

# MYCOTAXON

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OF RESEARCH ON TAXONOMY & NOMENCLATURE OF FUNGI & LICHENS

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## CONTENTS

Specific and infraspecific names for fungi used in 1821. Part I. Introduction, A & B. RONALD H. PETERSEN	149
A new North American species of the lichen genus <i>Gomphillus</i> ..... THEODORE L. ESSLINGER	189
<i>Chlorosplenium</i> and its segregates. II. The genera <i>Chlorociboria</i> and <i>Chlorencoelia</i> .... JOHN R. DIXON	193
Book Reviews..... G. L. HENNEBERT	238
Cultural characters of certain <i>Amanita</i> taxa. M. PRISCELLA CAMPBELL AND RONALD H. PETERSEN	239
INDEX of Fungous and Lichen Taxa.....	260
Reviewers.....	264
Errata.....	264

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VOLUME I, 1974-1975

*COMPLETE IN THREE QUARTERLY ISSUES*

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*INCLUDING FIGURES*

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## TABLE OF CONTENTS, VOLUME ONE

BURDSALL, H. H., JR. & W. E. ESLYN A new <i>Phanerochaete</i> with a <i>Chrysosporium</i> imperfect state .....	123
BURK, WILLIAM R. & RICHARD E. REX <i>Polyporus squamosus</i> in Utah .....	135
CACAVIO, GENNARO J., <i>see</i> PFISTER <i>et al.</i>	
CAMPBELL, M. PRISCILLA & RONALD H. PETERSEN Cultural characters of certain <i>Amanita</i> taxa .....	239
CARPENTER, STEVEN E., <i>see</i> KORF & CARPENTER	
DESAI, B. G., <i>see</i> HENNEBERT & DESAI	
DEY, JONATHAN P. New records and distributions for several lichens in the southeastern United States .....	143
DIXON, JOHN R. <i>Chlorosplenium</i> and its segregates. I. Introduction and the genus <i>Chlorosplenium</i> .....	65
<i>Chlorosplenium</i> and its segregates. II. The genera <i>Chlorociboria</i> and <i>Chlorencoelia</i> .....	193
ESSLINGER, THEODORE L. A new North American species of the lichen genus <i>Gomphillus</i> ....	189
ESLYN, W. E., <i>see</i> BURDSALL & ESLYN	
HALE, MASON E., JR. Notes on species of <i>Parmotrema</i> (Lichenes: Parmeliaceae) containing yellow pigments .....	105
HENNEBERT, G. L. Book Reviews .....	63, 238
HENNEBERT, G. L. & B. G. DESAI <i>Lomentospora prolificans</i> , a new hyphomycete from greenhouse soil .....	45
HENNEBERT, G. L. & RICHARD P. KORF Mycotaxon, a new international journal on taxonomy and nomenclature of fungi and lichens .....	1
HUGHES, S. J. <i>Capnobotrys dingleyae</i> n. sp. ....	121
KORF, RICHARD P. Instructions to authors for preparing camera-ready manuscripts for Mycotaxon .....	3
On the typification of <i>Sclerotinia</i> .....	146
<i>Peziza flavovirens</i> , an older name for <i>Vibrissea pezizoides</i> ....	134
<i>see</i> HENNEBERT & KORF	
KORF, RICHARD P. & STEVEN E. CARPENTER <i>Bisporella</i> , a generic name for <i>Helotium citrinum</i> and its allies, and the generic names <i>Calycella</i> and <i>Calycina</i> .....	51
PETERSEN, RONALD H. Specific and infraspecific names used for fungi in 1821. Part I. Introduction, A & B. ....	149
<i>see</i> CAMPBELL & PETERSEN	

PFISTER, DONALD H., GLENDA J. WINN & GENNARO J. CACAVIO  
 Some comments on *Pulchromyces fimicola* from the Americas as  
 noted by W. H. Weston ..... 137

REX, RICHARD E., see BURK & REX

SHERWOOD, MARTHA A.  
 New hyphomycetes from Guadeloupe, F.W.I. *Albosynnema filicola*,  
*Tetracrium musicola*, and *Thozetellopsis calicioides* ..... 117

Taxonomic studies in the Phacidiales: *Stictis maritima* and  
 the genus *Lasiostictis* ..... 41

SOPER, RICHARD S.  
 The genus *Massospora*, entomopathogenic for cicadas, Part I,  
 Taxonomy of the genus ..... 13

WINN, GLENDA J., see PFISTER *et al.*

Errata ..... 264

I.M.A. Nomenclature Notice ..... 142

Index of Fungous and Lichen Taxa ..... 260

Reviewers ..... 264

# MYCOTAXON

Vol. I, No. 3, pp. 149-188

January-March 1975

SPECIFIC AND INFRASPECIFIC NAMES FOR FUNGI USED IN 1821.

PART I. INTRODUCTION, A & B.<sup>1</sup>

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## *Summary*

A discussion of the mycological literature which was issued in 1821, and to the pre-1821 source literature is introduced, and an annotated list of this literature is included. Specific and infraspecific fungus names used in 1821 are listed, and their nomenclatural history is outlined.

Just at this time, there is growing unrest with the system of multiple starting points for nomenclature of fungi. Some proposals have been made recently to change this system, the most radical being to revert back to 1 May 1753 for a starting date for all fungi. In order to be able to competently deal with such a proposal, however, it is essential that mycologists have a basic understanding of the implications and ramifications of the *present* system. A brief introduction to nomenclatural cases has led me to the conclusion that, at least in regard to the problem of starting point, this basic understanding does not exist.

First, it would seem elemental that mycologists know what literature appeared at or very shortly after the starting date. On this point, very little has been published (Rogers, 1941, 1951, 1954). The late M. A. Donk was informally able to add several more references to the 1821 litera-

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<sup>1</sup>This paper represents contribution No. 438 from the Botanical Laboratories, University of Tennessee.

ture alone, but still a number remained to be discovered. Undoubtedly not all have been dusted off yet, but in my opinion, the lion's share, including all *major* contributions, have now been resurrected.

Second, as a student of the basidiomycetous fungi, I have been more concerned with the starting date for "Fungi Caeteri" than for the groups with earlier starting dates. Therefore, my study has centered on the literature and names appearing in the literature of 1821 and shortly thereafter. This paper, in fact, is a compilation of (only) those fungus names appearing in 1821, and includes only names belonging to groups whose starting date is 1 January 1821.

Third, I suspect that the only way in which the 1821 starting point system can be shown either workable or untenable is by its rigorous exercise. It is exactly this exercise which I hope this series of papers will provide, by furnishing a list of fungal specific and infraspecific names which appeared in 1821, and the origins of these names. For the time being, the reader must draw his own conclusion as to the worth of the 1821 system, but suffice to say that *names adopted in the 1821 literature can be systematically traced to their origins*, and presumably, those names which escaped until 1822 or later may equally be hunted down *in systematic fashion*, so that future investigators may make use of them without individually performing the laborious library search.

Fourth; by comparison of a given name to this list, two basic units of information become available. 1) If the name appears in the list, it was adopted in the 1821 literature, and its origin is traced. 2) If the name does not appear in the list, it was not validated in the literature searched, and validation probably took place *after* 1821. In this regard, the reader is referred to the concordance of Le Turquier de Longchamp, which appeared in 1826, and which compiled *all* names used by Bulliard, Persoon, De Candolle, and Fries in various ways and to the "Nomenclator" of Steudel (1824) which listed most of the names of these workers, with synonyms indicated in italics, thus validating most of these names in that year. So for names not appearing in the list here presented, the search generally for validation narrows to a date from 1822 through 1824, but hardly later. In most instances, there is no need to use the later volumes of Fries for validation sources of



pre-1821 names, but only as "sanctioning" books, as suggested by Donk.

Care must be taken in using this compilation to separate taxonomy from nomenclature very sharply. I have made no attempt whatsoever to trace the taxonomic concepts behind the representative names, but only to trace the names themselves, as directed by the 1821 validating authors. Thus the taxonomic concept behind the name *Agaricus aurantiaca* differs sharply with the various pre-1821 authors, nevertheless the ancestry of the name seems quite distinct.

Very quickly in such a bibliographic search, it becomes obvious that two strong strains of early literature exist. One of them sprang from the French literature, notably Bulliard ("Herbier...") and De Candolle ("Flore Francaise..."), but also including Lamarck. The French 1821 literature almost exclusively cited these authorities plus Persoon's *Synopsis*. Conversely, there was a strong intra-English tradition including Curtis ("Fl. Londinensis...") Abbot ("Flora Bedfordensis..."), Hudson ("Fl. Anglica..."), Relhan ("Fl. Cantab..."), Withering ("Arrangement...") and chiefly Sowerby ("English Fungi..."). The English literature of 1821 heavily cites from these authors, largely ignoring Persoon (with the notable exception of Gray). But the extremely important key to the whole search is Persoon, for the continental compilers of 1821 used names from Persoon (through Bulliard and De Candolle), and Persoon (chiefly his "Synopsis" and "Observations") cited the preceding English workers. Thus many names attributable to English authors can be legitimately traced from continental compilers through the "Codex" of Persoon. Furthermore, Persoon introduced large numbers of names for the first time as well. Hence Persoon becomes a sort of nomenclatural screen, passing through many prior names, screening out many others, and adding large numbers of his own. Almost all Persoon's names were adopted within the span of the "starting point" books (1821-32).

Actually, the number of sources for fungus names is remarkably small. With the assumption that scores of sources would require search, the actual limited source material was a pleasant surprise. Presumably, the 1821 writers had access only to certain sources, and especially in the French school, did not consider compilers and general floricultivists worthy of reference.

Of course, subordinate only to locating the 1821 literature is the problem of sequencing these references, for the validating author will be determined by priority of publication after the starting date. Fortunately, partial success can be achieved in this endeavor. Some insight has been shed already on the relative placement during 1821 of S. F. Gray's "Natural Arrangement," Purton's "Appendix to the Midland Flora," Mérat's "Flore Bordelaise" (Rogers 1943, 1951, 1954) and Fries's "Systema" by legislation. I can add the following points.

Forster's "Introduction" (published anonymously) probably appeared quite late in 1820 (or quite early in 1821), for its title page reads 1820, while the reference by Willström cites it as 1821. I have quite arbitrarily decided to consider it as pre-1821 for two reasons. First, it probably was indeed pre-1821. Second, with no author of record on the publication itself, it might be possible to mistake the publication as linked to Forster. In this event, validation cited as "*Fungus quiaelibet* [Doe] Anonymus" would obviously be controversial. So happily, the title page date may relieve the problem of author citation. Yet, future bibliographic studies may reveal the true *effective* date of publication to be after 1 January 1821.

The title page of "Flora o. Bot. Zeitung" no. 22 reads 14 June 1821, and I can find no reason to dispute this general date. If Rogers was correct in his conclusion that Mérat's "Flore Bordelaise" appeared during the week of 9-15 June, 1821, I am ready to (arbitrarily) assume that Ritter van Schrank's publication in "Flora" came thereafter.

Purton's "Appendix" Part 1 (p. 314) cites Hooker's "Flora Scotica" and so this portion of Purton's publication appeared some weeks or months after Hooker. Rogers has concluded that Purton's "Appendix" was issued after August 1, and quite possibly significantly later, making placement of Purton less definite.

Ehrenberg's review in "Flor o. Bot. Zeitung" no. 33 was dated (title page) 7 September 1821, and I can find no reason to doubt this.

Laterrade (p. 477) discusses the collecting season of 1821, in regard to *Amanita verna*, which probably did not fruit until very late June. Again, given time for process-

ing, it is likely that this work did not appear until fall or early winter.

The parts of Zantedeschi's "Continuazione" may be generally dated as follows: 1) the first 1821 portion appeared in a fascicle entitled "Secondo Bimestre Marzo, e Aprile 1821." The latter month is quite accurate, apparently, for there appear references to "Ann. Gén. des Sciences Phys., Fev. 1821" (p. 157) and "Journ. de Pharm., Fev. et Mars 1821" (p. 158), and a table of climatological data on the last page of the issue runs *through* March 31. Thus April is not an injudicious guess for a time of effective publication. 2) The fascicle including Zantedeschi's second 1821 offering is entitled (p. 259) "Quarto Bimestre Luglio, e Agosto 1821." Again, August is probable as an issue period, for the last page of the fascicle bears the notation "Modena adi 22 Luglio 1821." The following fascicle, "Quinto..." includes climatological data *starting* July 1, perhaps indicating that July's data had not been readied when "Quarto Bimestre" was sent to the publisher. 3) Zantedeschi's third 1821 contribution may be dated probably in October. The title page states "Quinto Bimestre Settembre, e Ottobre 1821," and climatological data on the final page runs *through* September 30. 4) Another chapter has been ascribed to Zantedeschi in 1821, but, although the fascicle is entitled "Sesto Bimestre Novembre, e Dicembre 1821," the climatological data included on the final page runs *through* December 31, making appearance of the fascicle in 1821 virtually impossible. I am ready to dismiss it for purposes of the present list of fungus names from 1821.

Sayre (1959) also cites Borén (1920, not seen) as giving 1821 as the year of publication of "Svensk Botanik..." vol. 9, which includes redescriptions and colored illustrations of a few agarics included by Fries in his "Systema." Because of their inclusion in "Systema," their inclusion in "Svensk Botanik" has little nomenclatural importance. I cannot find a more accurate date of publication.

Hooker's publication of Curtis's "Flora Londinensis..." is also impossible to accurately date. According to Sayre (1959), the fascicles were produced unnumbered, so that each binder could arrange the plates as met his desires. The individual plates were often (although not invariably) numbered, with the accompanying text numbered identically.

The bound copy at Kew, for example seems to be arranged "phylogenetically" within fascicles, so that the fungi are near or at the beginning of fascicles 1 and 2 of volume 4. Conversely, Sayre cites 1821 as the publication year for the entire volume, but only fascicle 2 is so dated on the title page. I cannot find a more accurate date. "Flora Londinensis..." includes references to Hooker's "Flora Scotica", but even these may have been taken from galley proofs by Hooker, making an accurate estimate for dating impossible.

Fascicle 29 of "Flora Danica..." edited by Hornemann is dated (p. 13) September 1821. With time allowed for printing, the fascicle probably appeared rather late in 1821, but I cannot pinpoint the date more accurately.

The date of appearance of Gray's "Natural Arrangement" is controversial. Rogers (1941, 1951) has given November, but most recently (in a letter in response to a query on the subject) has stated the earliest possible date to be 21 November. Conversely, Sayre (1959) gives 10 September. Because of Rogers's newer information, I am inclined to accept the later date.

In the same communication, Rogers also noted that Purton ("Appendix" part 2, p. 574) cites the date 20 September 1821 (with the assumption that publication must have been subsequent to that date), and that the Linnaean Society of London received the volume on 6 November. Moreover, Rogers gives evidence that St. Amans's "Flora Agenaise" appeared in the week of 20-28 April.

The elogy to Palisot de Beauvois by Thiébaud-de-Berneaud contains only a single species name (*Microspheria polymorpha*) with no author citation, and so is of little consequence. I can find no implicit means of sequencing the publication. It might be mentioned, however, that the genus name *Trichospermum* is also used (p. 39), but with a reference to an unpublished memoir of the Institute. This constitutes no validation, therefore, and a later valid description must be sought, and the name given priority only from that later date.

The dates of the "Dictionnaire des Sciences Naturelles" may be ascertained with unusual accuracy from Sayre (1959). They are as follows: vol. 18, 6 April 1821; vol. 19, 26 January 1821; vol. 20, 29 June 1821; vol. 21, 29 September

1821; vol. 22, 29 December 1821.

The preface to Krombholz's small volume was dated 1 November 1820, and allowance for normal time in press suggests an appearance early in 1821, although not with accuracy. If this date is compared with the dedication of "Nova Acta... Academiae Caesareae Leopoldino-Carolinae" (18 October 1820), and an arbitrarily equal time is allotted for the press in each case, then the latter may be dated before the former, but this may well not be the situation.

Sayre (1959) supplies a date (through a review) of 10 May 1821 for Hooker's "Flora Scotica", the preface of which is dated 10 April 1821. This surely represents a short press time, and may well indicate that portions of the work had been printed before receipt by the printer of the preface.

Insofar as I can tell, then, the sequence of appearance of 1821 fungus literature is as appears in Table I.

Of all the authors of validating literature in 1821, only Fries directed the reader to a specific authority for each name. Fries's choice of authority was not cited in the text, but in the index to volumes 1 and 3. In most cases, the author cited in the index matched one of those in the protologue, but in rare instances this was not the case. Moreover, some question may be raised as to whether Fries simply gleaned the name of the taxon from the authority cited in the index, or whether the taxonomic concept of that author was co-opted also. The latter would seem the case.

One of the more cumbersome nomenclatural situations surrounds the various issue dates of the plates and text of Bulliard's "Histoire des Champignons..." (really a division of his "Herbier de la France..."). On one hand, virtually all the plates were issued before any portion of the text. Several fascicles of plates were issued in time for citation by later writers like Persoon in 1801. But none of the plates were accompanied by descriptions, and some bore only vernacular names, and so the plates themselves cannot bear priority. Indeed, several of these names were adopted by later authors (notably Persoon), who supplied descriptions *before* those furnished by Bulliard himself. Strictly speaking, such names should not be attributed to Bulliard, but to the author who supplied a protologue. For purposes of this paper, however, it is clear that Bulliard was the name-bringer and so both the plate number and text page are

## Possible sequence of 1821 fungus literature

<u>Publication</u>	<u>Date</u> <sup>1</sup>	<u>Source</u>
1. Fries, "Systema" vol. 1	1 January	Legislation
2. "Dictionnaire" vol. 19	26 January	Sayre (1959)
3. Sprengel, "Neue Entdeckungen"	early	Stafleu (1967)
4. "Nova Acta..."	early	date of dedication
5. Krombholz	early	date of preface
6. Zantedeschi, "Continuato"	April	p. 169, data through 31 March
7. St. Amans, "Flore Agenaise"	20-28 April	Rogers (see text)
8. Hooker, "Flora Scotica"	10 May	Rogers (1951)
9. Mérat, "Nouvelle Flore"	9-15 June	Rogers (1954)
10. Ritter v. Schrank	14 June	Title page fascicle
11. "Dictionnaire" vol. 20	29 June	Sayre (1959)
12. Zantedeschi, "Continuato"	3 August	p. 337, "22 Luglio 1821"
13. Purton, "Appendix" pt. 1	after 1 August	p. viii: Rogers (1954)
14. Ehrenberg, "Flora"	7 September	Title page of fascicle

15.	"Dictionnaire" vol. 21	29 September	Sayre (1959)
16.	Zantedeschi, "Continuato"	4 October	p. 414, data through 30 September
17.	Purton, "Appendix" pt. 2	early November	Rogers (see text)
18.	Latterrade, "Flore Bordelaise"	fall or winter	p. 477, reference to <i>A. verna</i>
19.	Gray, "Natural Arrangement"	21 November	Rogers (see text)
20.	Schleicher, "Catalogus"	December	see text
21.	"Dictionnaire" vol. 22	29 December	Sayre (1959)

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<sup>1</sup>Forster is considered pre-1821: Zantedeschi, "Continuato" 4 is considered post 1821: unsequencable (see text) are Foderé; Fries's "Scleromyceti;" Fries's "Brand och rost på växter;" Hooker *in* Curtis; Nocca & Balbis; Re; Roques; Thiébaud-de-Berneaud; Flora Danica; Svensk Botanik.

cited.

To make the situation a bit worse, Bulliard died before completing the printing of the plates (although they were all engraved with Bulliard's names) and before writing some of the text. The introduction to volume two, part one states that all the text *after* page 508 was written by Ventenat, including the descriptions (but not the names). In some cases (see the concordance at the rear of volume two), Ventenat considered one Bulliard name to represent two or more species, and so some names given by Bulliard in his plates disappeared in subsequent treatment in the text, although usually cited as synonyms. Strictly speaking then, some "Bulliard" names should be attributed to Ventenat, who supplied them with a protologue.

Although Vol. 1, Part 1 bears a title page date of 1809, Rickett (North American Flora, Vol. 1, Part 1) has concluded that this part, at least, was published in 1791.

Many authors have made some distinction between Bulliard's "Herbier" and his "Histoire," but Bulliard did not (except for two divisions of the same work), and none is made herein.

A few symbols require explanation. Pre-1821 literature sources have been placed within square brackets. While recognizing the omission of this symbol from the Seattle Code, it is consistent with previous Codes, and I find the symbol especially useful.

Each name is initially cited from the 1821 literature, with abbreviated citation to author. This citation is followed by an arrow indicating the direction of the original name-giving process. The citation(s) which follow constitute the "original" source(s) of the name, insofar as I can verify it. Variations in spelling (orthographic variants - *in my estimation*) are indicated in quotes, while other genera under which the name was included are enclosed in parentheses. *Tremella* was considered variously as an algal or fungal genus, and this is noted where appropriate. Finally, original literature sources I have not actually seen are indicated in quotes, for I have them only on the authority of authors.

Under normal circumstances, the number of such "second-hand" citations would have been reduced materially before publication, but with moves afoot to change the



starting date system, publication in as short a time as possible becomes important, and I trust that most of the second-hand citations will turn out to be correct.

The symbol for death, the dagger ( † ), has been used to denote names and/or citations which are doubtful or moribund. In most cases, the name has been only doubtfully placed in the cited genus, and therefore needs further clarification, and in others the name is contrary to the Code for some reason (i.e. only a vernacular name appears in many BH citations, contrary to the Code).

An example of the process follows.

abietina (*Thelephora*) Fr: 442 + [FO 2: 274 (*Stereum*) +  
PS: 573 (*Thelephora*)]

The name *Thelephora abietina* appears on page 442 of Fries's "Systema", volume 1, in 1821. Fries directs the reader to the name supplied by Persoon, so it is this author who is cited as "original". The name *abietina* (as representing this species) first appeared in Persoon's "Synopsis" (PS: 573) under the genus *Thelephora*. Later, Fries himself, in his "Observationes" (FO) used the name, but under the genus *Stereum*. It was this name, with this history, which was adopted by Fries in 1821.

There are a number of literature citations which I have not been able to examine as yet. Many of them are general titles, with no assurance that fungi are discussed or mentioned. The following reference, although ostensibly dealing with lichens (not covered under this starting date), includes several fungi according to Dr. Hawksworth (personal communication), but I have not seen it, and names from it are therefore not included in this summary.

Schaerer, Eman. 1821. Lichenes helvetici parenchymate pulveraceo instructi. Naturwissenschaftlichen Anzeiger der allgemeinen Schweizerischen Gesellschaft für die Naturwissenschaften. 1 (Wintermonat no. 5): 33-37.

#### *Acknowledgements and dedication.*

Many individuals have contributed to this project through their advice and their libraries. My thanks goes especially to Drs. Derek Reid (K), Tina Gilliam (BPI),

Olivier Monthoux (G), G. Govi (Bologna) and Lennart Holm (UPS) for furnishing reprints or copies of 1821 literature and to Dr. D. P. Rogers for advice on dating of 1821 publications. To Mr. John Stevenson, who collected and preserved the excellent source library at the National Fungus Collections, goes my esteem and thanks.

The New York Botanical Garden has perhaps the best library under one roof in North America, and the staff there has been most cooperative. Rivaling or surpassing that single institution are the collective libraries of the National Fungus Collections and the U. S. Department of Agriculture Library at Beltsville, Md., the Library of Congress and the Smithsonian Institution library in Washington, D. C. In all these libraries, the librarians have been courteous and helpful.

In Europe, I have consulted the excellent libraries at Leiden (L), Uppsala (UPS), Geneva (G), British Museum (BM) and Kew (K). The library staffs have been uniformly helpful.

Because of his enormous influence on my thinking and career, and his constant inspiration, after death as well as before, I dedicate this series to the memory of Dr. M. A. Donk.

### *The 1821 Literature*

- E: Ehrenberg. 1821 (published anonymously). I. Recensionen. *Horae physicae Berolinensis collectae ex symbolic vivorum doctorum Linkii, Rudolphi, Klugii, Nesii ad Esenbeck, Ottonis, de Chamisso, Hornschuch, a Schlechtendahl et Ehrenbergii edi curavit Dr. C. G. Nees ab Esenbeck. Flora o. Bot. Zeitung (Regensburg), no. 33: 509-522.*
- ENA: Ehrenberg, C. G. 1821. *De Mycetogenesi. Nova Acta Physico-Medica Acad. Caesareae Leopoldino-Carolinae. Nat. Cur. 10: 161-222.*
- F: Foderé, Fr. Em. 1821. *Voyage aux Alpes Maritimes, ou histoire naturelle, agraire, civile et médicale, du comté de Nice et pays limitrophes; enrichi de notes de comparais avec d'autres contrées. Tome premier. xxiv + 376 pp. Paris.*

- FBR: Fries, E. 1821. Om brand och rost på växter, sente fullständig underrätelse om deras kännetecken, orsaker, skada samt medel till dess förekommande. 54 pp. Lund.  
[A copy of this rare paper was furnished by Dr. Lennart Holm, to whom I extend my thanks.]
- Fr.: Fries, E. 1821. Systema Mycologicum, sistens fungorum ordines, genera et species, huc usque cognitae, quas ad normam methodi naturalis determinavit, disposuit atque descripsit. Vol. 1: lviii + 520 pp. Lundae.  
[The commentary by Stafleu (1967) is interesting. The volume apparently was quickly reprinted, with the original edition bearing "Ex officina Berlingiana," and the reprint "Gryphiswaldae, sumtibus Ernesti Mauritii" on the title page.]
- FSS: Fries, E. 1821. Scleromyceti Sueciae.  
Decades XV - XVIII. Lund. [nos. 141-180]  
Decades XIX - XXII. Lund. [nos. 181-220]  
[The full first edition of this exsiccata may be found at BPI. The most informative paper on this work is that of Holm & Nannfeldt, 1963.]
- G: Gray, Samuel Frederick. 1821. A natural arrangement of British plants according to their relationships to each other as pointed out by Jussieu, De Candolle, Brown, etc., including those cultivated for use; with an introduction to botany in which the terms newly introduced are explained.  
Vol. 1. xxviii + 824 pp. London
- H: Hooker, William Jackson. 1821. Flora Scotica; or a description of Scottish plants, arranged both according to the artificial and natural methods. In two parts.  
Part 2 (Acotyledons). 162 pp. London.
- HFD: Hornemann, J. W., Editor. 1821. Icones plantarum sponte nascentium in regnis Daniae et Norvegiae, et in Ducatibus Slevici, Holsatiae et Oldenburg; ad illustrantum opus de iisdem plantis, Regio jussu exarandum, Florae Danicae. Fascicle 29, pls. 1681-1740 + accompanying text. Havniae.

- HFL: Hooker, W. J. 1821 *in* Flora Londinensis: containing a history of the plants indigenous to Great Britain, illustrated by figures of the natural size. [2nd Edition] London. Vol. 4, fascicle 2: numbered plates plus accompanying text.
- K: Krombholz, Julius Vincenz. 1821. *Conspectus fungorum esulentorum, qui per decursum anni 1820 Pragae publice vendebantur.* 40 pp. Pragae.
- L: Latterrade, J. F. 1821. *Flore Bordelaise ou description caractéristique des plantes qui croissent naturellement aux environs de Bordeaux, avec l'etymologie, le site, l'epoque de floraison, etc.; leurs propriétés et leurs principaux usages; précédée de notions élémentaires sur la botanique.* Second edition. 516 pp. Bordeaux.
- LD: Leman, *in* [Anonymous] "Plusieurs Professeurs du Jardin du Roi, et des principales Écoles de Paris." 1821. *Dictionnaire des Sciences Naturelles, dans lequel on traite méthodiquement des différens êtres de la nature, considérés soit en eux-mêmes, d'après l'état actuel de nos connoissances, soit relativement a l'utilité qu'en peuvent retirer la médecine, l'agriculture, le commerce et les arts. Suivi d'une biographie des plus célèbres naturalistes.* [Leman wrote all of the offerings on fungi in volumes 18-22 and these individual entries (all signed) are as follows:]
- |          |                        |         |
|----------|------------------------|---------|
| Vol. 18. | <u>Gemmularia</u>      | p. 311  |
|          | <u>Geoglossum</u>      | 357-358 |
|          | <u>Geotrichum</u>      | 445     |
| Vol. 19. | <u>Gomphus</u>         | 194     |
|          | <u>Gonytrichum</u>     | 209     |
| Vol. 20. | <u>Gymnopus</u>        | 140     |
|          | <u>Gymnosporangium</u> | 140-142 |
|          | <u>Gyrraria</u>        | 179     |
|          | Gyrole                 | 181     |
|          | <u>Haplaria</u>        | 273     |
|          | <u>Helicosporium</u>   | 460-461 |
|          | <u>Helicotrichum</u>   | 461     |
|          | <u>Helmisporium</u>    | 495-497 |
|          | <u>Helotium</u>        | 507-510 |
|          | <u>Helvella</u>        | 510-514 |
|          | <u>Helycomyces</u>     | 517     |

Vol. 21.	<u>Hericium</u>	52
	<u>Hericius</u>	52
	<u>Hexagonia</u>	143
	<u>Himantia</u>	161-166
	<u>Hormiscium</u>	430
Vol. 22.	<u>Hydnum</u>	91-97
	<u>Hydrophora</u>	261
	<u>Hygromitra</u>	305-306
	Hymenothèques	337
	Hyphomycetes	348
	<u>Hypochnus</u>	368-369
	<u>Hypoderma</u>	369-371
	<u>Hypodermium</u>	371
	<u>Hypolepia</u>	375
	<u>Hyponervis</u>	376
	<u>Hypoxylées</u>	384-385
	<u>Hypoxylon</u>	385-386
	<u>Hysterium</u>	399-402

MNA; Martius, C. P. 1821. Decas Plantarum Mycetoidearum, quas itinere Brasiliensi. Nova Acta Physico-Medica Acad. Caesaræ Leopoldinæ-Carolinæ. Nat. Cur. 10(1): 505-512 + 'pl. xlvi.

M: Mérat, F. V. 1821. Nouvelle flore des environs de Paris. Second edition.  
 Vol. 1. iii + 292 pp. Paris.  
 Vol. 2. xiii + 468 pp. Paris.  
 [According to Rogers (1941) this appeared in the week of 9-15 June.]

N&B: Nocca, Dominus & Joannes Baptista Balbis. 1821. Flora Ticinensis seu enumerato plantarum quas in peregrinationibus multiplicibus plures per annos solertissime in Papiensi agro peractis observarunt, et collegerunt.  
 Vol. 2. xvi + 393 pp. + 39 corrigenda + pls. xi-xxvii. Ticini.

NNA: Nees v. Esenbeck, Th. Fr. L. 1821. Boleti fomentarii Pers. varietas singularis; etc. Nova Acta Physico-Medica Acad. Caesaræ Leopoldinæ-Carolinæ. Nat. Cur. 10: 235-238.

- P: Purton, T. 1821. An appendix to the Midland Flora; comprising also corrections and additions referring to the two former volumes: and occasional observations tending to elucidate the study of British fungi. Vol. 3. xiv + 575 pp. London.
- R: Roques, Joseph. 1821. Phytographie médicale ornée de figures coloriées de grandeur naturelle, ou l'on expose l'histoire des poisons tirés du régnes végétal, et les moyens de remédier a leurs effets déletères, avec des observations sur les propriétés et les usages des plantes heroïques.  
Vol. 1. xii + 304 pp. Paris.  
Vol. 2. 328 pp. Paris.  
[I have seen only the volumes at Kew, which are accompanied by numerous colored plates, in no apparent order, and miscellaneous notes. I have been furnished a copy of the appropriate portions by Dr. Derek Reid.]
- Re: Re, Ioannis Francisci. [1821] Ad Floram Pedemontanam Appendix. 62 pp. Taurini.
- RvS: Ritter v. Schrank. 1821. Betrachtungen über die Fungi subcutanei der Pflanzen. Flora o. Bot. Zeitung (Regensburg), no. 22: 337-349.
- SA: St.-Amans, M. de 1821. Flore Agenaise ou description methodique des plantes observées dans le département de Lot-et-Garonne et dans quelques parties des départements voisins. lxi + 632 pp. Agen.  
[See Donk in Taxon 6: 253. 1957. for notes on the dates of appearance.]
- SB: Svensk Botanik, utgiven af J. W. Palmstruck, och <sup>o</sup> nyo upplagd af G. J. Billberg. vol. 9: unnumbered pagination.
- Sch: Schleicher, J. C. 1821. Catalogus hucusque absolutus omnium plantarum in Helvetia cis et transalpina sponte nascentium. Fourth edition. ii + 64 pp. Cambarii.
- Spr: Sprengel, K. 1821. Neue Entdeckungen im ganzen Umfang de Pflanzenkunde, herausgegeben. Vol. 2. 363 pp. Leipzig.

- Z: Zantedeschi, G. 1821. Continuazione della descrizione dei funghi della Provincia Bresciana del sig. Giovanni Zantedeschi Medico in Bovegno nella Valle Trompia. Giorn. Fisica, Chimica, Storia Naturale, Med. & Arti de Configliachi & Brugatelli. Decade II, Vol. 4: 90-113; 307-319; 344-354.  
[Xerox copies of appropriate pages were furnished me by Dr. G. Govi]

*The Pre-1821 Source Literature*

- AdS: Abbildungen der Schwämme [C. F. Hoffmann, anonymously]  
Erstes heft. 1790. taf. i-x. no location.  
Zweytes heft. 1791. taf. xi-xx. no location.  
Drittes heft. 1793. taf. xxi-xxx. no location.  
[I have run literature through the copy at BPI]
- A&S: Albertini, I. B. & L. D. de Schweinitz. 1805. Conspectus fungorum in Lusatae superioris agro Niskiensi crescentium e methodo Persooniana. xxiv + 376 pp + 12 pls. Lipsiae.  
[There is a microfiche edition available from IDC]
- BEF: Batsch, A. J. G. C. 1783. Elenchus Fungorum. Accedunt icones LVII fungorum nonnullorum agri jenensis, secundum naturam ab autore depictae, aeri incisae et vivis coloribus fucatae a I. S. Capiex. Halae. 184 pp + 12 pls.
- BEFC 1: Batsch, A. J. G. C. 1786. Elenchus Fungorum Continuatio Prima. Describens CXXV species et varietates totidem iconibus LIX - CXXXIII repraesentatas. Halae. 280 pp + pls. 13-30.
- BEFC 2: Batsch, A. J. G. C. 1789. Elenchus Fungorum. Continuatio Secunda. Describens XLIX species et varietates totidem iconibus CLXXXIV - CCXXXII repraesentatas. 164 pp + pls. 31-42. Halae.
- BH: Bulliard, P. Histoire des champignons de la France, ou traité élémentaire, renfermant dans un ordre méthodique les descriptions et les figures des champignons qui croissent naturellement en France.  
Tome I. Part 1. "1809" [1791 according to Rickett, North American Flora 1(1) xvi + 232.]

Paris.

Tome I. Part 2. "1809". [1791, according to Stafleu, 1967:67] pp. 233-368 + ix index + 173 pls. Paris

Tome II. Part 1. 1809. pp. 369-540. Paris.

Tome II. Part 2. 1812. pp. 541-684. Paris.

[According to Stafleu, Vol. 2 was issued in three parts: part 1: pp 373-508 + 108 pls; part 2: pp. 369-372, 509-540, by Bulliard and Ventenat; part 3: pp. 541-700 + 112 pls. edited and published by Ventenat. Most subsequent authors cite the plates only. I have seen copies at NY, BPI, and K, and have run the literature through the copy at BPI.]

Bolt.: Bolton, James. An history of fungusses, growing about Halifax. With forty-four copper plates; on which are engraved fifty-one species of agarics. Wherein their appearances in the different stages of growth are faithfully exhibited in about two hundred figures, copied with great care from the plants, when newly gathered and in a state of perfection. With a particular description of each species, in all its stages, from the first appearance to the utter decay of the plant; with time they are gathered; the soil and situation in which they grow; their duration; and the particular places mentioned, where all the new and rare species were found. The whole being a plain recital of facts, the results of more than twenty years observation.

Vol. 1. 1788. xvi + 44 pp + 44 pls.

Halifax.

Vol. 2. 1788. (similar title) xvii-xxv + pp. 45-92 + pls. 45-92. Huddersfield.

Vol. 3. 1789. (similar title) xxvi-xxxii + pp. 93-182 + pls. 93-182. Huddersfield.

Bosc: Bosc, Louis 1811. Memoire sur quelques especes de champignons des parties meridionales de l'Amerique septentrionale. Mag. d. Ges. naturf. Freunde, Berlin V: 83.

CFL: Curtis, William. Flora Londinensis, or plates and descriptions of such plants as grow wild in the environs of London: with their places of growth, and times of flowering; their several names according to Linnaeus and other authors: with a particular



description of each plant in Latin and English, to which are added, their several uses in medicine, agriculture, rural economy, and other arts.

Vol. I. Unpaged text accompanying numbered plates out of order. London.

[No fungi occur in this volume, for the system is that of Linnaeus.]

Vol. II. Unpaged text and numbered plates out of order. London.

[These rare volumes may be found at the Library of Congress, Washington. The beautiful plates of fungi are found at the rear of Vol. II, and then in no discernable order.]

- DC 2: de Lamarck, J. and A. de Candolle. 1815. Flore française ou descriptions succinctes de toutes les plantes qui croissent naturellement en France, disposées selon une nouvelle méthode d'analyse, et précédées par un exposé des principes élémentaires de la botanique. Third Edition. "Augmentée du tome V, ou sixième volume." Paris. Vol. 2. 600 pp.
- DC 6: Candolle, A. P. de. 1815. Flore française, .... Vol. 6 ("Tome cinquième, ou sixième volume). Paris. 662 pp.  
[A revision of a series begun by Lamarck, and so indexed in some libraries.]
- DCM: De Candolle, Augustin Pyramus. 1815. Mémoires sur les Rhizoctones, nouveau genre de champignons qui attaquent les racines des plantes, et en particulier celle de la Luzerne cultivée. Mem. Mus., Paris II: 209.  
1815. Mémoire sur le genre *Sclerotium*, et en particulier sur l'Ergot des céréales. Mem. Mus., Paris II: 401.  
1817. Mémoire sur les champignons parasite, I. Mém. sur le genre *Xyloma*. Mem. Mus., Paris III: 312.  
1817. Mémoire sur les champignons parasite. II. Mem. sur les genres *Asteroma*, *Polystigma*, et *Stilospora*. Mem. Mus., Paris III: 328.  
[I have not seen these references, and the citations are taken from Lindau and Sydow's *Thesaurus*.]
- Dick.: Dickson, James. Fasciculi IV plantarum cryptogamicarum Britanniae.  
Fasc. I. 1785. 26 pp + 3 pls. London.

- Fasc. II. 1790. 31 pp + 3 pls. London.  
 Fasc. III. 1793. 24 pp + 3 pls. London.  
 Fasc. IV. 1801. 28 pp + 3 pls. London.

EJG: Ehrenberg, C. G. 1820. *Fungorum nova genera tria.*  
*Jährbucher der Gewächskunde.* 1: 51-58 + pl.

FD: *Icones plantarum sponte nascentium in regnis Daniae et Norvegiae et in Ducatibus Slevici, Holsatiae et Oldenburg: ad illustrandum opus de iisdem Plantis, Regio jussu exarandum, Florae Danicae.* Havniae.  
 [usually cited at "Flora Danica"]

Fasc.: 1: 1-60. 1761. 16: 901-960. 1787.  
 2: 61-120. 1763. 17: 961-1020. 1790.  
 3: 121-180. 1764. 18: 1021-1080. 1792.  
 4: 181-240. 1765. 19: 1081-1140. 1794.  
 5: 241-300. 1766. 20: 1141-1200. 1797.  
 6: 301-360. 1767. 21: 1201-1260. 1799.  
 7: 361-420. 1768. 22: 1261-1320. 1806.  
 8: 421-480. 1769. 23: 1321-1380. 1808.  
 9: 481-540. 1770. 24: 1381-1440. 1810.  
 10: 541-600. 1771. 25: 1441-1500. 1813.  
 11: 601-660. 1775. 26: 1501-1560. 1816.  
 12: 661-720. 1777. 27: 1561-1620. 1818.  
 13: 721-780. 1778. 28: 1621-1680. 1819.  
 14: 781-840. 1780. 29: 1681-1740. 1821.  
 15: 841-900. 1782. (total: 51 fascs. +  
 supplement, to 1880)

FNS: Fries, Elias Magnus. *Novitiae florae Suecicae.*  
 Lundae.

- Part I. 1814. 22 pp.  
 Part II. 1814. pp. 23-40.  
 Part III. 1817. pp. 41-50.  
 Part IV. 1817. pp. 51-60.  
 Part V. 1819. pp. 61-72.

[I have run literature through these parts at BPI.  
 There are parts VI and VII at NY and Arnold Arboretum,  
 Harvard Univ.]

FO 1: Fries, E. M. 1815. *Observationes Mycologicae.*  
 Havniae. 230 pp. + pls. I-IV.  
 [Microfiche edition available from IDC]

- FO 2: Fries, E. M. 1818. *Observationes Mycologicae, praecipue ad illustrandam Floram Suevicam. Hafniae.* 376 pp. + pls. V-VIII.  
[Microfiche edition available from IDC]
- HEB: Holmskjöld, Theodoro. *Beata ruris otia fungis Danicis.*  
Vol. 1. 1790. xxiv + 118 pp. Havniae.  
[Kobbernes orden og forklaring. Ordo et explicatio inconum. 38 pp + 31 pls.]  
Vol. 2. 1799. 70 pp + 42 pls. Havniae.  
[I have used the copies at NY and BPI]
- HDF: Hoffmann, Georg Franz. 1795. *Deutschlands flora oder botanisches Taschenbuch. Zweyter teil. Cryptogamie.* 200 pp + 14 pls. Erlangen.  
[Copy at BPI]
- HFA: Hudson [i], Gulielmi. 1778. *Flora Anglica; exhibens plantas per regnum Brittaniae sponte crescentes, distributas secundum systema sexuale: cum differentiis specierum, synonymis auctorum, nominibus incolarum, solo locarum, tempore florendi, officinalibus pharmacopaeorum.* Vol. 2: pp. 335-690. London.  
[I have seen the copy at the U. S. Dept. Agriculture library at Beltsville, Md.]
- Hoffm: Hoffmann, C. F. 1789. *Nomenclator fungorum. Pars I. Agarici.* viii + 256 pp + vi pls. Berolin.  
\_\_\_\_\_ 1790. *Nomenclator fungorum. Pars I. Agarici. Continuatio prima, indice locupletata* 85 pp. Berolin.
- HV: Hoffmann, Georg Franz. *Vegetabilia cryptogamica.*  
Fasc. I. 1787. viii + 42 pp. + 8 pls.  
Fasc. II. 1790. 34 pp + 8 pls.
- LDC: de Lamarck, Jean Baptiste Antoine Pierre Monnet and A. P. De Candolle. 1808.  
*Synopsis plantarum in Flora Gallica descriptionarum.* Paris xxiv + 432 pp.  
[Copy at NY]

- LM: Link, Heinrich Friedrich. 1809. *Observationes in ordines plantarum naturales. Dissertatio I, complectans Ananrarum ordines epiphytas, Mucedines, Gastromycos et fungos.* Mag. d. Ges. naturf. Freunde, Berlin III: 3-42.  
 1816. *Observationes in ordines plantarum naturales. Dissertatio II, sistens nuperas de Mucedinum et Gastromycorum ordinibus observationes.* Mag. d. Ges. naturf. Freunde, Berlin VII: 25-45.
- PCC: Persoon, C. H. 1797. *Commentatio de fungis clav-aeformibus sistens specierum huc usque notarum descriptiones cum differentiis specificis nec non auctorum synonymis.* Lipsiae 124 pp + 4 pls.  
 [Microfiche edition: IDC]
- PCS: Persoon, C. H. 1800. *Commentarius D. Iac. Christ. Schaefferi quondam eccles. evangel. Ratisbon. pastoris et superintendentis, Fungorum Bavariae Indigenorum, icones pictas differentiis specificis, synonymis et observationibus selectis illustrans.* Erlangae. 130 pp + index.  
 [Microfiche edition: IDC]
- PD: Persoon, C. H. 1797. *Tentamen dispositionis methodicae fungorum, in classes ordines genera et familias, cum supplemento adjecto.* Lipsiae. iv + 76 pp.  
 [Microfiche edition: IDC]
- POM 1: Persoon, C. H. 1796. *Observationes Mycologicae seu descriptiones tam novorum, quam notabilium fungorum exhibitae. Pars prima.* Lipsiae. 115 p, 6 pls.  
 [Microfiche edition: IDC]
- POM 2: Persoon, C. H. 1799. *Observationes Mycologicae ... pars secunda.* Lipsiae, 105 pp, 6 pls.  
 [Microfiche edition: IDC]
- PIC: Persoon, C. H. 1798-1800. *Icones et descriptiones fungorum minus cognitorum. Fasciculus I.* Lipsiae. 28 pp + 7 pls. Fasc. II. pp. 29-60 + pls. 8-12.  
 [Microfiche edition: IDC]
- NS: Nees von Esenbeck, E. G. 1817. *Das system der Pilze und Schwämme.* xxxviii + 329 pp + "Ueberblick des Entstems der Pilze und Schwämme - zur erklärang

der Kupfertafeln." 86 pp.

- Roth: Roth, Albrecht Wilhelm. Tentamen Florae Germanicae.  
 Vol. I. 1788. xvi + 560 pp. Lipsiae.  
 Vol. II. 1789. ii + 624 pp. Lipsiae.  
 Vol. II, part 2. 1793. 593 pp. Lipsiae.  
 Vol. III. 1800. 578 pp. Lipsiae.
- Schr.: Schrader, Heinrich Adolph. 1794. Spicilegium florae Germanicae. Hannoverae. 194 pp + 4 pls.
- Scop.: Scopoli, Joannis Antonii. 1772. Flora Carniolica exhibens plantas Carnioliae indigenas et distributas in classes, genera, species, varietates, ordine Linnaeano. Second Edition.  
 Vol. 2. 496 pp + index.  
 [Copies at NY, BPI]
- Sib.: Sibthorp, John. 1794. Flora Oxoniensis, exhibens plantas in agro Oxoniensi sponte crescentes, secundum systema sexuale distributas. xxiv + 422 pp. Oxonii.  
 [Copy at Library of Congress]  
 Swartz, Olaf. Flora Indiae occidentalis aucta atque illustrata, sive descriptiones plantarum in Prodrom rescentitarum.  
 Vol. I. 1797. viii + 460 pp + 15 pls. Erlangen.  
 Vol. II. 1800. pp 641-1230 + pls. 16-29. Erlangen.  
 Vol. III. 1806. pp 1231-2018 + index Erlangen.
- TM: Tode, Henrico Iulio. Fungi Mecklenburgensis selecti.  
 Fasc. I. 1790. viii + 47 + index + vii pls. Luneburgi.  
 Fasc. II. 1891. viii + 64 + index + xvii pls. Luneburgi.
- Willd.: Willdenow, Caroli Ludovici. 1787. Florae Berolinensis Prodromus. xvi + 439 pp + vii pls. Berolin.
- With.: Withering, William. A botanical arrangement of all the vegetables naturally growing in Great Britain, with descriptions of the genera and

species, etc.

Third Edition. Vol. 4. 1796. 418 pp +  
3 pls.

[I have not seen this edition.]

- abietina (Clavaria) Fr: 469; Schl: 56 ← [PD: 37]  
 abietina (Thelephora) Fr: 442 ← [FO 2: 274 (Stereum) ← PS: 573 (Thelephora)]  
 abietinum (Hericium) Schl: 57 ← ["Schrad. p. 181"]  
 abietinum (Daedalea) Fr: 334 ← [BH: 379, pl. 442 fig. 2 (Agaricus)]  
 abietinum (Hysterium) Schl: 58 ← [POM 1: 31]  
 abietinus (Agaricus) Re: 52; M: 50 ← [BH: 379, pl. 442 f. 2]  
 abietinus (Boletus) Schl: 56; P: 242; G: 643 ← [PS: 541 ← "Dick. 3: 9"]  
 abietinus (Polyporus) Fr: 370 ← [PS: 541 (Boletus) ← "Dick. 3: 9"]  
 acnathoides (Boletus) M: 43 ← [BH: 337, pl. 486]  
 acariforme ("Erysibe" Erysiphe) G: 590 ← [S: f. pl. 146 (Lycoperdon)] :Fr 3: 210 (Institale)  
 acaulis (Helvella) M: 29 ← [POM 2: 20]  
 accerinum (Erineum) N&B: 368 ← [PD: 43]  
 acerbus (Agaricus) Fr: 49; M: 70 ← [BH: 603, pl. 571 f. 2]  
 acerina (Rubigo) G: 556 ← [PD: 43]  
 acerina (Thelephora) Fr: 453 ← [PS: 581 ← POM 1: 37 (Corticium)]  
 acerinum (Dematium) Schl: 57 (?sp. nov.)  
 acerinum (Erineum) FBR: 41, P: 313, H: 34, Schl: 57, M: 16, SA: 529 ← [PD: 43]  
 acerinum (Erysiphe) Schl: 57 ← [(?orthographic variant of "aceris")]  
 acerinum (Rhytisma) FSS no. 207 ← [PD: 5, not 52 (Xyloma)] : Fr 2: 569  
 acerinum (Xyloma) H: 9, Schl: 60, Spr: 279 (?as Rhytisma), RvS: 345, N&B: 301, M: 149, SA:  
 517 ← [PD: 5, not 52]  
 acerinum (Xyloma) G: 545 ← [NS 1: 25]  
 aceris (Erysiphe) M: 131, SA: 615 ← [DC 6: 104]  
 acerosus (Agaricus) Fr: 191, not 101 (sp. nov.)  
 acervatus (Agaricus) Fr: 122 (sp. nov.)  
 acetabulum (Peziza) SA: 533, M: 24 ← [LSP: 1181] :Fr 2: 44  
 acharii (Actidium) LD 22: 401 ← [FOM 1: 190]

- achilleae (Xyloma) Schl: 60 (?sp. nov.) :Fr 3: 199 (Labrella)  
 aciculare (Helotium) G: 660, SA: 530 ← [PS: 677 (Helotium) ← POM 2: 20 (Leotia)]  
 :Fr 2: 156  
 acris (Agaricus) Fr: 65 ← [Bolt. t. 60]  
 acris (Agaricus) P: 397, N&B: 326, R: 30 ← [Bolt. t. 60 ← "Withering"]  
 acris (Agaricus) SA: 563, M: 53, R: 27 ← [BH: 500, pl. 200]  
 acris (Agaricus lactifluus) Z: 316 ← [Bolt. t. 60]  
 acris (Lactarius) G: 625 ← [Bolt. t. 60]  
 aculeiformis (Clavaria) SA: 539, M: 31 ← [BH: 214, pl. 463 f. 4]  
 acuminata (Sphaeria) G: 530 ← [S: f. pl. 394 f. 3 (Sphaeria fusco marginata [var.] \_\_\_\_\_)]  
 :Fr. 2: 506  
 acuta (Clavaria) Fr: 485, G: 657 ← [S: f. pl. 333]  
 acuta (Sphaeria) P: 489, G: 530 ← ["Hoffm. 1: 22"] Fr 2: 506.  
 acutus (Agaricus) Fr: 233 ← [PS: 316]  
 adhaerens (Agaricus) Fr: 96 ← [A&S: 186, not 187]  
 adhaesivus (Agaricus) P: 187 ← [With. 4: 160]  
 adhaesivus (Agaricus adhaerens [var.]) Fr: 96 ← [With. 4: 160]  
 adiposus (Agaricus) Fr: 242 ← [BEFC 1: 147]  
 adonis (Agaricus) Fr: 152, M: 64 ← [BH: 445, pl. 560 f. 2]  
 adonis (Mycena) G: 620 ← [BH: 445, pl. 560 f. 2 (Agaricus)]  
 adstringens (Agaricus) Fr: 195 ← [PS: 350]  
 adusta (Omphalia) G: 614 ← [PS: 459 (Agaricus)]  
 adustus (Agaricus) Fr: 60, P: 400 ← [PS: 459, var. α only]  
 adustus (Agaricus omphalia) Z: 349 (?nom. nov.)  
 adustus (Polyporus) Fr: 363 ← [Willd: 392 (Boletus)]  
 aecidioides (Stictus) G: 663 ← [NS 1: 256 (Peziza)]  
 aegarophila (Conferva) P: 175 ← [LSpPl: 1637 "aegagropila"]  
 aegopodii (Sphaeria) H: 8 ← [POM 1: 17]: Fr 2: 526  
 aereus (Boletus) Fr: 393, M: 44, SA: 533, R: 23 ← [BH: 321, pl. 385]  
 aeruginea (Agaricus plumbeus var.) M: 54-55 ← ["Lamarck, Dict. 1: 105"]



aeruginosa (Peziza) Schl: 58 ← [PS: 663 ← POM 1: 27] : Fr 2: 130  
 aeruginosa (Helvella) P: 258 ← [PS: 617]  
 aeruginosa (Pratella) G: 626 ← [CFL 2: pl. 309]  
 aeruginosum (Fusidium) G: 544 ← ["LM 3: 8"]  
 aeruginosum (Helotium) G: 661 ← [PS: 617 ← "FD pl. 534, f. 2" (Helvella)]  
 aeruginosus (Agaricus) Fr: 286, P: 414 ← [CFL 2: pl. 309]  
 aeruginosus (Agaricus pratella) Z: 308 ← [CFL 2: pl. 309]  
 aestuans (Agaricus) Fr: 47 (sp. nov.)  
 affricatus (Agaricus) Fr: 169, not 162 (sp. nov.)  
 agardhii (Hydnum) Fr: 418 ← [FNS: 40, not 39]  
 agariciformis (Helvella) P: 451 ← [Bolt: 98]  
 agariciformis (Helotium) M: 19, SA: 530, LD20: 508 ← [Bolt: 98]  
 agariciformis (Xylaria) G: 511 ← [Bolt: 130 (Sphaeria)]  
 agaricoides (Morchella) M: 90 ← [DC 2: 212]  
 aggregatum (Dichosporium) G: 569 ← [NS 1: 105] : Fr 3: 219  
 aggregatus (Agaricus gymnopus) Z: 98 ← ["Sch. pl. 305"]  
 alba (Agaricus pudicus var.) M: 86 ← [BH: 635, pl. 597]  
 alba (Amanita) R: 46 (sp. nov.)  
 alba (Auricularia papyrina var.) M: 35 ← [BH: 279, pl. 402]  
 alba (Clavaria coralloides var.) M: 32 ← [BH: 201, pl. 496, fs. L, M, P]  
 alba (Helvella elastica var.) M: 29 ← [BH: 300, pl. 242]  
 alba (Morchella esculenta var.) M: 90 ← [BH: 274, pl. 218 (Phallus)]  
 alba (Peziza callosa var.) M: 21 ← [BH: 252, pl. 416 f. 1]  
 alba (Peziza fructigena var.) M: 23 ← [BH: 236, pl. 228, fs. C, D]  
 alba (Peziza papillaris var.) M: 22 ← [BH: 244, pl. 467, f. 1]  
 alba (Ramaria coralloides [var.]) G: 655 (var. nov.)  
 alba (Tremella cerebrina var.) M: 28 ← [BH: 222, pl. 386, f. A]  
 albellus (Agaricus) L: 474 (sp. nov.)  
 albellus (Agaricus) M: 70, R: 35 ← [Sch. 4: 34, pl. 78]  
 albertini (Agaricus) Fr: 179 (nom. nov.)

- albicans (Sphaeria) M: 144 ← [POM 1: 71]  
 albicans (Xylaria) G: 511 (nom. nov.)  
 albida (Daedalea) P: 253 ← [Sch. 4: 84, pl. 124 (Boletus)]  
 albida (Daedalea) Fr: 338 ← [FO 1: 107]  
 albida (Gyromyces) G: 593 ← [HFA: 565, as alga]  
 albida (Tremella) P: 512, H: 31 ← [HFA: 565, as alga]  
 albidus (Albatrellus) G: 645 ← [PS: 515 (Boletus)]  
 albidus (Cantharellus) Fr: 319 (nom. nov.)  
 albipes (Agaricus gnaphaliocephalus var.) M: 69 (var. nov., not BH)  
 albisporus (Boletus aereus [var.]) SA: 553 (var. nov., not BH)  
 albobrunneus (Agaricus) Fr: 37 ← [FO 2: 118 "albo-brunneus" ← PS: 293  
 "albobrunneus" ← PCS: 15 "brunneus"]  
 albo-grysea (Peziza papillaris var.) M: 22 (var. nov., not BH)  
 alboviolaceus (Agaricus) Fr: 218, not 213 ← [PS: 286 "albo-violaceus"]  
 album (Erysiphe) Schl: 57 ← [FO 1: 207]  
 album (Sclerotium) SA: 617 ← [DC 6: 112]  
 album (Tuber) K: 39, SA: 619, G: 592 ← [BH: 80, pl. 404]: Fr 2: 293 (Rhizopogon)  
 albus (Agaricus) Fr: 53 ← [Sch 4: 68, pl. 256]  
 albus (Agaricus gymnopus) Z: 90 ← [PS: 363 (Agaricus \_\_\_\_\_)]  
 albus (Agaricus pyxidatus var.) M: 68 (var. nov., not BH)  
 albus (Agaricus grammopodius var.) M: 71 (var. nov., not BH)  
 albus (Agaricus pectinaceus var.) M: 52 (var. nov., not BH)  
 albus (Gymnopus) G: 610 ← [PS: 363 (Agaricus)]  
 albus (Agaricus adonis var.) M: 64 (var. nov., not BH)  
 alcalinus (Agaricus) Fr: 142 ← [FO 2: 153]  
 alchemillae (Xyloma) Schl: 60 (sp. nov.)  
 aleuriatus (Agaricus) Fr: 238 ← [FO 1: 49]  
 algidus (Agaricus) Fr: 190 (nom. nov.)  
 alliaceus (Agaricus) Fr: 140 ← ["Jacquin, obs., p. 100"]  
 alliaceus (Agaricus) P: 208, H: 23 ← [With III, 4: 277]

- alliaceus (Agaricus) M: 62, R: 34 ← [BH: 551, pl. 153]  
 alliatus (Agaricus gymnopus) Z: 92 (nom. nov.)  
 allochroa (Botrytis) G: 553 ← ["LM 3: 16"] : Fr 3: 402  
 alnea (Peziza) Schl: 58 ← [PS: 673]  
 alnea (Thelephora) Fr: 446 (nom. nov.)  
 alnea (Rubigo) G: 556 ← [PS: 701 (Erineum)]  
 alneum (Erineum) Re: 55, H: 34, M: 17, Schl: 57, P: 314 + ← [PS: 701]  
 alneum (Erysiphe) Schl: 57 ← ["Fr"]  
 alneum (Xyloma) M: 149, H: 9, Schl: 60, P: 318 ← [PS: 108] : Fr 2: 564 (Dothidia)  
 alneus (Agaricus) L: 472, H: 25, M: 50, N&B: 331, Schl: 56 ← [LSP: 1176]  
 alneus (Agaricus) SA: 559 ← [Scop 2: 460]  
 alneus (Apus) G: 617 ← [Hoffm 1: 253 (Agaricus)]  
 alneus (Boletus) G: 640 ← [POM 1: 86]  
 alni (Erysiphe) Re: 55, M: 131, G: 589 "Erysibe" ← ["LDC: 57"]  
 alnicola (Agaricus) Fr: 250 (nom. nov.)  
 alternatum (Acremonium) G: 550 ← ["LM 3: 15"] : Fr 3: 425  
 altum (Hormiscium) LD 21: 430 ← ["Ehrenb. Sylv. Mycol. p. 10"]  
 aluta (Byssus) M: 12 ← [PD: 43]  
 alutacea (Scodellina) G: 668 ← [POM 2: 78 (Peziza)]  
 alutacea (Xylaria) G: 511 ← [PCC: 12(Sphaeria)] : Fr 2: 325 (Sphaeria)  
 alutaceum (Hydnum) Fr: 417 (sp. nov.)  
 alutaceus (Agaricus) Fr: 55 ← [PS: 441 (Agaricus russula \_\_\_\_\_) ← POM 1: 101  
 (Russula esculenta var.)]  
 alutaceus (Polyporus) Fr: 360 (sp. nov.)  
 alveolaris (Cantharellus) Fr: 322 ← [DC 6: 43 (Merulius)]  
 alveolaris (Polyporus) Fr: 343 ← ["Bosc: 84"]  
 amadelphus (Agaricus) Fr: 135, M: 67 ← [BH: 537, pl. 550, f. 3]  
 amara (Helvella) LD20: 513 ← ["Loureiro, Cochinchine, p. 695"]  
 amarus (Agaricus) Fr: 87 (sp. nov.)  
 amarus (Agaricus) M: 60, SA: 569, N&B: 323 R: 33 ← [BH: 478, pl. 30]

- ambiens (Circinostoma) G: 521 ← [PS: 44 (Sphaeria)] : Fr 2: 403 (Sphaeria)  
 amboinensis (Polyporus) Fr: 354 (sp. nov.)  
 ambustus (Agaricus) "Fr: 158" (not located)  
 amelanchier (Sphaeria) Schl: 59 (sp. nov.)  
 amethystea (Clavaria) SA: 540, N&B: 345 ← [BH: 200, pl. 496, f. 2 "amethystea" ← HBR:  
 110 "amethystina" (Ramaria)]  
 amethystaeus (Agaricus) N&B: 330 ← [HFA: 612 "amethystina"]  
 amethystea (Clavaria) M: 32 ← [BH: 200, pl. 496, f. 2 "amethystea" ← HBR: 110  
 "amethystina" (Ramaria)]  
 amethystea (Omphalia) G: 614 ← [HFA: 612 "amethystina" (Agaricus)]  
 amethystea (Ramaria) G: 656 ← [PS: 590 "amethystea" (Clavaria) ← HBR: 110  
 "amethystina" (Ramaria)]  
 amethystea (Tremella) M: 28, SA: 536 ← [BH: 229, pl. 499, f. 5]  
 amethysteus (Agaricus) M: 68 ← [HFA: 612 "amethystina"]  
 amethysteus (Agaricus omphalia) Z: 347 ← [HFA: 612 "amethystina" (Agaricus \_\_\_\_\_)]  
 amethystina (Clavaria) Fr: 472 ← [BH: 200, pl. 496, f. 2 "amethystea" ← HBR: 110  
 "amethystina" (Ramaria)]  
 amethystinus (Agaricus) H: 20, P: 399 ← [HFA: 612]  
 amictus (Agaricus) Fr: 141 "amictus" of index ← ["A&S no. 552"]  
 amorpha (Peziza) P: 265 †, Schl: 58 ← [PS: 657] : Fr El 1: 183  
 amorphus (Polyporus) Fr: 364 ← [FO 2: 258]  
 amphibolia (Thelephora, as "T. L [ejostroma] \_\_\_\_\_") Fr: 454 ← [FO 1: 151, not 150]  
 amplus (Agaricus) Fr: 95 ← [PS: 359]  
 andromedae (Xyloma, not Rhytisma) Spr: 279 ← [PS: 104] : Fr 2: 567  
 andromedae (Xyloma) Schl: 60 ← [PS: 104]  
 androsaceus (Agaricus) Fr: 137, Schl: 56, M: 61, SA: 571 ← [LSP:1175]  
 androsaceus (Agaricus omphalia) Z: 345 ← [LSP: 1175]  
 androsaceus (Merulius) P: 390, H: 25 ← [LSP: 1175 (Agaricus)]  
 anethi (Sphaeria) FSS no. 193 ← [POM 1: 67] : Fr 2: 429  
 angulare (Xyloma) P: 317 (sp. nov.)

angustata (Clavaria) Fr: 481 ← [PCC: 72]  
 angustata (Daedalea) Fr: 338, G: 639 ← [S: p. f. pl. 193]  
 angustatum (Hysterium) M: 153, Schl: 58, H: 8, P: 320, G: 510 ← [PS: 99] : Fr 2: 580  
 angustus (Agaricus) Fr: 195 ← [PS: 345]  
 annosus (Polyporus) Fr: 373 (sp. nov.)  
 annularius (Agaricus) SA: 586, M: 85, N&B: 310, R: 39 ← [BH: 626, pl. 377]  
 annularius (Boletus) L: 471, M: 46 ← [BH: 316, pl. 332]  
 annulatus (Thamnomycetes) Ehren: 519 ← [?]  
 annulatus (Boletus) K: 22 ← [PS: 503 "annulatus" ← PCS: 45 "annularius" ← BH:  
 316 "annularius"]  
 annularius (Agaricus) L: 475 ← [BH: 626, pl. 377 "annularius"]  
 anomala (Clavaria) Fr: 480 (nom. nov.)  
 anomalus (Agaricus) Fr: 220 as "A. anomalus α proteus" (nom. nov.)  
 antennaeformis (Monilia) G: 557 ← ["HDF: t. 13, f. 4"]  
 anthocephala (Clavaria) P: 474 ← [BH: 197, pl. 452 ← "Relh. no. 1276"]  
 anthocephala (Clavaria) M: 33 ← [BH: 197, pl. 452]  
 apalus (Agaricus) Fr: 265, not. 268 ← [FO 2: 142]  
 apiculata (Clavaria) Fr: 470 (nom. nov.)  
 apocyni (Sclerotium) Schl: 59 (sp. nov.)  
 appendiculatus (Agaricus) SA: 570, N&B: 324, P: 230 ← [BH: 442, pl. 392]  
 appendiculatus (Agaricus) M: 60 ← ["Sch. pl. 237"]  
 appendiculatus (Agaricus pratella) Z: 309 ← [BH: 442, pl. 392]  
 appplanatus (Boletus) G: 642 ← [PS: 536 (B. fomentarius [var.]) ← ?POM 2: 2]  
 applicatus (Agaricus) Fr: 192, P: 239, Schl: 56 ← [BEF: 171]  
 applicatus (Resupinatus) G: 617 ← [BEF: 171 (Agaricus)]  
 apum (Xylaria) G: 511 (sp. nov.)  
 aquatica (Peziza) M: 20 ← ["DC Dict. Encycl. 5: 216"]  
 aquifolii (Phacidium) Schl: 58 ← [?K]  
 aquifolii (Xyloma) SA: 518 ← [DC 6: 159]  
 aquilegiae (Erysiphe) M: 132 ← [DC 6: 105]

- aquilus (Agaricus) Fr: 208 (sp. nov.)  
 aquosus (Agaricus) Fr: 125, SA: 569, P: 232, M: 59 ← [BH: pl. 17, not BH: 470]  
 araneosa (Peziza) SA: 531, M: 21, P: 265, N&B: 350 ← [BH: 264, pl. 280] : Fr 2:69  
 araneosa (Sphaeria) G: 526 ← [PID: 24] : Fr. 2: 447, not 477  
 araneosus (Agaricus) P: 204 (nom. nov.), N&B: 311 (nom. nov.) ← [BH: pl. 598 f. 2B †]  
 araneosus (Agaricus) M: 82 ← [BH: pl. 250 "araneosus violaceus" ← ?Linn.]  
 arborea (Tremella) H: 31, P: 511 ← [HFA: 563, as alga]  
 arboreus (Boletus) P: 245 ← [S: p. f. pl. 346]  
 arbuti (Astoma) G: 525 ← [S: p. f. pl. 370, f. 6 (Sphaeria minutissima [var.])] : non Fr.  
 arcticum (Tryblidium) Spr: 310 ← [?Ehrenberg]  
 arcuatus (Agaricus) Fr: 109, not 103, M: 73, SA: 577 ← [BH: 595, pl. 443]  
 arcuatus (Mucor) MNA: 505 (sp. nov.)  
 arcularius (Polyporus) Fr: 342, "P. fav [olus] \_\_\_\_\_" ← [BEF: 97]  
 ardenia (Clavaria) Fr: 478 ← [S: p. f. pl. 215]  
 ardeniae (Clavaria) G: 657 ← [S: p. f. pl. 215, "ardenia"]  
 ardosiacea (Peziza callosa var.) M: 21 ← [BH: 252, pl. 416, f. 1]  
 ardosiacus (Agaricus) Fr: 198, M: 66 ← [BH: 472, pl. 348]  
 argematus (Agaricus) Fr: 75 ← [FO 2: 190]  
 argentatus (Agaricus) Fr: 218 ← [PS: 286]  
 argentea (Byssus parietina var.) M: 11 (nom. nov.)  
 argillacea (Clavaria) Fr: 482 ← [PCC: 74]  
 argillacea (Peziza) G: 666 ← [S: p. f. pl. 148] : Fr 2: 66  
 argutum (Hydnum) Fr: 424 (sp. nov.)  
 argyraceus (Agaricus) SA: 580, M: 78, N&B: 316 ← [BH: 584, pl. 423]  
 armeniacus (Agaricus) Fr: 234 ← [Sch 4: 35, pl. 81]  
 armillatus (Agaricus) Fr: 214 (nom. nov.)  
 aromaticus (Agaricus) Fr: 35 ← [S: p. f. pl. 144]  
 artemisiae (Xyloma) FSS no. 219 (sp. nov.) : Fr 2: 600  
 articulatum (Erineum) M: 17 ← [DC 2: 188 "arriculatum" ← PD: 41]

artocreas (Sphaeria) FSS no. 151 ← ["Tode 2: 77"] : Fr 2: 523  
 arundinacea (Peripherostoma) G: 515 ← [S: p. f. pl. 336 (Sphaeria)]  
 arundinacea (Sphaeria) P: 287 ← [S: p. f. pl. 336] : Fr 2: 429  
 arundinaceum (Hypoderma) M: 152, G: 509, SA: 516, LD 22: 370 ← [DC 2: 305]  
 arundinaceum (Hysterium) Schl: 58 ← [DC 2: 305 (Hypoderma)] : Fr 2: 590  
 arundinaceum (Xyloma) M: 150 ← [DC 6: 162] : Fr El 2: 112 (Eustegia)  
 arundinaceus (Agaricus) SA: 571, M: 62, N&B: 314 ← [BH: 458, pl. 403]  
 arundinis (Sphaeria) FSS no. 153 (sp. nov.): Fr 2: 510  
 arvalis (Agaricus) Fr: 263 (sp. nov.)  
 arvensis (Agaricus edulis var.) M: 61 ← [Sch 4: 73, pl. 310 (Agaricus \_\_\_\_\_)]  
 asemus (Agaricus) Fr: 121 ← [FO 2: 125 "A. butyraceus var. \_\_\_\_\_"]  
 asper (Agaricus) Fr: 18, not 13, N&B: 308 ← [AbS 3]  
 aspera (Amanita) G: 600, R: 40 ← [AbS 3]  
 aspideus (Agaricus) Fr: 63 ← [FO 2: 189]  
 asprellus (Agaricus) Fr: 208 (sp. nov.)  
 asserculorum (Daedalea) Schl: 57 ← [?Pers.]  
 asterosperma (Stilbospora) G: 545 ← ["Hoffm. 2: pl. 13, f. 3"] : Fr 3: 448  
 asterospora (Stilbospora) M: 147 ← [HDF: p. f. pl. 13]  
 astragali (Erysiphe) M: 132 ← [DC 6: 105]  
 astragalinus (Agaricus) Fr: 251, not 25 (sp. nov.)  
 astroideus (Agaricus) Fr: 312 "A. copr[inus] \_\_\_\_\_" ← [BH: 413 (Agaricus \_\_\_\_\_)]  
 atramentarius (Agaricus) SA: 566, M: 56, N&B: 319 ← [BH: 413, pl. 164]  
 atrata (Octospora) G: 667 ← [PS: 669 (Peziza)] : Fr 2: 148 (Peziza)  
 atrata (Thelephora) Fr: 437 ← ["Swartz III: 1933"]  
 atratum (Sclerotium) SA: 617 ← ["DCM 2: 414"] : Fr 2: 251  
 atratus (Agaricus) Fr: 168 ← [FO 2: 215 "utratus"]  
 atro-alba (Mycena) G: 619 ← [Bolt: 137 (Agaricus)]  
 atroalbus (Agaricus) Fr: 141 "atro-albus" of index ← [Bolt: 137 "atro-albus"]  
 atro-albus (Crepidopus ostreatus [var.]) G: 616 (var. nov.)  
 atrocaeruleus (Agaricus) Fr: 190 "atro-caeruleus" of index ← [FO 1: 95 "atro-caeruleus"]

- atrocyaneus* (Agaricus) Fr: 147 ← [BEFC 1: 101]  
*atropuncta* (Cortinaria viscida [var.]) G: 629 ("var. nov.")  
*atropunctus* (Agaricus) Fr: 195 ← [PS: 353]  
*atropurpureum* (Geoglossum) Fr: 490, G: 658 ← [BEF: 133 (Clavaria)]  
*atro-rufa* (Mycena) G: 620 ← [Bolt: 51, not 52 (Agaricus)]  
*atrotomentosus* (Agaricus) Fr: 272 ← [BEF: 89]  
*atrovirens* (Agaricus) Fr: 43 ← [PS: 319]  
*attenuata* (Monilia) Schl: 58 ← [?Pers., ?orthographic variant of antennata]  
*aucupariae* (Hysterium) Schl: 58 ← [?Pers.]  
*aueri* (Agaricus) Fr: 134 ← ["Sadl." (?Nees)]  
*aurantia* (Aegerita) M: 15 ← [BH: 103, pl. 504, f. 5]  
*aurantia* (Egerita) SA: 528 ← [BH: 103, pl. 504, f. 5]  
*aurantia* (Peziza) H: 33 ← ["FD pl. 657"] : Fr 2: 49  
*aurantius* (Boletus) LD 20: 181 ← [BH: 320, pl. 236 "aurantiacus"]  
*aurantiaca* (Amanita) G: 599 ← [PS: 252 (Amanita) ← BH: 666 (Agaricus)]  
*aurantiaca* (Byssus) SA: 526, M: 12 ← ["LDC: 524"]  
*aurantiaca* (Clavaria) Fr: 482 ← [POM 1: 32 "aurantia"]  
*aurantiaca* (Himantia) LD 21: 165 ← ["LDC: 524" (Byssus)]  
*aurantiaca* (Scodellina) G: 668 ← ["FD pl. 657" (Peziza)]  
*aurantiaca* (Sphaeria) G: 526 ← [PIC 2: 45 "aurantia"] : Fr 2: 440  
*aurantiaca* (Thelephora) Fr: 445 "aurantia" ← [PS: 576 (Thelephora) ← PD: 31, not  
 21 (Corticium)]  
*aurantiacum* (Hydnum) Fr: 403 ← [FO 1: 131 ( \_\_\_\_\_ ) ← BEFC 2: 103  
 (H. suberosum var. \_\_\_\_\_ )]  
*aurantiacum* (Leccinum) G: 646 ← [BH: 320, pl. 236 (Boletus)]  
*aurantiacus* (Agaricus) Fr: 68 (nom. nov.)  
*aurantiacus* (Agaricus) L: 476, M: 88, N&B: 306, SA: 588 ← [BH: 666, pl. 120]  
*aurantiacus* (Boletus) H: 26, P: 436, N&B: 334, SA: 555, M: 46 R: 23 ← [BH: 320, pl. 236]  
*aurantiacus* (Boletus aurantiacus var.) M: 46 ← [BH: 320, pl. 236 (Boletus \_\_\_\_\_ )]



- aurantiacus (Lactarius) G: 624 ← [PS: 432 (Agar. lactifluus testaceus var. \_\_\_\_\_)]
- aurantiacus (Merulius) G: 636, R: 53 ← ["Murr. Syst. veg. 14: 975"]
- aurantiomarginatus (Agaricus) Fr: 113 (nom. nov.)
- aurantius (Agaricus) Fr: 39 ← [Sch 4: 18, pl. 37]
- aurantius (Agaricus) P: 415, H: 22 ← [CFL: 308]
- aurea (Byssus) SA: 526, L: 466, M: 12 ← [LSpPl 2: 1638]
- aurea (Daedalea) Fr: 339 (nom. nov.)
- aurea (Helvella) H: 31 ← ["FD: pl. 534"]
- aurea (Lepiota) G: 603 ← [BH: pl. 92, not p. 626 (Agaricus)]
- aurea (Peziza) P: 464 ← ["Relh. ed. alt. no. 1244"] : non Fr.
- aureum (Erineum) M: 17 ← [PS: 700]
- aureum (Helotium) LD 20: 509 ← [PS: 678]
- aureum (Sporotrichum) G: 551 ← ["LM 3: 13"] : Fr 3: 418
- aureus (Hypochnus) LD 22: 368 ← [FOM 2: 281]
- aureus (Mucor) MNA: 506 (sp. nov.)
- aureus (Agaricus) Fr: 241, P: 194, SA: 586, M: 85, N&B: 310 ← [BH: pl. 92, not p. 626]
- auricula (Agaricus) Fr: 85 ← [DC 6: 48, not Duby]
- auricula (Peziza) L: 468, M: 26 ← [LSP: 1157 (Tremella) as alga]
- auricula (Tremella) H: 32 ← [LSP: 1157, as alga]
- auricula judae (Peziza) SA: 534 † ← [LSP: 1157 (Tremella) "auricula," as alga] : Fr 2: 221
- auricula judae (Tremella) Schl: 60, N&B: 347 † ← [LSP: 1157, "auricula," as alga]
- auricularis (Gyraria) G: 594, LD 22: 306 ("auricularia") ← [LSP: 1157 (Tremella),  
"auricula," as alga]
- auriscalpium (Hydnum) Fr: 406, P: 449, H: 28, M: 38, LD 22: 94 ← [LSP: 1178]
- aurivella (Lepiota squarrosa var.) G: 602 ← [BEFC 1: 153 (Agaricus \_\_\_\_\_)]
- aurivellus (Agaricus) Fr: 242 ← [BEFC 1: 153]
- avellana (Thelephora) Fr: 442 (sp. nov.)
- azonites (Agaricus) SA: 564, M: 54 ← [BH: 497, pl. 559, f. 1]

- badia (Scodellina) G: 669 ← [POM 2: 78 (Peziza)] : Fr 2: 46  
 badia (Grifola) G: 644 ← [PS: 523 (Boletus)]  
 badipus (Gymnopus) G: 605 ← [PS: 318 (Agaricus)]  
 badium (Sporotrichum) G: 551 ← ["LM 3: 12"]  
 badius (Boletus castaneus var.) Fr: 392 (Boletus \_\_\_\_\_ of index) (var. nov.)  
 barbajobi (Hydnum) M: 37 ← "With. III 4: 337" ← [BH: 303, pl. 481, f. 2 "barba jobis"]  
 barba jobi (Hydnum) SA: 545 ← [BH: 303, pl. 481, f. 2 "barba jobis"]  
 barba jovis (Hydnum) Fr: 421 ← [BH: 303, pl. 481, f. 2]  
 barbatum (Exormatostoma) G: 523 ← ["Pers., Ann. Bot. 11: 24" (Sphaeria)] : Fr 2: 514  
 (Sphaeria)  
 barbatus (Agaricus) Fr: 217 ← [BEF: 39]  
 battarae (Agaricus) Fr: 175 (nom. nov.)  
 bellus (Agaricus) Fr: 107 ← [PS: 452]  
 berberidis (Cucurbitaria) G: 519 ← [PD: 3 (Sphaeria)]  
 berberidis ("Erysibe," Erysiphe) G: 590 ← [DC 2: 275]  
 berberidis (Erysiphe) M: 133 ← [DC 2: 275]  
 berberidis (Hysterium) Schl: 58 ← [?Pers.]  
 berberidis (Sphaeria) SA: 523, M: 143 ← [PD: 3] : Fr 2: 415  
 bertieri (Agaricus) Fr: 175 (nom. nov.)  
 betulae (Erineum) Schl: 57 ← [?Pers.]  
 betulae (Erysiphe) M: 133 ← [DC 6: 107]  
 betulina (Daedalea) Fr: 333 ← ["Agar[dh]" ← LSP: 1176]  
 betulinum (Erineum) H: 34 ← [A&S: 370, not PS: 15]  
 betulinum (Xyloma) SA: 518, M: 149 ← [A&S: 63 (Xyloma acerinum [var.]])  
 betulinus (Agaricus) P: 435, M: 24 + ← [LSpPl: 1645]  
 betulinus (Boletus) M: 44 ← [BH: 348, pl. 312]  
 betulinus (Boletus) G: 641 ← ["Gmelin. Syst. Nat. 2: 1436"]

betulinus (Daedalea) P: 247 ← [LSpP1: 1645 (Agaricus)]  
 betulinus (Polyporus) Fr: 358 ← [BH: 348, pl. 312 (Boletus)]  
 bicolor (Campsotrichum) LD 20: 460 ← [EJG 1: 55]  
 bicolor (Cortinaria) G: 628 ← [PS: 281 (Agaricus)]  
 bicolor (Diamphora) MNA: 510 (sp. nov.)  
 bicolor (Hydnum) Fr: 417, not 407 ← [A&S: 270]  
 bicolor (Peziza) Re: 49, P: 468, M: 22, SA: 532 ← [BH: 243, pl. 410, f. 3] : Fr 2: 92  
 bicolor (Sphaeria) SA: 521, M: 139 ← [DC 2: 286]  
 bicolor (Stachylidium) G: 553 ← ["LM 3: 15"] : Fr 3: 391  
 bicolor (Thelephora) Fr: 438 ← [PS: 568, not Schrader]  
 bienne (Hydnum) M: 39 ← [PS: 550 (Sistotrema) ← BH: 333, pl. 449, f. 1 (Boletus)]  
 bienne (Sistotrema) G: 648 ← [PS: 550 ← BH: 333, pl. 449, f. 1 (Boletus)]  
 biennis (Boletus) P: 441 ← [PS: 550 (Sistotrema) ← BH: 333, pl. 449, f. 1 (Boletus)]  
 biennis (Daedalea) Fr: 332, P: 247 ← [BH: 333, pl. 449, f. 1 (Boletus)]  
 biennis (Thelephora) Fr: 449 (nom. nov.)  
 bifidus (Agaricus) M: 53 (nom. nov.) ← [BH: pl. 26 †, not p. 599]  
 bifrons (Astoma) G: 525 ← [S: p. f. pl. 316 (Sphaeria)]  
 bifrons (Sphaeria) P: 494 ← [S: p. f. pl. 316]  
 bifrons (Xyloma) SA: 518 ← [DC 6: 156]  
 bifurca (Clavaria) SA: 539, G: 657, M: 31 ← [BH: 207, pl. 264]  
 biocellata (Erysibe) ENA: 211 (sp. nov.)  
 bivelus (Agaricus) Fr: 215 ← [FO 2: 58]  
 blattarius (Agaricus) Fr: 246 (sp. nov.)  
 blennius (Agaricus) Fr: 67 (nom. nov.)  
 bolaris (Agaricus) Fr: 228 ← [PS: 291]  
 boletiformis (Tremella) P: 512 (nom. nov.)  
 boltonii (Agaricus) Fr: 303 ← [PS: 415]  
 boltonii (Prunulus) G: 632 (nom. nov.)  
 bombardica (Sphaeria) P: "282," 492, G: 527 ← [Bolt: 122 "bombardica" ← BEFC 1: 271  
 "bombarda"] : Fr 2: 456 "bombarda"

- bombycina (Byssus) G: 558 ← [Roth 3: 563]  
 bombycinus (Agaricus) Fr: 277 ← [Sch 4: 42, pl. 98]  
 borealis (Polyporus) Fr: 366 (sp. nov.)  
 botrytis (Clavaria) Fr: 466, K: 33, N&B: 344 ← [PCC: 41]  
 botrytis (Mucor) G: 561 ← [S: p. f. pl. 359 "botritis"]  
 bovinus (Boletus) Fr: 388, P: 436, H: 26 ← [LSP: 1177]  
 brasiliensis (Daedalea) Fr: 332 (nom. nov.)  
 brassicae (Astoma) G: 524 ← ["Dick 1: 23" (Sphaeria)]  
 brassicae (Sclerotium) G: 591 ← [PD: 15] : Fr 2: 249 (Sclerotium semen [var.] \_\_\_\_\_)  
 brevipes (Agaricus) M: 72, N&B: 316 ← [BH: 594, pl. 521, f. 2]  
 brevipes (Gymnopus) G: 609 ← [BH: 594, pl. 521, f. 2 (Agaricus)]  
 brumalis (Agaricus) Fr: 171 ← [FO 2: 206]  
 brumalis (Polyporus) Fr: 348 + ← [PD: 27]  
 brunneus (Agaricus) Fr: 211 ← [PS: 274]  
 bryophilus (Cantharellus) Fr: 325 ← [PS: 495 (Merulius) ← POM 1: 8 (Agaricus)]  
 buccinalis (Merulius) P: 180 ← ["With. IV 4: 146"]  
 bufonius (Agaricus) Fr: 88, not 83 ← [PS: 359]  
 buglossoides (Fistulina) SA: 546 ← [BH: 314, pl. 464]  
 bulbiger (Agaricus) Fr: 27 ← [A&S: 150]  
 bulbosa (Amanita) G: 599 ← [Sch 4: 61, pl. 241 (Agaricus)]  
 bulbosa (Aregma) Schl: 56 ← [?Fr]  
 bulbosa (Cortinaria) G: 630 ← [PS: 295 (Agaricus) ← S: p. f. pl. 130\*]  
 bulbosum (Stilbum) G: 564 ← [TM 1: 10]

\*Two distinct concepts surround this name. One, that of an *Amanita* (cf. PS: 250, DC 2: no. 564, etc.) was adopted by L, M, N&B and SA. The other, that of a *Cortinarius* (cf. PS: 295, etc.) was adopted by P. Fries used the name under *Agaricus* Tribe *Cortinari*, but cited Sowerby as authority, including PS: 295 ("195") as an additional synonym. Sowerby's concept was clearly an *Amanita*, for he informally proposed it as a variety of *Agaricus muscarius*.

- bulbosus (Agaricus) L: 476, M: 88, N&B: 306, SA: 589 ← [Sch 4: 61, pl. 241]  
 bulbosus (Agaricus) Fr: 214, P: 407 ← [PS: 295 ← S: p. f. pl. 130\*]  
 bulbosus (Agaricus) F: 249 + ← no author, no reference  
 bullaceus (Agaricus) Fr: 297, M: 58 ← [BH: 421, pl. 566, f. 2]  
 bullata (Sphaeria) H: 5, N&B: 298 ← ["Hoffm. veg. crypt. 1: 5" (?polynomial)] : Fr 2: 349  
 bullata (Stilbospora) Schl: 59 (sp. nov.)  
 bullatum (Sclerotium) SA: 618 ← [DC 6: 113] : Fr 2: 259  
 bulliardi (Agaricus) Fr: 221 ← [PS: 289 (Agaricus \_\_\_\_\_) ← POM 2: 43 (Agaricus  
 bombycinus var. \_\_\_\_\_)]  
 bulliardi (Daedalea) Fr: 338 (nom. nov.)  
 bulliardi (Helvella) M: 30 ← [DC 2: 246 ← PS: 612 (Leotia)]  
 butyraceus (Agaricus) Fr: 121, M: 73 ← [BH: 615, pl. 572]  
 buxiaria (Sphaeria punctiformis var.) M: 146 (var. nov.) : Fr 2: 525  
 byssiseda (Clavaria) Fr: 476 ← [POM 1: 32]  
 byssiseda (Sphaeria) M: 144, LD 22: 386 ← [TM 2: 10 "byssyseda"] : Fr 2: 442  
 byssisedus (Agaricus) Fr: 276 ← ["PID pl. 14, f. 4"]  
 byssoidea (Rhizomorpha) M: 137 ← [DC 6: 116 "bissoidea"]  
 byssoidea (Sphaeria) G: 527 ← [TM 2: 10 (Sphaeria \_\_\_\_\_ fusca †)]  
 byssoides (Auricularia) M: 35 ← [PS: 577 (Thelephora)]  
 byssoides (Clavaria) M: 31 ← [BH: 209, pl. 415, f. 2]  
 byssoides (Corynoides) G: 654 ← [S: p. f. pl. 335 (Clavaria)]  
 byssoides (Himantia) LD 21: 163 ← [FOM 2: 284 ← PS: 577 (Thelephora)]  
 byssoides (Periconia) M: 18 ← [PS: 686] : Fr 3: 343 (Sporocybe)  
 byssoides (Thelephora) Fr: 452 ← [PS: 577]

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\* See previous footnote.

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## A NEW NORTH AMERICAN SPECIES OF THE LICHEN GENUS GOMPHILLUS

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While collecting lichens and bryophytes in the vicinity of a large granitic outcrop in Wake County, North Carolina, I discovered an undescribed species belonging to the lichen genus *Gomphillus*. Until now only one species, *G. calicioides* (Duby) Nyl., had been recognized in the genus. It does not occur outside of Europe.

*Gomphillus americanus* Essl., sp. nov.

Figures 1 and 2

Similis *G. calicioides* sed apothecia matura fatiscentia et stipitatescens differt.

Thallus crustose, thin and membranous, white to pale greenish-white or grayish-green, growing in roughly orbicular patches from a few centimeters to (rarely) as large as 15 cm in diameter. Mature apothecia dark brown or blackening, paler below, sessile but often appearing very short stipitate because of the pale, slightly narrowed base, (300-) 380-800  $\mu\text{m}$  tall, 250-500  $\mu\text{m}$  in diameter, mostly one- or two-headed, occasionally polycephalic; postmature apothecia disintegrating or dissolving and becoming distinctly stipitate, the stipe 1-3.5 mm long and 110-230  $\mu\text{m}$  in diameter, slightly wider at the base and tapering upward, mostly pellucid-whitish, sometimes darkening slightly. Asci 280-340 x 7-10  $\mu\text{m}$ , cylindric; spores 180-240  $\mu\text{m}$  long and (1.5-) 2-2.5 (-3)  $\mu\text{m}$  in diameter, transversely many-septate (the cells mostly 2-6  $\mu\text{m}$  long); paraphyses less than 1  $\mu\text{m}$  in diameter, branched and anastomosed. Thallus, apothecia and stipes all color tests negative (the moss substrate is sometimes K+ orange-yellow). Constituents: Atranorin (slight) and traces of 2 or 3 terpenoid compounds (these latter may have come from the substrate moss).

Type: U.S.A. North Carolina. Wake Co.: ca. 5 mi. SE of the town of Wake Forest in the vicinity of a large granite outcrop along the Cedar Fork of the Little River (35° 55' N lat., 78° 23' W long.); growing over mosses (mostly *Entodon seductrix* (Hedw.) C.M. and *Leucodon julaceus* (Hedw.) Sull.) on a hardwood log, 28 March 1971, Esslinger 3184A (US, holotype; DUKE, Herb. Esslinger, isotypes). The following collections were made in different spots at the same locality on 15 March 1974: over mosses (mostly *L. julaceus*) and the

immediately adjacent bark on a hardwood log, Esslinger 4156 (US, DUKE, Herb. Esslinger); over mosses (*L. julaceus* and *Thuidium delicatulum* (Hedw.) BSG) on the base of living *Juniperus virginiana*, Esslinger 4157 (Herb. Esslinger); over mosses (*L. julaceus*) on a branch of living *Juniperus virginiana*, three or four feet above the ground, Esslinger 4158 (Herb. Esslinger).

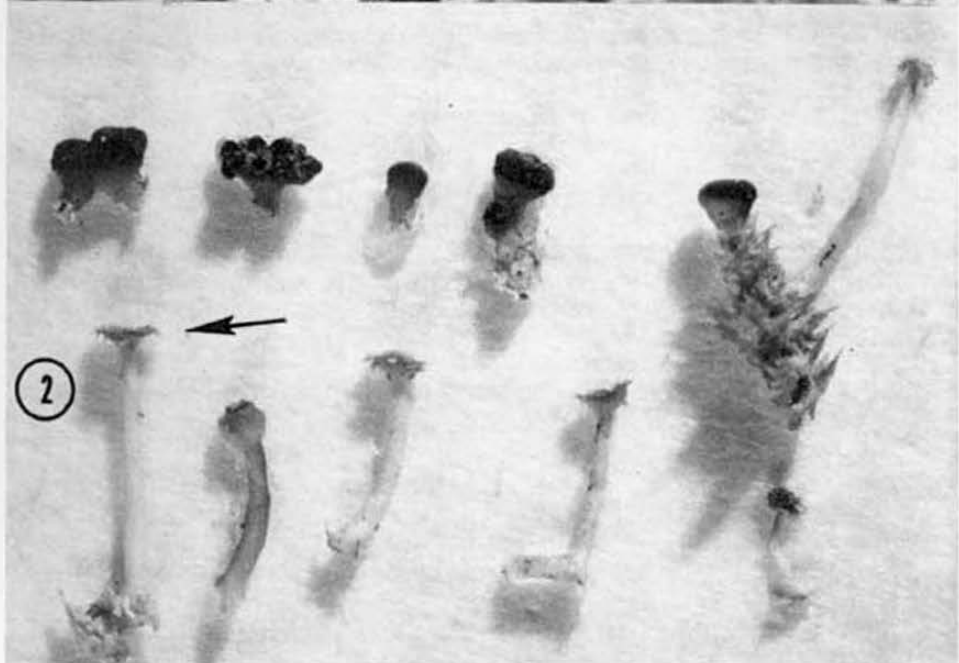
*Gomphillus americanus* and the European *G. calicioides* are very similar in most respects. The appearance of the mature apothecia, externally and internally, is virtually identical in both species although the apothecia and spores of *G. americanus* seem to average slightly larger than those of *G. calicioides*. The major difference between *G. calicioides* and *G. americanus* is the very peculiar manner in which the postmature apothecia of the latter species dissolve and become stipitate. Nothing similar to this was observed in any of the material of *G. calicioides* available to me (cited below) nor was any mention of such a development found in the literature.

Although the mature apothecia (nonstipitate) and postmature apothecia (stipitate) of *G. americanus* occur intermixed on the thallus, few intermediate stages between the two types were seen. The process of stipe formation and apothecial dissolution in this species is apparently quite rapid. By the time the stipe has formed, very little of the apothecium itself is left. At the top of an elongated stipe, all that remains to be seen of the apothecium is a strange appearing, pale to often somewhat darkened fringe (Figs. 1 and 2, arrows) apparently formed from what remains of the paraphyses and possibly some excipular material. Often, just below this fringe is a pellucid swelling that appears to be part of the stipe but which, upon wetting, becomes gelatinous. This gelatinous material consists of a mass of spores and possibly also some paraphyses. No traces of asci can be detected at this stage.

The systematic position of the genus *Gomphillus* is uncertain. Generally it has been aligned with *Baeomyces* in the Cladoniaceae (Duby, 1830; Nylander, 1860; Zahlbruckner, 1905; Räsänen, 1943) although Nylander (1855) in his original description of the genus, placed it in the tribe Lecidinei. Its supposed relationship to *Baeomyces* was based largely on the stipitate appearance of the apothecia. As recently demonstrated by Jahns (1970), however, the apothecia of *G. calicioides* are not truly stipitate but simply appear so because they are slightly taller than they are broad and because the base is narrower and often paler than the upper part. Mature apothecia of *G. americanus* are similarly pseudostipitate but become truly stipitate in the postmature stage. Recently several authors (Poelt, 1973; Henssen & Jahns, 1974) have followed Nylander's original proposal to place *Gomphillus* in the Lecideaceae. While this disposition for the genus is certainly more satisfactory than in the Cladoniaceae, the extreme heterogeneity of the Lecideaceae is only magnified by such a move. Although superficially similar to certain species of *Bacidia*, *Gomphillus* has no close relatives in the Lecideaceae and should probably eventually be placed in a family of its own.

Although it is doubtless not a common lichen, *G. americanus*





Figures 1 and 2. *Gomphillus americanus*. Fig. 1: Thallus and apothecia on the natural substrate. Fig. 2: Various mature and post-mature apothecia. In both figures the arrow is pointing to a remnant apothecial fringe at the top of a stipe.  $\times 14$ .

will probably be found to have a distribution considerably broader than that indicated by the few collections cited here. It is a very inconspicuous and easily overlooked lichen, often appearing like little more than discolored patches on the substrate moss. The apothecia are virtually invisible without the use of a hand-lens and even with one their nature is not immediately clear. Considering the rather broad distribution of *G. calicioides* through much of southern Europe, it would not be surprising to find this new species in scattered localities throughout much of the southeastern deciduous forest.

The following specimens of *G. calicioides* from Europe were examined:

FRANCE. Basses Pyrénées: Haute-Saule, Aussurucq, Arbailles alt. 600 m.s.m., ad truncum muscosum Fagi Silvaticae, Vivant, 28.XII. 1972, in Vězda, Lich. Sel. Exs. 1167 (US, DUKE). Manche: Bricquebec, sur les troncs, De Brébisson s.n., in Malbranche, Lich. Norm. 393 (DUKE; mixed with *Baeomyces rufus* (Huds.) Rebent.); Forêt de Bricquebec, Roumequère, 1870 (US).

ITALY: Quercia al Montello, Beltrami, 26.III.1856 (US).

PORTUGAL. Estremadura: Serra de Sintra, Cruz Alta, ad muscos et supra cortices vetustas Cupressorum cultarum, circ. 480 m.s.m., Tavares, 1946, in Tavares, Lich. Lusitaniae Sel. Exs. 11 (US).

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CHLOROSPENIUM AND ITS SEGREGATES. II.  
THE GENERA CHLOROCIBORIA AND CHLORENCOELIA<sup>1</sup>

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ABSTRACT

Four species of *Chlorociboria* are recognized in this monograph; one is divided into two geographically disjunct subspecies, both of which are associated with a phialoconidial state, *Dothiorina tulasnei*. A new species, *C. argentinensis*, and two new combinations, *C. aeruginascens* subsp. *brasiliensis* and *C. omnivirens*, are proposed. Six species and two varieties previously assigned to the genus are reassigned to other genera.

A new genus, *Chlorencoelia*, and the new combinations *C. versiformis* and *C. torta* are proposed for two species previously treated as members of *Chlorosplenium* and *Chlorociboria*.

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THE GENUS <i>CHLOROCIBORIA</i> SEAVER emend. DIXON . . . .	194
Generic Diagnosis of the Genus <i>Chlorociboria</i>	
Seaver emend. ( <i>Helotiales</i> , <i>Leotiaceae</i> ) . . . .	196
Nomenclatural Status of the Specific Epithets	
"aeuruginosa" and "aeuruginascens" . . . . .	197
Key to the Species of <i>Chlorociboria</i> . . . . .	199
The Perfect States of <i>Chlorociboria</i> . . . . .	200
The Phialoconidial States of <i>Chlorociboria</i> . . . .	218
Excluded Species and Synonyms . . . . .	221
THE GENUS <i>CHLORENCOELIA</i> DIXON . . . . .	222
Generic Diagnosis of the Genus <i>Chlorencoelia</i>	
Dixon ( <i>Helotiales</i> , <i>Leotiaceae</i> ) . . . . .	223
Key to the Species of <i>Chlorencoelia</i> . . . . .	224
ACKNOWLEDGMENTS . . . . .	233
LITERATURE CITED . . . . .	234

#### THE GENUS *CHLOROCIBORIA* SEAVER emend. DIXON

When Seaver (1936) erected the genus *Chlorociboria* he did not specifically indicate a taxonomic position for the genus. In 1951, Seaver placed this genus in the family Helotiaceae, tribe Helotieae. Rehm (1893) placed the species now in *Chlorociboria* in the Helotiaceae ("Helotieae") subtribe Ciboriinae ("Ciborieae"). Nannfeldt (1932) placed these species in his family Helotiaceae subfamily Ombrophiloideae. White (1941) suggested that *Chlorociboria* might prove to belong to the Ciborioideae of Nannfeldt (1932), which Whetzel (1945) raised to family rank as the Sclerotiniaceae. Dennis (1956) placed the genus *Chlorociboria* in the Helotiaceae subfamily Phialeoideae. In 1968 Dennis, under the name of *Chlorosplenium*, treated this genus in the Helotiaceae tribe Helotieae (ut "Helotioideae"). Ramamurthi, Korf and Batra (1958) placed the genus in the Sclerotiniaceae and Korf (1958) wrote, "The discovery of at least three Japanese species in which the ascospores regularly germinate by spermatia (much as in some species of *Rutstroemia*) lends additional weight to my view that the genus is correctly a member of that [Sclerotiniaceae] family." Berthet (1964b), however, pointed out, "*Chlorosplenium aeruginosum*, comme nous le signalions dès 1961, possède un mycélium aux articles uninuclées; cette espèce doit donc être placée, comme nous l'avions fait alors, dans les HELOTIACEAE, et rien ne permet d'en faire une SCLEROTINIACEAE, comme l'ont fait Ramamurthi, Korf et Batra (1957), puis Korf (1958, 1959b)."

On the basis of my study, I find that this genus fits

very well in the Leotiaceae (= Helotiaceae) as most other authors have concluded. However, its gelatinous hyphae, its ability to stain wood, its production of microconidia from ascospores and its general morphological features recall several species of *Claussenomyces*. I conclude that *Chlorociboria* should be considered a member of the subfamily Leotioideae, tribe Leotieae. It should also be pointed out that the granularly roughened tomentum hyphae remind one of the granularly roughened hairs exhibited in the Hyaloscyphaceae, both in members of the Trichoscyphelloideae and Hyaloscyphoideae, and the genus *Chlorociboria* may prove to be a connecting link to this family as well.

The pigmentation exhibited by members of this genus has been studied in *Chlorociboria aeruginosa*. Recently Blackburn et al. (1962, 1965) have elucidated the structure of this pigmentation and have confirmed the conclusions of Rommier (1868), Lieberman (1874), Frenzel (1928), and Kogl et al. (1925, 1930a, 1930b) that Xylindein (a peri-hydroxyquinone compound) is responsible for the green coloration of this fungus. Xylindein is formed by the hyphae of the fungus, and even though not readily soluble in water, it does leach from the hyphae staining the substrate which in time displays the aeruginous coloration typical of the fungus. Berthet (1964b) wrote, "*Chlorosplenium aeruginosum* possède des hyphes dont les inclusions lipidiques sont colorées en bleu-vert intense," and in regards to the hyphae of the "stroma" produced in culture, "Ce pigment se trouve répandu dans le milieu en amas irréguliers, probablement à la mort des hyphes qui le renferment."

Berkeley (1860) wrote that the "spawn" of *Chlorosplenium aeruginosum* (most likely *C. aeruginascens* since *C. aeruginosum* does not appear to occur in England) is used by craftsmen in Tunbridge Wells. Evidently they allow the mycelia to develop in the wood and after the wood has been stained, it is manufactured into various objects, *i.e.*, boxes, toys, bowls, etc. According to the Encyclopaedia Britannica (Anon., 1964), "The industry known as Tunbridge Wells ware continued during 300 years, but the factory closed and the small existing supply comes from the spare work of old hands."

GENERIC DIAGNOSIS  
OF THE GENUS *CHLOROCIBORIA* SEAVER emend.  
(HELTOIALES, LEOTIACEAE)

*CHLOROCIBORIA* Seaver ex Ram., Korf & Bat., Mycologia 49: 857. 1958, emend. Dixon

≡ [*Chlorociboria* Seaver, Mycologia 28: 390. 1936, not validly published, no Latin diagnosis nor reference to a previously and validly published Latin diagnosis.]

**NAME:** from Greek, "Chloris," the green one, and *Ciboria*, genus of Inoperculate Discomycetes; referring to the color of the apothecia and the taxonomic affinity to the genus *Ciboria*.

**HOLOTYPE:** *Helvella aeruginosa* Oeder per Purton [= *Chlorociboria aeruginascens* (Nyl.) Kanouse ex Ram., Korf & Bat.], selected by Seaver (1936) and Ramamurthi, Korf and Batra (1958).

**PHIALOCONIDIAL STATE:** *Dothiorina* von Höhnel.

**Apothecia:** superficial, solitary to caespitose, centrally to excentrically stipitate, fleshy to coriaceous.

**Disc:** shallow cupulate to infundibuliform, orangish-yellow to aeruginous and concolorous with the receptacle.

**Receptacle:** glabrous or finely tomentose, or with dark aeruginous pustules.

**Stipe:** glabrous to finely tomentose to heavily pustulate with dark aeruginous pustules.

**Asci:** cylindrical-clavate with long tapering stalks, apex rounded to subconic and inoperculate, J+, arising from repeating croziers.

**Ascospores:** fusiform to fusiform-elliptic, in some species sub-allantoid, unicellular to occasionally 1-septate, hyaline or with green contents.

**Paraphyses:** filiform, blunt at the apex, hyaline, septate, branching near the base.

**Subhymenium:** not always distinctly delimited, composed of tightly compacted *textura intricata*.

**Medullary Excipulum:** of loose to tightly compacted, hyaline to aeruginous, gelatinized *textura intricata*.

**Ectal Excipulum:** of gelatinized, hyaline (in young specimens) to heavily pigmented (in more mature specimens) *textura intricata*, or *textura angularis* to *textura globulosa*. Substrate always stained aeruginous and usually stained in a

extended area.

*Habitat*: on decayed and decorticated wood.

NOMENCLATRURAL STATUS OF THE SPECIFIC EPITHETS  
"AERUGINOSA" AND "AERUGINASCENS"

Confusion exists in the literature concerning the application of the specific epithets "aeruginascens" and "aeruginosa." It has become increasingly clear that (1) the names *Peziza aeruginosa* and *P. aeruginascens* are in desperate need of typification, (2) that every attempt should be utilized to follow the spirit of the International Code of Botanical Nomenclature's Recommendation 7b as adopted at the Seattle Congress (Stafleu and Voss, 1969) which states: "Whenever the elements on which the name of a taxon is based are heterogeneous, the lectotype should be so selected as to preserve current usage unless that element is discordant with the original description and (or) figure," and (3) that any means possible should be used to avoid burdening the literature with another name for a taxon which already has a valid name.

Let us examine the history of these two specific epithets. In 1770 Oeder in the *Flora Danica* [vol. 3 (Fasc. 9): 7, Tab. 534, fig. 2] described and illustrated under the polynomial "Elvela aeruginosa, minima pileo difformi viridissima" a specimen collected by J. G. König in Iceland. Twenty-five years later Persoon (1795) erected independently the species *Peziza aeruginosa*. Later, Persoon (1801) in his *Synopsis Methodica Fungorum* page 663 again described *Peziza aeruginosa* and on page 617 of the same work cited *Helvella ? aeruginosa* based on the description and illustration of Oeder.

Nylander (1869) erected *Peziza aeruginascens* for a species similar to *P. aeruginosa* Pers., but with smaller spores (6-8 × 1.5-2.5 μm). He wrote: "*P. aeruginosa* Raven. Fung. Carol. V, 40, et auctor omnium pr. p.; *Chlorosplenium aeruginosum* Tul. Sel. Fung. Carp. III, p. 187, t. 20, f. 15-19, cum spermogonis." Almost all later authors because of the similarity of the specific epithets have assumed that *Helvella aeruginosa* Oeder and *Peziza aeruginosa* Pers. were synonymous. This is in fact not the case. *Peziza aeruginosa* of Persoon is a large-spored fungus known to Nylander (1869), Schumacher (1803), Albertini and Schweinitz (1805), Schweinitz (1822), etc. It is *Helvella aeruginosa* Oeder (never placed in *Peziza*) which is the fungus named by Nylander (1869) as *Peziza aeruginascens*. Mistakenly, Persoon himself

(1822) synonymized the two species.

Which of the two identical species epithets did Fries 'sanction' when he treated *Peziza aeruginosa* in the *Systema Mycologicum* 2(1): 130. 1822? Both appear in his synonymy. The index to volume 2 is of no help in this instance, for no author is credited there. The index to the whole work, in volume 3, cites the author as "Fl. Dan." But Fries had cited two plates of the *Flora Danica*, one (534) being Oeder's species, the other (1260) being Persoon's. It is only in the *Systema Mycologicum* 2(1): 22. 1822 that the answer is to be found, for here Fries unequivocally states: "H[elvella]. aeruginosa Pers. syn. est *P. aeruginosae* varietas." Fries thus accepted Persoon's name as the basis of the species, not Oeder's. Even though Fries (1822) synonymized the two species, he clearly had Persoon's fungus in mind when he drew up the description of *Peziza aeruginosa*, because the excentrically stipitate fungus illustrated by Holmskjöld (1799) as *P. aeruginosa* was different enough for Fries to recognize it as a variety, *P. aeruginosa* var. *subgrisea*. Holmskjöld's illustration is undoubtedly the same fungus called *P. aeruginascens* by Nylander.

The small-spored fungus (*P. aeruginascens*) which occurs in Europe and Scandinavia became known by the misapplied name, *P. aeruginosa*. Since *P. aeruginascens* was the same fungus, it has been treated as a synonym of *P. aeruginosa* by various workers. In North America, where both species occur sympatrically, workers such as Kanouse (1947) and Ramamurthi, Korf and Batra (1958) recognized Nylander's *P. aeruginascens* as well as *P. aeruginosa* in the concept of Persoon, but attributed, in error, the latter specific epithet to Oeder instead of to Persoon.

Neither of these species has been lectotypified. An attempt to locate an authentic specimen from Oeder's herbarium and an authentic specimen from Persoon's herbarium was made. I have examined the only remaining specimen labelled *P. aeruginosa* in the Persoon herbarium and find it to be *P. aeruginascens* Nyl. I therefore avoided typifying *P. aeruginosa* by this specimen. Attempts to locate an Oeder specimen of *Helvella aeruginosa* were fruitless, and Dr. Skovsted of the Botanical Museum and Herbarium, Copenhagen, informed me (pers. comm.), "There are scarcely any fungi left of those used for the illustrations in *Flora Danica*, and I believe that König's material from Iceland has been lost." It is possible under the International Code of Botanical Nomenclature to typify the species by *Flora Danica* Tab. 534, but I felt that since this species is so poorly illustrated, having only a habit sketch, that this would not be suitable.



In hopes of conserving the current usage of these specific epithets, I am neotypifying *Peziza aeruginosa* by a specimen from the Fries herbarium at Uppsala which preserves Fries's concept of the species, preserves current usage, and which conforms with Persoon's original concept of the species. I am also lectotypifying *P. aeruginascens* by one of the syntype specimens from the Nylander herbarium now on deposit at Helsinki. I hereby designate this same Nylander collection as the neotype of *Helvella aeruginosa* Oeder per Purton. In so doing I am adopting a position that will conserve the usage of these specific epithets by such authors as Kanouse (1947), Ramamurthi, Korf and Batra (1958), Korf (1958, 1959a, b), Dennis (1960, 1968, 1970, 1972), Gamundí (1962), etc.

#### KEY TO THE SPECIES OF CHLOROCIBORIA

1. Ectal excipulum giving rise to tomentum hyphae..... 2
- 1'. Ectal excipulum not giving rise to tomentum hyphae, but instead at points along the ectal excipulum forming conical mounds of heavily pigmented and granulated *textura angularis* to *textura globulosa* which project almost perpendicularly from the flanks of the apothecium..... 4
- 2 (1). Ectal excipulum giving rise to few to numerous, coiled or sometimes straight, smooth-walled tomentum hyphae; often with several apothecia arising from each darkly pigmented, irregularly shaped fundament or "stromatic mass," excentrically stipitate to infrequently centrally stipitate..... 3
- 2' (1). Ectal excipulum giving rise to few to numerous, straight or coiled, strongly granularly roughened tomentum hyphae, apothecia arising singly from a scarcely differentiated, darkly pigmented, irregularly shaped fundament or "stromatic mass;" centrally stipitate to rarely excentrically stipitate, ascospores (8-) 9-14 (-15) × 2-4 μm..... 1. *C. aeruginosa*
- 3 (2). Ascospores 5-7 (-10) × 1.0-1.5 (-2.4) μm; asci (40-) 50-65 (-75) × 3-4 (-5) μm..... 2. *C. aeruginascens* subsp. *aeruginascens*
- 3' (2). Ascospores 3.0-5.5 (-6) × 1-1.5 μm; asci (35-) 41-49 × 3-4 μm..... 3. *C. aeruginascens* subsp. *brasiliensis*
- 4 (1'). Ascospores (7-) 9.0-10.2 (-11) × 1.7-2.0 μm; several apothecia arising from each darkly

- pigmented, irregularly shaped fundament or "stromatic mass;" centrally stipitate.....  
 ..... 4. *C. argentinensis*  
 4' (1'). Ascospores (11-) 14-18 (-20) × 3-4 μm; apothecia arising singly from a scarcely differentiated, darkly pigmented, irregularly shaped fundament or "stromatic mass;" centrally substipitate to stipitate.....  
 ..... 5. *C. omnivirens*

THE PERFECT STATES OF CHLOROCIBORIA

1. CHLOROCIBORIA AERUGINOSA (Pers. per Pers. : Fr.) Seaver  
 ex Ram., Korf & Bat. [ut "(Oed. ex Gray) Seaver"],  
 Mycologia 49: 859. 1958.  
 ≡ [*Peziza aeruginosa* Pers., [Neue] Ann. Bot. (Usteri)  
 [Stuck] 9: 27. 1795.]  
 ≡ *Peziza aeruginosa* Pers. per Pers., Myc. Eur. 1: 291.  
 1822 (pro parte typica) : Fr., Syst. Mycol. 2(1):  
 130. 1822 (pro parte typica). (!!)  
 ≡ *Chlorosplenium aeruginosum* (Pers. per Pers. : Fr.)  
 Auct., non *C. aeruginosum* (Oeder per Purton) de  
 Not. 1864.  
 ≡ [*Chlorociboria aeruginosa* (Pers. per Pers. : Fr.)  
 Seaver [ut "(Oed.) Seaver"], Mycologia 28: 391.  
 1936, pro parte typica (genus not validly publish-  
 ed).]  
 = *Peziza aeruginea* Berk., Hooker's J. Bot. Kew Gard. Misc.  
 6: 210. 1854. (!!)  
 ≡ *Chlorosplenium aerugineum* (Berk.) Sacc., Syll. Fung.  
 8: 318. 1889.  
 = *Chlorosplenium discoideum* Masee, Brit. Fungus-Fl. 4:  
 286. 1895. (!!)

(Figs. 19-20, 28)

*Apothecia*: superficial, solitary to gregarious, never with several apothecia arising from the same fundament or "stromatic mass," centrally to slightly excentrically stipitate.

*Disc*: < 5 mm in diam, cupulate to rarely convex-plane, color varying even in the same collection from orange-yellow to almost concolorous with the receptacle to light pea-green (Capucine Yellow to Sorrento Green to Pale Cendre Green) when fresh, becoming slightly darker from that in the fresh state to greenish-black upon drying, edges of disc enrolling

to the point of often touching.

*Receptacle*: glabrous or finely tomentose, pustulate, aeruginous (Sorrento Green to Dark Viridian Green) when fresh, becoming bluish-aeruginous upon drying, often vertically ribbed or rugose, especially upon drying.

*Stipe*:  $< 3 \times 0.5-1.0$  mm, concolorous with the receptacle, pustulate (often more so than the receptacle), on breaking showing an outer aeruginous cortex with an orange-yellow (Capucine Yellow) medullary tissue.

*Hymenium*: (55-) 75-90 (-106)  $\mu\text{m}$  high, hyaline to aeruginous, often with portions of the hymenium becoming more darkly pigmented.

*Asci*: cylindric-clavate, with a long tapering stalk, (57-) 68-80 (-95)  $\times$  (4.0-) 5-7 (-7.5)  $\mu\text{m}$  (mean of collections  $79 \times 7 \mu\text{m}$ ), strongly J+, 8-spored, wall at apex 1.0-1.5  $\mu\text{m}$  thick, 0.25-0.5  $\mu\text{m}$  thick along the sides of the ascus, arising from repeating croziers.

*Ascospores*: irregularly biseriate, unicellular to submedian 1-septate, fusiform-elliptic, hyaline or with light green contents, prominently biguttulate and/or with several smaller guttules, (8-) 9-14 (-15)  $\times$  2-4  $\mu\text{m}$  (mean of collections  $13 \times 3 \mu\text{m}$ ), spores often germinating in the ascus by unipolar or bipolar germ tubes, with occasional globose or subglobose microconidia 1.0-2.5  $\mu\text{m}$  in diam being produced at the ends of the germ tube and floating free in the mounting media.

*Paraphyses*: filiform, blunt at the apex, hyaline, septate, branching near the base, (1.0-) 1.5 (-2.0)  $\mu\text{m}$  in diam, scarcely extending beyond the asci.

*Subhymenium*: (5-) 10-25 (-45)  $\mu\text{m}$  thick, of hyaline to aeruginous *textura intricata*, hyphae 1-3  $\mu\text{m}$  in diam.

*Medullary Excipulum*: of gelatinized, thin-walled, loose to tightly compacted *textura intricata*, hyaline to light green (an occasional specimen dark green), hyphae sympodially branched, (2-) 3-4 (-5)  $\mu\text{m}$  in diam.

*Ectal Excipulum*: 15-85  $\mu\text{m}$  thick, of green hyphae forming a single layer of gelatinized hyaline and/or green, granulated *textura intricata*, *textura epidermoidea* or *textura oblita*, dark aeruginous in fully mature apothecia, ectal excipular hyphae giving rise to straight or coiled, strongly granularly roughened tomentum hyphae, in old and in fully mature specimens the outer layer often becoming brown, especially in the lower portion of the stipe.

*Habitat*: on decayed and decorticated wood; collected on wood of *Abies*, *Acer*, *Akebia*, *Alnus*, *Betula*, *Carpinus*, *Corylus*, *Fagus*, *Fraxinus*, *Liriodendron*, *Nothofagus*, *Picea*, *Pinus*, *Populus*, *Prunus*, *Salix*, *Tsuga*, *Quercus* and unidentified wood.

*Range and Seasons of Fructification:* North, South and Central America, China, India, Japan, Philippines, Union of Soviet Socialist Republics; Spring, Summer and Autumn.

*Name:* from Latin, "aeruginosus," deep-green, with a mixture of blue, referring to the color of the apothecia.

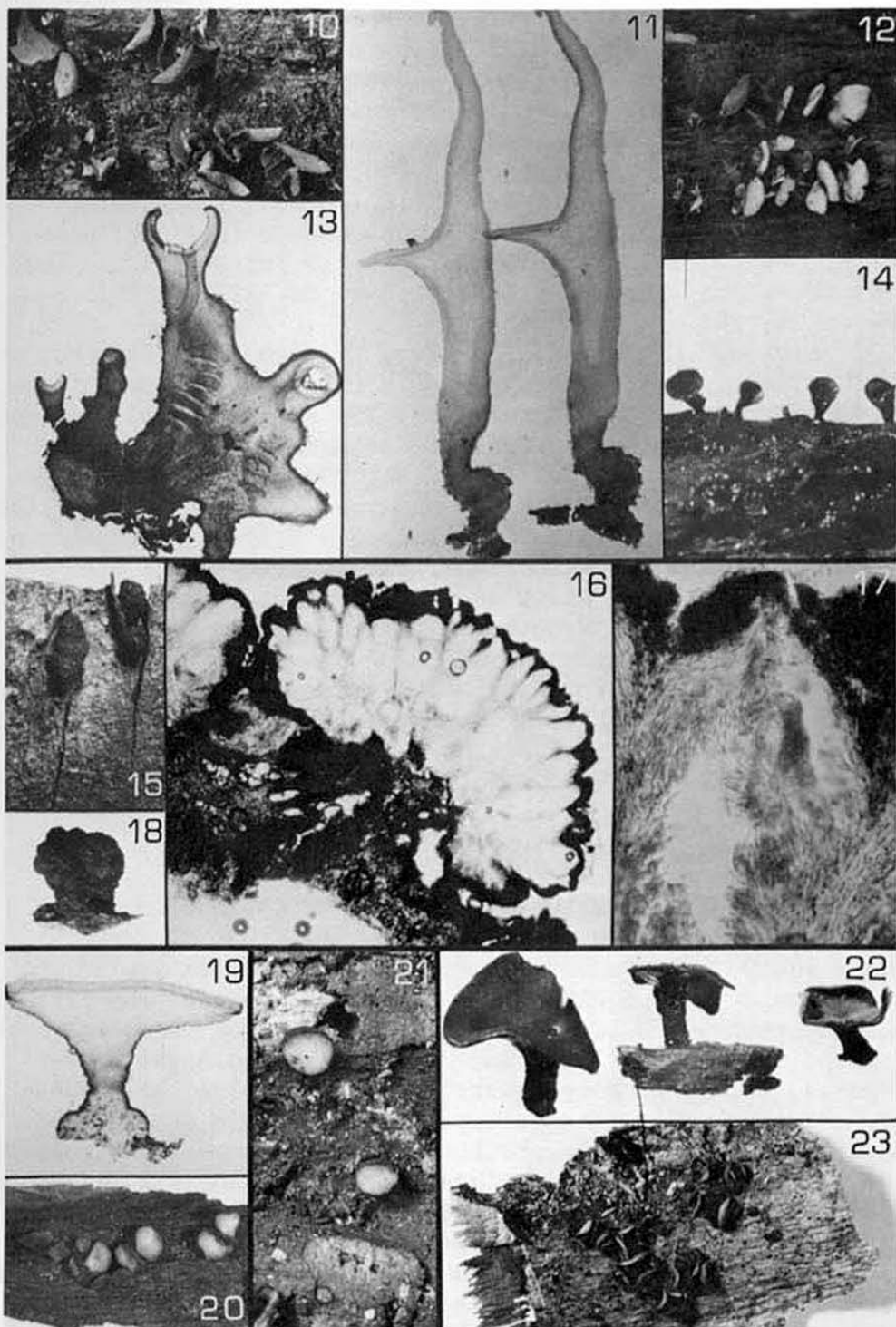
*Neotype Locality:* unknown.

*Neotype Specimen:* *Helotium aeruginosum*, in lignis *Betula*, (locality unknown), Kalchbrenner, (no date), UPS-Fries No. 287 (= CUP 51738).

*Illustrations:* Vahl., Fl. Danica Tab. 1260. 1797 (ut *Peziza*); Weberbauer, Pilze Norddeuts. 1: Tab. 1, fig. 5a, b, & c. 1873 (ut *Peziza*)!; Saccardo, Fungi Italici, Tab. 1348. 1883 (ut *Helotium*); Boudier, Ic. Mycol. Tab. 485. 1908 (ut *Chlorosplenium*)!; Migula, Kryptog.-Flora in Thomé's Fl. Deuts. 3(3<sup>2</sup>): Pl. 166, figs. 4-6. 1913 (ut *Chlorosplenium*)!; Akai, Bot. & Zool. 2: 835, fig. 2. 1934 (ut *Chlorosplenium*); Le Gal, Prodr. Flore Mycol. Madagascar 4: 363, fig. 161. 1953 (ut *Chlorociboria*); Gamundí, Darwiniana 12: Pl. 5, figs. 1-7. 1962 (ut *Chlorosplenium*)!; Ramamurthi, Korf and Batra, Mycologia 49: 856, fig. 1. 1958 (ut *Chlorociboria*)!; Korf, Sci. Rep. Yokohama Natl. Univ. Sect. 2, Biol. Sci. 7: 25, figs. 7 & 10. 1959 (ut *Chlorociboria* et Tax. sp. 3)!.

*Exsiccati:* Ellis, North American Fungi No. 987 (ut *Chlorosplenium*) CUP-A, CUP-D 11212 (76-26); Fuckel, Fungi Rhenani No. 1158 (ut *Helotium*) FH (= CUP 52690); Herbar Barbey-Boissier No. 1279 (ut *Chlorosplenium*) BPI; Libert,

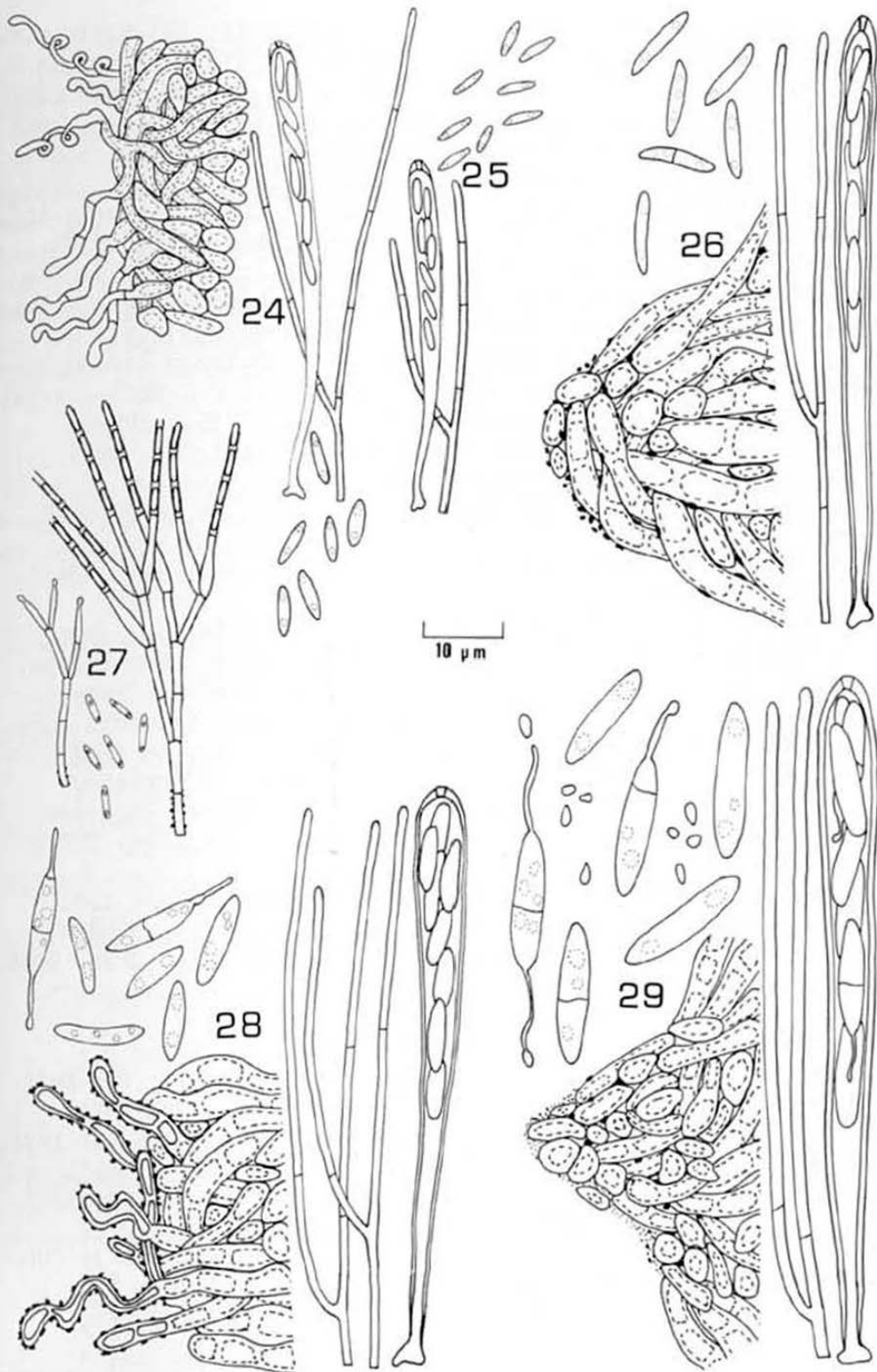
FIGS. 10-23. Photographs of *Chlorociboria* spp. and of *Dothiorina tulasnei*. FIGS. 10-14. *C. aeruginascens*. 10. Rehydrated apothecia, CUP 51821, approx.  $\times 2.5$ . 11. Complete section of apothecia, BPI-Jaczewski-s.n., 1895, approx.  $\times 7$ . 12. Freshly collected apothecia, CUP 51685, approx.  $\times 1.5$ . 13. Several young apothecia being formed on a single fundamen-  
 14. Rehydrated apothecia in side view, CUP 51685, approx.  $\times 1.5$ . FIGS. 15-18. *Dothiorina tulasnei*. 15. Gross view of young stromata, CUP 52701,  $\times 10$ . 16. Section of stromata, CUP 51855,  $\times 133$ . 17. Enlarged view of a pycnidium, CUP 51855,  $\times 770$ . 18. Side view of a stroma, CUP 52701,  $\times 6$ . FIGS. 19-20. *C. aeruginosa*. 19. Complete section of apothecium, CUP-VZ 4472, approx.  $\times 12$ . 20. Rehydrated apothecia, CUP-D 1349 (76-42), approx.  $\times 2.5$ . FIG. 21. *C. omnivirens*, gross view of rehydrated apothecia, R.P.K.-JA 2079, approx.  $\times 3$ . FIGS. 22-23. *C. argentinensis*. 22. Dried apothecia, BA 20262, approx.  $\times 4$ . 23. Dried apothecia, BA 21223, approx.  $\times 2$ .



Pl. Crypt. Arduennae No. 328 (ut *Peziza*) PAD-Saccardo (= CUP 51746); Ravenel, Fungi Caroliniana Exs. Fasc. V, No. 40 (ut *Peziza*) FH, CUP-D 6334 (76-68), 3667 (76-49); Rehm, Ascomyceten Exs. No. 409b (ut *Chlorosplenium*) CUP-D 4890 (76-57); Rick, Fungi Austro-Americani Exs. No. 6a (ut *Chlorosplenium aeruginascens*) BPI; Roumeguère, Fungi Sel. Exs. No. 5522 (ut *Chlorosplenium*) CUP-A, CUP-D 11610 (76-25); Roumeguère, Fungi Gallici Exs. No. 1858 (ut *Chlorosplenium*) CUP; Siemaszko, Fungi Bialowiezenses Exs. No. 19 (ut *Chlorosplenium*) BPI, P; Weese, Eumycetes Selecti Exs. No. 127 (ut *Chlorosplenium*) BPI.

*Excluded Exsiccati*: Berkeley, British Fungi Exs. No. 281 issued as *Peziza aeruginosa* is *Chlorociboria aeruginascens*; Karsten, Fungi Fennici No. 151 issued as *Chlorosplenium aeruginosum* is *Chlorociboria aeruginascens*; Petrak, Flora Bohemica et Moraviae Exs. No. 234 issued as *Chlorosplenium aeruginosum* is *Claussenomyces atrovirens*; Phillips, Elvellacei Britannici No. 86 issued as *Helotium aeruginosum* is *Chlorociboria aeruginascens*; Rabenhorst, Fungi Europaei No. 1310 issued as *Peziza aeruginosa* is *Chlorociboria aeruginascens*; Saccardo, Mycotheca Italica No. 333 issued as *Chlorosplenium aeruginosum* is *Chlorociboria aeruginascens*; Smarods, Fungi Latvici Exs. No. 771 issued as *Chlorosplenium aeruginosum* is *Chlorociboria aeruginascens*; Wilson & Seaver, Ascomycetes and Lower Fungi No. 78 issued as *Chlorosplenium aeruginosum* is *Chlorociboria aeruginascens*.

FIGS. 24-29. Camera-lucida drawings of *Chlorociboria* spp. and of *Dothiorina tulasnei*, × 1000. FIG. 24. *C. aeruginascens* subsp. *aeruginascens*. Portion of ectal excipulum and tomentum hyphae, R.P.K. 3340; ascus, paraphysis, and six ascospores, CUP-D 1221 (76-10). FIG. 25. *C. aeruginascens* subsp. *brasiliensis*. Ascus, paraphysis, and eight ascospores, BPI-Rick, Fungi Austro-Americani No. 6. FIG. 26. *C. argentinensis*. Six ascospores, paraphysis, ascus, and conical mass of hyphae protruding from the ectal excipulum, BA 21223. FIG. 27. *D. tulasnei*. Young phialide, six microconidia, and more mature phialide producing spores, CUP 52701. FIG. 28. *C. aeruginosa*. Seven ascospores, two in process of germination, CUP-D 1349 (76-46); portion of ectal excipulum and tomentum hyphae, CUP-VZ 4522; two paraphyses, ascus, CUP-D 1349 (76-46). FIG. 29. *C. omnivirens*. Six ascospores, two in the process of germination, and scattered microconidia, ascus, paraphysis, and conical mass of hyphae protruding from the ectal excipulum, CUP-JA 52.



- Specimens Examined:* U.S.A. - CALIFORNIA: BPI-Parks s.n., April 7, 1925. IDAHO: BPI-Weir 8067; CUP 51853. INDIANA: CUP-D 10953 (76-71). MICHIGAN: CUP 51774, 51799. MINNESOTA: CUP-D 10668 (76-78). NEW HAMPSHIRE: CUP 19508, 51846. NEW YORK: BPI-Tapke s.n., Spring 1917; CUP 51707, 51837, 51847, 51849, 51852; CUP-A 12168, 14875; CUP-D 1349 (76-42), 2163 (76-43); CUP-LG 137; R.P.K. 2522. OHIO: CUP-D 2717 (76-44), 4940 (76-58). OREGON: BPI-Kienholz K55; OSC 6415, 29395. PENNSYLVANIA: CUP 131, 45629; PH-Schweinitz Syn. 899, 156 (substrate unknown), Schweinitz, (date unknown), Bethlehem, ut *Peziza aeruginosa*. WASHINGTON: BPI-Humphrey s.n., Oct. 12, 1909, '9-15-1910 on *Alnus*, 9-15-1910 on *Tsuga heterophylla*?; BPI-Weir s.n., Sept. 1915. WYOMING: CUP-D 9863 (76-75). ARGENTINA: BA-20361, 20557 (= R.P.K. 2985), 20873, 20875, 21001, 21127, 21785; BA-Singer 3371; R.P.K. 2955. BRASIL: BPI-Rick s.n., 1923. CANADA - QUEBEC: BPI-McKeen s.n., Nov. 26, 1950; CUP 52347. CHINA: BPI-Deng 5191, 7541, Shen 340, Shen s.n., Sept. 22, 1933, Tsiang 260. COSTA RICA: BPI-Quiros s.n., July 4, 1948. ENGLAND: Holotype of *Chlorosplenium discoideum* Masee, on green colored wood of *Robinia* sp., Kew Gardens, Masee, 9/1894, NY (= CUP 51727); Isotype: CUP-D 8050 (77-50). INDIA: Holotype of *Peziza aeruginea* Berk., on dead wood, Khasia, Hooker and Thomson, (no date), K-Berkeley (= R.P.K. 2939); Isotype NY-Masee, s.n.; CUP-IN 463, 464. JAMAICA: BPI-Orcutt 5716, Welden 571, 928, 950; CUP-D 8043 (76-73), 4980 (77-121). JAPAN - HOKKAIDO: CUP-JA 2631. HONSHU: CUP-JA 1602 (=TNS 201039), 1803, 3514; R.P.K.-JA 1682, 1686. KYUSHU: CUP-JA 401, 419, 1531. YAKU ISLAND: CUP-JA 2020, 2026, 2058. MEXICO: CUP-ME 159. PANAMA: BPI-Martin 2199, 2398, 2773. PHILIPPINES: CUP-SA 1538, 1586, 1624, 1629. UNION OF SOVIET SOCIALIST REPUBLICS - RUSSIA: TAA-Kullman and Raïtviir 61115, Raïtviir 42584, 43431. UKRANIA: BPI-V.P. et L.J. Savicz et A.J. Bjelajeva s.n., 15-VII-1924. VENEZUELA: CUP 4472; NY-Dumont-VE 7 (= CUP-VZ 4516), 38 (= CUP-VZ 4529), 252 (=CUP-VZ 4528), 114 (= CUP-VZ 4525), 145 (= CUP-VZ 4533), 247 (= CUP-VZ 4517), 454 (= CUP-VZ 4521), 511 (= CUP-VZ 4532), 523 (= CUP-VZ 4534); 794 (= CUP-VZ 4524), 795 (= CUP-VZ 4518); 798 (= CUP-VZ 4526), 1330 (= CUP-VZ 4515), 1356 (= CUP-VZ 4522), 1427 (= CUP-VZ 4520), 2348 (= CUP-VZ 4523; NY-Wurdack 31431, 31518. LOCALITY UNKNOWN: Neotype specimen of *Peziza aeruginosa* Pers. per Pers. : Fr., UPS-Fries 287, in lignis *Betula*, (locality unknown), Kalchbrenner, (no date) (= CUP 51738).



*Notes:* This species is easily distinguished by the size of its ascospores and its granularly roughened tomentum hyphae. I have examined several specimens which on casual observation appear not to possess any such tomentum hyphae, but which have beyond question ascospores typical of this species. Careful examination especially at the margin of the apothecia always shows that tomentum hyphae are present; hence, if there is any question as to the presence of tomentum hyphae the observer is urged to examine the apothecial margin. This species appears to be somewhat more southern in its distribution (on the basis of numbers of specimens examined), but definitely overlaps the ranges of its closest relative, *Chlorociboria aeruginascens*.

Gamundí (1962) reports the presence of "pelos himeniales" for this species. I have examined the same specimens in which she indicated these hymenial hairs occur, but have been unable to locate any such structures either in squashed or sectioned material.

2. CHLOROCIBORIA AERUGINASCENS (Nyl.) Kan. ex Ram., Korf & Bat., Mycologia 49: 858. 1958, subsp. aeruginascens.

= [*Peziza viridissima*, *petiolata*, *scypho infundibuliformi* Hall., Hist. Stirp. Indig. Helvetiae Inch. 2: 131. 1768.]

≡ [*Peziza viridis stipitata*, *viridis*, *arborea* Wigg., Primit. Fl. Holsaticae p. 106. 1780.]

= [*Elvela aeruginosa*, *minima pileo difformi viridissima* Oed., Flora Danica 3(9): 7, Tab. 534, fig. 2. 1770.]

≡ [*Helvella aeruginosa* Oed. ex With., Arrangement Brit. Plants, ed. 3, p. 341. 1796.]

≡ *Helvella aeruginosa* Oeder per Purton, App. Midl. Fl. p. 258. 1821. (!!)

≡ *Helotium aeruginosum* (Oed. per Purton) Gray, Nat. Arrangement Brit. Plants p. 661. 1821.

≡ *Chlorosplenium aeruginosum* (Oed. per Purton) de Not., Comment. Soc. Critt. Ital. 1: 376. 1864.

= [*Merulius aeruginosa* Schum., Enum. Pl. Saell. p. 371. 1803.] (!!)

= *Peziza aeruginosa* Pers. per Pers. : Fr. [var.] b. *subgrisea* Fr., Syst. Mycol. 2(1): 130. 1822.

≡ *Peziza aeruginascens* Nyl., Not. Sällsk. Fauna Fl. Förh. 10: 42. 1869. (!!)

≡ *Chlorosplenium aeruginascens* (Nyl.) Karst., Not. Sällsk. Fauna Fl. Förh. 11: 233. 1870 (ut "aeruginescens," Seaver, Mycologia 28: 391. 1936, pro synonym. et lapsus calami).

- ≡ *Helotium aeruginascens* (Nyl.) Schroet., Krypt.-Fl. Schles. 3<sup>2</sup>(1): 83. 1893.
- ≡ *Chrysosplenium aeruginascens* (Nyl.) Karst. in Allescher, Ber. Bot. Vereines Landshut 15: 82. 1898 (lapsus calami).
- ≡ [*Chlorociboria aeruginascens* (Nyl.) Kanouse, Mycologia 39: 641. 1947 (generic name not validly published).]
- ≡ [*Chlorociboria aeruginosa* "(Oed. ex Gray) Seaver" var. *aeruginascens* (Nyl.) Bellemère, Bull. Soc. Mycol. France 83: 585. 1968 (basionym not cited).]
- = *Chlorosplenium indicum* Singh (ut errore "Dumont, Korf & Singh"), Trans. Brit. Mycol. Soc. 63: 293. 1974. (!)

#### MISAPPLIED NAMES:

- Peziza aeruginosa* Pers. per Pers., Myc. Eur. 1: 291. 1822 : Fr., Syst. Myc. 2(1): 130. 1822 (pro parte non typica).
- ≡ [*Chlorociboria aeruginosa* (Pers. per Pers. : Fr.) Seaver (ut "(Oed.) Seaver"), Mycologia 28: 391. 1936 (pro parte non typica; genus not validly published).]
- ≡ *Chlorociboria aeruginosa* (Pers. per Pers. : Fr.) Seaver ex Ram., Korf & Bat. (ut "(Oed. ex Gray) Seaver" Mycologia 49: 859. 1958 (pro parte non typica).

(Figs. 10-14, 24)

*Apothecia*: superficial, solitary to gregarious, eccentrically to infrequently centrally stipitate, frequently with several apothecia arising from a darkly pigmented and irregularly shaped fundament or "stromatic mass" which in section has a medulla of hyaline to light-green textura intricata and a cortex of tightly compacted and darkly aeruginous textura intricata, gymnocarpic in development.

*Disc*: < 7 mm in diam, cupulate to spathulate when young, becoming expanded-infundibuliform in fully mature specimens, color varying from light orange-yellow to concolorous with the receptacle to whitish-pale-green (Amber Yellow to Benzol Green to Pale Glaucous-Green), on drying becoming slightly darker than that in the fresh state.

*Receptacle*: glabrous or finely tomentose, bluish-aeruginous (Benzol Green to Sorrento Green), lower portion furrowed and rugose especially upon drying.

*Stipe*: < 6 × 1.0-1.5 mm, concolorous with the receptacle, on breaking showing a cortex and medulla both concolorous with the receptacle.

*Hymenium*: (45-) 60-85 (-100) μm high, hyaline to aeruginous, often with portions of the hymenium being more darkly pigmented.

*Asci*: cylindric-clavate, with a long tapering stalk, (40-) 50-65 (-75)  $\times$  3-4 (-5)  $\mu\text{m}$  (mean of collections 54  $\times$  4  $\mu\text{m}$ ), strongly J+, 8-spored, wall at apex 1.0-1.5  $\mu\text{m}$  thick, 0.25-0.5  $\mu\text{m}$  thick along the sides of the ascus, arising from repeating croziers.

*Ascospores*: irregularly biseriate, unicellular, fusiform to elliptic-fusiform, hyaline or with light green contents with bipolar guttules, smooth-walled, 5-7 (-10)  $\times$  1.0-1.5 (-2.4)  $\mu\text{m}$  (mean of collections 6  $\times$  1.5  $\mu\text{m}$ ).

*Paraphyses*: filiform, blunt at the apex, hyaline, septate, branching near the base, (1.0-) 1.5 (-2.0)  $\mu\text{m}$  in diam, scarcely extending beyond the asci.

*Subhymenium*: (5-) 10-25 (-40)  $\mu\text{m}$  thick, of gelatinized, hyaline to aeruginous *textura intricata*, hyphae 1-2 (-3)  $\mu\text{m}$  in diam.

*Medullary Excipulum*: of gelatinized, thin-walled, loose to tightly compacted *textura intricata*, with hyaline to light green contents (an occasional specimen dark green), hyphae sympodially branched, 1.5-3 (-4)  $\mu\text{m}$  in diam.

*Ectal Excipulum*: 30-75  $\mu\text{m}$  thick, of hyaline to aeruginous hyphae forming a single layer of gelatinized *textura intricata* to *textura epidermoidea*, dark aeruginous in fully mature apothecia, ectal hyphae giving rise to few to numerous, coiled or sometimes straight, smooth-walled tomentum hyphae, often with tomentum hyphae so numerous that they appear to form an outer layer of the ectal excipulum, tomentum hyphae 1.0-1.5 (-2)  $\mu\text{m}$  in diam.

*Cultural Characters*: Very slow growing on agar (PDA), producing an aeruginous colony from which hyphae penetrate into the agar and ramify through it. No conidia produced. Agar appearing dark aeruginous due to leaching of aeruginous pigment into media. Hyphae 1.0-2.5  $\mu\text{m}$  in diam, frequently branched, highly guttulate, thin-walled, with hyaline to light green contents. Two of my cultures are on deposit with the American Type Culture Collection as ATCC 24028 (= specimen CUP 51683) and ATCC 24029 (= specimen CUP 51676).

*Habitat*: on decorticated and decayed wood; collected on *Abies*, *Alnus*, *Betula*, *Carpinus*, *Cornus*, *Crataegus*, *Fagus*, *Fraxinus*, *Pasania*, *Picea*, *Pinus*, *Podocarpus*, *Populus*, *Salix*, *Sorbus*, *Tilia*, *Tsuga*, *Ulmus*, *Quercus* and unidentified wood.

*Range and Seasons of Fructification*: world-wide; collections from North & South America, Europe, Scandinavia, India, Japan, China, Philippines, Union of Soviet Socialist Republics; Spring, Summer, and Autumn.

*Name*: from Latin, "aeruginosus," deep-green, with a mixture of blue, + "-ascens," Latin suffix, becoming; perhaps referring to the fact the substrate becomes aeruginous.

*Lectotype Locality:* Ostrobothniae australis, Kuortane, northwest Finland.

*Lectotype Specimen:* (substrate unknown), Ostrobothniae australis, Kuortane, P. A. Karsten, 28. VII. 1859, det. W. Nylander, H-Karsten s.n. (= CUP 52630).

*Illustrations:* Oeder, Fl. Danica, Tab. 534, fig. 2. 1770 (ut *Elvela aeruginosa*); Holmskjöld, Beata ruris otia fung. dan. 2: Pl. 12. 1799 (ut *Peziza aeruginosa*); Greville, Scot. Crypt. Fl. 5: Pl. 241. 1827 (ut *Peziza aeruginosa*); Tulasne & Tulasne, Sel. Fung. Carp. 3: Pl. 20, figs. 15-19. 1865 (ut *Chlorosplenium aeruginosum*)!; Lindau, Naturl. Pflanzen-fam. I 1\*: 196, fig. 155 H-J. 1897 (ut *Chlorosplenium aeruginosum*); Migula, Kryptog.-Flora in Thomé's Fl. Deutschl. 3(3<sup>2</sup>): Pl. 169, figs. 5-6. 1913 (ut *Chlorosplenium*); Akai, Bot. & Zool. 2: 835, fig. 2. 1934 (ut *Chlorosplenium*); Kobayasi in Asahina, Nippon inkwas yokubutu Dukan, Pl. 141, figs. 3-5, 1939 (ut *Chlorociboria aeruginosa*); Dennis, Mycol. Pap. 62, fig. 39. 1956 (ut *Chlorociboria aeruginosa*); Dennis, Brit. Cup Fungi Pl. 15, fig. F. 1960; Ramamurthi, Korf & Batra, Mycologia 49: 856, fig. 2. 1958; Korf, Sci. Rep. Yokohama Natl. Univ. Sect. 2, Biol. Sci. 7: 25, figs. 8-9, 1958 (ut *Chlorociboria* et ? Tax. sp. 2)!; Bellemère, Bull. Soc. Mycol. France 83: 584, fig. 68, A-H. 1967 (ut *Chlorociboria aeruginosa*)!; Dennis, Brit. Ascomycetes, Pl. 18, fig. F. 1968 (ut *Chlorosplenium*).

*Exsiccati:* Berkeley, British Fungi Exs. No. 281 (ut *Peziza aeruginosa*) FH; Jaczewski, Komarov & Tranzschel, Fungi Rossiae Exs. No. 194 (ut *Chlorosplenium*) BPI, CUP-D 4534 (76-16); Jaap, Fungi Selecti Exs. No. 457 (ut *Chlorosplenium*) BPI; Karsten, Fungi Fenniae No. 151 (ut *Chlorosplenium aeruginosum*) FH; Phillips, Elvellacei Britannici No. 86 (ut *Helotium aeruginosum*) FH, CUP-D 11088 (76-24); Rabenhorst, Fungi Europaei No. 1310 (ut *Peziza aeruginosa*) FH, CUP; Rehm, Ascomyceten Exs. No. 408 (ut *Chlorosplenium*) CUP-D 4885 (76-18); Saccardo, Mycotheca Italica No. 333 (ut *Chlorosplenium aeruginosum*) BPI; Smarods, Fungi Latvici Exs. No. 771 (ut *Chlorosplenium aeruginosum*) CUP 33049; Wilson & Seaver, Ascomycetes and Lower Fungi No. 78 (ut *Chlorosplenium aeruginosum*) CUP, CUP-D 10000 (76-76).

*Excluded Exsiccati:* Rick, Fungi Austro-Americani No. 6 issued as *Chlorosplenium aeruginascens* is *Chlorociboria aeruginascens* subsp. *brasiliensis*; Ibid., No. 6a, issued as *Chlorosplenium aeruginascens* is *Chlorociboria aeruginosa*.

*Specimens Examined:* U.S.A. - ALASKA: BPI-Baxter s.n., Aug. 24, 1936; NY-Cooke 42266. CALIFORNIA: BPI-McMurphy s. n., Jan. 14, 1924; Parks 2687, 5210, s.n., 31. Aug. 1960. COLORADO: CUP-D 6668 (76-70). GEORGIA: CUP 51773. IDAHO:

BPI-Slipp 1072; CUP 52636; OSC 25794. IOWA: CUP-D 470 (76-30). MAINE: CUP-D 8981 (77-123). MASSACHUSETTS: CUP 51845; CUP-D 4536 (76-52). MICHIGAN: C-Povah s.n., Aug. 20, 1930; CUP 51679, 51689, 51691, 51693, 51695, 51698, 51700, 51705, 51765, 51766, 51768, 51775, 51776, 51779, 51780, 51791, 51800-825. MINNESOTA: NY-Cooke 43493, 43623. NEW HAMPSHIRE: FH-no collector, s.n., Sept. 93. NEW JERSEY: CUP 51836; CUP-D 4537 (76-53). NEW YORK: BPI-Seaman s.n., Buffalo; CUP 11858, 43235, 51674, 51676-78, 51683-85, 51692, 51694, 51696, 51697, 51699, 51706, 51767, 51828-29, 51830-35, 51844, 51848, 51850; CUP-D 9549 (77-125), 9554 (77-126); CUP-LG 354; R.P.K. 782, 53-102. NORTH CAROLINA: BPI-Miller s.n., Aug. 18, 1933; CUP 37276, 51867, 51770, 51851. OHIO: CUP-D 1231 (76-4). OREGON: OSC 25793, 27978, 30119. TENNESSEE: CUP 51676, 51686, 51688, 51690. VERMONT: CUP-D 9008 (77-124). WASHINGTON: BPI-Maas 1778, Smith 2576; OSC 25797. WISCONSIN: CUP 51682, 51838, 51839, 51840-43.

BULGARIA: TAA-Parmasto 19299.

CANADA - BRITISH COLUMBIA: BPI-Mounce 7306; OSC 25795; V-collector unknown, s.n., Oct. 6, 1965. ONTARIO: BPI-Cain s.n., Sept. 6, 1933, Cain 41241, Elliott 89367, Jackson 1830, Senn 5340; C-Elliott 89367; CUP 51921, 52708; R.P.K. 3932. QUEBEC: BPI-Emmons s.n., Aug. 24-26, 1938.

CHINA: BPI-Deng 501, Teng 3371.

CUBA: FH-Wright, Fungi Cubenses Wrightiani No. 625 [= CUP-D 3561 (76-47)].

CZECHOSLOVAKIA: BPI-Pilat s.n., VII-1934.

DENMARK: C-Dissing s.n., 10-8-1963, F. et W. s.n., Oct. 1908, Hansen s.n., 30.8.1965, Kongr. s.n., 28.VIII.1969, Lind s.n., 12-9-1904, Milan s.n., 13.8.1965, Mortensen s.n., 19 Oct. 1884, Raunkjaer s.n., April 1912, Rostrup s.n., 17/79, 3/5 81, 12/ 81, 6/9 81, 21/10 95, 27-10. 1895, 4/ 03, Wieze s.n., Sjaellands; CP-Åmose s.n., 26.11.1961, Fussingø s.n., 3.10.1952, Hind s.n., 30/10 1911, NB[uchwald] s.n., 1955, NB[uchwald] s.n., 18.9.1961, Rostrup s.n., 29.9.89, 10. 1895, 20.5.91, Stenskov s.n., 8. 1905.

ENGLAND: BPI-Shear s.n., Sept. 18, 1930; CUP-D 146 (76-28), 147 (76-29).

FINLAND: *Ostrobottniae australis*, Kuortane, (substrate unknown), P. A. Karsten, 28. VII. 1859, det. W. Nylander ut *Peziza aeruginascens*, H-Karsten Herb., s.n. (= CUP 52630), lectotype specimen (designated here) of *Chlorociboria aeruginascens* subsp. *aeruginascens* and neotype specimen (also designated here) of *Helvella aeruginosa* Oeder per Purton).

GREENLAND: C-Lange s.n., 28/9 1946.

INDIA: CUP-IN 468 (= Singh 3492), paratype specimen of *Chlorosplenium indicum* Singh.

JAPAN - HOKKAIDO: CUP-JA 446, 2635, 2659. HONSHU: CUP-JA 1542, 1554, 1555, 1594; R.P.K.-JA 1686. KYUSHU: CUP-JA 331, 346, 357, 400.

NETHERLANDS: C-Schumacher No. 1919, (locality, collector and date unknown), [orig. descr.: in trunco subputrido (Charlottenlund) Octob.], holotype of *Merulius aeruginosa*.

PHILIPPINES: CUP-SA 1529.

SWEDEN: BPI-Haglund s.n., 30/8 1901, Nannfeldt s.n., 10.VIII-1928; C-Haglund s.n., 24/8 1910; CUP-D 28 (76-27), 2516 (76-3), 9915 (76-22); UPS-Fries, lignum Småland: Femsjö, 1856, ut *Helotium aeruginosum*, det. J.A. Nannfeldt (= CUP 51735).

UNION OF SOVIET SOCIALIST REPUBLICS - ARMENIA: TAA-Raitviir 43130 (= R.P.K. 3332). GEORGIA: TAA-Parmasto 16854, Raitviir 44858. KAMCHATKA: TAA-Parmasto 12493. KURIL ISLANDS: TAA-Parmasto 12186. RUSSIA: BPI-Jaczewski s.n., 1895; TAA-Maasik 19623, Parmasto 7231, 8092, 14381, 15359, 16005, 16191, Kullman & Raitviir 61197, 61252, 61255, Raitviir 42258, 42292, 42307, 42550, 42521, 42601, 42750, Remm 44362. UKRANIA: BPI-V.P. et L.J. Savicz et Z.J. Bjeljajeva s.n., 15-VII-1924; H-Karsten s.n., ad Salic., Rossia, Kola, P. A. Karsten, 27.VII.1861, det. W. Nylander (=CUP 52631), syntype (lectoparatype, designated here) specimen of *Peziza aeruginascens* Nylander.

VENEZUELA: NY-Dumont-VE 76 (= CUP-VZ 4527), 150 (= CUP-VZ 4519), 157 (= CUP-VZ 4531), 406 (= CUP-VZ 4530), Morillo 1520, Wurdack 34156.

LOCALITY UNKNOWN: L-Persoon, L-910,261-154, (locality, date and collector unknown) ut *Peziza aeruginosa* (= CUP 51759).

*Notes:* This species is distinguished by its small sized fusoid spores  $5-7 (-10) \times 1.0-1.5 (-2.4) \mu\text{m}$ , and by its tomentum hyphae which are smooth and usually coiled. I have examined several specimens which on casual examination seem to lack tomentum hyphae. Careful examination shows that tomentum hyphae typical of this species are present, but not as numerous as is the usual case. This species often produces several apothecia from the same fundament, a feature never found in *Chlorociboria aeruginosa*, with which it is often confused.

I have examined the specimen from Japan (CUP-JA 446) which Korf (1958: fig. 9) illustrated and which has ascospores  $6-10 \times 1.5-2 \mu\text{m}$  and a mean size of  $8 \times 1.5 \mu\text{m}$ . While these ascospores are clearly within the range exhibited by *C. aeruginascens*, the mean size is somewhat larger than the  $6 \times 1.5 \mu\text{m}$  exhibited by other collections I have observed.

This specimen is in all other respects *C. aeruginascens*, and until more information concerning the role of biological and environmental factors are at hand in regard to this species, I choose not to designate it a distinct taxon.

Schweinitz's species *Cantharellus viridis* Schw. [= *Chlorosplenium viride* (Schw.) Morgan] could provide an older epithet for *C. aeruginascens* if the type or an authentic specimen could be located (cfr. the discussion in Part I of this paper, MYCOTAXON 1(2): 103. 1974).

3. CHLOROCIBORIA AERUGINASCENS (Nyl.) Kan. ex Ram., Korf & Bat. subsp. *brasiliensis* (Berk. & Cooke) Dixon, *comb. et stat. nov.*  
 = *Chlorosplenium brasiliense* Berk. & Cooke, J. Linn. Soc., Bot. 15: 363. 1876. (!!)  
 = *Chlorosplenium puiggarii* Speg., Anales Soc. Ci. Argent. 12: 89. 1881. (!!)  
 = ? *Chlorosplenium microspermum* Henn., Hedwigia 41: 26. 1902.

(Fig. 25)

In all respects similar to *Chlorociboria aeruginascens* subsp. *aeruginascens* except asci (35-) 41-49 × 3-4 μm (mean of collections 43.5 × 3.5 μm) and ascospores 3.0-5.5 (-6) × 1-1.5 μm (mean of collections 4.9 × 1.3 μm).

*Habitat*: on decayed wood.

*Range and Seasons of Fructification*: collected in Brazil, Jamaica, and Venezuela; Autumn and Winter.

*Name*: Brasil + -ensis; referring to the type locality.

*Type Specimen*: (substrate unknown), R. Tapajos, Brazil, Trail No. 29, (date unknown), K (= CUP 52720)

*Illustrations*: none.

*Exsiccati*: Rick, Fungi Austro-Americani No. 6 (ut *Chlorosplenium aeruginascens*) BPI.

*Specimens Examined*: BRASIL: (substrate unknown), R. Tapajos, Brazil, Trail No. 29, (date unknown), K (= CUP 52720), holotype of *Chlorosplenium brasiliense*; BPI-Noak s.n., 12. 1896 [= CUP-D 6834 (76-20)], Rick s.n., 1924, Rick 107; FH-Rick s.n. (date unknown); LPS 24436, (substrate unknown), Apiaty, Brazil, J. Puiggari No. 1490, 1556, V/1881, holotype specimen of *Chlorosplenium puiggarii*; isotypes of same, BA (= CUP 51749), BPI (= CUP 51714).

JAMAICA: K-Welden 420 (= BPI-Welden 420).

VENEZUELA: K-Dennis 1195, 1307A.

*Notes*: This subspecies has been recognized at least

twice in the literature at the specific rank and possibly a third time (by Hennings as *Chlorosplenium microspermum*). I have examined several specimens of this subspecies and feel that while they exhibit consistently smaller asci and ascospores, in all other respects they have the same gross and microanatomical features as does *C. aeruginascens* subsp. *aeruginascens*.

#### 4. *Chlorociboria argentinensis* Dixon, *spec. nov.*

(Figs. 22-23, 26)

Apothecia superficialia, solitaria vel gregaria, saepe pluribus ab entis fundamento ("massa stromatica") obscure pigmentifero vel irregulariter formato. Discus usque ad 4 mm diametro, cupulatus in speciminibus juvenibus, planescens in speciminibus magis maturis, dilutae-aeruginosae ubi dulces, atro-aeruginosescens ubi aridae et non recepidum diluta coloratio qui humecto in aquam. Margines disci incurvus ubi aridae. Receptaculum glabrum, papulosum (pustulae atro-aeruginosae), portionis rugulosae imprimis ubi aridae. Stipes centralis vel leviter excentricus, usque ad 0.5-1.5 x 0.5-1 mm, concolor cum receptaculo, valde papulosus, ubi fractus aeruginosus cortex et albida medulla constitutum. Hymenium (70-) 75-90 (-95)  $\mu\text{m}$  altum, hyalinum vel aeruginosum frequenter cum portionis plurae obscure pigmentiferae. Asci octospori, cylindraneo-clavati, basaliter longe angustati, (61-) 70-82 (-95) x (3.5-) 4.0-5.0 (-5.5)  $\mu\text{m}$  (modorum collectionis 79.0 x 4.5  $\mu\text{m}$ ), ad apicem inoperculati, poro valde jodi ope azurescente, tunica in apice 1.0-1.5  $\mu\text{m}$  crassa, secus latera 0.25-0.5  $\mu\text{m}$  crassa. Ascosporae irregulariter biseriatae, unicellularis (aliquando cum uno submedio septo), fusioideo-ellipticae, hyalinae vel cum viride quod intus continetur, biguttulatae, tunica laevis, (7-) 9.0-10.2 (-11) x 1.7-2.0  $\mu\text{m}$  (modorum collectionis 9.6 x 1.9  $\mu\text{m}$ ). Paraphyses septatae, filiformes, hyalinae, ramificans prope basem, (1.0-) 1.5 (-2.0)  $\mu\text{m}$  diametro. Subhymenium 10-30 (-40)  $\mu\text{m}$  crassum, ex textura intricata, septatae, gelatinosa, hyalina vel atro-aeruginosa formatum, hyphis 1-3  $\mu\text{m}$  diametro. Excipulum medullare ex textura intricata crasse tunicata laxa vel stricta formatum, quod intus continetur diluta vel atro-aeruginosa, sympodialiter ramosis, hyphis 2.5-5  $\mu\text{m}$  diametro. Excipulum ectale 45-90  $\mu\text{m}$  crassum, ex textura intricata, gelatinosa, atro-aeruginosa formatum, in speciminibus perfecte maturis ex textura angularis vel textura epidermoidea formatum, non hyphis tomenti formati loco ad punctum secus ectale conicus tumulus ex textura angulari vel globulosa obscure pigmentifera et granulata fere sub angulo 90° ab superficie apotheciorum abeuntes edente. Habitat in ligno carioso, Tucumania, America Meridionali.

*Apothecia*: superficial, solitary to gregarious, frequently with several apothecia arising from a darkly pigmented and irregularly shaped fundament or "stromatic mass," which in section has a medulla of hyaline to light-green textura intricata and a cortex of tightly compacted and darkly aeruginous textura intricata, centrally stipitate to slightly excentrically stipitate.



*Disc:* < 4 mm in diam, cupulate in young specimens, becoming plane in more mature specimens, pale blue-green (Malchite Green to Deep Glaucus Green) when fresh (according to Gamundí, 1962), becoming aeruginous-black (Dusky Dull Green to Black) upon drying, and not recovering the lighter coloration when moistened with water, margins of disc enrolling to the point of touching when dry.

*Receptacle:* glabrous, aeruginous when fresh, drying to a darker aeruginous (Dusky Bluish Green), lower portion furrowed and rugose especially upon drying, with dark aeruginous pustules.

*Stipe:* 0.5-1.5 × 0.5-1.0 mm, concolorous with the receptacle, heavily pustulate, on breaking showing an outer aeruginous cortex with a whitish medulla.

*Hymenium:* (70-) 75-90 (-95)  $\mu\text{m}$  high, hyaline to aeruginous, often with portions of the hymenium being more darkly pigmented.

*Asci:* cylindrical-clavate, with a long tapering stalk, (61-) 70-82 (-95) × (3.5-) 4.0-5.0 (-5.5)  $\mu\text{m}$ , (mean of collections 79.0 × 4.5  $\mu\text{m}$ ), strongly J+, 8-spored, rounded to subconic at the apex, wall at the apex 1.0-1.5  $\mu\text{m}$  thick, 0.25-0.5  $\mu\text{m}$  thick along the sides.

*Ascospores:* irregularly biseriate, unicellular (an occasional spore sub-median 1-septate), fusiform to elliptic-fusiform, hyaline or with light green contents, with bipolar guttules, smooth-walled, (7-) 9.0-10.2 (-11) × 1.7-2.0  $\mu\text{m}$  (mean of collections 9.6 × 1.9  $\mu\text{m}$ ).

*Paraphyses:* filiform, blunt at the apex, hyaline, septate, branching near the base, (1.0-) 1.5 (-2.0)  $\mu\text{m}$  in diam, scarcely extending beyond the asci.

*Subhymenium:* 10-30 (-40)  $\mu\text{m}$  thick, of gelatinized hyaline to dark aeruginous *textura intricata*, hyphae 1-3  $\mu\text{m}$  in diam.

*Medullary Excipulum:* of gelatinized, thick-walled, loose to tightly compacted *textura intricata*, contents light to dark aeruginous, hyphae sympodially branched, 2.5-5  $\mu\text{m}$  in diam.

*Ectal Excipulum:* 45-90  $\mu\text{m}$  thick, of dark aeruginous hyphae forming a layer of gelatinized *textura intricata* which in fully mature specimens becomes *textura angularis* to *textura epidermoidea*, no tomentum hyphae present, but at points conical mounds of heavily pigmented and granulated *textura angularis* to *textura globulosa* project almost perpendicularly from the flanks of the apothecia.

*Habitat:* on decorticated and decayed wood; collected on *Nothofagus dombeyi* and *Nothofagus* sp., and unidentified wood.

*Range and Seasons of Fructification:* collected only in Argentina; Spring, Summer and Autumn.

*Name:* Argentina + -ensis; referring to the type locality.

*Type Specimen:* (substrate unknown), ARG., R. Negro, P. N. N. Huapí, L. Frías, camino a Paso de las Nubes, C. Pujals - I. Gamundí, 24/IV/1958, BA (= CUP 52726).

*Illustrations:* Gamundí, Darwiniana 12: Pl. 5, figs. 8-13. 1962 (ut *Chlorosplenium aeruginum*).

*Exsiccati:* none.

*Specimens Examined:* ARGENTINA: BA-Dicke s.n., 24/XI/1966; BA-20042, 20359, 20400, 20620 (= R.P.K. 2896), 20929, 21090, 21099, 21113, 21152, 21179, 21201, 21223, 21265, 21354, 21375, 21396, 21400, 21585, 21636, Gamundí s.n., 31/III/1963.

*Notes:* This species is distinguished from other species of *Chlorociboria* by its dark aeruginous hymenium which becomes blackish aeruginous on drying and does not recover its lighter coloration even when rehydrated in water, its fusoid spores which are  $9.0-10.2 \times 1.7-2.0 \mu\text{m}$  and by its ectal excipulum which forms conical mounds of hyphae which are heavily pigmented and granulated and project almost perpendicularly from the flanks of the apothecia.

Gamundí (1962) has an excellent description of this species (as *Chlorosplenium aeruginum*) and reports the presence of "pelos himeniales." In her discussion and illustration of these hymenial hairs, she indicates they are very similar to the type of tomentum hyphae arising from the ectal excipulum of *Chlorociboria aeruginosa*. I have examined these same specimens but have been unable to locate any such structures in either squashed or sectioned material.

5. *Chlorociboria omnivirens* (Berk.) Dixon, *comb. nov.*

≡ *Peziza omnivirens* Berk., in J. D. Hooker's Bot. Ant. Voy. H. M. Disc. Erebus & Terror, II: Flora Tasmaniae 2: 275. 1860. (!!)

≡ *Chlorosplenium omnivirens* (Berk.) Cooke, in Mueller's Fragmenta Phytog. Austr. 11 (Suppl. 6): 100. 1880.

(Figs. 21, 29)

*Apothecia:* superficial, solitary to gregarious, never with several apothecia arising from the same fundament or "stromatic mass," centrally to slightly excentrically substipitate to stipitate, gymnocarpic in development.

*Disc:* < 4 mm in diam, cupulate to convex-plane, color varying from orange-yellow (Capucine Yellow) in younger specimens, becoming greenish-black (Dusky Dull Green to Black) in older specimens, edges of the disc not enrolling on drying.

*Receptacle:* glabrous, pustulate, aeruginous to dark aeruginous (Sorrento Green to Dark Viridian Green) when rehydrated, becoming darker aeruginous green to black upon drying, often vertically ribbed or rugose, especially upon drying.

*Stipe:* 0.5-1.5 × 0.5-1.0 mm, concolorous with the receptacle, pustulate, often more pustulate than the receptacle, on breaking showing an outer aeruginous cortex and a whitish medulla.

*Hymenium:* (85-) 90-120 (-160) μm in height, hyaline to dark aeruginous, often with portions of the hymenium becoming more darkly pigmented.

*Asci:* cylindric-clavate, with a long tapering stalk, (65-) 76-90 (-95) × (6.5-) 7-8.5 (-9.0) μm (mean of collections 76.5 × 7.0 μm), strongly J+, 8-spored, wall at apex 2-3 μm thick, 0.5-1.0 μm thick along the sides of the ascus, arising from repeating croziers.

*Ascospores:* irregularly biseriate, unicellular to submedian 1-septate, fusiform-elliptic, hyaline or with light green contents, prominently biguttulate and/or with several smaller guttules, (11-) 14-18 (-20) × 3-4 μm (mean of collections 16 × 3.5 μm), spores frequently germinating in the ascus by unipolar or bipolar germ tubes, with globose to subglobose microconidia 1.0-2.5 μm in diam frequently being produced at the ends of the germ tube and floating free in the mounting media.

*Paraphyses:* filiform, blunt at the apex, hyaline, septate, branching near the base, 1.5-2.0 μm in diam, scarcely extending beyond the asci.

*Subhymenium:* 10-25 (-35) μm thick, of hyaline to aeruginous *textura intricata*, hyphae 1.5-3 μm in diam.

*Medullary Excipulum:* of gelatinized, thin-walled, loose to tightly compacted *textura intricata* (in the type specimen the hyphae are more highly gelatinized than in the Japanese material), hyphae sympodially branched, (2-) 3-4 (-5) μm in diam.

*Ectal Excipulum:* 45-60 μm thick, of gelatinized, heavily pigmented *textura intricata* to *textura angularis*, no tomentum hyphae present, but at points along the flanks conical mounds of heavily pigmented and granulated *textura angularis* to *textura globulosa* project almost perpendicularly.

*Habitat:* decayed and decorticated wood; collected on

*Thuja standishii* and unidentified wood.

*Range and Season of Fructification:* Japan and Tasmania; Autumn.

*Name:* from Latin, "omnino," adv., entirely, + "virens," green; referring to the coloration of the apothecia.

*Type Locality:* Tasmania.

*Type Specimen:* (substrate unknown), Tasmania, Archer s.n., (date unknown), K-Berkeley (= CUP 51757).

*Illustrations:* Korf, Sci. Rep. Yokohama Natl. Univ. Sect. 2, Biol. Sci. 7: 25, fig. 6 (ut Tax. sp. I) et 27, figs. 11-12 (ut Tax. spp. IV et V)!

*Exsiccati:* none.

*Specimens Examined:* JAPAN - HONSHU: CUP-JA 31, 52, 1603. KYUSHU: CUP-JA 347. YAKU ISLAND: CUP-JA 2079.

TASMANIA: K-Berkeley Archer s.n., holotype of *Peziza omnivirens* (= CUP 51757).

*Notes:* This species is redescribed here after 115 years. It is distinguished from *C. aeruginosa*, its closest relative, by its larger asci and ascospores and its conical mounds of hyphae which are heavily pigmented and granulated and project nearly perpendicularly from the flanks of the apothecium. It tends to be somewhat more substipitate than stipitate, but I have observed specimens which are definitely stipitate.

#### THE PHIALOCONIDIAL STATES OF CHLOROCIBORIA

Tulasne and Tulasne (1865) were the first workers to recognize the connection of *Dothiorina tulasnei* (as *Sphaeria moriformis* Tode var. [unnamed]) to a perfect state species of *Chlorociboria*. They discussed and illustrated very accurately the imperfect state and gave detailed measurements of ascospores and asci which agree with *Chlorociboria aeruginascens* subsp. *aeruginascens*. Saccardo (1884) transferred Tulasne and Tulasne's unnamed variety to the genus *Dothiorella* as *D. tulasnei* and stated, as had Tulasne and Tulasne, that it was a spermagonial state.

Von Höhnel (1911) erected a new genus, *Dothiorina*, to accommodate *Dothiorella tulasnei*, stating, "*Dothiorella* Sacc. 1880, ist im heutigen Umfange eine Mischgattung" and "Die Gattung wurde in Michelia, 1880, II Bd., p. 5, aufgestellt und hier als Typus *D. pyrenophora* (Berk.) Sacc. angeführt." Von Höhnel also goes on to say in regard to *D. pyrenophora* that, "Diese Art wird aber in Syll. Fung., III, p. 380, als *Botryodiplodia* bezeichnet, da die Sporen nach Cooke braun und

zweizellig sind."

I have seen several specimens of *Dothiorina tulasnei* collected separately and collections of this species collected with both *C. aeruginascens* subsp. *aeruginascens* and *C. a.* subsp. *brasiliensis*, but never have I observed the two fungi on the same substrate in such close proximity to each other that I could be convinced that they grew from the same mycelia and were in fact different states of the same fungus.

I am extremely indebted to Dr. André Bellemère, Laboratoires de Sciences Naturelles, St.-Cloud, who was kind enough to send me a microphotograph of a specimen collected on "bois de l'Hautil près de Triel-sur-Seine, non loin de Paris, où il a été trouvé le 17 avril 1960 (N° 276)," which clearly shows that there are mycelial connections between these two states.

Berthet (1964b) described the cultural characteristics he noted in cultures derived from germinated ascospores. It is not possible with any certainty to deduce whether the ascospores were from an apothecium of *C. aeruginascens* or *C. aeruginosa* from his description. His illustrations and discussion of the sporogenous hyphae he obtained in culture (Berthet, 1964a) and the spores they produce agree with observations I have made on phialides produced in the pycnidial chambers of *Dothiorina tulasnei*. I have been successful in obtaining cultures of *C. aeruginascens* from germinated ascospores which agree with Berthet's observations in all respects except unlike his cultures, my isolates do not produce phialoconidia at either 4° C or 20-25° C. Brefeld (1891) also illustrated mycelia and spores which he obtained in culture, but lack of sterile and pure culture techniques during the late eighteen hundreds and the poor quality of Brefeld's illustrations makes it uncertain if he was dealing with a pure culture. Berthet (1964a) observed that the phialoconidia produced in his cultures germinated easily. This fact would indicate that *Dothiorina tulasnei* is an imperfect state and not a spermatial state as indicated by Tulasne and Tulasne (1865) and Saccardo (1884). Today *D. tulasnei* would be placed in the Sphaeropsidales, Zythiaceae (= Nectrioidaceae).

The only other species that has been added to *Dothiorina* is *Psilonia discoidea* Berk. & Broome. Von Höhnel (1925) evidently made this transfer on the basis of Rabenhorst, Fungi Europaei Exs. No. 1075. I have examined this collection and find that it is dissimilar to *D. tulasnei*. The stroma is very effuse, more carbonaceous, black with yellow pycnidia, and produces dark brown-walled, frequently septate hyphae which ramify throughout the substrate. The spores produced

are also phialoconidia,  $3-4 \times 2 \mu\text{m}$ , but the phialophores are not branched and do not produce flask-shaped phialides. Von Höhnel felt that *D. discoidea* was the imperfect state of a "*Helotium*, vielleicht *Helotium ferrugineum* (Schum.)". Hence, while I am not certain to which genus *D. discoidea* belongs, I believe it is not congeneric with *D. tulasnei*, and that von Höhnel was over-influenced by the parallel nature of the hyphae between the pycnidial chambers in making *D. discoidea* a member of his genus *Dothiorina*.

1. DOTHIORINA TULASNEI (Sacc.) v. Höhn., Akad. Wiss. Wien Sitzungsber., Math.-Naturwiss. Kl., Abt. 1, 120: 86. 1911.

≡ [*Sphaeria moriformis* Tode var. (unnamed), Tul. & Tul., Sel. Fung. Carp. 3: 187. 1865.]

≡ *Dothiorella tulasnei* Sacc., Syll. Fung. 3: 39. 1884.

(Figs. 15-18, 27)

*Fructification*: a subspherical to moriform stroma  $< 2$  mm in diam, often with several stromata coalescing, superficial to erumpent through the bark, when rehydrated dark aeruginous and sub-fleshy, drying blackish aeruginous to almost black, and on drying becoming somewhat more carbonaceous, producing numerous oval to pyriform pycnidial chambers,  $30-70 \mu\text{m}$  wide at their widest point, which are lined with numerous, short, cylindrical, inflated, frequently flask-shaped phialides  $5-11 \times 1.5-2.5 \mu\text{m}$ , produced singly or in groups of two, three or four on branching phialophores. Phialophores  $1.5-3 \mu\text{m}$  in diam, with hyaline to light green contents and heavily granulated (with green granules) at the point of origin in the locule. Phialoconidia  $3-5 \times 1 (-1.5) \mu\text{m}$ , baciliform to oblong-elliptic with light green contents, occasionally hyaline. Stroma in section of strongly gelatinized hyphae forming a *textura intricata*, with green contents, becoming more parallel between pycnidial chambers, and brownish to black-walled at the surface of the stroma,  $2-3.5 \mu\text{m}$  in diam.

*Habitat*: on decayed wood, staining the wood aeruginous. Occasionally found in association with its perfect states, *Chlorociboria aeruginascens* subsp. *aeruginascens* and *C. a.* subsp. *brasiliensis*.

*Range and Seasons of Fructification*: North and South America and Europe; collected in Summer and Autumn, apparently very rare.

*Name*: Latinized name of the Tulasne brothers.

*Illustrations:* Tulasne and Tulasne, Sel. Fung. Carp. 3: pl. 20, figs. 17-18. 1865 (ut *Sphaeria moriformis* var.); Bellemère, Bull. Soc. Mycol. France 83: 584, fig. 68 B, I, J. 1967 (ut *Chlorociboria aeruginosa*).

*Exsiccati:* Ellis and Everhart, North American Fungi No. 2047 (ut *Chlorosplenium aeruginosum*, Spermogonia) PAD-Saccardo (= CUP 51752), CUP-A; Fuckel, Fungi Rhenani No. 2479 (ut *Helotium aeruginosum*, fungus spermogonium) FH (= CUP 52697); Herbar Barbey-Boissier No. 1240 (ut *Chlorosplenium aeruginosum*, Fungus conidiophorus) BPI (= CUP 51855).

*Specimens Examined:* U.S.A. - CONNECTICUT: on alder, West Haven, R. Thaxter No. 194 (ut *Chlorosplenium aeruginosum*, conidial stage) FH (= CUP 52701).

AUSTRIA: Auf Holz, Sonntagsberg, Strasse s.n., Dec. 1910, FH-Höhnel No. 3329.

VENEZUELA: on green stained wood, cloud forest below (E. of) Hotel Humboldt, El Airla, Dto. Federal, Venezuela, R.W.G. Dennis No. 1195, 5.7.58 (ut *Chlorociboria* and imperfect stage) K.

#### EXCLUDED SPECIES AND SYNONYMS

1. CHLOROCIBORIA AERUGINELLA (Karst.) Dennis ex Ram., Korf & Bat.  $\equiv$  *Dasyscyphus aeruginellus* (Karst.) Korf & Dixon in Dixon; for complete synonymy see MYCOTAXON 1(2): 85. 1974.
2. [CHLOROCIBORIA AERUGINOSA var. AERUGINASCENS (Nyl.) Bellemère]  $\equiv$  *Chlorociboria aeruginascens* subsp. *aeruginascens*, q.v.
3. CHLOROCIBORIA BULGARIOIDES (Rabenh.) Ram., Korf & Bat.  $\equiv$  *Rutstroemia bulgarioides* (Rabenh.) Karst.; for complete synonymy see MYCOTAXON 1(2): 88-90. 1974.
4. CHLOROCIBORIA MUSAE Dennis, Kew Bull. 13: 460. 1958.

*Notes:* Examination of the type specimen of this species shows it to have an ectal excipulum of thin-walled, nearly hyaline, globose cells and ascospores  $5-6 \times 1.5-2 \mu\text{m}$  as reported by Dennis (1958). I feel this species is surely a member of the genus *Ciboriopsis*. Since many species of *Ciboriopsis* seem to grade into *Ciboria*, I hesitate to make a new combination until monographic work has been done on the genus *Ciboriopsis*.

*Specimens Examined*: BOLIVIA: on banana, Rio Yariza, Prov. Nor-Yungas, Dpto. La Paz, R. Singer No. B-1377, 23. 2. 1956, K (= CUP 51754), holotype specimen.

5. CHLOROCIBORIA RUGIPES (Peck) Ram. & Korf in Ram., Korf & Bat. = *Chlorencoelia torta* (Schw.) Dixon, q.v.
6. CHLOROCIBORIA STROBILINA (Alb. & Schw. per Fr.) Seaver = *Rutstroemia bulgarioides* (Rabenh.) Karst.; for complete synonymy see MYCOTAXON 1(2): 88-90. 1974.
7. CHLOROCIBORIA VERSIFORMIS (Pers. per Pers. : Fr.) Seaver ex Ram., Korf & Bat. ≡ *Chlorencoelia versiformis* (Pers. per Pers. : Fr.) Dixon, q.v.
8. CHLOROCIBORIA VERSIFORMIS var. OLIVACEA (Rodway) Dennis = *Chlorencoelia torta* (Schw.) Dixon, q.v.

#### THE GENUS CHLORENCOELIA DIXON

For two species that have been treated both in *Chlorosplenium* and in *Chlorociboria*, I now propose a new genus. Seaver (1951) apparently was the first person to recognize the affinities of these species when he transferred *Peziza versiformis* to the genus *Midotis*. (His concept of *P. versiformis* included both species of the genus.) During the course of this study I have observed several specimens of *Chlorencoelia torta* in which the cells of the ectal excipulum (of brown-walled *textura angularis* to *textura globulosa*) are loose and encoelioid. *Chlorencoelia* should be considered as a member of the Leotiaceae (= Helotiaceae), subfamily Encoelioidae. The members of *Cordierites* show similarities with *Chlorencoelia* both in gross morphological characters and more especially in their microanatomical features. It should also be noted that the species of *Chlorencoelia* show affinities with *Encoelia* (Fr.) Karst. and to some lesser extent with *Velutarina* Korf.



GENERIC DIAGNOSIS  
OF THE GENUS *CHLORENCOELIA* DIXON  
(HELOTIALES, LEOTIACEAE)

*CHLORENCOELIA* Dixon, *gen. nov.*

**NAME:** from Greek, "Chloris," the green one, + the generic name *Encoelia*; referring to the color of the apothecia plus the generic name of a related genus.

**HOLOTYPE:** *Peziza versiformis* Pers. per Pers., Myc. Eur. 1: 243. 1822, : Fr., Syst. Mycol. 2(1): 130. 1822.

Apothecia superficialia, solitaria vel gregaria vel in fasciculo caespitose, stipitato conferta. Discus non profunde cupulatus vel infundibuliformis, convexoexpansus vel repandus in speciminibus magis maturis. Asci octospori, cylindraco-clavati, basaliter longe angustati, ad apicem inoperculati, poro valde jodi ope azurescente, apicibus rotundatis vel subconicus. Ascospores hyalinae, 0-1-septatae. Paraphyses septatae, filiformes, ad apices aliquando subclavatae, non ramificantes vel ramificantes prope basem. Subhymenium ex textura intricata hyaline et/vel dilute ferruginea formatum. Excipulum medullare ex textura intricata parietibus hyalina vel rufa, laxa vel stricta formatum, hyphis laevibus et/vel granulis rufis asperatis, sympodialiter ramosis. Excipulum ectale formatum ex textura angulari vel textura globulosa tenui vel crassa, hyalina vel parietibus rufa, et hyphas tomenti filamentosas vel subglobosas vel clare clavatus fere sub angulo 90° ab superficie apotheciorum abeuntes edente. Habitat in ligno carioso.

*Apothecia:* superficial, solitary to gregarious, occasionally in caespitose clusters from a common stipe.

*Disc:* shallow cupulate to infundibuliform, becoming convex-expanded to repand in mature specimens.

*Asci:* 8-spored, cylindric-clavate with long tapering stalks, apex inoperculate, strongly J+, apex rounded to subconic.

*Ascospores:* ellipsoid to cylindric-oblong to allantoid, unicellular to 1-septate, hyaline.

*Paraphyses:* filiform, septate, occasionally subclavate at the apex, unbranched or branching near the base.

*Subhymenium:* of hyaline and/or light brown textura intricata.

*Medullary Excipulum:* of hyaline to dark brown-walled, loose to tightly compacted textura intricata, hyphae smooth and/or roughened with dark brown granulations, sympodially branched.

*Ectal Excipulum:* of thin to thick walled, hyaline to dark-walled textura angularis to textura globulosa which give rise to filamentous or subglobose to definitely clavate tomentum hyphae oriented nearly perpendicularly to the flanks of the apothecia, tomentum hyphae frequently containing green pigmentation and/or green granules.

*Habitat*: on decorticated and decayed wood.

*Notes*: This genus is distinguished from *Cordierites* Mont., its closest relative, by its ascus apices which stain strongly blue in iodine, its apothecia being yellow-orange to olivaceous-green in color, its lack of an ionomidotic reaction in KOH, and its apothecia which do not branch and become irregularly lobed or lacerated as in *Cordierites*.

KEY TO THE SPECIES OF CHLORENCOELIA

1. Ascospores cylindrical to allantoid, (10-) 11-15 (-16) × 2.5-3.5 μm; medullary excipulum of hyaline to light brown-walled hyphae; ectal excipulum producing filamentous to slightly clavate tomentum hyphae..... 1. *C. versiformis*
- 1'. Ascospores irregularly ellipsoid, (5.6-) 9-11 (-12) × 2-4 μm; medullary excipulum of dark-walled hyphae; ectal excipulum of stalked, subglobose to definitely clavate tomentum hyphae..... 2. *C. torta*

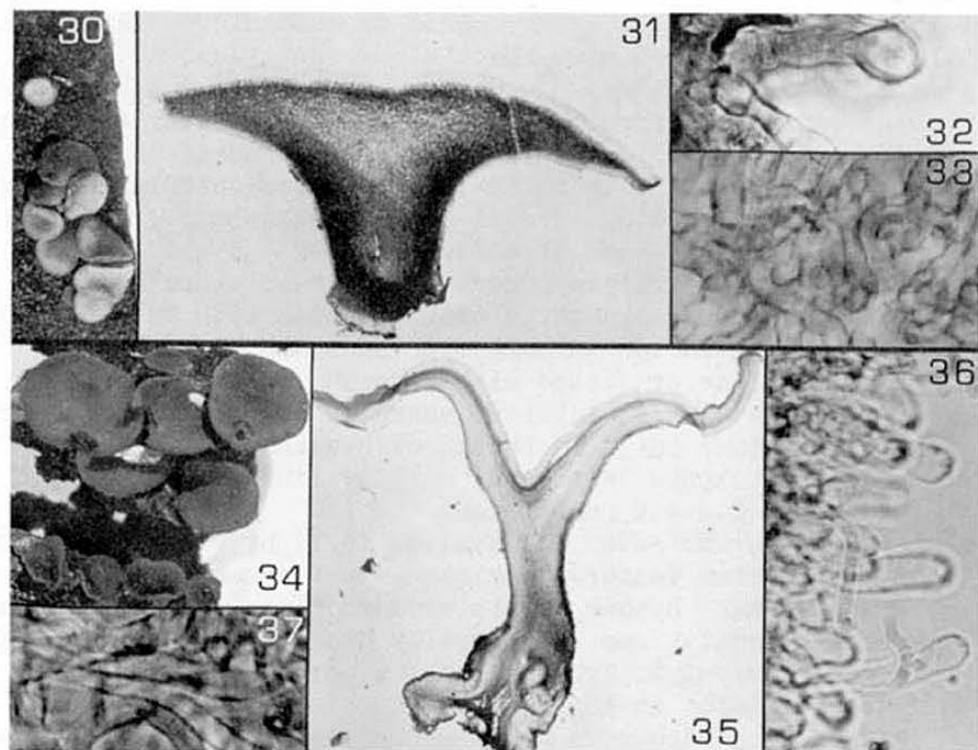
1. *Chloroencoelia versiformis* (Pers. per Pers. : Fr.) Dixon, *comb. nov.*  
 ≡ [*Peziza versiformis* Pers., Ic. Descr. Fung. p. 25, 1800.] (!!)  
 ≡ *Peziza versiformis* Pers. per Pers., Myc. Eur. 1: 243. 1822, : Fr., Syst. Mycol. 2(1): 130. 1822.  
 ≡ *Helotium versiforme* (Pers. per Pers. : Fr.) Fr., Summa Veg. Scand. p. 356. 1849.  
 ≡ *Chlorosplenium versiforme* (Pers. per Pers. : Fr.) de Not., Comment. Soc. Critt. Ital. 1: 376. 1864.  
 ≡ *Coryne versiformis* (Pers. per Pers. : Fr.) Schroet., Krypt.-Fl. Schles. 3<sup>2</sup>(Lief. 1): 99. 1893.  
 ≡ [*Chlorociboria versiformis* (Pers. per Pers. : Fr.) Seaver, Mycologia 28: 393. 1936 (genus not validly published).]  
 ≡ *Midotis versiformis* (Pers. per Pers. : Fr.) Seaver, N. Amer. Cup Fungi (Inopercul.), p. 94. 1951.  
 ≡ *Chlorociboria versiformis* (Pers. per Pers. : Fr.) Seaver ex Ram., Korf & Bat., Mycologia 49: 860. 1958.  
 = *Craterellus caespitosus* Peck, Annual Rep. New York State Mus. 25: 82. 1873. (!!)  
 = [*Coryne sarcoides* (Gray) Tul. (ut "(Jacq.) Tul.") var. *viridescens* Rehm in Voss, Verh. Zool.-bot. Ges., Wien 37: 224. 1887 (*nomen nudum*).]

= *Coryne sarcoides* (Gray) Tul. [ut "(Jacq.)"] var. *viridescens* Rehm in Rabenhorst's Krypt.Fl. II 1<sup>3</sup>(Lief. 35): 492. 1891. (!!)

(Figs. 34-37, 39)

*Apothecia*: superficial, solitary to gregarious, occasionally in caespitose clusters from a common stipe.

*Disc*: shallow cupulate to infundibuliform, becoming convex-expanded to repand in mature specimens, occasionally revolute, olive-yellow to olive-green in fresh specimens (Mars



FIGS. 30-36. Photographs of *Chlorencoelia* spp. FIGS. 30-33. *C. torta*. 30. Freshly collected apothecia, CUP 51796, approx.  $\times 3.5$ . 31. Complete section of an apothecium, CUP 51730, approx.  $\times 14$ . 32. A single tomentum hypha, CUP 51771,  $\times 1400$ . 33. Medullary hyphae, CUP 51671,  $\times 1600$ . FIGS. 34-37. *C. versiformis*. 34. Freshly collected apothecia, CUP 51710, approx.  $\times 1.5$ . 35. Complete section of an apothecium, CUP 52734, approx.  $\times 8$ . 36. Tomentum hyphae, CUP-D 4523 (77-47),  $\times 2100$ . 37. Medullary hyphae, CUP 51710,  $\times 1900$ .

Yellow to Olive Citrine) becoming chestnut brown to black (Mummy Brown to Black) upon drying, < 9 (-17) mm in diam, mostly 7-9 mm in diam.

*Receptacle*: dark olive-green to brownish-olive when fresh, drying to dark brown or greenish-black, with a pruinose greenish-yellow cast when dry, furrowed to rugose.

*Stipe*: < 7 × 0.5-1 mm, concolorous with the receptacle, glabrous, rugose especially upon drying.

*Hymenium*: (80-) 95-130 (-145) μm high, hyaline with occasional brown portions due to abundance of pigmented paraphyses.

*Asci*: cylindric-clavate with long tapering stalks, (79-) 95-130 (-150) × (4-) 5-8 μm (mean of collections 106 × 6 μm), 8-spored, strongly J+, apex rounded to subconic, wall at apex 1.5-3 μm thick, 0.5-1.0 μm thick along the sides, arising from repeating croziers.

*Ascospores*: irregularly biseriate, unicellular to submedian 1-septate, hyaline, smooth-walled, cylindric-oblong to allantoid, non-guttulate to bi-, tri-, tetra-guttulate, occasionally also including several smaller guttules, (10-) 11-15 (-16) × 2.5-3.5 μm (mean of collections 12 × 3 μm).

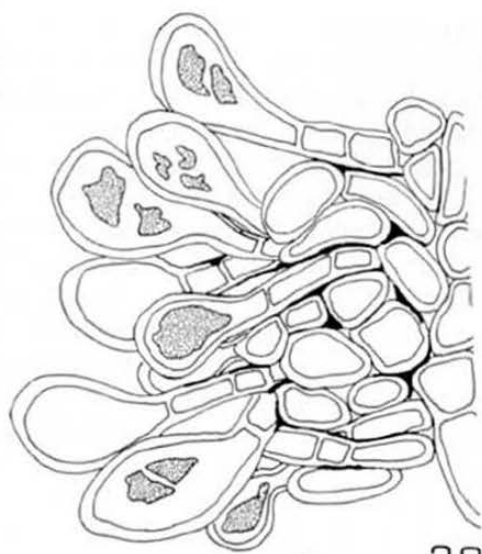
*Paraphyses*: filiform, occasionally subclavate at the apex, unbranched or branching near the base with the point of branching being so low in some specimens as to appear unbranched, hyaline or filled with numerous guttules and/or green granules, 2-3 μm in diam, scarcely longer than the asci.

*Subhymenium*: 20-35 μm thick, of hyaline and/or light brown-walled textura intricata, with hyaline or brown contents, hyphae 2.4-4.0 μm in diam.

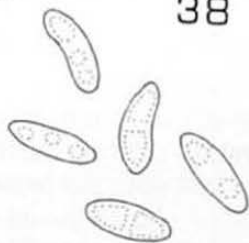
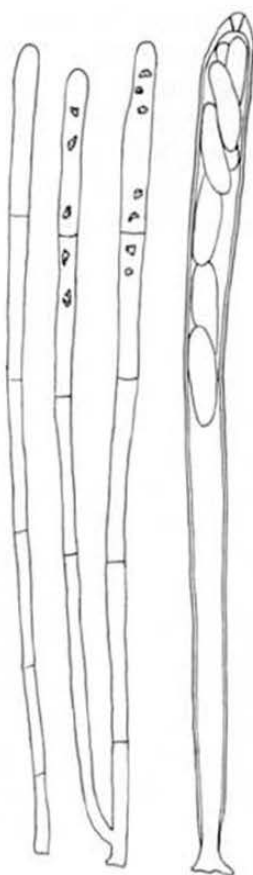
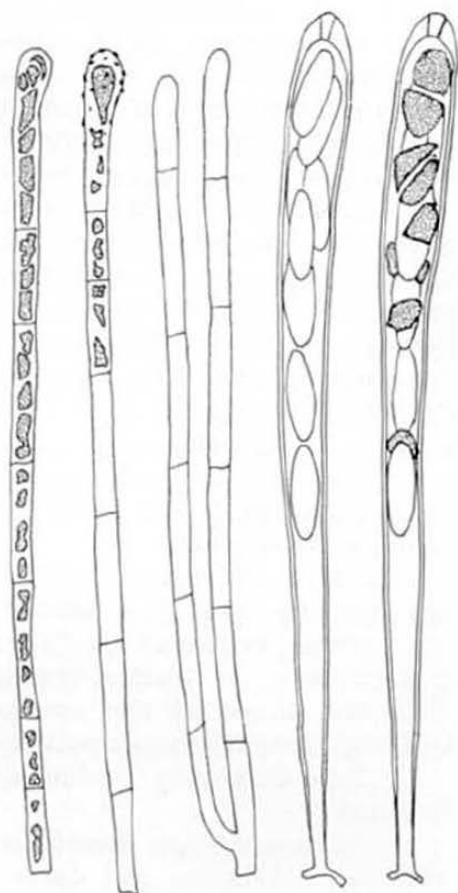
*Medullary Excipulum*: of hyaline to light-brown, loose to tightly compacted textura intricata, portions often with collapsed hyphae; hyphae smooth or more often roughened with dark brown granulations, sympodially branched, 3-5 μm in diam.

*Ectal Excipulum*: 25-100 μm thick, of hyaline to dark-walled (especially in fully mature specimens) textura intricata to textura angularis which gives rise to filamentous to slightly clavate tomentum hyphae oriented nearly perpendicularly to the flanks of the apothecium; hyphae at the base of

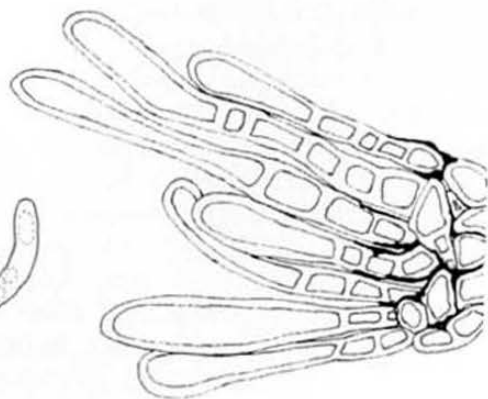
FIGS. 38-39. Camera lucida drawings of *Chlorencoelia* spp. Pigments in amorphous or granular form shown shaded, × 1000. FIG. 38. *C. torta*. Portion of ectal excipulum and tomentum hyphae, three paraphyses, two asci and five ascospores, CUP 51671. FIG. 39. *C. versiformis*. Two paraphyses, four ascospores, and portion of ectal excipulum and tomentum hyphae, CUP 51708.



38

10  $\mu\text{m}$ 

39



the tomentum hyphae often highly septate, forming cuboid cells of various sizes, tomentum hyphae 5-7  $\mu\text{m}$  in diam with hyaline walls 0.25 (-1.5)  $\mu\text{m}$  thick, in occasional specimens tomentum hyphae containing green pigment and/or granules. In KOH (2% aqueous), Aerosol, and Acid-alcohol producing a yellowish-green coloration in the mounting solution.

*Cultural Characters:* Very slow growing on agar (PDA), producing greyish-brown, humped-up colonies. No conidia produced. Agar appearing brownish-black when viewed from the underside. Hyphae 1.5-5  $\mu\text{m}$  in diam, frequently branched, highly guttulate, thin-walled with occasional hyphae with dark brown granulations, contents hyaline to light-brown. Culture on deposit with American Type Culture Collection as ATCC 24031 (= specimen CUP 51710).

*Habitat:* decayed wood of angiosperm and gymnosperm trees; collected on *Betula*, *Nothofagus*, *Quercus*, *Tsuga*, and unidentified wood.

*Range and Seasons of Fructification:* world-wide; Summer and Autumn, most frequently in Autumn.

*Name:* from Latin, "verso," to turn up, to turn hither and thither, + "formo," shape or form; referring to the fact that the shape of the apothecium may be spathuloid or otideoid and sometimes convoluted.

*Type Locality:* unknown (? Hercynia [Harz region, mid-Germany]).

*Presumed Type Specimen:* L-Persoon 910, 256-1329 (substrate, collector and date unknown) (= CUP 51760).

*Illustrations:* Persoon, Ic. Descr. Fung. Tab. 7, fig. 7, 1800 (ut *Peziza*)!; Berkeley, Outl. Brit. Fungol. Pl. 2, fig. 6, 1860 (ut *Helotium*, habit); Lagarde, Ann. Mycol. 4: figs. 43-45, 1906 (ut *Chlorosplenium*)!; Boudier, Ic. Mycol. Pl. 486, 1908 (ut *Chlorosplenium*)!; Seaver, Mycologia 28: 392. 1936 (ut *Chlorociboria*); Kobayasi, J. Jap. Bot. 13: 469. 1937 (ut *Chlorociboria*); Kobayasi in Asahina, Nippon Inkwasoyokubutu Dukan, p. 300, Pl. 141, figs. 1-2, 1939 (ut *Chlorociboria*); Seaver, N. Amer. Cup-Fungi (Inopercul.) Pl. 99, fig. 1, 1951 (ut *Midotis*); Dennis, Mycol. Pap. 62, p. 47, fig. 40, 1956 (ut *Chlorociboria*); Ramamurthi, Korf and Batra, Mycologia 49: 856, fig. 3, 1958 (ut *Chlorociboria*); Dennis, Brit. Cup Fung. Pl. 15, fig. G, 1960 (ut *Chlorociboria*); Dennis, Brit. Ascomycetes, Pl. 18, fig. G, 1968 (ut *Chlorosplenium*).

*Exsiccati:* Berkeley, British Fungi Exs. No. 274 (ut *Peziza*) FH (= CUP 52700); Ellis and Everhart, North American Fungi No. 988 (ut *Chlorosplenium*) [a mixed collection, packets in some herbaria are *Chlorenchocelia torta*!] CUP-D 11213 (77-61); Weese, Eumycetes Selecti Exs. No. 252 (ut *Chlorosplenium*) BPI (= CUP 51763).

*Excluded Exsiccati*: Herbar Barbey-Boissier No. 1285, issued as *Coryne versiformis* is *Rutstroemia bulgarioides*; de Thümen, Mycotheca Universalis No. 217 issued as *Helotium versiforme* is *Rutstroemia bulgarioides*.

*Specimens Examined*: U.S.A. - MICHIGAN: CUP 51708, 51709, 51777, 51778, 51797; CUP-D 10839 (77-115). MINNESOTA: CUP-D 10674 (77-114). NEW HAMPSHIRE: CUP-D 4529 (77-93). NEW YORK: CUP 51710, 51732, 51786, 51787, 51792; CUP-D 4522 (77-46), 4523 (77-47), 5984 (92-176); R.P.K. 871; NYS-Peck s.n., on old decayed log, Portville, September [? 1872], holotype of *Craterellus caespitosus*, isotypes: CUP 51721, CUP-D 6038 (77-100). NORTH CAROLINA: CUP 51772. OHIO: CUP-D 2687 (77-83), 4825 (77-98), 10720 (77-116). PENNSYLVANIA: CUP-D 3993 (77-90); PH-Schweinitz Syn. No. 900, (no substrate, no date, no collector - ? Schweinitz), Bethlehem, ut *Peziza versiformis* Pers. [= CUP-D 3993 (77-90)]. WEST VIRGINIA: CUP-D 6473 (77-104).

ARGENTINA: BA 21401.

CANADA - BRITISH COLUMBIA: BPI-Weir 2658. ONTARIO: BPI-Cain 10096 (= TRTC 10096), 30845, 32871 (= TRTC 32871); CUP-D 4532 (77-96); R.P.K. 2417 (= TRTC 30743). QUEBEC: BPI-Steenson s.n., Aug. 24-26, 1938.

DENMARK: CP-Rosenvinge s.n., 9-10-1888.

JAPAN - HOKKAIDO: CUP-JA 2636.

SWEDEN: CUP-D 29 (77-60).

UNION OF SOVIET SOCIALIST REPUBLICS - RUSSIA: TAA-Parasto 17785, Raïtviir 42566 (= R.P.K. 3380).

YUGOSLAVIA: S-Rehm, Voss s.n., (no date), auf Lindenholz, Lees in Krain, holotype of *Coryne sarcoides* var. *viridescens* (= CUP 52709).

LOCALITY UNKNOWN: UPS-Fries s.n., (collector, locality and date unknown), ut *Peziza versiformis* (= CUP 51737); L-Persoon Herb. 910, 256-1329 (= CUP 51760), presumed holotype of *P. versiformis*.

*Notes*: This species is distinguished from *C. torta* by its more filamentous tomentum hyphae, much lighter colored medullary hyphae, and larger cylindrical to allantoid ascospores. The ascocarp of this species is usually somewhat larger, 7-9 (-17) mm in diam, whereas *C. torta* is usually < 7 mm in diam. As in *C. torta* the tomentum hyphae and paraphyses are often highly pigmented and/or granulated, but normally not to the extent exhibited in that species.

2. *Chlorenchocelia torta* (Schw.) Dixon, *comb. nov.*  
 = *Peziza torta* Schw., Trans. Amer. Philos. Soc. 4: 175. 1832. (!!)
- = *Chlorosplenium subtortum* Fr., Summa Veg. Scand. p. 356 (in nota). 1849, a gratuitous renaming.
- = *Peziza subtorta* (Fr.) de Not., Comment. Soc. Critt. Ital. 1: 376. 1864.
- = *Chlorosplenium tortum* (Schw.) Sacc., Syll. Fung. 8: 320. 1889.
- = *Helotium rugipes* Peck, Annual Rep. New York State Mus. 26: 82. 1874. (!!)
- = *Lanzia rugipes* (Peck) Sacc., Syll. Fung. 8: 480. 1889.
- = *Chlorociboria rugipes* (Peck) Ram. & Korf in Ram., Korf & Bat., Mycologia 49: 859. 1958.
- = *Chlorosplenium rugipes* (Peck) Korf, Bull. Natl. Sci. Mus. 4: 391. 1959.
- = *Ciboria olivacea* Rodway, Pap. & Proc. Roy. Soc. Tasmania 1924: 105. 1925. (!!)
- = *Chlorociboria versiformis* (Pers. per Pers. : Fr.) Seaver ex Ram., Korf & Bat. var. *olivacea* (Rodway) Dennis, Kew Bull. 13: 340. 1958.
- = *Chlorosplenium rodwayi* Korf, Bull. Natl. Sci. Mus. 4: 391. 1959, non *C. olivaceum* Rick 1931 nec *C. olivaceum* Seaver 1951.

(Figs. 30-33, 38)

*Apothecia*: superficial, solitary to gregarious, occasionally in caespitose clusters from a common stipe.

*Disc*: shallow cupulate to infundibuliform, becoming convex-expanded to repand in mature specimens, olive-yellow to olive-green in fresh specimens (Mars Yellow to Olive Citrine) becoming olive to deep olive green upon drying, edges of disc enrolling upon drying, < 7 (-12) mm in diam, mostly 3-7 mm in diam.

*Receptacle*: dark olive-green to brownish olive when fresh, with a pruinose greenish-yellow cast when dry, furrowed to rugose.

*Stipe*: < 3 × 0.5-1.0 mm, concolorous with the receptacle, glabrous, rugose especially upon drying.

*Hymenium*: (85-) 95-120 (-140) μm high, hyaline with brown portions due to abundance of pigmented paraphyses.

*Asci*: cylindrical-clavate with a long tapered stalk, (69-) 90-121 (-126) × 5-7 μm (mean of collections 101 × 6 μm), 8-spored, strongly J+, apex rounded to subconic, wall at apex 1.5-3 μm thick, 0.5-1.0 μm thick along the sides of the ascus, arising from repeating croziers.



*Ascospores*: irregularly biseriolate, unicellular, hyaline, smooth-walled, irregularly ellipsoid with rounded ends, prominently biguttulate, occasionally with several smaller guttules, (5.6-) 9-11 (-12)  $\times$  2-4  $\mu\text{m}$  (mean of collections 9.6  $\times$  3.0  $\mu\text{m}$ ).

*Paraphyses*: filiform, occasionally subclavate at the apex, unbranched or branching near the base with the point of branching being so low in some specimens as to appear unbranched, hyaline or filled with numerous guttules and/or green pigmented granules, septate, 2-3  $\mu\text{m}$  in diam, scarcely longer than the asci.

*Subhymenium*: 20-35  $\mu\text{m}$  thick, of hyaline and/or light brown *textura intricata*, hyphae 2-4 (-5)  $\mu\text{m}$  in diam.

*Medullary Excipulum*: of hyaline to dark brown-walled, loose to tightly compacted *textura intricata*, portions often with collapsed hyphae, in section darker than in *C. versiformis*, hyphae smooth and/or roughened with dark brown granulations, sympodially branched, 3-6  $\mu\text{m}$  in diam with occasional hyphae ballooning out along their length to produce cells 13-20  $\times$  25-30  $\mu\text{m}$  in diam.

*Ectal Excipulum*: 35-115  $\mu\text{m}$  thick, of thin to thick-walled, hyaline to dark-walled *textura angularis* to *textura globulosa* (often remaining as *textura intricata*, especially near the margins), giving rise to stalked, sub-globose to definitely clavate tomentum hyphae oriented nearly perpendicularly to the flanks of the apothecium, tomentum hyphae 8-12  $\mu\text{m}$  in diam and frequently containing green pigments and/or green granules, occasionally with algal elements interspersed among the cells of the ectal excipulum.

*Habitat*: on decayed wood; collected on *Acer*, *Betula*, *Fagus*, *Quercus*, *Tabebuia*, coniferous and unidentified wood.

*Range and Seasons of Fruetification*: North America, Puerto Rico, Japan, New Zealand, Tasmania, Union of Soviet Socialist Republics; Summer and Autumn.

*Name*: from Latin, "tortus," twisted, crooked; referring to the shape of the apothecia.

*Type Locality*: Salem [now Winston-Salem], North Carolina, U.S.A.

*Presumed Type Specimen*: (substrate unknown), Salem, Schweinitz, (no date), PH-Schweinitz Syn. Fung. No. 876-113 (= CUP 51670); isotypes: CUP-D 3365 (77-58), 3566 (77-59); UPS-Fries s.n. (= CUP 51734).

*Illustrations*: Dennis, Kew Bull. 13: 340, fig. 22, 1958 (ut *Chlorociboria versiforme* var. *olivacea*)!; Ramamurthi, Korf and Batra, Mycologia 49: 856, fig. 4, 1958 (ut *Chlorociboria rugipes*); Korf, Sci. Rep. Yokohama Natl. Univ. Sect. 2, Biol. Sci. 7: 27, figs. 13-14, 1958 (ut Tax. sp. VI et *Chlorociboria* ? *rugipes*)!.

*Exsiccati*: Ellis and Everhart, North American Fungi No. 988 (ut *Chlorosplenium versiforme*) [a mixed collection, packets in some herbaria are *Chlorencoelia versiformis*!] CUP-A.

*Specimens Examined*: U.S.A. - ALABAMA: CUP-D 3564 (77-88). CONNECTICUT: CUP-D 3563 (77-87). GEORGIA: CUP 37277; R.P.K. 813. INDIANA: CUP 52461. IOWA: CUP-D 8052 (77-105). KENTUCKY: CUP-D 10525 (77-113). MAINE: CUP 51731, CUP-D 5271 (77-99). MASSACHUSETTS: BPI-Cain 40545 (= TRTC 40545), 40560 (= TRTC 40560); CUP-D 4530 (77-94); R.P.K. 3826. MICHIGAN: CUP 51798. NEW JERSEY: CUP 51790; CUP-D 4533 (77-87), 5981 (92-173). NEW YORK: CUP 51671, 51711, 51712, 51730, 51789, 51791, 51793, 51794, 51796, 52627; CUP-LG 12; NYS-Peck s.n., on decayed wood, East Worcester, Otsego Co., July (no year), holotype of *Helotium rugipes*, isotypes: CUP-D 5982 (92-174), R.P.K. 2620; CUP-D 5983 (92-175), (no substrate), Adirondack Mts., Dr. Peck, (no date), authentic material of *Helotium rugipes*. NORTH CAROLINA: CUP 51769, 51771; CUP-D 9469 (77-106); PH-Schweinitz Syn. Fung. No. 876-133, (substrate unknown), Salem, (no date), presumed holotype of *Peziza torta* (= CUP 51670). OHIO: BPI-Elliott 12488 (= DAOM 12488); CUP 51788; CUP-D 4531 (77-95). PENNSYLVANIA: BPI-Henry 1385, 3035; CUP-D 564 (77-84), 3565 (77-89). VIRGINIA: CUP 51781, 51782, 51784. WISCONSIN: CUP-D 10022 (77-111); R.P.K. 2792.

CANADA - ONTARIO: BPI-Groves & Biggs 9251; R.P.K. 2415. QUEBEC: BPI-Shear 4167b.

JAPAN - HONSHU: CUP-JA 178, 479. KYUSHU: CUP-JA 414.

NEW ZEALAND: R.P.K. 3243 (= Dingley 19026).

PUERTO RICO: CUP-PR 4054.

TASMANIA: HO-Rodway s.n., (no substrate), National Park, (no collector), June 1924 (= CUP 52628, = R.P.K. 2842), holotype of *Ciboria olivacea*.

UNION OF SOVIET SOCIALIST REPUBLICS - RUSSIA: TAA-Kullman & Raitviir 61253, Parmasto 15418, 15469 (= R.P.K. 3375), 16220.

LOCALITY UNKNOWN: L-Persoon 910, 256-1318 (locality, date and collector unknown) ut *Peziza versiformis* (= CUP 51761).

*Notes*: This species while distinct from *Chlorencoelia versiformis* is often confused with it. The ranges of *C. torta* and *C. versiformis* overlap. The paraphyses and the subglobose to definitely clavate tomentum hyphae of *C. torta* often have strongly green pigmented and heavily granular contents. I have examined specimens which appear to be malformed in that they possess a poorly developed hymenium. When this occurs, such specimens always exhibit paraphyses and tomentum hyphae with an abundance of pigmentation.

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## BOOK REVIEWS

by

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MYCOLOGIST'S HANDBOOK, AN INTRODUCTION TO THE PRINCIPLES OF TAXONOMY AND NOMENCLATURE IN THE FUNGI AND LICHENS, par D.L. HAWKSWORTH, 231 p., 22 figs., 16 x 24 cm, relié toile. Publ. C.M.I., Kew, distribué par Commonwealth Agricultural Bureaux, Farnham Royal, Slough SL2 3BN, U.K., 1974. £5.50.

Ce livre peut être considéré comme une révision complète du livre de G.R. BISBY "An Introduction to the Taxonomy and Nomenclature of Fungi", dont la seconde édition fut épuisée en 1969.

Le but du livre est d'initier aux principes et aux méthodes de l'étude taxonomique des champignons et lichens. Il va de la récolte à la publication, en passant par toutes les étapes de l'étude systématique: l'examen des échantillons, leur préservation en herbier, la culture, la description, les mensurations, le dessin, les catégories taxonomiques, le travail en herbier, la recherche bibliographique, la dénomination, les synonymies, la citation des auteurs, les méthodes taxonomiques (taxonomie numérique, cartes perforées), le travail monographique, le relevé géographique et écologique, la référence aux ouvrages et périodiques, la préparation du manuscrit, la correction des épreuves et le tirage à part. A cela s'ajoutent des listes des principaux auteurs, herbiers et ouvrages mycologiques et un glossaire des termes de taxonomie et de nomenclature.

De plus, comme le fit BISBY, l'auteur reproduit dans leur quasi entièreté les règles de nomenclature des champignons selon le dernier Code International de Nomenclature Botanique (1972). Au texte des règles, l'auteur ajoute de nombreux exemples commentés tirés de la mycologie et de la lichénologie, tandis qu'il délaisse les exemples du Code relatifs aux autres groupes botaniques. En introduction aux règles, l'auteur initie clairement le lecteur aux concepts essentiels de validité de publication, d'application des noms fixée par typification, de légitimité des noms, de priorité du nom légitime correct et de conservation.

Par la somme d'informations pratiques et le commentaire des règles de nomenclature, ce livre est vraiment un "Manuel pour le Mycologue", encore faut-il comprendre



CULTURAL CHARACTERS OF CERTAIN AMANITA TAXA.<sup>1</sup>

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*Summary*

Several freshly collected fruit bodies of *Amanita* taxa were isolated in pure culture. Following the procedure of Nobles (1965) the isolates were assigned key codes. Although basic similarities were observed, Nobles' key lacked the diagnostic characters to adequately describe or separate them. Because of the differential and rapid growth and distinctive taxonomic characters on potato dextrose agar, it was a more useful reference medium for *Amanita* than malt agar.

Names and numbers of isolates of taxa reported here follow: *Amanita citrina* (1); *A. citrina* f. *lavendula* (1); *A. flavoconia* (2); *Amanita* sp. aff. *flavoconia* (1); *A. muscaria* (3); *A. polyparamis* (1); *A. rubescens* (1); *Amanita* sp. aff. *strobiliformis* (1); *A. velatipes* (1).

Cultural taxonomy was shown to have validity in supplementing classical taxonomy in *Amanita*. Although morphological and anatomical fruit body characters sometimes showed only slight differences cultural characters were distinctive. Thus, a combination of cultural and classical taxonomy has potential for providing the most comprehensive descriptions and separation of

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<sup>1</sup>This paper has been extracted from a thesis submitted in partial fulfillment of the requirements for the degree Master of Science in Botany, University of Tennessee, by MPC. Contribution no. 437.

taxa.

Outstanding microscopic features, including hyphal forms, basidia, blastospores, and clamp connections are illustrated.

## INTRODUCTION

As a valid generic name, *Amanita* dates from the publication of W. J. Hooker's "Flora Scotica" in 1821 (Donk, 1962), and the present macroscopic concept of the genus is consistent with Hooker's description: "Bursting from a volva. Pileus fleshy, generally warted. Gills crowded, nearly entire. Stipes mostly elongated, annulate, or naked." In addition, the gills are usually free and the spore print white or nearly white.

Classification of species of the genus has relied primarily on variations of these macroscopic characters. In more modern taxonomy, the distribution and hyphal construction of volval remnants on the mature fruit body have been used as diagnostic features. Bas (1969) proposed preliminary sections of *Amanita* based on volval characters in combination with amyloidity of spores and sulcation of the pileus margin. The microscopic structure of the volva is now being studied to help in determining relationships between large infrageneric groups and in assigning the growing number of species to smaller units within these alliances.

Davidson, Campbell, and Vaughn (1942) were the first to report extensively on culture characters of basidiomycetes. They used their data to establish a "key pattern" for the identification and classification of wood-rotting fungi, emphasizing mat color, oxidase reaction, growth rate, and microscopic hyphal structures. Nobles (1948) expanded the system of Davidson *et al.* into a key to be used for identification, included more species, and devised a standard method for cultural study of wood-rotting fungi so that additional species could be incorporated. Nobles (1958b) attempted to correlate cultural characters with the taxonomy and phylogeny of the Polyporaceae, and in her most comprehensive key (1965), enlarged the number of characters and established the standards used by most researchers for describing cultures of basidiomycetes.

No published reports have been found to formally describe cultural characters in agaric taxa. While many investigations have included manipulation of agaric cultures, the key code system of Nobles has not been applied, and formal descriptions of cultures are apparently completely lacking. Although valid reasons for such omissions are many, perhaps chiefly that cultures of agaric taxa have hitherto been unnecessary for purposes of identification, the application of a well-known cultural taxonomic system such as that by Nobles, appears worthwhile. At worst, it could prove useless for agaric cultures; at best, it could systematize valuable additional taxonomic information. It was against this background that the present preliminary study was attempted.

#### METHODS AND MATERIALS

Specimens were collected throughout summer, 1973 in the Knoxville vicinity and fall, 1973 in Nova Scotia, Canada. The gills of young sporocarps, especially buttons with intact veils, were used to establish dikaryon cultures in malt agar, employing the initial isolation technique described by Petersen (1972). The regimen outlined by Nobles (1965) was followed for the growth, incubation, and examination of the cultures. In addition to malt agar (Difco: "MA"), isolates were grown on malt agar supplemented with 0.005g/l each of biotin and thiamin ("MA+"), and on potato dextrose agar (Difco: "PDA"). The rationale was to provide a basis for comparison and further description.

Key character code numbers were taken from Nobles (1965). Colors enclosed in quotation marks were taken from Ridgway (1912). Fruit bodies were annotated, dried, and deposited in the herbarium of the University of Tennessee (TENN).

Isolate numbers, names, and voucher herbarium specimens are cited below.

Descriptions are based on observations from 3-5 replicate plates. In species with several isolates, their common characteristics are described apart from characteristics unique to an individual isolate, with reference to distinguishing features of the fruit bodies.

Terms used for describing mat texture are listed and defined by Nobles (1965), in addition to which the term "*helicoid*" refers to spiralling, tendril-like, usually aerial hyphae, varying in diameter from that of a normal undifferentiated generative hypha to much more slender. Long hyphal tips may be coiled or coiling may encompass only short intercalary or terminal segments. "Vesicular" describes hyphae which include intermittent enlarged, rounded, spherical, lobose, or utriform cells. "Gloeoplerous" is used to describe cells the contents of which are refringent and assumed oleiferous.

Extracellular oxidase reactions include the Baven-damn test, following the procedure described by Davidson, Campbell, and Blaisdell (1938) on tannic acid agar, and the guaiacum test outlined by Nobles (1958) on malt agar.

## RESULTS

*Amanita citrina* (Schaeffer) Gilbert, Iconogr. Mycol., Milano, xxvii, Suppl. I, p. 78, 1941.

Isolate: Kejimikujik National Park, Victoria Lake, Annapolis Co., Nova Scotia, Can., ll. ix.73., TENN no. 38253

Key Code: MA, MA+,PDA: 1. 6. 26. 32. 36. 38. 47. 56.

Colony on MA approx 4 mm diam after 6 weeks, mat white to "tilleul buff", appressed wooly, spreading; margin uneven. Advancing zone: hyphae generative, less than 2  $\mu$  diam, filamentous becoming variable in diameter. Mat: hyphae generative, typically gnarled, moniliform, sometimes with refringent guttules, finger-like projections near some septa resembling aborted clamp connections or juvenile branches. (Fig. 1, C.) Extracellular oxidase reactions negative.

Colony on MA+ approx 4 mm diam in 6 weeks, mat white, profuse, cottony; margin even. Advancing zone: hyphae generative, thin-walled, without clamp connections, of 2 morphological types: a) approx 2  $\mu$  diam, filamentous, relatively untangled, unbranched hyphal tips, occasionally refringent; b) up to 4  $\mu$  diam, cells with swollen ends, commonly branched, with numerous lateral

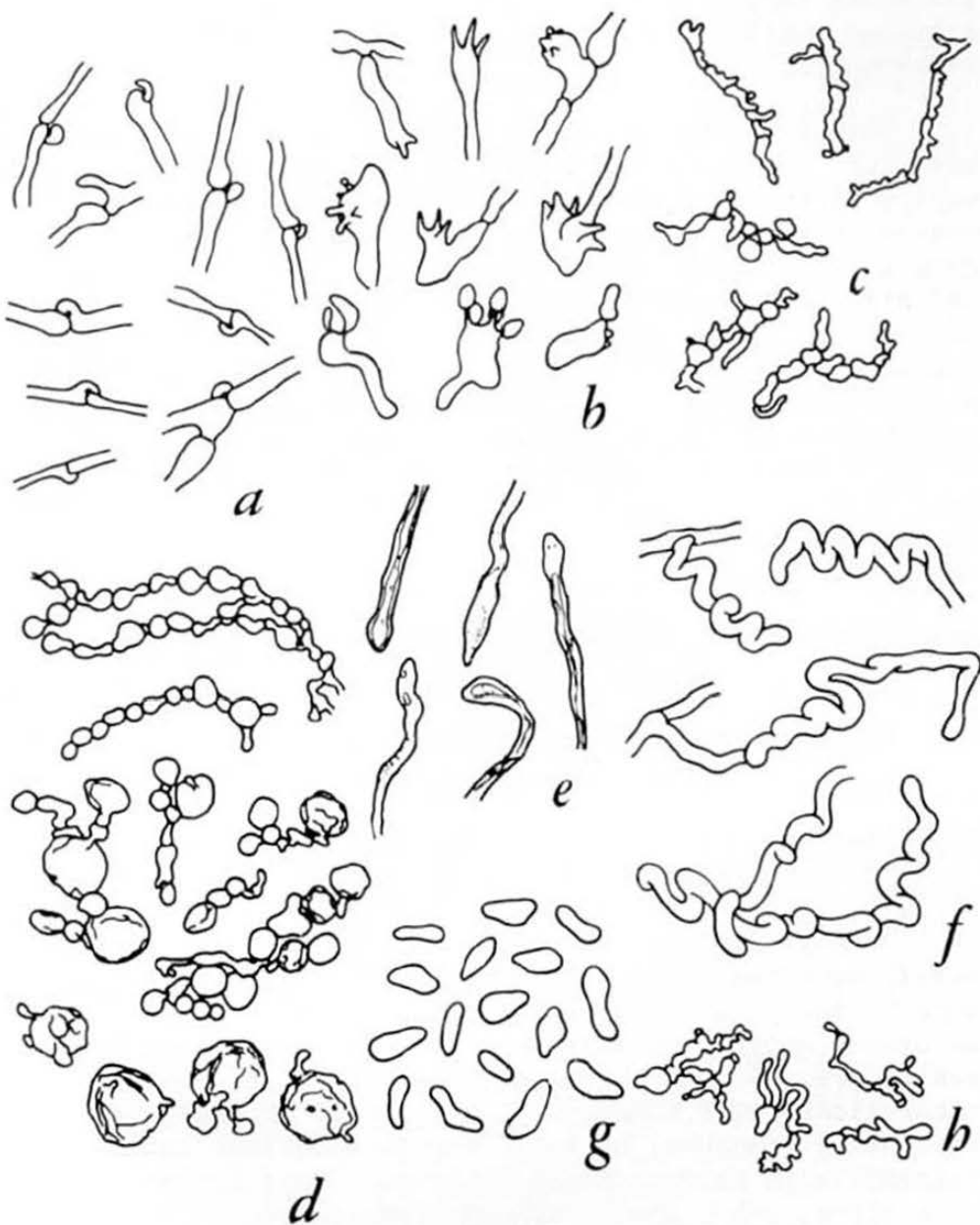


Fig. 1. Hyphae of Amanita cultures. a. Clamp connections. b. Basidia. c. gnarled, profusely branched hyphae. d. Monikiform hyphae. e. Refringent hyphae. f. Helicoid hyphae. g. Blastospores. h. Lobose cells. a. Amanita affin strobiliformis. b, e, g. A. citrina var. lavendula. c. A. citrina. d, h. A. muscaria. f. A. velatipes.

protrusions. Mat: hyphae generative, moniliform, including large, collapsed vesicles, empty or with granular contents, sometimes detached and possibly senescent.

Colony on PDA approx 6 mm diam after 6 weeks, white becoming "tilleul buff" toward margin, mat appressed wooly, diffusely spreading with scattered areas of concentrated growth; margin uneven. Advancing zone: hyphae generative, without clamp connections, cell apices inflated or septa with short, occasional, finger-like projections, of 4 morphological types: a) 1.5-2.0  $\mu$  diam, unbranched, filamentous, often in strands; b) approx 2-3  $\mu$  diam, gnarled by short, blunt, evenly spaced lateral protrusions and large, swollen, irregularly lobose cells; c) 3-5  $\mu$  diam, moniliform, especially prevalent in older mat; d) helicoid hyphae. Mat: hyphae generative, similar to advancing zone.

*Amanita citrina* f. *lavendula* Vesely, Atlas Champ. Eur. Ser. A., 1: 20, 1934.

Isolate: Great Smoky Mountains National Park, Cades Cove, Tenn., 5.x.73., Tenn. no. 38290.

Key Code: MA, MA+: 1. 6. 7. 33. 36. 38. 46. 56.  
PDA: 1. 6. 32. 36. 38. 47. 56.

Colony on MA exceeding 100 mm diam within 5-6 weeks, aerial mycelium "pale ochraceous buff", mat coarsely wooly except finely farinaceous around inoculum, scattered areas of denser growth; margin uneven. Advancing zone: hyphae generative, 2-5  $\mu$  diam, thin-walled, without clamp connections, with numerous blunt lateral protrusions initiating branches; helicoid hyphae sometimes intertwining, with heterogeneous contents. Mat: hyphae generative, 3-5  $\mu$  diam, without clamp connections, mostly filamentous, with frothy contents; basidia in oldest regions with 2-7 blunt sterigmata (Fig. 1, b); blastospores 2-3 X 3-9  $\mu$ , spherical, oval, fusiform, utriform to elliptical, all variably constricted, formed on lateral conidiophores as blown-out vesicles (Fig. 1, g). Extracellular oxidase reactions negative.

Colony on MA+ approx 92 mm diam in 6 weeks, color and texture similar to MA but uniformly dense; margin even.

Advancing zone: hyphae generative, of 2 morphological types: a) 1-4  $\mu$  diam, thin-walled, without clamp connections, frequently branched, undifferentiated except for some swollen, refringent hyphal tips with thickened walls; b) 2-4  $\mu$  diam, thin-walled, filamentous, without clamp connections, with refringent material intermittently lining walls or forming globules.

Colony on PDA approx 33 mm diam after 6 weeks, diminishing in color from "pale ochraceous buff" near inoculum to almost colorless on margin, mat wooly and diffuse except farinaceous and opaque near inoculum; margin even. Advancing zone: hyphae generative, approx 2  $\mu$  diam, frequently coiled, knotted, and sometimes twining into hyphal ropes. Young mat: hyphae generative, approx 1-4  $\mu$  diam, abundantly branched, contents heterogeneous and sometimes refringent; some elongated, nonseptate, refringent hyphal tips with thickened walls, ropy or granular contents, swollen ends sometimes membrane-bound, rarely with protrusions resembling sterigmata, possibly constituting an incipient hymenium (Fig. 1, e). Older mat: hyphae generative, approx 2-3  $\mu$  diam, filamentous, highly branched.

*Amanita flavoconia* Atkinson, Journ. Mycol. 8: 110, 1902.

Isolate: Black Hole, near Baxter's Harbor, Kings Co., Nova Scotia, Can., 30.viii.73, Tenn. no. 38036.

Key Code: MA, MA+, PDA: 1. 6. 26. 32. 36. 38. 47. 56.

Isolate: Gaspareau Woods, approx 3 mi SE Wolfville, Kings Co., Nova Scotia, Can., 28.viii.73, Tenn. no. 37906.

Key Code: MA, MA+: 1. 6. 26. 32. 36. 38. 47. 56.  
PDA: 1. 6. 26. 32. 36. 38. 47. 53. 56.

Colony on MA 16-20 mm diam in 6 weeks; aerial mycelium "tilleul buff"; submerged mycelium "cinnamon buff"; mat felty, topography flat, older mat tough, resilient; advancing zone thin, homogeneous, untangled; margin uneven. Advancing zone: hyphae generative, approx 3  $\mu$  diam, thin-walled, without clamp connections, typically gnarled by alternate swelling and constriction, sometimes moniliform and appearing to bud, occasionally

loosely coiled and intertwined, some areas with large, refringent guttules. Mat: hyphae generative, up to 5  $\mu$  diam, thin-walled, with swollen apices, without clamp connections, gnarled, vesicular; large, irregularly lobose and broadly clavate cells occurring in series as well as interspersed; a few regions of numerous helicoid hyphae, sometimes coiled only for a short distance and then becoming normal, otherwise coiled along entire length of hyphal tip; spherical terminal cells, 14-30  $\mu$  diam, frequent with contents homogeneous, frothy, vacuolate, or refringent, confluent with wall or shriveled and collapsed. Extracellular oxidase reactions negative.

38036. Advancing zone: a few short parallel hyphae aggregated into rope-like rhizomorphs.

37906. Mat: hyphae approx 5  $\mu$  diam, highly branched; terminal vesicles sometimes with slightly thickened walls.

Colony on MA+ approx 11-13 mm diam in 6 weeks, "tilleul buff" alternating with concentric white zones and corresponding to appressed vs. aerial topography, respectively, texture felty becoming finely farinaceous where mycelium submerges, advancing zone dense, almost opaque; margin uneven. Advancing zone: hyphae generative, thin-walled, without clamp connections, with swollen apices, moniliform or closely compacted with heterogeneous contents; gloeoplerous generative hyphae occasional, with refringent material lining walls or forming regular guttules, with terminal and intercalary vesicles, 16-20  $\mu$  diam often with refringent inclusions. Mat: hyphae generative, nearly always gloeoplerous, moniliform, and intricately branched.

Colony on PDA 19-21 mm diam in 6 weeks, "cream buff"; mat mostly submerged; surface coarsely granular to subfelty; advancing zone translucent, tangled, spreading diffusely; margin uneven. Advancing zone: hyphae generative, 3-5  $\mu$  diam along length, thin-walled, without clamp connections; contents heterogeneous including vacuoles, refringent guttules and refringent material intermittently lining walls; cells often inflated asymmetrically at base, sometimes clavate; terminal and intercalary vesicles with heterogeneous contents; moniliform and helicoid hyphae scattered. Mat: hyphae as above but increasingly moniliform, in number and degree.



38036. Colony: distinctly zonate, zones concentric with wavy, cottony margins, texture downy, appressed.

37906. Colony: odor acidic.

*Amanita* sp. (affin *flavoconia*)

Isolate: Scot's Bay, Cape Split, Kings Co., Nova Scotia, Can., 29.viii.73, Tenn. no. 37929.

Key Code: MA, MA+, PDA: 1. 6. 26. 32. 36. 38. 47. 56.

Colony on MA approx 40 mm diam in 6 weeks, aerial mycelium "tilleul buff", submerged mycelium "cinnamon buff", felty, advancing zone thin, homogeneous, untangled; margin uneven. Advancing zone: hyphae generative, 2-3  $\mu$  diam, thin-walled, without clamp connections or inflated ends; contents frothy to granular; numerous lateral protrusions initiating branches; some swollen, broadly clavate cells in series but no moniliform chains; gloeoplerous hyphae with small guttules; helicoid hyphae of normal diameter. Extracellular oxidase reactions negative.

Colony on MA+ approx 17 mm diam in 6 weeks, aerial mycelium "pale vinaceous fawn", submerged mycelium "cream buff", wooly, submerging in advancing zone; margin uneven. Advancing zone: hyphae generative, as above, mostly undifferentiated.

Colony on PDA approx 40 mm diam in 6 weeks, "olive buff", uniformly dense, wooly, mostly submerged; margin uneven. Advancing zone: hyphae generative, 3-5  $\mu$  diam, thin-walled, without clamp connections, nuclei conspicuous; swollen intercalary cells preceding branching; clavate cells typical, segregated on long hyphal tips; some gloeoplerous hyphae with small refringent guttules; terminal and intercalary vesicles with deeply staining contents; moniliform hyphae not common. Mat: hyphae generative, similar to advancing zone.

*Amanita muscaria* (L. per Fr.) Hook., Flora Scotica, London, p. 19, 1821.

Isolate: Gaspareau Woods, approx 3 mi SE Wolfville, Kings Co., Nova Scotia, Can., 28.viii.73, Tenn. no. 37908.

Key Code: MA, MA+, PDA: 1. 6. 10, 26. 32. 36. 38. 47. 56.

Isolate: Scot's Bay, Cape Split, Kings Co., Nova Scotia, Can., 29.viii.73, Tenn. no. 37928.

Key Code: MA, MA+: 1. 6. 26. 32. 36. 38. 47. 56.  
PDA: 1. 6. 26. 32. 36. 38. 47. 51. 56.

Isolate: Kejimikujik National Park, Victoria Lake, Annapolis Co., Nova Scotia, Can., 11.ix.73, Tenn. no. 38250.

Key Code: MA, MA+, PDA: 1. 6. 26. 32. 36. 38. 47. 56.

Colony on MA:

37908. Colony approx 5 mm diam after 6 weeks, aerial mycelium white, submerged mycelium "drab gray", mat felty to velvety, highly convoluted; margin even.

37928. Colony approx 23 mm diam in 6 weeks, "light pinkish cinamon" surrounding inoculum, sharply demarcated from "pale pinkish buff" mycelium toward margin, homogeneously wooly with occasional hyphal tufts, not submerging; margin even.

38250. Colony approx 6 mm diam in 6 weeks, "avellaneous"; mat mostly aerial, texture chamoislike, extremely convoluted; margin uneven.

Advancing zone: hyphae generative, without clamp connections, contents heterogeneous, of 4 morphological types: a) very common vesicular to moniliform or articulated, with bizarre lobose or spherical cells (Fig. 1, h), interconnected in one isolate only (37908), frequently branched, often with large rough-walled vesicles approx 20  $\mu$  diam, empty and collapsed or with refringent contents, sometimes detached (Fig. 1, d); b) approx 2  $\mu$  diam, filamentous; c) approx 3  $\mu$  diam, thin-walled, composed of elongated cells with swollen apices; d) 4  $\mu$  diam or greater, long, occasionally refringent, cells with swollen apices. Mat: hyphae generative,

similar to advancing zone with more extreme cell shapes and increased refringence. Extracellular oxidase reactions negative with gum guaiacum, no growth but a faint brown diffusion zone on tannic acid agar (37908 and 38250), no diffusion zone (37928).

Colony on MA+:

37908. Colony approx 5 mm diam in 6 weeks, mat similar to MA.

37928. Colony approx 30 mm diam in 6 weeks, mat similar to MA except becoming submerged toward margin.

38250. Colony approx 6 mm in 6 weeks, "wood brown", mat felty and farinaceous due to intermingling of white hyphae, compact, tightly convoluted, growing upward on itself rather than into agar; margin uneven.

Advancing zone: hyphae generative, approx 3  $\mu$  diam, thin-walled, without clamp connections, of 3 morphological types: a) predominantly moniliform or vesicular with large lobose, randomly constricted and inflated cells, vesicles sometimes actively budding new vesicles or branches, empty and collapsed or contents refringent or homogeneous; b) approx 3  $\mu$  diam, filamentous, moderately branched, contents granular; c) (37928 only) approx 2  $\mu$  diam, short, tendril-like helicoid hyphae, tightly coiled in older mat. Mat: hyphae generative, similar to advancing zone.

Colony on PDA:

37908. Colony approx 2 mm diam in 6 weeks, mostly restricted to inoculum block, aerial mycelium white, submerged mycelium "drab gray", mat downy, convoluted, compact, advancing zone irregularly spreading; margin uneven.

37928. Colony approx 19 mm diam in 6 weeks, "cartridge buff", mat wooly, with massed aerial hyphae of variable density; margin uneven with areas of diffuse, silky, submerged hyphal tips. Odor of urine, faintly earthy.

38250 Colony approx 8 mm after 6 weeks, "buckthorn brown", mat chamoislike with white felty concentric zones,

undulating topography of mat corresponding to crenations in advancing margin; margin uneven.

Advancing zone: hyphae generative, thin-walled, without clamp connections, contents moderately vacuolate, cells often with swollen apices, hyphae of 4 morphological types: a) vesicular and moniliform, with large (12-22  $\mu$  diam) terminal vesicles and intercalary utriform cells, both turgid and collapsed, sometimes refringent, interconnected in one isolate only (37908); b) approx 2  $\mu$  diam, filamentous, often copiously branched, cells with swollen apices; c) 3-5  $\mu$  diam, composed of bulbous cells; d) (37928 only) helicoid hyphae, approx 3  $\mu$  diam and loosely coiled or 1-2  $\mu$  diam and tendril-like. Mat: hyphae generative, including types in advancing zone but predominantly moniliform and refringent with large terminal vesicles.

*Amanita polypyraxis* (Berk. and Curt.) Sacc., Syll. Fung. 5: p. 18, 1887.

Isolate: Gatlinburg, Tenn., Sevier Co., 16th hole, Gatlinburg Country Club, 16.x.73., Jenkins coll., DJ723 (herb. D. J. Jenkins).

Key Code: MA, MA+: 1. 6. 26. 32. 36. 38. 47. 53. 56.  
PDA: 1. 6. 26. 32. 36. 38. 47. 56.

Colony on MA approx 78 mm diam in 6 weeks, chalk white, mat raised, cottony becoming flattened and downy toward margin, prominently zonate; margin even. Advancing zone: hyphae generative; a) approx 2  $\mu$  diam, thin-walled, without clamp connections, branched; b) approx 4  $\mu$  diam, filamentous with refringent guttules. Mat: hyphae generative, similar to advancing zone. Extracellular oxidase reactions negative.

Colony on MA+ approx 6 mm diam in 6 weeks, chalk white, mat cottony becoming thin and appressed in advancing zone; margin even. Odor of rancid pork. Advancing zone: hyphae generative, thin-walled, without clamp connections, of 3 morphological types: a) 3-4  $\mu$  diam, frequently branched, highly vacuolated especially in terminal vesicles which are often gloeoplerous; detached vesicles appearing rough walled, collapsed, with inner membrane shrunken and separating from wall; b) helicoid,

appearing knotted due to extreme coiling; c) moniliform, consisting of spherical and randomly lobose cells. Mat: hyphae generative, similar to advancing zone.

Colony on PDA approx 64 mm diam in 6 weeks, chalk white, cottony becoming downy away from inoculum with interspersed raised areas; margin uneven. Advancing zone: hyphae generative, approx 3  $\mu$  diam, without clamp connections, frequently with slightly thickened cells, uniformly filamentous or interspersed with spherical and clavate cells with extremely heterogeneous contents, sometimes with small gloeoplerous guttules; terminal vesicles 12-18  $\mu$  diam, with walls sometimes roughened and thickened and contents shrunken from wall, often with smaller vesicles or hyphal initials protruding laterally. Mat: hyphae generative, mostly moniliform with refringent globules concentrated in cell apices, otherwise contents homogeneous, budding of new vesicles and lateral branching common.

*Amanita rubescens* (Pers. per Fr.) S. F. Gray, Nat. Arr. Brit. Plants, 1: 600, 1821.

Isolate: Kings Co., Nova Scotia, Can., 10.ix.73., Tenn. no. 38249.

Key Code: MA, MA+, PDA: 1. 6. 26. 32. 36. 38. 47. 56.

Colony on MA approx 50 mm diam in 6 weeks, "tilleul buff", mat wooly, submerged toward advancing zone; margin even. Advancing zone: hyphae generative, 3-4  $\mu$  diam, thin-walled, without clamp connections, undifferentiated except for some short, irregularly thickened, swollen cells, large vacuoles, and refringent guttules. Mat: hyphae generative, 3-4  $\mu$  diam, thin-walled, without clamp connections; bulbous cells and terminal vesicles occasional, often with granular contents; helicoid hyphae with variable coiling, loosely folded or accordianed to tightly spiraled. Extracellular oxidase reactions negative with gum guaiacum, no growth but a faint brown diffusion zone on tannic acid agar.

Colony on MA+ approx 44 mm diam after 6 weeks, "pale olive buff", aerial and wooly near inoculum, submerged in advancing zone; margin even. Advancing zone: hyphae generative, 3-4  $\mu$  diam, thin-walled, without clamp connections, filamentous, unbranched and undifferentiated

tips or occasionally shorter with irregularly thickened walls and dense contents; helicoid hyphae present. Mat: hyphae generative, similar to advancing zone but with thickened, fusiform cells, singly and in chains.

Colony on PDA approx 40 mm diam after 6 weeks, off-white, woolly overall, ranging from loose tangles to dense tufts; margin even. Advancing zone: hyphae generative, of 4 morphological types; a) approx 4  $\mu$  diam, thin-walled, without clamp connections, cell apices often swollen preliminary to branching; b) moniliform, with thickened cells and large, terminal, densely staining vesicles; contents becoming heterogeneous with age and size; c) helicoid, varying from tightly coiled to slightly serpentine or folded; d) approx 2  $\mu$  diam, with refringent guttules. Mat: hyphae generative, as in advancing zone with increasing heterogeneity in form and contents.

*Amanita* sp. (sect. *Lepidella* affin. *strobiliformis*)

Isolate: Gatlinburg, Tenn., Sevier Co., 16th hole, Gatlinburg Country Club, 16.x.73., Jenkins coll., DJ725 (herb. D. J. Jenkins).

Key Code: MA, MA+: 1. 6. 26. 32. 36. 39. 47. 56.  
PDA: 1. 5. 7. 32. 36. 39. 47. 50. 56.

Colony on MA restricted to inoculum block after 6 weeks, mycelium white, sparse, cottony, agar reverse "fuscous" under inoculum. Hyphae generative, thin-walled, without clamp connections, short, vesicular; numerous vesicles detached from hyphae, 16-28  $\mu$  diam, mostly spherical, sometimes collapsed, empty or with homogeneous, frothy, granular, or gloeoplerous contents. Extracellular oxidase reactions negative.

Colony on MA+ barely exceeding inoculum after 6 weeks, rudimentary mat "avellaneous", totally submerged; margin even. Advancing zone: hyphae generative, without clamp connections, of 4 morphological types: a) 2-5  $\mu$  diam, thin-walled, unbranched, hardly tangled hyphal tips, frequently severely constricted and nonstaining for short distances, then resuming normal diameter; b) moniliform, with vesicles appearing to bud out one or more smaller vesicles; numerous large, collapsed, nonstaining vesicles, terminal, intercalary, or detached; c) thin, tightly

coiled, tendril-like helicoid hyphae; d) undifferentiated or vesicular hyphae with refringent guttules.

Colony on PDA approx 22 mm diam after 6 weeks, aerial mycelium white, cottony, submerged mycelium "tulle buff" with "chestnut brown" band immediately surrounding inoculum; margin even. Odor strong, slightly spicy, fungal, reminiscent of dried apples. Advancing zone: hyphae generative, 3-5 (8)  $\mu$  diam, thin-walled, with rare clamp connections and false clamps (Fig. 1, a), contents homogeneous to slightly vacuolate, morphologically undifferentiated. Mat: generative hyphae similar to advancing zone, dolipore apparatus especially prominent seen at 2000X magnification.

*Amanita velatipes* Atkinson, 1903. Mushrooms, pp. 63-66, Figs. 64-67.

Isolate: Unaka Mts., Unicoi Co., Tenn., 12.viii.73., Jenkins coll., DJ674 (herb. D. J. Jenkins).

Key Code: MA, MA+: 1. 6. 16. 32. 36. 38. 47. 53. 56.  
PDA: 1. 6. 7. 32. 36. 39. 47. 56.

Colony on MA approx 8 mm diam after 6 weeks, aerial mycelium chalk white, submerged mycelium "pale olive buff", mat velvety with scattered cottony tufts, not spreading but very compressed and highly convoluted; margin even. Advancing zone: hyphae generative, approx 3  $\mu$  diam, thin-walled, without clamp connections, long, unbranched, hardly tangled or vacuolated, commonly with small refringent guttules. Mat: hyphae generative, as in advancing zone with areas of abundant gloeoplerous generative, often inflated hyphae. Extracellular oxidase reactions negative.

Colony on MA+ approx 19 mm diam in 6 weeks, velvety and highly contoured close to inoculum, becoming appressed in a narrow concentric zone, finally forming a raised cottony, chalk white aerial mycelium of variable density; macroscopic hyphal "ropes" traversing appressed zone; margin uneven. Odor faint, of ammonia. Advancing zone: hyphae generative, thin-walled, 2-4  $\mu$  diam, without clamp connections, long, hardly tangled, contents homogeneous except for vacuoles, branching commonly at acute angles. Mat: hyphae generative, with numerous intercalary

vesicles, sometimes with refringent inclusions; helicoid hyphae common, with coiling encompassing entire length of hyphal tip or merely short intercalary or terminal segments (Fig. 1, f). Hyphal ropes consisting of parallel hyphae up to 650  $\mu$  long, highly vacuolate, unbranched, sometimes with refringent guttules.

Colony on PDA approx 35 mm diam in 6 weeks, felty near inoculum, with adjacent narrow, dark ("pale olive buff") appressed zone sharply delimited from conspicuously raised, chalk white cottony mat, progressively submerging toward margin; margin even. Advancing zone: hyphae generative, thin-walled, 3-5  $\mu$  diam, with clamp connections, mostly filamentous, with branching from lateral protrusions. Mat: hyphae generative, similar to advancing zone but usually gloeoplerous.

## DISCUSSION

While there are several distinctive morphological hyphal types and cell shapes in cultures of *Amanita*, taxa cannot be successfully segregated using Nobles' key code for the Polyporaceae. Dichotomies designed for recognizing and differentiating taxa on the basis of special structures are not generally applicable to the limited number of forms seen in *Amanita* which, with a few exceptions, may all be grouped under Nobles' "noteworthy swellings on hyphae". The majority of isolates key out further on the basis of negative attributes, i.e. conidia, chlamydospores, oidia lacking; reverse unchanged in color; plates not covered in 6 weeks. The result is a large group of isolates with identical key codes but with often unique, uncoded characters.

An attempt to formulate a key pattern specific for *Amanita* was made, but this encountered difficulties. Consistency was found to be lacking between isolates of the same species, not only in growth rate, but also in hyphal forms, special structures, mat characters, and odor. Of the three isolates of *Amanita muscaria*, all collected in Nova Scotia, one was strikingly dissimilar in rate of growth, appearance of mat, and in the absence of a diffusion zone on tannic acid agar. The classical taxonomy of this species is presently undergoing investigation (Jenkins, 1974) to identify and verify infraspecific taxa, and a definitive statement cannot be



made here concerning the disparate isolate. Possibly this isolate was a "variety" of *A. muscaria* with subtle sporocarp differences, or perhaps such cultural characters represent a real, but hitherto unrecognized, character field for separation of "taxa" now passing under single nomenclatural designations.

*Amanita citrina* f. *lavendula*, highly distinctive from *A. citrina* in culture, is not as readily distinguished from *A. citrina* by classical taxonomic characters. In fact, it was the wide disparity in cultural characteristics which prompted reexamination of the voucher fruit bodies, where one collection was identified as *A. citrina* f. *lavendula* (exhibiting an abrupt, pinkish-lavender volva and smaller spores, 4-6  $\mu$  diam vs. 7.5-9  $\mu$  diam in the typical form).

Variability in the three cultures of *Amanita flavoconia* was likewise found to correspond to disparities among the fruit bodies. Two isolates (see above) were very similar in cultural characteristics and growth rates, while their sporocarps possessed the identical amyloid, elliptical spores. A third isolate under the same name was outstanding because of its comparably rapid growth, different mat color and texture, and minimal hyphal differentiation. Upon reexamination, the sporocarp of this isolate was found to have globose to subglobose spores as well as deeper orange color on the dried pileus.

Bas (1969) considers *Amanita strobiliformis* a European species; isolate no. DJ725 is therefore placed in his section *Lepidella* with recognition of its affinities for, but not conspecificity to that species.

After comparing the growth rates and the occurrence of taxonomically important features in these isolates on three different media, PDA must be considered the reference agar of choice, preferable to both MA and MA+. Of the 12 isolates in culture, 7 showed maximum growth on PDA, compared to 3 on MA, and 2 on MA+. (See Table 1) In addition, mat color, texture, and topography on PDA were frequently in sharp contrast to mats of the same isolate on MA and MA+.

Moreover, while hyphal types characteristic of a species, i.e. vesicular, moniliform, helicoid,

TABLE 1  
DIAMETER OF COLONY AFTER 6 WEEKS ( IN MM)

SPECIES	MA	MA+	PDA
<i>Amanita citrina</i>	4	4	6
<i>Amanita citrina</i> f. <i>lavendula</i>	100+	92	33
<i>Amanita flavoconia</i>	16-20	11-13	19-21
<i>Amanita</i> sp. (affin. <i>flavoconia</i> )	40	17	40
<i>Amanita muscaria</i>	5-6,(23)	5-6,(30)	2-8,(19)
<i>Amanita polypyraxis</i>	78	66	64
<i>Amanita rubescens</i>	50	44	40
<i>Amanita</i> sp. (affin. <i>strobiliiformis</i> )	0	1	22
<i>Amanita velatipes</i>	8	19	35

undifferentiated, generally occurred on all three media, unique structures sometimes occurred only on PDA. *Amanita "strobiliiformis"*, thin-walled and consistently without clamp connections on MA, exhibited rare clamp connections on PDA. Although *Amanita citrina* f. *lavendula* was notable on MA for having basidia and blastospores, aggregations considered as an incipient hymenium were found on PDA, equally valid as a taxonomic character. Differential growth on PDA and MA suggests the possibility of cultural characterization on other favorable media, such as W. L., Mycological (Difco) (Stark, personal communication) KHO, and cherry agar (Semerdzieva, 1966).

The vitamin supplement in MA+ enhanced growth over MA in only 2 of 12 isolates and had a negligible or inhibitory effect in the remaining isolates. Mat characteristics on MA+ were usually indistinguishable from those on MA and microscopic features were never distinctive.

These examples lend further support to combining cultural taxonomy with classical taxonomy for more comprehensive species descriptions. Further studies, utilizing larger numbers of cultures and taxa from wider geographical ranges would appear potentially profitable.

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## BOOK REVIEWS (continued from page 238)

ici les mycologues, lichénologues, phytopathologues et tous ceux qui, en étudiant, amateur ou spécialiste, désirent étudier et décrire des fungi.

THE LICHENS, édité par Vernon AHMADJIAN et Mason E. HALE, xiv + 697 p., illustr., 16 x 24 cm, relié. Academic Press Inc., 24-28 Oval Road, London NW1, 1973. \$38.00.

Ce livre, composé par 23 spécialistes, rassemble toutes les connaissances actuelles sur la structure, le développement, la physiologie, la chimie, l'écologie, la taxonomie des lichens. Ce n'est toutefois pas une encyclopédie, mais une synthèse très élaborée, selon un plan logique.

Les différentes parties concernent successivement  
 (1) la forme, l'anatomie et le développement (H.M. Jahns), une évaluation taxonomique des caractères morphologiques (J. Poelt), la reproduction sexuelle (M.A. Letrouit-Galinou), les propagules (F.B. Pyatt) et la structure fine des lichens (E. Peveling) (182 p.);  
 (2) la physiologie (125 p.), en particulier le métabolisme des hydrates de carbone et de l'azote;  
 (3) la réponse à l'environnement (185 p.) avec les relations lichen-eau (O.B. Blum), lichen-substrat (I.M. Brodo), lichen-pollution de l'air (O.L. Gilbert) et croissance (M.E. Hale);  
 (4) les produits de métabolisme (70 p.);  
 (5) les interactions symbiotiques (35 p.) avec la synthèse des lichens (V. Ahmadjian).

Trois chapitres, mis en appendice parce que techniques sans doute, sont aussi intéressants: la classification des lichens (J. Poelt), les méthodes d'isolement et de culture (V. Ahmadjian) et l'étude des substances lichéniques (J. Santesson).

On regrettera peut-être que les considérations sur la classification des lichens n'ont pu être poussées au delà des familles ni assorties de clés des familles et des genres.

Ce "traité des lichens" est, par beaucoup d'aspects, comparable au THE FUNGI de Ainsworth, Sparrow et Sussman et le complète très bien.

## INDEX TO FUNGIOUS AND LICHEN TAXA

The Index includes genera, infrageneric taxa, species, and infraspecific taxa. New taxa are in CAPITALS, and the pages where they are published are in *italics*. (The list of epithets on pp. 173-187 is not indexed here.)

- Agaricus 146  
 Aglacephalum 138  
 Albosynnema 118; *FILICICOLA* 117, 118  
 Allomyces 18  
 Amanita 239, 240, 243, 254, 255; sect *Lepidella* 252, 255; *citrina* 239, 242, 243, 255, 256; *f lavendula* 239, 244, 255, 256; var *lavendula* 243; *flavoconia* 239, 245, 255, 256; *muscaria* 239, 243, 254-256; *polyparamis* 239, 250, 256; *rubescens* 239, 251, 256; sp *affin flavoconia* 239, 247, 256; sp *affin strobiliformis* 239, 243, 252, 256; *strobiliformis* 255, 256; *velatipes* 239, 243, 253, 256; *verna* 152  
 Anaptychia *corallophora* 144; *microphylla* 145  
 Apostemidium *torrenticola* 134  
 Ascobolus 100; *atrovirens* 87; *epimyces* 95; *foliicola* 100; *striisporus* 100  
 Ascocoryne 55  
 Asteroma 167  
 Bacidia 190  
 Baeomyces 190; *rufus* 192  
 Beauveria 50  
 Bispora 55-57; *monilifera* 55-58; *monilioides* 55, 57  
 Bisporella 51, 55, 57, 66, 71; *CITRINA* 51, 58, 71; *monilifera* 51, 55, 58; *PALLESCENS* 51, 58; *STRUMOSA* 51, 59, 60; *SULFURINA* 51, 59, 60  
 Boletus 146  
 Botrydiplodia 218  
 Botryotinia 103, 148  
 Botrytis 137  
 Bulgariella *foliacea* 88  
 Calloria *atrovirens* 87  
 Calycella 51-53, 55, 57, 58, 66, 71; *alutacea* 53; *citrina* 52, 55, 58, 59; *monilifera* 55-58; *pallescens* 52, 57, 58; *strumosa* 57, 59; *sulfurina* 52, 57, 59  
 Calycina 51, 53, 54; *citrina* 59; *firma* 53; *herbarum* 53, 54; *pallescens* 53, 58; *sulfurina* 59  
 Cantharellus *viridis* 103, 213  
 Capnobotrys 121; *DINGLEYAE* 121  
 Capnophialophora 121, 122  
 Catinella 66, 70; *nigro-olivacea* 70; *olivacea* 70  
 Cenangium *ferruginosum*  $\beta$  *strobilina* 89; *hypochlorum* 83; *strobilinum* 89  
 CHLORENCOELIA 65, 66, 69, 73, 97, 193, 194, 222, 223-226; *TORTA* 98, 100, 193, 222, 224-226, 228-230, 232; *VERSIFORMIS* 101, 193, 222, 224-226, 231, 232  
 Chlorociboria 65, 66, 69-72, 74-76, 97, 193-196, 199, 200, 202, 204, 210, 216, 218, 221, 222, 228; *aeruginascens* 85, 86, 103, 196, 202, 207, 208, 212, 213, 219; subsp *AERUGINASCENS* 96, 199, 204, 207, 211, 213, 214, 218-221; subsp *BRASILIENSIS* 88, 97, 98, 193, 199, 204, 210, 213, 219, 220; *aeruginella* 85, 221; *aeruginosa* 75, 86, 94, 103, 195, 199, 200, 202, 204, 208, 210, 212, 216, 218, 219, 221; var *aeruginascens* 208, 221; *ARGENTINENSIS* 193, 200, 202, 204, 214; *bulgarioides* 89, 221; *musae* 221; *OMNIVIRENS* 98, 193, 200, 202, 204, 216; *rugipes* 222, 230, 231; *strobilina* 74, 89, 91, 222; *versiformis* 222, 224; var *olivacea* 222, 230, 231  
 Chloroscypha 66, 72, 93, 102; *chloromela* 72, 93; [*chromomela*, *lapsus*, 72]  
 Chlorospleniella *atrovirens* 87; *fenica* 102; *stemma* 100  
 Chlorosplenium 65, 66, 69-79, 81, 94, 96, 97, 99, 101, 134, 193, 194, 202, 204, 210, 222, 228; *aeruginascens* 85, 195, 204, 207, 210, 213; *aeruginellum* 85; *aerugineum* 86, 200, 216; *aeruginosum* 74, 76, 86, 88, 194, 195, 197, 200, 204, 207, 210, 221; *amenticolum* 70, 86; *atrovirens* 87; *a-*

- troviride 73, 88; brasiliense 76, 88, 213; bulgarioides 88, 90; caesio-luteum 92; canadense 93; chlora 66, 71, 75-79, 81, 83, 85, 96-98; chloromelum 93; chlorophanum 102; chrysotrichum 93; discoideum 94, 200, 206; e-latinum 69, 94; epimyces 95; fennicum 102; flavovirens 95, 96; foliaceum 88, 95; fuegianum 95, 96; HYPOCHLORA 65, 78, 79-81, 83; indicum 96, 208, 211; kriegerianum 94, 96; lividum 89, 90, 96; luteovirens 102; melatheja 96; microspermum 97, 213, 214; nigrescente-olivaceum 89, 97; olivaceum 78, 82, 83, 97, 230; omnivirens 98, 216; puiggarii 98, 213; repandum 73, 78, 98; rodwayi 98, 230; rugipes 98, 230; salviicolor 98; schweinitzii 73, 78, 82, 83, 98; sericeum 99; stemmatum 100; striisporum 100; subtortum 73, 100, 230; tortum 100, 230; tuberosum 103; urbanum 103; versiforme 76, 101, 224, 232; virescens 87, 101; viride 103, 213
- Chrysosplenium 77; aeruginascens 208
- Chrysosporium 123, 124, 126, 127, 130, 131; lignorum 123-125, 130; pruinatum 123-125, 130
- Ciboria 66, 70, 74, 77, 91, 147, 196, 221; amenticola 86; bulgarioides 89; caucus 147; chlorophana 102; kriegeriana 94, 95; livida 89; olivacea 230, 232; rufo-fusca 70, 91; strobilina 89, 91; var bresadolae 89; viridi-fusca 70, 86
- Ciborinia 148
- Ciboriopsis 221
- Cladonia chlorophaea 143; cryptochlorophaea 143; grayi 143; merochlorophaea 143
- Claussenomyces 66, 72, 88, 98, 194; atrovirens 72, 87, 88, 204; SALVIICOLOR 65, 72, 98
- Coccomyces 41, 42; maritimus 42
- Cordierites 66, 73, 88, 95, 222, 224
- Coryne 55; atrovirens 87; fennica 102; flavo-virens 134; sarcoides var viridescens 224, 225, 229; stemmata 100; versiformis 91, 224, 229; virescens 87
- Corynella 72; atrovirens 87; stemmata 100
- Craterellus caespitosus 224, 229
- Cudoniella 51
- Cyathicula 66, 72, 90, 92, 96; FUEGIANA 65, 72, 95; STROBILINA 65, 72, 92
- Dacrymyces virescens 87
- Dacryopsis ellisiana 93
- Daedaleopsis confragosa 57
- Dasyscypha chlorella 101; melaxantha 96; morgani 101; sericea 99
- Dasyscyphella aeruginosa 70, 99
- Dasyscyphus 54, 66, 70, 71, 97, 99; AERUGINELLUS 65, 70, 85, 221; chlorellus 101; MELATHEJA 65, 70, 97; melaxanthus 96; morgani 101; sericeus 70, 99; viridulus 101
- Dematium 56; antennaeforme 56
- Dichaena strumosa 59
- Dothiorella 218; pyrenophora 218; tulasnei 218, 220
- Dothiorina 196, 218-220; discoidea 220; tulasnei 193, 202, 204, 218-220
- Elvela aeruginosa 210; aeruginosa ... viridissima 207
- Encoelia 222, 223; hypochlora 83, 84
- Entomophthora 13, 15, 26; PORTERI 13, 28, 38
- Erinella aeruginosa 99; sericea 99
- Erioderma mollissimum 144
- Gemmularia 162
- Geniculisporium 50
- Geoglossum 162
- Geotrichum 162
- Gomphillus 189, 190; AMERICANUS 189-191; calicioides 189, 190, 192
- Gomphus 162
- Gonytrichum 162
- Gymnopus 162
- Gymnosporangium 162
- Gyraria 162
- Haglundia 66, 70; perelegans 70
- Haplaria 162
- Helicosporium 162
- Helicotrichum 162
- Helmisporium 162
- Helotium 51, 53, 55, 57, 74, 162, 202, 220, 228; sect Calycella 52, 54; subg Bisporella 57; subg Calycella 52, 54; subg Hymenoscypha

54; aeruginascens 208; aeruginellum 85, 86, 97; aeruginosum 202, 204, 207, 210, 212, 221; amenti 86, 87; baeumleri 86, 87; chlora 78; citrinum 51, 59; var pallescens 58; elatinum 94; ferrugineum 220; flavovirens 134; fuegianum 95; herbarum 54; luteovirens 102; magellanicum 95; moniliferum 56, 58; pallescens 58; rugipes 230, 232; strobilinum 92; strumosum 59; sulfurinum 59; versiforme 91, 224, 229; var livido-purpurascens 89

Helvella 162; aeruginosa 74, 195, 197-199, 207, 211

Helycomyces 162

Hericium 163

Hericius 163

Heterodermia 144; corallophora 143, 144; granulifera 144; microphylla 143, 145; tremulans 145

Hexagonia 163

Himantia 163

Holwaya 66, 73; mucida 73, 93

Hormiscium 163

Humaria bulgarioides 89

Hydnum 163

Hydrophora 163

Hygromitra 163

Hymenoscypha 54; monilifera 58

Hymenoscyphus 51, 53, 54, 57; fructigenus 53, 54; moniliferus 58

Hypodontia 124

Hypochnus 163

Hypoderma 163

Hypodermium 163

Hypolepia 163

Hyponervis 163

Hypoxyton 88, 163

Hysterium 163

Kriegeria chloromela 93; olivacea 94

Lachnella aeruginosa 73; chlorascens 78; melaxantha 96

Lachnum viridulum 92, 97, 101

Lanzia rugipes 230

Lasiostictis 41, 42; conigena 41-43; fimbriata 41-43

LOMENTOSPORA 45, 50; PROLIFICANS 45, 46, 47-49

Macroscyphus 54

Massospora 13-17, 19, 21, 22, 24, 25, 27, 31, 32, 35, 39; CARINETA 13, 21, 22, 35; cicadina 14-18, 20, 24, 25, 31-33; cleoni 15; DICEROPROCTA 13, 23-25, 35; DIMINUTA 13, 22, 38; DORISIANA 13, 19, 20, 25, 35; FIDICINA 13, 25, 26, 40; levispora 14, 15, 18, 21, 23, 31, 33; OCYPETES 13, 19, 20, 36; PLATYPEDIA 13, 23, 26, 31, 35; richteri 15; spinosa 15, 17, 18, 20, 26, 31, 32, 34; staritzii 15; TETTIGATES 13, 20, 21, 37; tipulae 13, 15, 26

Menisporiopsis 120

Merulius aeruginosa 207, 212

Microsphaeria polymorpha 154

Midotis 222, 228; versiformis 224

Mollisia 76, 100; atrovirens 87

Myriosclerotinia 148

Naemacyclus 41; niveus 41

Nephroma parile 144

Niptera pallescens 58

Octospora citrina 59

Ombrophila atrovirens 87; baeumleri 86, 87; fennica 102; kriegeriana 94, 95; livida 89; stemmata 100; strobilina 90-92

Ovulinia 148

Pachydisca flavo-virens 134

Parmelia subg Amphigymnia 105; affluens 105; appendiculata 106, 111; araucariarum 106; cornuta 108; var crocea 111; crocea 111; crocoides 109; endosulphurea 110; lyngaeana 111; merrillii 111; myelochroa 109-111, 113; permutata 113; subcolorata 113; sulphurata 113; tinctorum var endosulphurea 110; ultralucens 108

Parmotrema 105, 107, 112, 115; affluens 105, 106, 108, 111, 114, 116; appendiculatum 106, 107, 109, 114, 115; araucariarum 106, 108, 114, 116; CONJUNCTUM 105, 107, 108, 111, 114, 116; cornutum 106, 108, 111, 113-115; cristatum 106, 109, 114, 115; crocoides 107, 109, 113-115; diffractaicum 108; dilatatum 106, 114; endosulphureum 108-111, 113-115; FLAVO-MEDULLOSUM 105, 107, 110, 114, 116; LYNGEANUM 105, 111, 112,



- 114, 115; myelochroum 111, 112, 114, 115; permutatum 113, 114, 116; sancti-angelii 114; subcoloratum 113-115; sulphuratum 106, 113-115; tinctorum 110; ULTRALUCENS 105, 108
- Peniophora 123, 124, 131; mollis 130
- Pezicula 83
- Peziza 82, 102, 197, 202, 204, 228; familia Calycinae 52, 54; familia Dasyscyphi 54; familia Hymenoscyphi 54; familia Macroscyphi 54; sect Hymenoscyphae 54; stirps Pezizae pedicellatae 52; subg Calycina 54; subg Hymenoscypha 54; trib Calycinae 52, 54; trib Hymenoscyphae 54; [?] (Mollisia) 76, 82; [?] (Phialea) 59; abietis 90;  $\beta\beta$  strobilina 89; aeruginascens 76, 103, 197-199, 207, 211; aeruginea 200, 206; aeruginella 85; aeruginosa 74, 76, 197-200, 204, 206, 208, 210, 212; var subgrisea 198, 207; atrovirens 87; bulgarioides 74, 88, 90, 91; caesio-lutea 92, 101; candolleana 148; chlora 73, 74, 76-78, 83; chlorascens 73, 74, 78, 82, 83, 85; chloromela 93; chlorophana 102; chrysotricha 93, 94; citrina 58, 59; crociticincta 78, 82; elatina 94; fenica 102; flavovirens 134; herbarum 51-53; hypochlora 84; lenticularis 56, 58; luteovirens 102; melatheja 96; melaxantha 96; monilifera 58; omnivirens 216, 218; pallescens 56-58; pomicolor 83; rufo-fusca 90, 91; sericea 99; stemmata 100; strobilina 89, 90, 92; subtorta 74, 230; torta 73, 230, 232; tuberosa b. strobilina 91;  $\beta\beta$  strobilina 90, 91; versiformis 74, 76, 222-224, 229, 232;  $\beta$  nigrescente-olivascens 89;  $\beta\beta$  livida 89, 90; var  $\beta$  livido-purpurascens 89; viridi-fusca 86; viridis ... arboorea 207; viridissima ... infundibuliforme 207
- Pezizella crociticincta 78
- Phaeohelotium 66, 71; flavum 71; monticola 71
- Phanerochaete 123, 124, 130; arizonica 126; CHRYSOSPORIUM 124, 126, 127, 129; cremea 127
- Phialea subg Hymenoscypha 54; citrina 59; eustrobilina 92; strobilina 91, 92; viridi-fusca 86
- Phymatotrichum fimicola 137
- Piceomphale 69, 74; bulgarioides 89
- Poculum 66, 69, 95-97
- Polyporus mcMurphyi 136; squamosus 135
- Polystigma 167
- Protomyces 14
- Pseudohelotium strumosum 59
- Psilonia discoidea 219
- Ptychogaster 124, 130
- Pulchromyces fimicola 137, 139, 141
- Raffaelea 50
- Rhinocladia 50
- Rhinotrichum 138
- Rutstroemia 53, 66, 69, 90, 194; bulgarioides 69, 88, 90, 96, 97, 221, 222, 229; elatina 94
- Sclerotinia 146-148; candolleana 146-148; scirpicola 148; sclerotiorum 146-148; tuberosa 146
- Sclerotium 167
- Sordaria 146
- Sorospora 15
- Sphaeria moriformis var [unnamed] 218, 220, 221
- Sporotrichum 123, 130; pulverulentum 123-125; pruinatum 123, 125
- Stereum 160
- Sticta 144; limbata 143, 144
- Stictis 41; [?] (Lasiostictis) 42; conigena 42; fimbriata 41-43; maritima 41-43
- Stilospora 167
- Stromatinia 148
- Tetracrium 117; incarnatum 117; MUSICOLA 117, 118
- Thelephora 160; abietina 160
- Thozetellopsis 119; CALICIOIDES 117, 119, 120
- Tremella 158; virescens 87
- Trichopeziza caesio-lutea 92; chrysotricha 93; melaxantha 96; viridula 101
- Trichospermum 154
- Tritirachium 50
- Tympanis atrovirens 87
- Urceolella melaxantha 96

Velutarina 66, 72, 222; rufo-oliva  
 vacea 72  
 Vibrissea FLAVOVIRENS 134; pezi-

zoides 134  
 Whetzelinia 103, 146-148  
 Xyloma 167

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