *Marasmius epodius*] (TENN 22578), 5.vii.34, Hesler [as *Marasmius siccus*] (TENN 3799).

## 13. *MARASMIUS NIGRODISCUS*

**United States**

**Alabama**. Lee Co.: Auburn, 1.viii.55, Hesler [as *Collybia glatfelteri*] (TENN 21966).

**Connecticut**. Middlesex Co.: East Haddam, 15.viii.86, Desjardin no. 4055 (TENN).

**Florida**. Alachua Co.: Gainesville, 2.viii.37, Murrill no. F16025 (BPI, FLAS), vi.2.38, Murrill no. F16336 (FLAS, TENN 16109), 7.vii.39, Murrill no. F19977 (FLAS) [all as *C. lilacina*].

**Georgia**. Clarke Co.: Athens, 24.viii.78, Halling no. 2514 (FH).

**Mississippi**. [All determined as *Marasmius tenuifolius*] Hinds Co.: Natchez Trace Parkway, 24.vi.75, Guravich no. 643 (MICH), 8.viii.75, Guravich no. 664 (MICH). Madison Co.: Natchez Trace Parkway, 30.ix.72, Guravich no. 195 (MICH), 22.vi.82, Guravich no. 1490 (MICH). Washington Co.: 9.ix.74, Guravich no. 418 (MICH), 1.vii.82, Guravich no. 1498 (MICH).

**Missouri**. St. Louis Co.: St. Louis, 14.vii.02, Glatfelter no. 888 (Holotype of *Gymnopus glatfelteri*: NYS); same location, 15.vii.02, Glatfelter no. 888-889 [as *Collybia striatulata*] (Authentic: BPI).

**New Jersey**. Somerset Co.: Hillsborough, 15.viii.82, Miller no. 20009 (VPI).

**New York**. Bronx Co.: New York Botanical Garden, 29.vii.15, Murrill (Holotype of *Gymnopus tenuifolius*: NY). Nassau Co.: Great Neck, 18.ix.81, Morris [as *Collybia glatfelteri*] (TENN 44543). Suffolk

Co.: Cold Spring Harbor, 13.vii.36, Hesler [as *C. glatfelteri*] (MICH, TENN 11457); Port Jefferson, 25.viii.04, Peck (Authentic: NYS); Wading River, vii, Peck (Holotype of *Collybia nigrodisca*: NYS).

**North Carolina**. Haywood Co.: between Harmon Den and Maggie Valley exits on Hwy 40, 2.vii.89, Halling no. 6237 (TENN). Macon Co.: Coweeta Hydrologic Lab, Shope Fork area, 22.vii.87, Desjardin no. 4381 (TENN), 24.vii.87, Desjardin no. 4392 (TENN), 14.vii.88, Desjardin no. 4599 (TENN), 1.viii.88, Desjardin no. 4666 (TENN); Highlands, 23.vii.53, Hesler [as *C. glatfelteri*] (TENN 20926); Oconaluftee, Petersen & Rogerson (TENN 27502). Orange Co.: Chapel Hill, 4.vii.17, Coker no. 2589 [as *C. lilacina*] (NCU), 9.x.44, Coker no. 13612 [as *C. lilacina*] (NCU). Swain Co.: Cherokee, 21.v.54, Hesler [as *Collybia strictipes*] (TENN 21373); GSMNP, Indian Creek, 10.ix.86, Desjardin no. 4166 (TENN).

**South Carolina**. Oconee Co.: Ellicott Wilderness area, Chattooga Picnic area, 12.viii.87, Desjardin no. 4443 (TENN).

**Tennessee**. Anderson Co.: Claxton School, 4.vii.46, Hesler (MICH, TENN 17624), 29.viii.49, Hesler (TENN 19268) [both as *C. glatfelteri*]. Blount Co.: GSMNP, Cades Cove, 8.viii.45, Smith [as *C. glatfelteri*] (TENN 17089); GSMNP, Cades Cove, 13.viii.38, Smith no. 10124 (MICH); 1.ix.40, Hesler (TENN 12901), 8.viii.45, Hesler no. 17089 (MICH); 11.viii.46, Hesler (TENN 17676), 3.ix.47, Hesler (TENN 17995), 10.ix.47, Hesler (TENN 17804), 20.vii.66, Hesler (TENN 29164), 12.viii.67, Hesler (TENN 29945) [all as *C. glatfelteri*]; GSMNP, Crib Gap, 31.viii.86, Desjardin no. 4070 (TENN), 26.vii.88, Desjardin no. 4635 (TENN). Campbell Co.: Norris Dam area, vii, Hesler (TENN 23754),

15.vii.61, Hesler (TENN 24395) [both as *C. glatfelteri*]. Carter Co.: Hampton, 24.vii.49, Hesler [as *C. glatfelteri*] (TENN 19190). Knox Co.: Knoxville, 1.viii.50, Hesler (TENN 19688), 23.vi.63, Hesler (TENN 25600), 4.vii.66, Hesler (TENN 29145, 29147), 2.x.66 (TENN 29443, 5.vi.67, Hesler (TENN 29615), 4.x.71, Sharp (TENN 35925), 10.viii.72, Bigelow & Hesler (TENN 37280), 8.vi.73, Hesler (TENN 35646), 29.vi.73, Hesler (TENN 35653), 26.v.74, Hesler (TENN 39209) [all as *C. glatfelteri*]; Knoxville, 21.vi.89, Desjardin no. 4913 (TENN), 23.vi.89, Desjardin no. 4921 (TENN), 2.vii.89, Desjardin no. 4954 (TENN); Roaring Springs, 15.vii.34, Hesler [as *C. glatfelteri*] (TENN 4315). Sevier Co.: GSMNP, Chimneys, 9.vii.49, Hesler [as *C. glatfelteri*] (TENN 19013); GSMNP, Elkmont, 3.ix.37, Smith & Hesler, Smith no. 7324 (MICH, TENN 11315), 26.vii.40, Hesler (TENN 12722) [both as *C. glatfelteri*]; GSMNP, Greenbrier, 31.vii.88, Desjardin no. 4659 (TENN); GSMNP, Keener House, 3.viii.38, Smith no. 9678 (MICH), 22.viii.38, Smith no. 10409 (MICH) [both as *C. glatfelteri*]; GSMNP, Laurel Falls trail, 8.viii.38, Smith no. 9929 (MICH); GSMNP, Mt. LeConte, 5.vii.34, Hesler (MICH, TENN 10198), 12.viii.38, Smith no. 10062 (MICH), 17.viii.38, Smith no. 10291 (MICH), 11.vii.53, Hesler (TENN 20943), 11.viii.53, Hesler (TENN 20980), 9.vii.54, Hesler (TENN 21420) [all as *C. glatfelteri*]; GSMNP, Park Headquarters near Sugarlands Ranger Station, 19.viii.48, Herler (TENN 18577), 23.vii.55, Hesler (TENN 21917) [both as *C. glatfelteri*]; same location, 1.vii.87, Desjardin no. 4301 (TENN).

**Texas**. Brazos Co.: Wellborn, 9.vi.52, Thiers no. 1684 (Holotype of *Collybia delicata*: MICH).

**Virginia**. Henrico Co.: Richmond, Alameda Rd., 26.x.85, Miller no. 22457 (VPI). Montgomery Co.: Blacksburg, vi.80, Vilgalys no. 101 (BPI), 26.vii.84, Vilgalys (BPI); Rt. 724, 20.vii.81, Bills no. 112 [as *Marasmius cystidiosus*] (VPI).

## 14. *MARASMIUS CYSTIDIOSUS*

**United States**

**Michigan**. Cheboygan Co.: Burt Lake, Indian River, 4.viii.20, Sumstine no. 5 [as *Marasmius fasciatus*] (MICH). Oakland Co.: Milford, 30.viii.40, Smith no. 15213 (Holotype of *Marasmius leighii*: MICH). Washtenaw Co.: Ann Arbor, near Whitmore Lake, 14.vii.29, Smith s.n. [as *M. leighii*] (MICH); Waterloo State Rec. Area, Chelsea, 26.vi.40, Smith s.n. [as *M. leighii*] (MICH).

**Minnesota**. Rice Co.: Wheeling Twp., near Nerstrand Woods State Park, 4.vii.62, Weaver no. 7-4-62-N-1, 27.ix.63, Weaver no. 9-27-63-N-4 (both MICH).

**New York**. Catskill Mts., ix, Peck [part of holotype specimen of *Collybia strictipes*] (NYS).

**North Carolina**. Macon Co.: Coweeta Hydrologic Lab, Shope Fork Creek, 14.vii.88, Desjardin no. 4594 (TENN), 1.vii.89, Desjardin no. 4935 (TENN). Swain Co.: GSMNP, Indian Creek, 30.vii.39, Hesler no. 12195 (Holotype: MICH); same location, 6.ix.37, Smith & Hesler nos. 7416, 7437 (both MICH), 14.viii.38, Smith no. 10167 (MICH), 24.viii.41, Hesler (TENN 13938), 5.vii.42, Hesler (FLAS, MICH, TENN 14266),

23.viii.42, Hesler (TENN 14409), 12.vi.44, Hesler (TENN 16349), 12.ix.47, Hesler (TENN 17947).

**Tennessee**. Sevier Co.: Mt. LeConte, 11.vii.53, Hesler (TENN 20893), 9.vii.54, Hesler (TENN 21413) [both as *Collybia fasciatus*].

## 15. *MARASMIUS OREADES*

**Argentina**

Buenos Aires, 15.iii.46, Wright (NY).

**Austria**

1872, de Thümen, Fungi Austriaci Exs. no. 610 (NY).

**England**

Surrey, Kew Gardens, 24.vii.1899, Massee (FH). Surrey, Petersham, 15.ix.05, Hartley-Smith (NY).

**France**

C. Roumeguere, Fungi Gallici Exs. nos. 853, 2002 (NY).

**Germany**

6.ix.18, Sydow, Mycotheca Germanica Exs. no. 1407 (PH).

**Italy**

Montello, Treviso, ix.04, Saccardo, Mycotheca Italica Exs. no. 1402 (NY).

**Nova Scotia**

Kings Co.: Kentville, 30.vii.65, Petersen & Olexia (TENN 28650).

**Sweden**

Mauritzberg, Murrill no. 4132 (NY). Noirkoping, 23.vii.02, Murrill no. 4206 (NY). Stockholm, 9.viii.78, Miller no. 17994 (VPI). Uppsala, Skolbacken, 1853, E. P. Fries (FH).

**United States**

**California**. Numerous specimens cited in Desjardin (1985a).

**Maine**. Hancock Co.: Bar Harbor, 1901, White (NY).

**Maryland**. Prince Georges Co.: Bowie, 20.v.66, Miller no. 3845 (VPI).

**Massachusetts**. Hampshire Co.: Amherst, Univ. of Massachusetts, 9.viii.86, Desjardin no. 4019 (TENN).

**Michigan**. Washtenaw Co.: Ann Arbor, 11.x.59, Miller no. 3343 (VPI).

**Missouri**. Boone Co.: Columbia, 15.vi.40, Routien no. 1075 (TENN 13291).

**Montana**. Martinsdale, Hussay Creek, 7.vii.77, Miller nos. 15940, 15941 (VPI).

**New Jersey**. Gloucester Co.: Newfield, x.1882, Ellis, N. Amer. Fungi Exs. no. 908 (NY, PH); same location, vii.1896, Ellis & Everhart, Fungi Columbiani Exs. no. 1002 (NY, PH).

**New York**. Bronx Co.: Bronx, New York Botanical Garden, 27.vi.87, Desjardin no. 4299 (TENN), 26.vii.88, Halling no. 5958 (TENN). Erie Co.: 14.vi.62, Petersen (TENN 27273), 29.vi.62, Petersen (TENN 27266). Genesee Co.: Stafford, 4.ix.35, Hesler (TENN 8398).

**North Carolina**. Orange Co.: Chapel Hill, 10.viii.15, Coker (NCU).

**Pennsylvania**. Chester Co.: Michner (PH). University Park, Penn. State Univ., 27.viii.33, Overholts (TENN 7269).

**Tennessee**. Knox Co.: Knoxville, 21.vi.89, Desjardin no. 4919 (TENN).

**Virginia**. Giles Co.: Mt. Lake, 5.ix.36, Shear (BPI); Newport, 23.x.76, Junnila no. 248 (FLAS 53275). Gloucester Co.: Yorktown, 1.vi.29, Shear (BPI). Montgomery Co.: Blacksburg, 3.x.76, Miller no. 15884, 1.vi.81, Bills no. 142, 2.vi.81, Miller no. 19261 (all VPI). Shenandoah Co.: 21.ix.77, Evans (BPI).

### 16. *MARASMIUS ALBOGRISEOIDES*

**United States**

**Tennessee**. Knox Co.: Knoxville, Cherokee Dr., Univ. Tennessee Woodlot, 7.ix.86, Desjardin no. 4147 (TENN).

### 17. *MARASMIUS STRICTIPES*

**United States**

**Massachusetts**. Berkshire Co.: North Adams, 16.viii.86, Desjardin no. 4067 (TENN). Suffolk Co.: Boston, 22.ix.37, Warner [as *Collybia colorea*] (BPI).

**Michigan**. Allegan Co.: New Richmond, 6.ix.10, Kauffman (MICH). Barry Co.: Otis Lake, 25.viii.66, Smith no. 73213 (MICH). Berrien Co.: Warren Woods, 1.x.55, Shaffer no. 609 (MICH). Oakland Co.:

Milford, 30.viii.40, Smith no. 15205 (MICH). Ogemaw Co.: Lupton, 25.ix.45, Smith no. 20742 (MICH). Washtenaw Co.: Silver Lake, Dexter, 28.vi.40, Smith no. 15144 (MICH); Waterloo Rec. Area, 5.ix.64, Homola no. 1018 (MICH).

**Missouri**. St. Louis Co.: St. Louis, Glatfelter no. 989 (BPI). County unknown: Wickes, 19.x.14, Burt [as *Collybia colorea*] (BPI).

**New Jersey**. Morris Co.: Hackettstown, Mine Hill, 17.viii.82, Miller no. 22022 (VPI).

**New York**. Tompkins Co.: Ithaca, 25.vii.04, Kaufmann (MICH). Catskill Mts., ix, Peck (Holotype of *Collybia strictipes*: NYS).

**North Carolina**. Haywood Co.: GSMNP, Cataloochee, 11.vii.88, Desjardin no. 4563 (TENN). Macon Co.: Coweeta Hydrologic Lab, Ball Creek area, 4.ix.86, Desjardin no. 4129 (TENN); Highlands, 2.ix.42, Hesler (TENN 14687); Highlands, Rustic Falls Rd off Horse Cove Rd, 30.vii.87, Desjardin no. 4411 (TENN), 10.viii.87, Desjardin no. 4417 (TENN), 11.viii.87, Desjardin no. 4439 (TENN). Orange Co.: Chapel Hill, 4.x.11, Coker no. 82, 11.x.11, Coker no. 354, 28.x.11, Coker no. 83, 17.x.12, Coker no. 584, 18.x.12, Coker no. 589, 24.x.12, Coker no. 628 [all as *Collybia nummularia*] (all NCU). Polk Co.: Tryon, Parson's Falls, 20.ix.80, Guravich no. 1009 (MICH). Swain Co.: GSMNP, Indian Creek, 23.viii.42, Hesler (MICH, TENN 14471). Transylvania Co.: Pink Beds, N of Brevard, 13.ix.74, Guravich no. 452 (MICH).

**Ohio**. Portage Co.: West Branch State Park, 8.vii.72, Gilliam no. 1499 (MICH).

**Pennsylvania**. Lebanon Co.: Mt. Gretna, 4.ix.24, Kauffman (MICH).

**South Carolina**. Oconee Co.: Ellicott Wilderness area, Chattooga Picnic area, 12.viii.87, Desjardin no. 4453 (TENN).

**Tennessee**. Blount Co.: GSMNP, Bote Mt. trail, 31.viii.86, Desjardin no. 4073 (TENN); GSMNP, Cades Cove, 10.viii.38, Smith no. 10004 (MICH), 13.viii.38, Smith no. 10117 (MICH), 7.x.45, Hesler (TENN 17204), 21.ix.52, Hesler (TENN 20597), 19.vi.54, Hesler (TENN 21393), 3.ix.86, Anke (TENN); GSMNP, Rich Mt., 19.viii.49, Hesler (TENN 19225). Carter Co.: Elizabethton, 27.viii.46, Hesler (MICH, TENN 17700). Knox Co.: Maloney Heights, 17.ix.50, Hesler (TENN 19743). Pickett Co.: Cumberland Plateau, 23.ix.86, Desjardin no. 4205 (TENN). Sevier Co.: GSMNP, Greenbrier, 17.ix.47, Hesler (TENN 17813); GSMNP, Mt. LeConte, 23.viii.47, Hesler (TENN 17970), 19.viii.48, Hesler (TENN 18598), 27.ix.56, Hesler (TENN 22419).

**Virginia**. Montgomery Co.: Blacksburg, Fishburn Tract, 12.x.80, Miller no. 19201 (VPI); McDonald Hollow, 29.v.84, Vilgalys no. 84/8 (BPI); Mudpike, 15.vi.82, Bills no. 286 (BPI). Patrick Co.: Fairystone Park, 11.xi.71, Miller no. 9085 (VPI).

### 18. *MARASMIUS PYRRHOCEPHALUS*

**Canada**

Ontario, Lincoln Co.: St. Catherines, Trout Farm, 17.ix.86, Fisher (TRTC); Niagara Falls, W of Dorchester Rd, 13.viii.87, Thorn no. 870813/01 (TENN).

**United States**

**Illinois**. Coles Co.: Fox Ridge State Park, S of Charleston,

30.x.87, Methven no. 5152 (EIU, TENN). Edgar Co.: Foley's Woods, Hwy 16 between Kansas and Paris, 17.x.88, Methven no. 5396 (EIU).

**Kansas**. Miami Co.: Fontana, 30.ix.70, Bujakiewicz no. 61 (MICH).

**Massachusetts**. Hampshire Co.: Amherst, 10.viii.86, Desjardin no. 4031 (TENN). Middlesex Co.: Wakefield, 15.viii, Linder & Singer no. M130 (FH).

**Michigan**. Barry Co.: Deep Lake, 16.v.70, Mazzer no. 6029 (MICH). Gratiot Co.: Ithaca, 21.v.48, Potter no. 4545, 8.vi.48, Potter no. 4612, 27.vii.49, Potter no. 7799 (all MICH). Jackson Co.: Big Portage Lake, 10.x.71, Gilliam no. 1445 (MICH); Waterloo Rec. Area, 21.ix.71, Gilliam no. 1236 (MICH). Lenawee Co.: Vales Lake, 9.vi.71, Gilliam no. 1009 (MICH). Livingston Co.: George's Reserve, 26.ix.45, Smith no. 20661, 15.x.49, Smith no. 34274, 6.x.50, Evans, 9.x.50, Evans, 15.vi.64, Homola no. 808, 17.vi.66, Homola no. 1899, 10.v.67, Hoseney no. 276, 17.v.68, Ammirati no. 1475, 25.ix.70, Hoseney no. 1689, 4.x.71, Gilliam no. 1316, 27.x.71, Hoseney no. 1893 (all MICH). Oakland Co.: Haven Hill, 17.v.68, Ammirati no. 1465, 25.v.70, Gilliam nos. 454, 455, 6.x.71, Gilliam no. 1441 (all MICH); Kent Lake, 12.viii.37, Smith no. 7003 (MICH). Washtenaw Co.: Ann Arbor, 23.v.1894, Merrow no. 89, 18.ix.05, Kauffman, 1.x.36, Smith no. 4982, 6.ix.40, Rea no. 761, 1.vi.70, Gilliam no. 496, 9.vii.70, Gilliam no. 624 (all MICH); Cassidy Rd, 8.viii.72, Gilliam no. 1526 (MICH); Redwing Preserve, 12.v.68, Ammirati no. 1454 (MICH); Sharon Hollow, 27.v.37, Smith no. 6227, 26.x.48, Smith no. 32015, 1.vi.68, Smith no. 75265, 27.v.70, Gilliam nos. 476, 478, 19.viii.70, Gilliam no. 930, 16.ix.70, Gilliam no. 944 (all MICH); Silver Lake, 2.x.36, Smith nos.

4993, 5000, 8.v.38, Smith no. 9525, 23.ix.38, Smith no. 11041, 14.vi.70, Gilliam no. 531 (all MICH); Stinchfield Woods, 29.vii.70, Gilliam no. 859, 9.x.71, Gilliam no. 1452 (both MICH); Waterloo Rec. Area, 17.vi.70, Gilliam no. 544, 22.vi.70, Gilliam nos. 566, 567, 568, 10.vii.70, Gilliam no. 630, 9.vi.71, Gilliam no. 1005 (all MICH); Winnewana Lake, 11.vii.70, Gilliam nos. 646, 647 (MICH).

**Minnesota**. Rice Co.: Wheeling Twp., 30.v.65, Weaver no. 1134, 23.vi.68, Weaver no. 1551 (both MICH).

**Nebraska**. Bellevue, 4.vii.1894, Pound & Clements, Bot. Surv. Nebraska no. 4242 (Lectotype of *Marasmius hirtipes*: NEB). Wabash, 14.vii.1894, Pound & Clements, Bot. Surv. Nebraska no. 4254 [as *M. hirtipes*] (NEB).

**New York**. Madison Co.: Oneida, viii.14, House no. 14.67 [as *Marasmius elongatipes*] (NYS). Wayne Co.: Savannah, viii.1872, Peck no. 40 (Lectotype of *Marasmius longipes*: NYS). County unknown: Vaughns, 14.viii.12, Burnham [as *Marasmius elongatipes*] (NYS). Locale unknown: Earle no. F19791 [as *Marasmius elongatipes*] (FLAS).

**North Carolina**. Buncombe Co.: Asheville, 1901, Beardslee (FH). Haywood Co.: GSMNP, Cataloochee, 11.vii.88, Desjardin no. 4569 (TENN). Macon Co.: Coweeta Hydrologic Lab, Ball Creek area, 4.ix.86, Desjardin no. 4130 (TENN); Highlands, 15.vi.56, Hesler [as *Marasmius elongatipes*] (TENN 22304); Highlands, Horse Cove Rd, 11.viii.87, Desjardin no. 4437, 12.vii.88, Desjardin no. 4573 (both TENN). Swain Co.: Almond, 21.ix.71, Harrison nos. 11216, 11217 (both MICH); GSMNP, Kepart Prong, 14.vi.87, Desjardin no. 4273 (TENN).

**Ohio**. Cuyahoga Co.: Cleveland, x.44, Walters no. 11 (MICH). Franklin Co.: Columbus, Sullivant no. 67 (Holotype of *Marasmius macrorrhizus*: PC). Hamilton Co.: Miami-Whitewater Forest Park, 13.xi.60, Cooke no. 32480 (MICH). Portage Co.: West Branch State Park, 23.vi.72, Mazzer no. 7553 (MICH). Preble Co.: Hueston Woods State park, 18.x.68, Patrick no. 566 (MICH). Scioto Co.: Shawnee State Forest, Hobey Hollow, 4.xi.61, Cooke no. 33105 (MICH). Warren Co.: Waynesville, 23.viii.1844, Lea (Holotype: K).

**Pennsylvania**. Lehigh Co.: Trexlertown, ex Herb. Wm Herbst (FH).

**Tennessee**. Anderson Co.: Demaree, 11.vii.34, Hesler [as *Marasmius elongatipes*] (TENN 4131); Oliver Springs, 25.x.36, Hesler [as *Marasmius elongatipes*] (TENN 9644). Blount Co.: GSMNP, Abrams Creek, 6.x.56, Hesler [as *Marasmius elongatipes*] (TENN 22446); GSMNP, Parsons Branch Rd. near Cades Cove, 10.ix.87, Desjardin no. 4503 (TENN). Knox Co.: Knoxville, 6.xi.85, Desjardin no. 3488, 25.xi.85, Desjardin no. 3498, 9.xi.86, Desjardin no. 4209, 13.xi.86, Desjardin no. 4218, 29.xi.86, Desjardin no. 4221 (all TENN). Sevier Co.: GSMNP, Grassy Patch, 15.v.38, Hesler [as *Marasmius elongatipes*] (TENN 11410).

**Vermont**. Addison Co.: Middlebury, 9.vi.1897, Burt (FH), 15.vii.1897, Burt (FH), 7.viii.1897, Burt (FH), 14.viii.1897, Burt (FH, PH).

**Virginia**. Giles Co.: Horton Center, Mt. Lake Rd., NW of Blacksburg, 18.viii.87, Desjardin no. 4467 (TENN). Montgomery Co.: Blacksburg, 29.v.83, Vilgalys no. 83/17 (BPI).

## 19. *MARASMIUS SCORODONIUS*

**Canada**

Ontario, Lake Timagami, 9.ix.36, Smith no. 4719 (MICH). Quebec, Portneuf Co., St. Gabriel-Ouest, 29.vii.67, Shaffer no. 5584 (MICH).

**Czechoslovakia**

Bohemia meridionalis, Trebon, viii.34, Kavina, Cryptogamae Cechoslovenicae Exs. no. 137 (NY).

**East Germany**

Brandenburg, Sophienstädt bei Biesenthal, 2.vii.10, Sydow, Mycotheca Germanica no. 852 (MICH). Carlsrahe, ex herb. Guyot (NY).

**Finland**

Jyväskylä, 14.viii.78, Miller no. 17387 (VPI). Sipilä, vii-ix, Karsten, Finland Fungi Exs. no. 232 (NY).

**France**

Rhône, La Tour de Salvagny, 16.vii.38, Josserand (MICH).

**Netherlands**

Gelderland, Wageningen, 3.viii.59, Bas (MICH, NY, TENN 23881, VPI).

**Nova Scotia**

Kings Co.: Kentville, 26.vii.65, Petersen & Olexia (TENN 28636); Kentville, Ravine, Research Station, 15.vii.72, Harrison nos. 11577, 11578, 11579 (MICH).

**Scotland**

Lothian, Edinburgh, 5.ix.78, Miller no. 17978 (VPI).

**Sweden**

Femsjö, 6.ix.1899, Burt (FH). Östergötland, Gryt Parish, Strömmen, 25.vii.60, Nannfeldt, Flora Suecica Exs. no. 16288 (MICH). Stockholm, 27.x.1895, Romell (NY). Uppsala, Kungsparken, 1853, det. E. P. Fries (FH)

**Switzerland**

Grisons, Basse-Engodine, 2.ix.46, Favre (MICH).

**United States**

**California**. Humboldt Co.: Patricks Pt. State park, 15.ix.68, Thiers no. 22911 (SFSU).

**Connecticut**. Fairfield Co.: Newtown, 23.vi.73, Smith nos. 84079, 84080, 84081, 84082, 84083, 84084 (all MICH).

**Illinois**. Cook Co.: Paddock Woods Forest Preserve, 22.vi.56, Shaffer no. 787 (MICH).

**Maine**. Hancock Co.: Lamoine, 28.vi.73, Smith nos. 84137, 84138.

**Maryland**. Soap Mt. State Sanitorium, viii.20, Kelly no. 530 (MICH).

**Massachusetts**. Berkshire Co.: North Adams, 16.viii.86, Desjardin no. 4060. Worchester Co: Petersham, 10.viii.86, Desjardin no. 4030 (TENN).

**Michigan**. Barry Co.: Rutland Twp., 16.viii.66, Mazzer no. 4261 (MICH). Cheboygan Co.: Indian Lake, 4.viii.20, Sumstine [as *Marasmius*

*alliatus*] (NY); Pine Pt., 13.vii.57, Smith no. 57314 (MICH). Gratiot Co.: Ithaca, 2.ix.47, Potter no. 3687 (MICH). Jackson Co.: Waterloo Rec. Area, 21.ix.71, Gilliam no. 1235 (MICH). Livingston Co.: George Reserve, 13.vii.64, Homola no. 903 (MICH). Marquette Co.: Ives Lake, 15.vii.70, Ammirati no. 4476 (MICH), 25.viii.71, Petersen (TENN 36156). Washtenaw Co.: Winnewana Lake, 11.vii.70, Gilliam no. 652 (MICH).

**Minnesota**. Rice Co.: Nerstrand Woods State park, 15.vii.68, Weaver no. 1588 (MICH).

**New Hampshire**. Carroll Co.: Chocorua, vii.06, Farlow, Reliquiae Farlowianae Fungi Exs. no. 337 (NCU, FH). Hillsborough Co.: Hillsboro, 17.viii.59, Miller no. 250 (MICH).

**New York**. Bronx Co.: New York Botanical Garden, 27.viii.11, Murrill (NY). Delaware Co.: Arkville, 7-17.viii.16, Murrill (NY). Saratoga Co.: Gansevoort, vii, Peck [as *Marasmius calopus*] (NYS). Warren Co.: Warrensburg, 26.ix.71, Gilliam no. 1301 (MICH).

**North Carolina**. Macon Co.: Cliffside Lake Cmpgrd., NW of Highlands, 29.vii.86, Desjardin no. 3975 (TENN); Coweeta Hydrologic Lab, Ball Creek area, 14.vii.86, Desjardin no. 3831 (TENN); Flat Top Mt. Rd, 14.vi.61, Hesler (TENN 24347); Glenn Falls area SW of Highlands, 7.vii.86, Desjardin no. 3737 (TENN); Harbison Lake, 29.vii.34, Hesler (BPI, FH, TENN 5157); Highlands, 16.viii.36, Hesler (BPI, FH, TENN 9257), 4.vii.37, Hesler (BPI, FH, MICH, TENN 10454), 29.vi.41, Hesler (TENN 13770), 11.viii.49, Hesler (TENN 19199), 15.vi.56, Hesler (TENN 22305), 18.vi.63, Hesler (TENN 25579). Orange Co.: Chapel Hill, 6.ix.15, Coker no. 1680, 21.vii.17, Coker & Neely no. 2739, 21.vii.17, Coker no. 2743, 30.vii.17, Coker no. 2808 [all as

*Marasmius alliatus*] (all NCU). Swain Co.: GSMNP, Deep Creek, 1.ix.71, Harrison no. 10986 (MICH). Transylvania Co.: Pisgah Nat. Forest, Black Mt. trail N of Brevard, 24.vii.86, Desjardin no. 3952 (TENN).

**Ohio**. Hocking Co.: Cedar Falls, 17.vii.60, Cooke no. 32109 (MICH).

**Rhode Island**. Locale unknown: ix.1848, Bennett no. 60 [as *Marasmius calopus*] (FH).

**Tennessee**. Blount Co.: GSMNP, Bote Mt. trail, 20.vii.86, Desjardin no. 3882 (TENN); GSMNP, Cades Cove, 11.ix.85, Desjardin no. 3418 (TENN). GSMNP, Parsons Branch Rd near Cades Cove, 13.vi.86, Desjardin no. 3609, 18.vii.86, Desjardin no. 3864, 10.ix.87, Desjardin no. 4500 (all TENN). Knox Co.: Knoxville, 7.vii.87, Desjardin no. 4339 (TENN); New Hopewell, 28.v.42, Hesler (TENN 14181); Timberlake Rd, 30.vi.53, Hesler (TENN 20872). Sevier Co.: GSMNP, Chimneys, 28.v.87, Desjardin no. 4238 (TENN); GSMNP, Greenbrier, 25.v.85, Methven no. 3747, 19.vii.86, Desjardin no. 3875, 31.vii.88, Desjardin no. 4660 (all TENN); GSMNP, Husky Gap trail, 4.ix.38, Smith no. 10898 (MICH); GSMNP, Mt. LeConte, 4.vi.57, Hesler (TENN 9183); GSMNP, Roaring Fork, 2.viii.36, Hesler (TENN 9113); same location, 9.vii.87, Desjardin no. 4351 (TENN).

**Vermont**. Windham Co.: Williamsville-Newfane Rd, 15.vii.61, Shaffer nos. 2907, 2908 (MICH).

**Virginia**. Rockbridge Co.: 12.vii.60, Dublin no. 610 (BPI).

**Wisconsin**. Dunn Co.: North Upper Tainter Lake, 30.vi.71, Mazzer no. 6534 (MICH). Kilbourn City, 10.vii.03, Moffatt (FH).

## 20. *MARASMIUS COPELANDII* var. *OLIDUS*

**United States**

**Florida**. Alachua Co.: San Felasco Hammock State Park, Planera Hammock, near Gainesville, 12.xii.87, Desjardin no. 4529 (TENN).

**Michigan**. Livingston Co.: Pickney, George Reserve, 4.x.36, Smith no. 5034, 24.ix.70, Hoseney (both MICH). Oakland Co.: Haven Hill, 11.x.59, Smith no. 62192 (MICH); Milford, 15.ix.38, Smith no. 10936 (MICH); Proud Lake, 1.xi.70, Gilliam no. 997 (Holotype of *Marasmius olidus*: MICH); same location, 15.x.55, Smith no. 51125 (MICH). Washtenaw Co.: Ann Arbor, 17.ix.07, Kauffman, 1.x.33, Smith no. 33-1056 (both MICH); Dexter, Silver Lake, 2.x.36, Smith no. 5004, 23.ix.38, Smith no. 11057 (both MICH).

**North Carolina**. Buncombe Co.: Asheville, 1918, Beardslee [as *Marasmius insititius*] (MICH). Swain Co.: GSMNP, Indian Creek, 23.viii.42, Hesler [as *Marasmius prasiosmus*] (TENN 14441).

**Vermont**. County unknown: South Dunmore, ix.1896, Burt (FH).

## 21. *MARASMIUS MINUTUS*

**United States**

**Massachusetts**. Middlesex Co.: Woburn, 18.ix.43, Linder & Singer [as *Marasmius capillipes*] (FH).

**Michigan**. Washtenaw Co.: Ann Arbor, viii.42, Smith no. 18842 (MICH)

**New Jersey**. Gloucester Co.: Newfield, 4.vi.1880, Ellis, N. Amer. Fungi Exs. no. 401 (Lectotype of *Marasmius pyrinus*: NY; Isolectotypes: BPI, FH, NY, PENN at PH, PH).

**New York**. Albany Co.: East Berne, viii, Peck (authentic: NYS). Rensselaer Co.: Sand Lake and Catskill Mts. (county unknown), vii.1873, Peck (Holotype: NYS). Saratoga Co.: South Ballston, viii, Peck (Authentic: NYS).

**Virginia**. Frederick Co.: Winchester, ix.38, Groves (BPI). Montgomery Co.: Blacksburg, 18.viii.87, Desjardin no. 4469A (TENN). County unknown: Clarendon, viii.26, Weir (BPI).

## 22. *MARASMIUS DELECTANS*

**Canada**

Ontario, Moonlight Bay, ix.21, Kelly no. 1158 (MICH).

**United States**

**Illinois**. Cook Co.: Paddock Woods Forest Preserve, 10.vii.56, Shaffer no. 844 (MICH). Mason Co.: Havana, Beardslee [as *marasmius albiceps*] (FH). Wabash Co.: Beall Woods State Park, 17.ix.88, Methven no. 5235 (EIU).

**Indiana**. Montgomery Co.: Pine Hills, 25.viii.61, Cooke no. 32820 (MICH); Shades State Park, 25.viii.61, Cooke no. 32725 (MICH). Owen Co.: Spencer, Green Bluffs, 22.viii.70, Shaffer no. 6354 (MICH). Warren Co.: High Bridge, 26.viii.61, Cooke no. 32872 (MICH).

**Massachusetts**. Berkshire Co.: North Adams, 16.viii.86, Desjardin no. 4066 (TENN).

**Michigan**. Cass Co.: Silver Creek Twp., 22.viii.54, Holfert (MICH). Emmet Co.: Pellston Hardwoods, 23.vii.52, Smith no. 39257 (MICH). Gratiot Co.: Edgewood, 22.vii.48, Potter no. 5755 (MICH); Ithaca, 31.viii.47, Potter no. 3678, 24.vii.48, Potter no. 5823, 13.viii.48, Potter no. 6057, 9.ix.48, Potter no. 6371, 27.vii.49, Potter no. 7812, 13.ix.49, Potter no. 8712, 22.ix.57, Potter no. 11898, 6.viii.61, Potter no. 12840 (all MICH). Livingston Co.: George Reserve, 27.vii.70, Gilliam no. 832, 4.x.71, Gilliam no. 1313, 11.viii.72, Hoseney (all MICH). Monroe Co.: Victor, Cedar Bluffs, 23.viii.70, Gilliam no. 935. Oakland Co.: Milford, 10.viii.37, Smith no. 6931, 15.ix.38, Smith no. 10962, 29.viii.40, Smith no. 15196 (all MICH); Pontiac, 24.viii.37, Smith no. 7248 (MICH); Proud Lake, 30.vii.70, Gilliam no. 866, 21.vii.71, Gilliam nos. 771, 772, 773, 774, 775, 3.viii.72, Gilliam no. 1520 (all MICH). Ontonagon Co.: Porcupine Mts. State Park, 23.viii.62, Peters no. 1115 (MICH). Washtenaw Co.: Ann Arbor, 27.vii.32, Smith s.n., 4.viii.35, Smith no. 1709 (both MICH); Dexter, 2.ix.40, Smith no. 15248 (MICH); Sharon Hollow, 19.viii.37, Smith no. 7098, 26.x.48, Smith no. 31992, 30,vii.60, Smith no. 62677, 4.viii.60, Shaffer no. 2511, 11.viii.60, Shaffer no. 2576, 23.vii.70, Gilliam no. 790, 16.ix.70, Gilliam no. 948 (all MICH); Stinchfield Woods, 29.vii.70, Gilliam no. 860 (MICH).

**Minnesota**. Anoka Co.: Cedar Creek Nat. Hist. Area, 2.vii.68, Weaver no. 1559 (MICH); East Bethel Village, 4.viii.67, Weaver no. 1448 (MICH). Crow Wing Co.: Pelican Township, 7.vii.62, Weaver no. 7-7-62-P3 (MICH).

**New York**. Essex Co.: Upper Jay, 24.viii.54, Shaffer no. 490 (MICH). Saratoga Co.: East Galway, 30.viii.1893, Burt (FH). County unknown: Vaughns, viii.12, Burnham (NYS).

**North Carolina**. Haywood Co.: between Harmon Den and Maggie Valley exits on Hwy 40, 2.vii.89, Desjardin no. 4952 (TENN); Waterville, GSMNP, Chestnut trail, 21.vii.86, Desjardin no. 3900 (TENN). Swain Co.: Indian Creek, 24.viii.71, Harrison no. 10857 (MICH).

**Ohio**. Butler Co.: Oxford, 2.viii.09, Stover (NYS). Coshocton Co.: Coshocton, 26.viii.42, Linder nos. 13745, 13767, 13.ix.42, Linder no. 14020 (all FH). Hamilton Co.: Miami-Whitewater Forest park, 2.vii.60, Cooke no. 31944 (MICH). Highland Co.: Fort Hill, 14.x.61, Cooke no. 32917 (MICH). Lake Co.: Painesville, 17.viii.26, Beardslee no. 26024 (MICH). Montgomery Co.: Preston, 1895, Morgan no. 21 (Lectotype: ISC); same location, ix, 1890, Morgan; 1905, Morgan; 27.viii.05, Morgan; 1906, Morgan; 7.vii.06, Morgan; 9.viii.06, Morgan (all authentic: all ISC). County unknown: Lane, 12.vii.22, Beardslee no. 22011 (MICH).

**Pennsylvania**. Lebanon Co.: Mt. Gretna, 28.viii.26, Kauffman (MICH).

**Tennessee**. Knox Co.: Knoxville, Cherokee Dr., 9.x.60, Campbell (TENN 24157; same location, 7.ix.86, Desjardin no. 4146. 3.vii.87, Desjardin no. 4316, 15.ix.87, Desjardin no. 4518 (all TENN); Timberlake Rd, 17.vii.53, Hesler (TENN 20897), 4.vii.56, Hesler (TENN 19203, 20.ix.57, Hesler (TENN 22642), 23.vi.63, Hesler (TENN 25596). Pickett Co.: Cumberland Plateau, 23.ix.86, Desjardin no. 4206 (TENN).

Sevier Co.: GSMNP, Nails Creek, 13.x.55, Hesler (TENN 22178); GSMNP, Roaring Springs, 9.vii.35, Hesler (TENN 7964).

**Vermont**. Addison Co.: Middlebury, Chipman's Hill, 19.viii.1896, Burt (FH, MICH).

**Virginia**. Giles Co.: Horton Center, Mt. Lake Rd NW of Blacksburg, 18.viii.87, Desjardin no. 4468 (TENN); Pandapus Pond Area, 7.ix.86, Miller no. 22671 (VPI). Montgomery Co.: Christiansburg, 19.vii.82, Bills no. 388 (VPI).

**Wisconsin**. Dunn Co.: Menomonie, Lake Menomin, 28.vi.71, Mazzer no. 6505 (MICH). Vernon Co.: Viroqua, 26.viii.72, Hoseney no. 2749 (MICH).

### 23. *MARASMIUS COHAERENS* var. *COHAERENS*

**Belgium**

Namur Prov., Ave et Auffe, Ry d' Ave, 24.ix.86, Halling no. 4916 (NY).

**Canada**

Ontario, Lake Timagomi, 12.ix.36, Smith no. 14835 (MICH); Magnetawan, 29.viii.21, Kelly no. 1183 (MICH).

**France**

Rhône, Marcy l' Etoile, 9.x.43, Josserand [as *Marasmius ceratopus*] (MICH).

**United States**

**Florida**. Alachua Co.: Gainesville, High Hammock, 25.vii.44, Murrill, F47657 [*pro parte*] (FLAS).

**Kansas**. Bourbon Co.: Fort Scott, 21.vi.02, Garrett, Bartholomew N. Amer. Fungi Exs. no. 48 [as *Marasmius spongiosus*] (FH).

**Michigan**. Alger Co.: Au Train, 27.viii.32, Mains no. 32-372 (MICH); Grand Sable Lake, 3.viii.71, Gilliam nos. 1183, 1184 (both MICH); Rock River, 16.ix.29, Kauffman (MICH). Emmet Co.: Harbor Spring, 7.vii.69, Smith no. 77574 (MICH); Wycamp Lake, 19.vii.65, Smith no. 71805 (MICH). Gratiot Co.: Ithaca, 12.ix.47, Potter no. 3846, 9.viii.48, Potter no. 6001 (both MICH). Jackson Co.: Big Portage Lake, 10.x.71, Gilliam no. 1450 (MICH). Livingston Co.: Pickney, George Reserve, 10.x.31, Smith s.n. (MICH). Luce Co.: Tahquamenon Falls State Park, 11.viii.52, Smith no. 39536 (MICH). Marquette Co.: Conway Lake, 1.viii.68, Gilliam no. 333 (MICH); Ford Rd, 15.vii.70, Ammirati no. 4463 (MICH); Howe Lake, 14.vii.70, Ammirati no. 4417 (MICH); Ives Lake, Mt. Huron Club, 9.vii.71, Gilliam no. 1132, 9.vii.71, Harrison no. 10347 (both MICH); Trout Lake, 18.vii.69, Ammirati no. 3150 (MICH). Montmorency Co.: NW corner, 18.vii.67, Smith no. 74591 (MICH). Oakland Co.: Milford, 15.ix.38, Smith no. 10961 (MICH); Proud Lake, 3.viii.72, Gilliam no. 1519 (MICH). Ontonagon Co.: Porcupine Mt. State Park, 24.viii.62, Shaffer no. 3778 (MICH). Otsego Co.: Hardwood Lake, 30.vii.71, Gilliam no. 1176 (MICH). Schoolcraft Co.: Garden Peninsula, 17.viii.61, Smith no. 63938 (MICH). Washtenaw Co.: Sharon Hollow, 16.ix.70, Gilliam no. 951

(MICH); Whitmore Lake, 21.viii.21, Kauffman (MICH), 8.x.31, Smith (TENN 2886).

**New York**. County unknown: Floodwood, 17.viii.1900, Burt [*pro parte*] (FH).

**North Carolina**. Buncombe Co.: Asheville, ix.18, Beardslee no. 18156 [as *Marasmius glabellus*] (MICH). Swain Co.: Almond, 21.ix.71, Harrison no. 11214 (MICH); same location, 21.ix.71, Harrison no. 11219 [as *Marasmius glabellus*] (MICH).

**Pennsylvania**. Lebanon Co.: Mt. Gretna, 6.ix.24, Kauffman (MICH).

**Tennessee**. Anderson Co.: Oliver Springs, 25.x.36, Hesler (MICH, TENN 10217). Blount Co.: GSMNP, Cades Cove, 17.ix.85, Desjardin no. 3473 (TENN). Scott Co.: Big South Fork of cumberland River, 16.ix.87, Desjardin no. 4522 (TENN).

**Virginia**. Montgomery Co.: Blacksburg, 11.x.73, Miller no. 9577 (VPI). County unknown: Shenandoah National Park, White Oak Canyon, 24.ix.36, Stevenson (BPI).

**West Germany**

Baden-Baden, 13.ix.65, Shaffer no. 4949 (MICH).

### 24. *MARASMIUS COHAERENS* var. *LACHNOPHYLLUS*

**Canada**

Ontario: Magnetawan, 20.vii.20, Kelly no. 785, ix.21, Kelly no. 1176, 28.viii.22, Kelly no. 1449 (all MICH); Petawawa Forest, 1.ix.47, Smith no. 26424 (MICH).

**Nova Scotia**

Colchester Co.: 2.ix.31, Smith no. 855 (MICH).

**United States**

**Florida**. Alachua Co.: Arredonda, 29.vii.38, West & Murrill, F18267 (Holotype of *Marasmius setulosus*: FLAS).

**Illinois**. Clark Co.: Rocky Branch Nature Preserve, 29.v.89, Methven no. 5589 (EIU, TENN). Cook Co.: Paddock Woods Forest Preserve, 10.vii.56, Shaffer no. 833 (MICH).

**Maine**. Aroostook Co.: Sinclair, 25.vii.56, Bigelow no. 3514 (MICH); Winterville, 6.vii.56, Bigelow no. 3045 (MICH).

**Massachusetts**. Berkshire Co.: North Adams, 15.viii.86, Desjardin no. 4056, 16.viii.86, Desjardin no. 4065 (both TENN).

**Michigan**. Alger Co.: Grand Sable Lake, 3.viii.71, Gilliam nos. 1185, 1186 (MICH). Barry Co.: Gun Lake, 18.vi.67, Mazzer no. 4813 (MICH); Otis Lake, 30.vi.70, Gilliam no. 610 (MICH). Berrien Co.: Warren Woods, 5.ix.55, Smith no. 51198 (MICH). Cheboygan Co.: 26.vii.61, Charlton no. G153 (MICH); Douglas Lake, 2.vii.46, Smith no. 21597 (MICH); Douglas Lake, Gorge, 21.vii.53, Singer no. N-700 (Holotype of *Marasmius cohaerens* var. *americanus*: F). Chippewa Co.: Emmons Slashings, 18.viii.59, Smith no. 61479 (MICH). Emmet Co.: Boyne Highlands, 7.vii.69, Smith no. 77575 (MICH); Mackinaw City, 29.vi.59, Smith no. 36499, 15.vii.57, Shaffer no. 1511 (both MICH); Pellston Hills, 17.vii.61, Smith no. 63578, 1.vii.69, Smith no. 77546 (both MICH). Gratiot Co.: Ithaca, 23.ix.47, Potter no. 3945 [plus 12 additional collections from the same locale] (MICH). Livingston Co.:

Pickney, George Reserve, 14.vii.60, Shaffer no. 2365 (MICH); Howell, 27.vi.72, Gilliam no. 1484 (MICH). Luce Co.: Tahquamenon Falls State Park, 13.viii.51, Smith no. 37787 (MICH). Marquette Co.: Huron Mt. Club, 17.viii.70, Ammirati no. 4954, 18.vii.71, Gilliam no. 1144 (both MICH); Ives Lake, 31.viii.68, Smith no. 1813 (MICH); Trout Lake, 5.viii.68, Gilliam nos. 355, 356, 357 (MICH). Monroe Co.: Petersburg, 27.vii.70, Gilliam no. 839 (MICH). Montcalm Co.: Crystal, 22.ix.48, Potter no. 6504 (MICH). Montmorency Co.: NW corner, 4.viii.67, Smith no. 74771, 4.vii.69, Smith no. 77554 (both MICH). Oakland Co.: Pontiac, 15.vi.37, Smith no. 6323, 24.vi.37, Smith no. 6387 (both MICH); Proud Lake Rec. Area, 13.ix.68, Ammirati no. 2477 (MICH). Otsego Co.: NE corner, 27.vii.71, Gilliam no. 1169 (MICH). Washtenaw Co.: Ann Arbor, 14.vii.20, Kauffman (MICH); Gorman Lake, 19.viii.72, Smith no. 81580 (MICH); Hankerd Rd, 26.vi.70, Gilliam no. 593 (MICH); Sharon Hollow, 22.vi.38, Smith no. 9572, 31.viii.60, Shaffer no. 2775 (both MICH); Silver Lake, Dexter, 28.vi.40, Smith no. 15141, 9.x.42, Smith no. 18791 (both MICH); South Lake, Pickney Rec. Area, 6.vii.70, Gilliam no. 620 (MICH); Waterloo Rec. Area, 22.vi.70, Gilliam no. 560, 10.vii.70, Gilliam no. 629 (both MICH).

**Minnesota**. Anoka Co.: Cedar Creek Nat. Hist. Area, 2.vii.68, Weaver no. 1562 (MICH).

**New York**. Franklin Co.: 21.viii.34, Smith no. 421, 26.viii.34, Smith no. 544 (both MICH). Genesee Co.: Bergen Swamp, 4.ix.72, Vishniac no. VII-130 (MICH). Lewis Co.: Greig, ix, Peck (Holotype of *Agaricus spinulifer*: NYS). Tompkins Co.: Ithaca, 6.viii.03, Kauffman (MICH). Adirondack Mts., 10.ix.14, Kauffman (MICH).

**North Carolina**. Henderson Co.: Tuxedo, 20.ix.80, Miller no. 19160 (VPI). Macon Co.: Chattooga Loop trail off Bull Pen Rd., 13.vii.88, Desjardin no. 4589 (TENN); Cliffside Lake Cmpgrd, NW of Highlands, 23.vii.87, Desjardin no. 4387 (TENN); Coweeta Hydrologic Lab, Shope Fork area, 14.vii.88, Desjardin no. 4603 (TENN); Highlands, Norton Rd, 26.viii.52, Hesler (TENN 20570); Highlands, 2.x.71, Harrison no. 11424 (MICH); Rustic Falls area off Horse Cove Rd, S of Highlands, 11.viii.87, Desjardin no. 4438 (TENN). Swain Co.: Almond, 21.ix.71, Harrison no. 11227 (MICH); GSMNP, Cowhee Bald, 12.ix.71, Harrison no. 11117 (MICH); GSMNP, Indian Creek, 14.viii.38, Smith no. 10183 (MICH), 10.ix.86, Desjardin no. 4167 (TENN).

**Ohio**. Butler Co.: Oxford, Hueston's Woods, 19.ix.09, Peck (BPI). Warren Co.: Waynesville, 5.ix.1844, Lea (Holotype of *Agaricus lachnophyllus*: K; Isotype: FH).

**Tennessee**. Blount Co.: GSMNP, Bote Mt. trail, 31.viii.86, Desjardin no. 4071 (TENN); GSMNP, Cades Cove, 2.vii.34, Hesler (TENN 3778); GSMNP, Crib Gap, near Cades Cove, 26.vii.88, Desjardin no. 4636 (TENN). Knox Co.: New Hopewell, 29.ix.49, Hesler (TENN 19404). Sevier Co.: GSMNP, Alum Cave Bluff area, 4.ix.59, Hesler (TENN 10687); GSMNP, Chimneys, 27.vi.37, Hesler (TENN 3777); GSMNP, Elkmont, 17.ix.16, Kauffman (MICH); Gatlinburg, 29.v.38, Hesler (TENN 11435); GSMNP, Grassy Patch, 26.viii.38, Smith no. 10549 (MICH); GSMNP, Greenbrier, 6.vi.87, Desjardin no. 4262, 31.vii.88, Desjardin no. 4658 (both TENN); GSMNP, Meigs Creek, 22.viii.36, Hesler (TENN 9364); GSMNP, Mt. LeConte, 4.vi.42, Hesler (MICH, TENN 14180), 1.vi.52, Hesler

(TENN 20416), 4.vi.54, Hesler (TENN 21381); GSMNP, Spruce Flats, 6.ix.36, Hesler (TENN 9423).

**Vermont**. Locale unknown: 4.ix.1898, Langlois [as *Collybia spinulifera*] (BPI).

**Virginia**. Giles Co.: Mt. Lake, 8-14.vii.09, Murrill no. 188 (NY). Montgomery Co.: Blacksburg, x.36, Shear, 17.vi.37, Shear (both BPI).

## 25. *MARASMIUS CILIATOMARGINATUS*

**United States**

**Alabama**. Clay Co. (?): Talladega National Forest, Lake Chinnabee Rec. Area, 23.vii.59, Thiers no. 7142 (SFSU).

**Florida**. Alachua Co.: Planer Hammock near Gainesville, 16.vii.38, West, Arnold & Murrill, F17369 [*pro parte*, as *Marasmius haematocephalus*] (FLAS).

**North Carolina**. Macon Co.: Highlands, Rustic Falls area off Horse Cove Rd, 10.viii.87, Desjardin no. 4414 (Holotype: TENN 47626). Orange Co.: Chapel Hill, 19.vii.17, Coker & Neely no. 2711, 8.vii.24, Coker no. 7352 [both as *Marasmius siccus*] (both NCU).

**Tennessee**. Blount Co.: GSMNP, Bote Mt. trail near Cades Cove, 31.viii.86, Desjardin no. 4078 (TENN 47628). Knox Co.: Knoxville, Cherokee Dr, 7.ix.86, Desjardin no. 4154 (TENN 47627); Roaring Springs, 15.vii.34, Hesler [as *Marasmius siccus*] (TENN 4299); Timberlake Rd, 7.vii.53, Hesler [*pro parte*, as *Marasmius siccus*] (TENN 20940).

## 26. *MARASMIUS FALCATIPES*

**United States**

**North Carolina**. Buncombe Co.: Lake Powatah, near Asheville, 5.ix.87, Desjardin no. 4472 (TENN 47635). Haywood Co.: GSMNP, Cataloochee, 6.ix.87, Desjardin no. 4485 (TENN 47636), 9.ix.87, Desjardin no. 4490 (TENN 47637). Macon Co.: Coweeta Hydrologic Lab, Ball Creek area, 4.ix.86, Desjardin no. 4134 (TENN 47631), 13.viii.87, Desjardin no. 4456 (TENN 47634); Highlands, Rustic Falls area off Horse Cove Rd, 10.viii.87, Desjardin no. 4415 (Holotype: TENN 47629); same location, 30.vii.87, Desjardin no. 4413 (TENN 47632). Orange Co.: Chapel Hill, 21.vii.17, Coker no. 2750 [as *Marasmius concinnus*] (NCU).

**South Carolina**. Oconee Co.: Ellicott Wilderness Area, Chattooga Picnic Area, 12.viii.87, Desjardin no. 4448 (TENN 47633).

**Tennessee**. Blount Co.: GSMNP, Cades Cove, 17.ix.85, Desjardin no. 3485 (TENN 47630).

**Virginia**. Giles Co.: Jefferson National Forest, 2.x.83, Miller no. 20804 (VPI). Montgomery Co.: Blacksburg, 14.ix.83, Vilgalys no. 83/195, US 900773 (BPI). Washington Co.: Little Tumbling Creek, 17.ix.83, Vilgalys no. 83/202, US 900121 (BPI). Locale unknown: Vilgalys, US 900746 (BPI).

## 27. *MARASMIUS SPISSUS*

**United States**

**Indiana**. Monroe Co.: Cedar bluffs, near Victor, 23.viii.70, Gilliam no. 938A (MICH).

**Michigan**. Oakland Co.: Milford, 19.ix.40, Smith no. 15426 (MICH). Washtenaw Co.: Sharon Hollow, 2.vii.60, Smith no. 62486 (Holotype: MICH).

**New York**. Albany Co.: Selkirk, viii, Peck [as *Marasmius anomalus*] (NYS). Saratoga Co.: Round Lake, viii, Peck [as *Marasmius anomalus*] (NYS).

**North Carolina**. Haywood Co.: Sunburst, 5.vi.11, House no. 11.33 [as *Gymnopus lachnophyllus*] (NY). Macon Co.: Coweeta Hydrologic Lab, Shope Fork area, 24.vii.87, Desjardin no. 4391, 14.vii.88, Desjardin no. 4598 (both TENN); Coweeta Hydrologic Lab, Ball Creek area, 4.ix.86, Desjardin no. 4128 (TENN); Highlands, Rustic Falls area off Horse Cove Rd, 11.viii.87, Desjardin no. 4433 (TENN). Swain Co.: GSMNP, Indian Creek, 14.viii.38, Smith no. 10153, 11.vii.70, Shaffer no. 6209, 1.ix.71, Harrison no. 10974 (all MICH). Transylvania Co.: Vanderbilt Estate, 13-24.vii.08, Murrill & House no. 274 [as *Gymnopus lachnophyllus*] (NY).

**Ohio**. Hocking Co.: Ash Cove, 17.vii.60, Cooke no. 32169 (MICH). Locale unknown: Morgan [as *Marasmius anomalus*] (NYS).

**Tennessee**. Blount Co.: GSMNP, Cades Cove, 13.viii.38, Smith no. 10116, 31.viii.38, Smith no. 10730 (both MICH); same location, 19.vi.70, Hesler [as *Collybia dryophila*] (TENN 35568). Sevier Co.: GSMNP, Mt. LeConte, 12.viii.38, Smith no. 10088 (MICH).

**Virginia**. Madison Co.: Shenandoah Nat. Park, 7.vii.84, Vilgalys no. 84/232 (BPI).

## 28. *MARASMIUS SULLIVANTII*

**United States**

**Alabama**. Clay Co.: Talladega National Forest, near Clairmont Springs, 27.vii.59, Thiers no. 7216 [*pro parte*] (SFSU); Talladega National Forest, near Munford, 28.vii, 59, Thiers no. 7245 (SFSU).

**Illinois**. Cook Co.: Paddock Woods Forest Preserve, 10.vii.56, Shaffer no. 842 (MICH). Moultrie Co.: Wolf Creek State Rec. Area, 4.ix.88, Methven no. 5200 (EIU).

**Indiana**. Monroe Co.: Cedar Bluffs, near Victor, 23.viii.70, Gilliam no. 938 (MICH). Montgomery Co.: Shades State park, 25.viii.61, Cooke no. 32715 (MICH).

**Massachusetts**. Franklin Co.: Amherst, Mt. Toby, 16.vi.73, Smith no. 84058 (MICH).

**Michigan**. Monroe Co.: Milan, 19.vi.69, Hoseney no. 1254 (MICH).

**Minnesota**. Rice Co.: Wheeling Twp., 14.vii.65, Weaver no. 1180 (MICH).

**Missouri**. Shannon Co.: Eminence, 18.viii.40, Routien no. 1423 [as *Marasmius elongatipes*] (TENN 13287).

**New York**. Albany Co.: Loudonville, 22.vii.45, House (MICH).

**North Carolina**. Haywood Co.: Springdale, Crawford's Creek, 3.viii.26, Coker no. 8009 [as *Marasmius bellipes*] (NCU). Macon Co.: Coweeta Hydrologic Lab, Ball Creek Area, 4.ix.86, Desjardin no. 4124, 14.vii.88, Desjardin no. 4595 (both TENN); Highlands, Rustic Falls area off Horse Cove Rd, 11.viii.87, Desjardin no. 4434 (TENN). Madison Co.: Hot Springs, 18.viii.24, Kauffman (MICH). Orange Co.: Chapel

Hill, 13.vi.17, Coker no. 2513, 23.vi.17, Coker no. 2553, 5.vii.17, Coker no. 2592, 12.vii.17, Coker no. 2650, 6.vi.19, Coker no. 3305, 22.viii.19, Coker no. 3480 [all as *Marasmius bellipes*] (all NCU). Swain Co.: GSMNP, Deep Creek, 27.viii.71, Harrison no. 10909, 1.ix.71, Harrison no. 10980 (both MICH); GSMNP, Indian Creek, 10.ix.86, Desjardin no. 4168 (TENN).

**Ohio**. Coshocton Co.: Coshocton, 18.vi.42, Moldenke, F19536 [as *Marasmius glabellus*] (FLAS). Cuyahoga Co.: Cleveland, 20.vi.46, Walters no. 123 (MICH). Hamilton Co.: near Cincinnati, 1902, Lloyd no. 27933 (BPI); Miami-Whitewater Forest Park, 2.vii.60, Cooke no. 31920 (MICH). Highland Co.: Fort Hill State memorial, 4.ix.65, Cooke nos. 35695, 35740, 35792 (MICH). Montgomery Co.: Preston, 1892, Morgan (ISC); same location, 18.vii.06, Morgan, 30.vii.06, Morgan, 6.viii.06, Morgan, 11.viii.06, Morgan, 30.vii.o6, Morgan (all ISC). Locale unknown: Sullivant no. 174 (Holotype: PC).

**South Carolina**. Oconee Co.: Ellicott Wilderness Area, 12.viii.87, Desjardin no. 4452 (TENN).

**Tennessee**. Blount Co.: GSMNP, Bote Mt. trail near Crib Gap, 31.viii.86, Desjardin no. 4072 (TENN); GSMNP, Cades Cove, 16.viii.38, Smith no. 10234 (MICH), 3.vi.59, Hesler (TENN 9087), 4.viii.85, Methven no. 4141 (TENN); GSMNP, Crib Gap, 18.vii.86, Desjardin no. 3854 (TENN). Knox Co.: Ball Camp Pike, near Knoxville, 13.viii.37, Hesler [as *Marasmius floridanus*] (MICH, TENN 18680); Knoxville, Cherokee Dr, 7.ix.86, Desjardin nos. 4151, 4152 (both TENN). Scott Co.: Big South Fork of Cumberland River, 16.ix.87, Desjardin no. 4523 (TENN). Sevier Co.: GSMNP, Greenbrier, 6.vi.87, Desjardin no. 4263, 31.vii.88,

Desjardin no. 4657 (both TENN); GSMNP, Husky Gap trail, 4.viii.38, Smith no. 9715 (MICH); GSMNP, Roaring Fork trail, 9.vii.87, Desjardin no. 4342 (TENN); GSMNP, Whittles, near Le Conte, 19.vi.54, Hesler [as *Marasmius floridanus*] (TENN 21390). Locale unknown: vi, Hesler (TENN 12703).

**Texas**. Polk Co.: Coldspring, 6.iv.53, Thiers no. 1818 (MICH).

**Vermont**. Addison Co.: Lake Dunmore, 15.vii.1900, Burt [as *Marasmius nigripes*] (FH).

**Virginia**. Fairfax Co.: Great Falls, 20.viii.18, Kauffman [*pro parte*], 18.vii.19, Kauffman (both MICH). Giles Co.: Horton Center off Mt. Lake Rd, NW of Blacksburg, 18.viii.87, Desjardin no. 4469 (TENN); Pandapas Pond, 6.vii.82, Vilgalys no. 82/255 (BPI).

### 29. *MARASMIUS GLABELLUS*

**United States**

**Massachusetts**. Berkshire Co.: North Adams, 15.viii.86, Desjardin no. 4054 (TENN).

**Michigan**. Cheboygan Co.: Univ. Michigan Biological Station, 21.vii.47, Smith no. 25892 (MICH). Emmet Co.: Harbor Springs, 7.vii.47, Smith no. 25580, 25.vii.61, Smith no. 63657 (both MICH); Mackinaw, 4.viii.49, Smith no. 32857 (MICH). Gratiot Co.: Ithaca, 29.ix.47, Potter no. 4025, 27.vii.49, Potter no. 7809, 13.ix.49, Potter no. 8718, 17.viii.59, Potter no. 12297 (all MICH). Luce Co.: Tahquamenon Falls State Park, 5.viii.55, Smith nos. 50039, 50040, 50041 (all MICH). Montmorency Co.: 4.viii.67, Smith no. 74774 (MICH).

Washtenaw Co.: Ann Arbor, 4.ix.12, Kauffman (MICH); Pickney, 23.vii.70, Gilliam no. 801 (MICH); Winnewana Lake, 29.viii.72, Gilliam no. 1551 (MICH).

**New York**. Lewis Co.: Croghan, July or August, Peck (Holotype [*pro parte*]: NYS); Croghan, Felt House, Peck (Authentic: NYS); Greig, ix, Peck (Authentic: NYS). Otsego Co.: Worcester, July or August, Peck (Holotype [*pro parte*]: NYS). Rensselaer Co.: Sand Lake, viii, Peck (Authentic: NYS). Wayne Co.: Savannah, viii.1872, Peck (Authentic: NYS). County unknown: Floodwood, viii, Peck (Authentic: NYS).

**North Carolina**. Macon Co.: Coweeta Hydrologic Lab, Ball Creek area, 4.ix.86, Desjardin no. 4125 (TENN). Swain Co.: Almond, 21.ix.71, Harrison no. 11212 (MICH).

**Ohio**. Highland Co.: Fort Hill State Memorial, 4.ix.65, Cooke no. 35821 (MICH).

**Tennessee**. Sevier Co.: GSMNP, Elkmont, 3.ix.37, Smith no. 7365 (MICH); GSMNP, Mt. LeConte, 5.vii.34, Hesler [as *Marasmius siccus*] (TENN 3797), 5.viii.64, Hesler (TENN 26300); GSMNP, Roaring Fork, 12.viii.68, Singer no. N1715 (F).

### 30. *MARASMIUS FLORIDANUS* var. *FLORIDANUS*

**United States**

**Alabama**. Clay Co.: Talladega National Forest, near Clairmont Springs, 27.vii.59, Thiers no. 7216 [*pro parte*] (SFSU). Cleburne Co.:

Talladega National Forest, near Cheaha State Park, 24.vii.59, Thiers no. 7191 (SFSU).

**Florida**. Alachua Co.: Planera Hammock, near Gainesville, 16.vii.38, West, Arnold & Murrill, F17347 (Holotype: FLAS). Highlands Co.: Highlands Hammock State Park, near Sebring, 1942, Singer no. F406 [as *Marasmius cladophyllus*] (F).

**Illinois**. Clarke Co.: Rocky Branch Nature Preserve, 26.ix.88, Methven no. 5288 (EIU).

**Michigan**. Washtenaw Co.: Sharon Hollow, NW of Manchester, 19.vii.37, Smith no. 6591 (Holotype of *Marasmius spadiceus*: MICH).

**North Carolina**. Orange Co.: Chapel Hill, 30.vi.16, Coker no. 2328, 3.vii.17, Coker no. 2586, 16.vii.17, Coker no. 2679, 7.vi.19, Coker no. 3318 [all as *Marasmius bellipes*] (all NCU).

**Ohio**. Butler Co.: Oxford, 2.vii.09, Stover no. 82 [as *Marasmius sp.*] (NYS). Cuyhoga Co.: near Cleveland, Spring of 1896, Beardslee no. 4 [as *Marasmius cohaerens*] (FH). Montgomery Co.: Preston, 7.vii.06, Morgan, 17.vii.06, Morgan, 18.vii.06, Morgan, 6.viii.06, Morgan, 11.viii.06, Morgan, 17.viii.06, Morgan [all as *Marasmius sp.*] (all ISC). Locale unknown: Morgan no. 138 [as *Marasmius glabellus*] (NYS).

**Tennessee**. Blount Co.: GSMNP, Cades Cove, 10.viii.38, Smith no. 10001 [as *Marasmius sullivantii*] (MICH). Campbell Co.: La Follette, 11.vii.34, Hesler (MICH [as *M. spissus*], TENN 10219). Knox Co.: Ball Camp Pike, near Knoxville, 8.vii.39, Hesler (MICH, TENN 12269); Timberlake Rd, 12.vii.56, Hesler (TENN 22318). Sevier Co.: GSMNP, Grassy Patch, 1.ix.38, Smith no. 10789 (MICH).

**Virginia**. Fairfax Co.: Great Falls, 20.viii.18, Kauffman [*pro parte*, as *M. sullivantii*] (MICH).

### 31. *MARASMIUS FLORIDANUS* var. *VIRGINIANUS*

**United States**

**Virginia**. Chesterfield Co.: Richmond, 10.ix.34, Linder (Holotype: FH).

### 32. *MARASMIUS PSEUDOBAMBUSINUS*

**United States**

**Illinois**. Moultrie Co.: NW of Mattoon, 8.viii.88, Methven no. 5170 (EIU, TENN).

**Louisiana**. Lafayette Co.: Lafayette, v.33, Neon no. 1997 [as *Marasmius graminum*] (FH).

**Pennsylvania**. Allegheny Co.: Pittsburgh, Millard Institute, 28.viii.39, Sumstine, 2.viii.40, Sumstine [both as *Marasmius felix*] (both NY).

**Tennessee**. Knox Co.: Knoxville, 12.vii.87, Desjardin no. 4353 (Holotype: TENN); same location, 18.vi.52, Hesler (TENN 20438), 1.viii.71, Hesler (TENN 35860), 7.vii.87, Desjardin no. 4334 (TENN), 13.vii.87, Desjardin no. 4354 (TENN).

## 33. *MARASMIUS HAEMATOCEPHALUS* var. *HAEMATOCEPHALUS*

**British Honduras**

Locale unknown: 1906, M. E. Peck (MICH).

**Cuba**

Santa Clara Province, Sebaruco, Soledad, Harvard Botanical Gardens, 9.vii.41, White no. 844 (MICH).

**Guyana**

Locale unknown: Ann. 1850, Leprieur no. 990, det. by Montagne (Authentic: PC).

**United States**

**Florida**. Alachua Co.: Gainesville, Newnans Lake, 16.vii.35, West (NY); Gainesville, 4.viii.81, Gibson, F52904 (FLAS). Clay Co.: Keystone Heights, Gold Head Branch State Park, 2.vii.39, West (NY). Dade Co.: Matheson Hammock, ix.42, Singer no. F675-675A (F). Highlands Co.: Highlands Hammock State Park, near Sebring, viii.42, Singer no. F496 (F).

**North Carolina**. Orange Co.: Hillsborough, viii, Curtis no. 473 (FH).

**Tennessee**. Knox Co.: Knoxville, 20.vii.49, Sharp (TENN 19455), 6.vii.87, Desjardin no. 4321, 29.vii.88, Desjardin no. 4640, 5.ix.88, Desjardin no. 4712 (all TENN); same location, 22.viii.42, Hesler [as *Marasmius siccus*] (Tenn 14442).

### 34. *MARASMIUS HAEMATOCEPHALUS* var. *ANOMALOIDES*

**United States**

**Tennessee**. Knox Co.: Knoxville, 6.vii.87, Desjardin no. 4322 (Holotype: TENN); same location, 29.vii.88, Desjardin no. 4639, 5.ix.88, Desjardin no. 4711 (both TENN).

### 35. *MARASMIUS SICCUS*

**Japan**

Kyūshū, Kagoshima, Sendai, 13.ix.14, Yasuda no. 279 (BPI).

**United States**

**Connecticut**. Fairfield Co.: Redding, 22.viii.02, Underwood & Earle (NY).

**Delaware**. County unknown: Faulkland, 2.viii.1887, Commons no. 588 (PH).

**Idaho**. Red River Bluff, 24.viii.46, Daubenmire (TENN 17767).

**Illinois**. Clark Co.: Rocky Branch Nature Preserve, 26.ix.88, Methven no. 5289 (EIU). Preserve Co.: Paddock Woods Forest Preserve, 10.vii.50, Shaffer no. 845 (MICH).

**Indiana**. Jefferson Co.: near Kent, 12.viii.34 (TENN 7166). Montgomery Co.: Crawfordsville, 26.ix.38, Wright (NY); Shades State Park, 25.viii.61, Cooke no. 32728 (MICH). Warren Co.: High Bridge, 26.viii.61, Cooke no. 32873 (MICH).

**Kansas**. Miami Co.: along Marais des Cygnes River, 30.ix.70, Bujakiewicz no. 67 (MICH).

**Maryland**. District of Columbia: 14-15.vii.05, Murrill (NY); Plummers Island, 8.viii.06, Ricker no. 1790 (BPI). Montgomery Co.: Chevy Chase, viii.1894, Hicks (BPI). State Sanitorium, 26.viii.20, Krieger s.n., Kelly no. 504 (both MICH);

**Michigan**. Barry Co.: Yankee Springs, 3.ix.55, Smith no. 51193 (MICH). Cass Co.: Silver Creek Twp., 22.viii.54, Halfert (MICH). Cheboygan Co.: Indian River, 10.viii.68, Patrick no. 428 (MICH). Gratiot Co.: Sumner, 19.vii.48, Potter no. 5695 (MICH); Ithaca, 31.viii.47, Potter no. 3683 (MICH). Lenawee Co.: Omsted State Game Area, 9.ix.70, Gilliam no. 940 (MICH). Livingston Co.: Oak Grove State Game Area, 18.vii.72, Gilliam no. 1512 (MICH). Oakland Co.: Proud Lake, 21.vii.70, Gilliam no. 756 (MICH). Ontonagon Co.: Porcupine Mt. State Park, 29.viii.62, Peters no. 1177 (MICH). Washtenaw Co.: Stinchfield Woods, 20.vii.70, Gilliam no. 741 (MICH).

**Minnesota**. Rice Co.: Wheeling Twp., 22.viii.65, Weaver no. 1232 (MICH).

**Nebraska**. Bellevue, 7.ix.1895, Pound & Saunders, Bot. Surv. Nebraska no. 5030 (Holotype of *Marasmius fulviceps*: NEB).

**New Hampshire**. Locale unknown: viii.1860, Blake no. 719 (FH).

**New York**. Albany Co.: Selkirk, viii, Peck (Lectotype of *Marasmius campanulatus*: NYS). Warren Co.: Warrensburg, 25.ix.71, Gilliam no. 1282 (MICH). County unknown: Portage, 17.viii, Peck [as *Marasmius campanulatus*] (NYS).

**North Carolina**. Forsyth Co.: "Salem," Schweinitz, (Holotype of *Agaricus siccus*: PH). Haywood Co.: between Harmon Denn and Maggie Valley exits on Hwy 40, 2.vii.89, Desjardin no. 4948 (TENN); GSMNP,

Harmon Den, 18.ix.88, Desjardin no. 4714 (TENN). Macon Co.: Highlands, 19.viii.61, Petersen (TENN 27445). Orange Co.: Chapel Hill, Springdale Farm, 27.vii.26, Couch & Totten [as *Marasmius pulcherripes*] (NCU). Swain Co.: GSMNP, Deep Creek, 1.ix.71, Harrison no. 10971 (MICH). Watauga Co.: Blowing Rock, 17.viii.22, Coker no. 5522 [as *Marasmius pulcherripes*] (NCU).

**Ohio**. Coshocton Co.: Coshocton, 18.vi.42, Moldenke, F10158 (FLAS).

**Pennsylvania**. Chester Co.: West Chester, ix.1885, Everhart, Ellis & Everhart N. Amer. Fungi Exs. no. 1591 (MICH, NY, PENN at PH, PH, TENN 9944). Lehigh Co.: Trexlertown, xii.1897, ex Herb. Wm Herbat (FH). Northampton Co.: "Bethlehem," Schweinitz (Holotype of *Agaricus siccus*: PH). County unknown: Delafield, Buck hill Falls, 1920 (NY). Locale unknown: Michener (NYS).

**Rhode Island**. Locale unknown: Olney no. 173 [as *Marasmius haematocephalus*] (FH).

**Tennessee**. Campbell Co.: White Oak Sinks, 11.viii.35, Hesler (TENN 8150). Carter Co.: Roan Mt., 22.viii.37, Hesler (TENN 10851); Unaka Springs, 18-24.viii.04, Murrill (NY). Fentress Co.: Buffalo cove, near Allardt, 8.vii.34, Hesler (TENN 3798). Knox Co.: Knoxville, Cherokee Dr, 7.ix.86, Desjardin no. 4156, 3.vii.87, Desjardin no. 4314 (both TENN). Union Co.: Norris Lake Forest, 20.vii.37, Hesler (MICH). County unknown: Dupont Springs, 19.viii.35, Hesler (TENN 8237).

**Vermont**. Addison Co.: Middlebury, 7.viii.1896, Burt (FH, PH).

**Virginia**. Giles Co.: Horton Center off Mt. Lake Rd, NW of Blacksburg, 18.viii.87, Desjardin no. 4464 (TENN); Mt. Lake, 8-14.vii.09, Murrill (NY); Pembroke, Jefferson Nat. Forest, trail to Cascades, ix.72, Miller no. 9001, 30.ix.76, Miller no. 15875 (both VPI). Montgomery Co.: Blacksburg, 23.viii.70, Miller no. 8646 (VPI). County unknown: Chain Bridge, 24.vii.19, Kauffman (MICH).

**West Virginia**. Fayette Co.: Short Creek, 16.viii.1893, Nuttall no. 61-1153 (MICH).

**Wisconsin**. Florence Co.: 13.ix.71, Gilliam no. 1226 (MICH).

## 36. *MARASMIUS PULCHERRIPES*

**Canada**

Ontario: Mer Bleue Bog, E of Ottawa, 21.vi.87, Desjardin no. 4291 (TENN).

**United States**

**Alabama**. Lee Co.: Auburn, Chewackla Park, 1.viii.55, Hesler [as *Marasmius bellipes*] (TENN 21986).

**California**. Marin Co.: Audubon Canyon Ranch, Calhoun no. 81-2726 (SFSU).

**Illinois**. Shelby Co.: Lake Shelbyville, Wolf Creek State Park, 19.ix.88, Methven no. 5251 (EIU).

**Maryland**. Baltimore Co.: Baltimore, Windsor Hills, 23.vii.19, Kelly no. 22 (MICH).

**Massachusetts**. Berkshire Co.: North Adams, 16.viii.86, Desjardin no. 4062 (TENN). Franklin Co.: Wendell State Forest, Ruggles Pond

Rec. Area, 9.viii.86, Desjardin no. 4017 (TENN). Hampshire Co.: Mt. Toby, near Amherst, 10.viii.86, Desjardin nos. 4026, 4029 (both TENN).

**Michigan**. Barry Co.: Otis Lake, 24.viii.70, Gilliam no. 813 (MICH); Williams Lake, 24.vii.70, Gilliam no. 814. Cheboygan Co.: Colonial Point, 30.viii.60, Smith no. 63063, 16.vii.61, N. Smith no. 43A (both MICH); Douglas Lake, 2.vii.46, Smith no. 21607, 12.viii.56, Thiers no. 3986 (both MICH); Mackinaw City, 2.viii.51, Thiers no. 1070 (MICH); Topinabee Oak Barrens, 13.vii.57, Shaffer no. 1500 (MICH); Univ. Michigan Biological Station, 5.viii.52, Smith no. 39364 (MICH). Emmet Co.: Cross Village Hardwoods, 25.vii.53, Smith no. 41689 (MICH). Gratiot Co.: Ithaca, 26.viii.47, Potter no. 3591, 28.viii.47, Potter no. 3623, 16.vii.48, Potter no. 5636, 9.ix.48, Potter no. 6370, 12.viii.49, Potter nos. 8220, 8235, 8.ix.49, Potter no. 8574, 18.vii.50, Potter no. 9772 (all MICH). Livingston Co.: Oak Grove State Game Reserve, 18.vii.72, Gilliam nos. 1513, 1514, 1517 (all MICH). Montmorency Co.: NW corner, 6.ix.69, Patrick no. 1343 (MICH). Oakland Co.: Halstead Rd, 13.vii.37, Smith no. 6520 (MICH); Proud Lake, 30.vii.70, Gilliam nos. 870, 871, 3.viii.70, Gilliam nos. 1522, 1523, 1524, 1525 (all MICH). Washtenaw Co.: Cassidy Rd, 12.vii.70, Gilliam no. 670, 8.viii.72, Gilliam no. 1528 (both MICH); Chelsea Woods, 1.viii.15, Kauffman, 25.vii.70, Gilliam no. 811 (both MICH); Hankerd Rd, 30.vii.70, Gilliam nos. 872, 873 (both MICH); Sharon Hollow, 19.viii.70, Gilliam nos. 927, 928 (both MICH); Silver Lake, Pickney, 22.viii.60, Shaffer nos. 2651, 2652 (both MICH); Stinchfield Woods, 3.vii.60, Smith no. 62504, 5.viii.60, Shaffer no. 2524, 20.vii.70, Gilliam nos. 726, 739, 740, 9.viii.72, Hoseney no. 2188 (all

MICH); Waterloo Rec. Area, 10.vii.70, Gilliam no. 631, 26.vii.70, Nimke no. 35 (both MICH); Winnewana Lake, 11.vii.70, Gilliam nos. 637, 654 (both MICH).

**New Hampshire**. Carroll Co.: Chatham, 12.viii.40, Rea no. 597 (MICH).

**New York**. Cortland Co.: Cortland Forest, SUNY Cortland, 10.ix.86, Methven no. 4963 (TENN). Monroe Co.: Mendon Ponds Park, 17.viii.72, Vishniac nos. VII-94, 84-7, 85-4 (all MICH). Ontario Co.: Mees Obs., 4.viii.72, Vishniac nos. VII-65, 81-8, 83-5 (all MICH). Putnam Co. (?): Garrisons, vi, Peck (Holotype: NYS). Saratoga Co.: East Galway, 8.viii.1893, Burt [as *Marasmius torquescens*] (FH). Ulster Co.: West Shokan, 9.viii, Peck (Authentic: NYS).

**North Carolina**. Haywood Co.: between Harmon Den and Maggie Valley exits on Hwy 40, 2.vii.89, Desjardin no. 4949 (TENN); GSMNP, Cataloochee, 9.ix.87, Desjardin no. 4487 (TENN). Macon Co.: Coweeta Hydrologic Lab, Ball Creek area, 4.ix.86, Desjardin no. 4123 (TENN); Coweeta Hydrologic Lab, Shope Fork area, 24.vii.87, Desjardin no. 4390, 14.vii.88, Desjardin no. 4596 (both TENN); Highlands, 27.vii.34, Hesler (TENN 5160), 29.vii.34, Hesler (TENN 5159) [both as *Marasmius siccus*]; Highlands, Rustic Falls area off Horse Cove Rd, 10.viii.87, Desjardin no. 4419 (TENN); Whiteside Mt., 16.vii.55, Hesler [as *Marasmius bellipes*] (TENN 21873). Orange Co.: Chapel Hill, 21.vii.17, Coker no. 2733, 6.vi.22, Coker no. 5183 (both NCU); Chapel Hill, Battle's Park, 29.ix.11, Coker no. 313, 5.vii.17, Coker no. 2609, 7.vii.17, Coker no. 2607, 19.vii.17, Coker no. 2723, 21.vii.17, Coker no. 2735, 30.vii.17, Coker no. 2812, 16.viii.19, Coker no. 3457 [all as

*Marasmius siccus*] (all NCU). Swain Co.: GSMNP, Deep Creek, 1.ix.71, Harrison nos. 10969, 10978, 10979 (all MICH).

**Ohio**. Montgomery Co.: Preston, Morgan no. 26 [as *Marasmius bellipes*] (ISC).

**Tennessee**. Blount Co.: GSMNP, Bote Mt. trail, near Crib Gap, 20.vii.86, Desjardin no. 3876, 31.viii.86, Desjardin nos. 4075, 4076 (all TENN); GSMNP, Gregory Bald trail, near Cades Cove, 7.vii.87, Desjardin nos. 4326, 4327 (both TENN). Fentriss Co.: Buffalo Cove, near Allardt, 8.vii.34, Hesler (TENN4944). Knox Co.: Knoxville, 26.x.36, Jennison (TENN 9645); Knoxville, Cherokee Dr, 3.vii.87, Desjardin no. 4317 (TENN); Timberlake Rd, 7.vii.53, Hesler (TENN 20940). Sevier Co.: GSMNP, Roaring Fork, 9.vii.87, Desjardin no. 4343 (TENN). Union Co.: Norris Dam, 26.vii.63, Hesler (TENN 25745).

**Vermont**. Bennington Co.: Green Mt. National Forest, 16.viii.86, Desjardin no. 4057 (TENN).

**Virginia**. Montgomery Co.: Blacksburg, 14.ix.83, Bills no. 679 [as *M. bellipes*] (VPI).

**West Virginia**. Summers Co.: Pipestem Gorge, 24.vii.77, Mazzer no. 14646 (BPI).

## 37. *MARASMIUS BELLIPES*

**United States**

**Ohio**. Butler Co.: Oxford, 8.vii.10, Stover (NYS). Montgomery Co.: Preston, 1906, Morgan no. 26 [three specimens] (Authentic: all

ISC). Locale unknown: 11.ix.05, Morgan (Lectotype: ISC); 8.vi.1892, morgan (Authentic: ISC).

**North Carolina**. Swain Co.: GSMNP, Indian Creek, 19.vii.61, Hesler (TENN 24378).

**Tennessee**. Knox Co.: Roaring Springs, 15.vii.34, Hesler (TENN 4298).

**Virginia**. Montgomery Co.: McCoy, 14.vii.82, Vilgalys no. 82/262 (VPI).

**Wisconsin**. Dunn Co.: Devil's Punch Bowl, S of Menomonie, 28.vi.71, Mazzer no. 6626 (MICH).

## 38. *MARASMIUS FULVOFERRUGINEUS*

**United States**

**Florida**. Alachua Co.: Gainesville, 8.xi.32, West & Murrill, F9924 [as *Marasmius siccus*] (FLAS, NCU); Sanchez Hammock, 23.vii.38, West & Murrill, F18360 [as *M. siccus*] (FLAS).

**North Carolina**. Durham Co.: Durham, 1935, Wolf [as *M. siccus*] (FH). Graham Co.: Cable Cove Cmpgrd, 24.viii.72, Shaffer no. 6913 (MICH). Henderson Co.: Elks, Green Cove, near Tuxedo, 14.ix.74, Gilliam no. 1557 (Holotype: MICH); same location, 14.ix.74, Gilliam no. 1558 (MICH). Macon Co.: Highlands, Horse Cove Rd, 27.vii.85, Methven no. 4063 (TENN); Highlands, Rustic Falls area off Horse Cove Rd, 30.vii.87, Desjardin no. 4412, 10.viii.87, Desjardin no. 4420 (both TENN). Swain Co.: Cherokee, 10.viii.54, Hesler [as *M. siccus*] (TENN 21497); GSMNP, Clingman's Dome, 6.ix.77, Miller no. 16129 (VPI);

GSMNP, Deep Creek, 6.ix.71, Harrison no. 11061, 8.ix.71, Harrison no. 11065, 23.ix.71, Harrison no. 11264 (all MICH).

**South Carolina**. Darlington Co.: Society Hill, viii.1849, Curtis [as *Marasmius haematocephalus*] (FH). Orangeburg Co.: Santee, viii, ex Ravenel, Curtis no. 1720 [as *M. haematocephalus*] (FH).

**Tennessee**. Blount Co.: GSMNP, Bote Mt. trail, near Crib Gap, 31.viii.86, Desjardin no. 4074 (TENN); GSMNP, Cades Cove, 14.viii.34, Hesler no. 5451 (FH), 8.viii.45, Hesler (TENN 17100), 1.x.55, Hesler (TENN 3800), 27.viii.65, Hesler (TENN 28173) [all as *M. siccus*]; GSMNP, Cades Cove, 16.viii.84, Methven no. 3064, 17.ix.85, Desjardin no. 3482 (both TENN); GSMNP, Crib Gap, 10.ix.87, Desjardin no. 4506 (TENN); GSMNP, Gregory Bald trail, near Cades Cove, 7.vii.87, Desjardin no. 4324 (TENN); GSMNP, Parsons Branch Rd, near Cades Cove, 10.ix.87, Desjardin no. 4501 (TENN). Johnson Co.: Shady Valley, 19.viii.34, Hesler [as *M. siccus*] (TENN 5452). Sevier Co.: GSMNP, Elkmont, 11.ix.16, Kauffman [as *M. siccus*] (MICH); GSMNP, Greenbrier, 31.vii.88, Desjardin no. 4656 (TENN); GSMNP, Husky Gap trail, 4.viii.38, Smith no. 9712 [as *M. siccus*] (MICH); GSMNP, Ramsey Cascade, 7.ix.77, Miller no. 16144 (VPI); GSMNP, Tremont, 13.ix.88, Desjardin no. 4713 (TENN); GSMNP, locale unknown, 6.ix.77, Miller no. 16093 (VPI).

# APPENDIX B

## CULTURE MEDIA

### Cornmeal-Dextrose-Yeast Agar (CMDY)

| | | |
|---|---|---|
| 17.0 | g | Difco Bacto Cornmeal Agar |
| 2.0 | g | Dextrose |
| 1.0 | g | Difco Bacto Yeast Extract |
| 1000 | ml | Distilled $H_2O$ |

### Malt-Extract Agar (MEA)

| | | |
|---|---|---|
| 12.5 | g | Difco Bacto Malt Extract |
| 20.0 | g | Difco Bacto Agar |
| 1000 | ml | Distilled $H_2O$ |

### Malt-Yeast-Soytone Agar (MYS)

| | | |
|---|---|---|
| 7.0 | g | Difco Bacto Malt Extract |
| 0.5 | g | Difco Bacto Yeast Extract |
| 1.0 | g | Difco Bacto Soytone |
| 15.0 | g | Difco Bacto Agar |
| 1000 | ml | Distilled $H_2O$ |

### Modified Melin-Norkrans Medium (MNM)

| | | |
|---|---|---|
| 0.25 | g | $(NH_4)_2HPO_4$ |
| 0.5 | g | $KH_2PO_4$ |
| 0.15 | g | $MgSO_4.7H_2O$ |
| 0.05 | g | $CaCl_2$ |
| 0.025 | g | NaCl |
| 1.2 | ml | $FeCl_3$ (1% soln.) |
| 100.0 | µm | Thiamin HCl |
| 10.0 | g | d-Glucose |
| 3.0 | g | Difco Bacto Malt Extract |
| 15.0 | g | Difco Bacto Agar |
| 1000 | ml | Distilled $H_2O$ |

pH adjusted to 5.5-5.7 after autoclaving

### Potato-Dextrose Agar (PDA)

| | | |
|---|---|---|
| 39.0 | g | Difco Bacto Potato Dextrose Agar |
| 1000 | ml | Distilled $H_2O$ |

# VITA

Dennis Edmund Desjardin was born on 18 May, 1950, in Crescent City, a coastal settlement in the redwood region of northern California. His elementary school education was received at St. Joseph's Catholic School. He attained the rank of Eagle Scout in the Boy Scouts of America in 1964, and represented northern California at the World Jamboree in 1967. Mr. Desjardin graduated from Del Norte High School in 1968, and attended San Jose State University from 1968 to 1971, but dropped out of college his senior year to pursue a career in music.

During the years between 1971 and 1981, Mr. Desjardin was a professional musician in the Bay Area of California, accomplished on flutes and saxophones. He recorded on many records, radio programs and feature films, and performed numerous live concerts. Concurrent with his musical career, Mr. Desjardin was a carpenter and home designer in Marin County.

In September, 1981, Mr. Desjardin enrolled at San Francisco State University to begin a study of mycology under the tutelage of Dr. Harry D. Thiers. He received a Bachelor of Science in Botany in May, 1983, and was awarded the San Francisco State Alumni Scholarship. Mr. Desjardin continued his studies with Dr. Thiers at San Francisco State University and received the Master of Arts in Ecology and Systematic Biology in May, 1985. He was awarded the Graduate Student Achievement Award for Academic Excellence in the Biological Sciences.

In September, 1985, Mr. Desjardin entered The Graduate School of The University of Tennessee, Knoxville, to study with Dr. Ronald H. Petersen in the Department of Botany. During his tenure there, he was awarded a National Science Foundation Doctoral Dissertation Improvement Grant, The Mycological Society of America Graduate Fellowship, and four Science Alliance Fellowships. In addition, he published 13 papers in professional journals, and presented three papers at professional meetings of the Mycological Society of America. He received the Doctor of Philosophy with a major in Botany in August, 1989, and was awarded The Chancellor's Award of The University of Tennessee for Extraordinary Professional Promise.

Dr. Desjardin assumed a position as Visiting Assistant Professor in the Department of Biology at Oberlin College, Oberlin, Ohio in July, 1989.

Dr. Desjardin is married to Noelyn M. Andersen, a Senior Animal Health Technician at The College of Veterinary Medicine, The University of Tennessee, Knoxville.