# MYCOTAXON

*AN INTERNATIONAL JOURNAL DESIGNED TO EXPEDITE PUBLICATION OF RESEARCH ON TAXONOMY & NOMENCLATURE OF FUNGI & LICHENS*

Vol. I July-September 1974 No. 1

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*ISSN 0093-4666* *MYXNAE 1(1) 1-64 (1974)*

*Published quarterly by MYCOTAXON, P.O. Box 264, Ithaca, NY 14850*
*Subscription prices per volume: $15 US & Canada, $16 other foreign; reduced rate for individuals only, $6 US & Canada, $7 other foreign*

MYCOTAXON

Vol. I, No. 1, pp. 1-2 July-September 1974

# MYCOTAXON, A NEW INTERNATIONAL JOURNAL ON TAXONOMY AND NOMENCLATURE OF FUNGI AND LICHENS

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The need for another journal covering the restricted area of mycological and lichenological taxonomy and nomenclature may not be self-evident in an era when proliferation of biological journals is an often unwelcome fact. We have conceived this journal to meet specific requirements that other journals have failed to serve.

To expedite publication was our first concern, for with the great majority of journals now printing the kind of articles acceptable to MYCOTAXON, a wait for publication after submission of a manuscript is frequently a year, often longer. MYCOTAXON aims to publish all manuscripts within four months of submission, often much more rapidly. To do this, the journal will appear quarterly, but the individual numbers will vary greatly in size, depending upon the amount of acceptable copy received.

To avoid assessment of page charges to authors or their institutions was our second concern. Many journals, faced with rising costs of publication, have resorted to charging authors for each page printed; in most cases, authors who plead financial hardship can still publish in such journals without paying the assessment. We feel that to place an author in the position of having to request financial relief

is demeaning. Subscription prices must bear the burden of production costs for MYCOTAXON. We reject the concept of financing publication through page charges.

Still another problem arises with many conventional journals, in that they either strictly limit the length of articles they will accept (often only 8 or 10 pages), or will assess *excess* page charges for longer articles. If not impossible, it is often prohibitively expensive to publish a long monograph in such journals. MYCOTAXON is designed to accept articles of any length, from a one-page note to a book-length monograph. There are no charges for excess pagination.

Individual mycologists (as opposed to universities, libraries, and commercial concerns) who purchase journals for their own use should – we felt – be able to buy a subscription at or even below the actual cost of production. With this in mind we offer MYCOTAXON to *individuals* at a substantially reduced subscription fee compared with the regular subscription rate. In order to qualify for such a reduced fee, the individual subscriber agrees that the issues are for his personal use, and will be kept as part of his personal library (that is, *not* given or sold to an institutional or commercial library) for at least three years following the publication of an issue.

Since taxonomy and nomenclature transcend national and linguistic borders, we were also concerned with producing an international journal, open for publication to all mycologists and lichenologists. Manuscript is acceptable in either French or English; summaries, however, may be in any language.

Since final, camera-ready copy is provided by the authors, *no proofs* are needed and none are provided, effecting a great saving in time.

By using the process of photo-offset lithography, we believe that MYCOTAXON can and does meet the rigorous requirements we have set. Publication in the new journal asks *more*, perhaps *much more*, of an author than does publication in a conventional, type-set journal. By following the detailed instructions to authors which we provide, any author should be able to prepare suitable camera-ready manuscript with the assistance of a capable typist.

MYCOTAXON

Vol. I, No. 1, pp. 3-12 July-September 1974

# INSTRUCTIONS TO AUTHORS FOR PREPARING CAMERA-READY MANUSCRIPTS FOR MYCOTAXON

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There are *six steps* which you should follow when you have completed your research if you wish to publish in MYCOTAXON. We urge you to read and re-read these instructions until you understand them fully.

Authors writing for MYCOTAXON are given complete freedom in certain matters. We feel that most often an author knows best how to present his material, and we do not wish to impose any of the usual editorial strictures on authors. Internal consistency within each article is far more important than consistency among different articles appearing in the journal. We do *require* that the manuscript be typed at a special size, single-spaced, and with a certain arrangement in the typing of the title, author's name, and author's address (see below, Step 4, §1, 4, 6). Otherwise we have only certain *recommendations*, as follows:

*Title.* A title should be as brief as is consistent with conveying enough information to someone reading the table of contents that he will be able to judge accurately the scope and content of the paper. Avoid the use of abbreviations in titles, and avoid any author citations in titles.

*References.* You may cite references however you wish, by author/date, by number, or by footnote. Journal names may be spelled out in full or abbreviated, but be consistent. We recommend that you use one of the conventional systems; that provided in *B—P—H* (*Botanico-Periodico-Huntianum*, published by Hunt Botanical Library, Pittsburgh, Pa.) is particularly good, as is that of the *World List of Scientific Periodicals* (published by Butterworth & Co., London).

*Scientific names.* Only the names of genera and infrageneric taxa (including the names of species and infraspecific epithets) should be *italicized;* other scientific names should be in Roman typeface. On typewriters in which italic type is not available, such names may be underlined instead. Do not use underlining for any other purpose.

*Latin diagnoses.* We request that you have your Latin diagnoses checked by a competent botanical Latin scholar.

*Code of Nomenclature.* Authors are urged to conform to the provisions of the International Code of Botanical Nomenclature.

*Summaries.* Short papers, 4 or fewer pages in length, probably do not require a summary. For longer papers, a summary is useful, and recommended. We suggest that it be placed first, before the text. The summary may be in the language of the original article, or in another or additional languages. We will accept up to three such summaries, *e.g.*, an article in English with English, Russian and Czech summaries would be wholly appropriate.

## STEP 1. DETERMINE WHETHER YOUR WORK IS SUITABLE FOR MYCOTAXON

MYCOTAXON is specifically restricted to papers on the taxonomy and nomenclature of fungi and lichens. We intend this broadly, to include not only monographic work or proposals dealing with specific nomenclatural problems: we will also accept papers devoted to floristics, reviews of taxonomic groups or of taxonomic criteria, nomenclatural and taxonomic argumentation and polemics, proceedings of symposia on taxonomic or nomenclatural matters, subject, title or taxon indices of taxonomists' writings, etc. Papers that deal with ecology, cytology, physiology, pathology, ultrastructure, etc., unless their primary focus is taxonomic, should be submitted to some other journal.

When authors are in doubt as to the suitability of their paper for MYCOTAXON, they are urged to send a draft copy of their manuscript to the appropriate Editor for a decision as to whether the content would be acceptable for the journal.

## STEP 2. PREPARE A DRAFT MANUSCRIPT AND OBTAIN PRE-SUBMISSION REVIEW

No articles will be accepted for publication in MYCOTAXON that have not been given critical review by a specialist in some institution other than that of the author(s). Unlike other journals, where the editors send a manuscript to reviewers *after* it has been submitted, MYCOTAXON insists that the author must himself first submit a completed draft (*not* camera-ready copy) of his manuscript, including copies of the plates, for *critical* comment to at least one scientist capable of judging the quality and presentation of the research results. This must be done *before* the author has his final manuscript typed for submission to MYCOTAXON. For papers 20 or more pages in length, *two* such pre-submission reviews are required. Usually an author knows best who is the most competent in his field to do such critical reviews. In those cases where an author is not certain whom to approach, he may send a draft copy of his manuscript (or a detailed abstract) to the appropriate Editor of MYCOTAXON, who will then suggest several possible reviewers. The comments of such reviewers should be carefully considered and the manuscript then altered to reflect these criticisms when they are judged to be constructive. Authors must submit the names and addresses of the outside reviewers to the Editors at the time the final manuscript is submitted,

with the understanding that the Editors may contact such reviewers if they have questions concerning the content of the paper. At the close of each volume, the names of those who have provided pre-submission reviews of articles in MYCOTAXON will be acknowledged.

## STEP 3. PLAN YOUR PLATES OF LINE DRAWINGS OR PHOTOGRAPHS FOR THE CAMERA-READY COPY

*Photographs* reproduce excellently with modern photo-offset lithography, and the method used is the production of a *halftone screen* by the printer. Gradations from white through grey to black are broken up into a series of dots of various sizes, just as is done with halftone plates printed by conventional letterpress methods. The same process is necessary for toned ink-wash or pencil drawings. The screen used in MYCOTAXON is a 150-line screen, which will reproduce excellent detail (but perhaps not the extremely fine detail needed to please workers publishing transmission electron micrographs, where a finer screen and glossy paper is needed).

Because halftone screens are an added expense, authors are allowed one halftone plate (up to page size) for each ten pages of manuscript, or fraction thereof. (An 11-page article thus qualifies for two halftone plates.) Authors who wish to publish papers with halftones in excess of this allowance should be prepared to pay for the extra cost of these (at 1974 prices, approximately $5.00 for each such halftone screen). There are no extra costs for line drawings, so these may be used in any quantity. MYCOTAXON has no provisions for publishing colored plates; preparation of these is so time-consuming and expensive that we cannot consider accepting such plates for publication.

The contrast among photographs grouped to make up one plate should not be too great. Plates should be planned to utilize the maximum page width whenever possible. Individual photographs making up a plate should be trimmed *squarely* on a good paper cutter so that the edges of adjacent photographs fit together neatly without any spaces between photographs. Commercially available press-on line stripping can be applied between the photographs, if desired. Immense care is essential, and the individual photographs should be mounted and grouped together on stiff paperboard, either with rubber cement or with photographic mounting tissue. Of course you should always use *glossy* prints for your plates.

*Line drawings* should always be made with black India ink. Individual line drawings can be cut out and assembled on a white background to make an attractive plate by gluing them to firm paperboard. The edges of these cut-outs will not reproduce if carefully glued, and need not be cut squarely. Plates of line drawings should also be planned to utilize full page width when possible. Do *not* mix photographs and line drawings in the same plate!

*A WORD OF WARNING ON AMOUNT OF REDUCTION*

Authors are cautioned against reducing their plates too much. Photographs reduced to less than 2/3 of their original size often suffer in reproduction. Line drawings should only very rarely be reduced to less than 1/2 of their original size. Leaving enough space *between* lines and dots used for shading is often more important than the width of the line or the diameter of the dot when line drawings are excessively reduced. Note also that lines which are too fine sometimes disappear entirely in reduction.

*DETERMINING THE SIZE OF YOUR PLATE*

Whether a plate is composed of photographs or of line drawings, an author will wish to determine the dimensions of the figures as they will be finally printed, to determine printed magnifications. If a figure does not occupy a full page, he will also want to determine the amount of space to leave blank on his final, camera-ready manuscript. The text of your article must be typed, according to whether you are using a Pica ("12 point") or an Elite ("10 point") typeface on your typewriter, on a specified size area (as indicated under Step 4, §1), i.e., 20 × 12.5 cm for Elite and 24 × 15 cm for Pica. In both cases there is some reduction between the size as submitted and the size when reproduced. The actual space that can be occupied by typed material or by a plate is, in the final printed version, a rectangle 17.6 × 11 cm (FIG. 1). There are five general options open to you which are outlined below.

*(1) USING THE SAME REDUCTION AS THE TYPED TEXT*

Surely the *easiest* plan for you and your typist is to allow your plate to receive the same reduction as your text. This means you would plan your plate to be 12.5 cm wide if your text is in Elite size, and any height not to exceed 20 cm; or, using a Pica typewriter, you would plan your plate 15 cm wide, and any height not exceeding 24 cm. In both cases the final width of the plate as printed will be 11 cm. You can, if you prefer, even insert your line drawings in their exact position in the manuscript when using this plan of reduction; do not do this with photographic plates, however, but instead leave the exact amount of blank space necessary in your typed copy. Submit your photographic plate, mounted on stiff paperboard, separately, since the printer must make a halftone screen from your photographic material before it can be reproduced.

*(2) USING NO REDUCTION*

If you desire to reproduce your figures at the exact size they are drawn or photographed, you should plan your plate to be 11 cm wide and not exceeding 17.6 cm in height.

*(3) OTHER REDUCTION POSSIBILITIES*

The relationship of final printed area, the area occupied

by a figure on Elite or Pica manuscript paper, and any original figure size can be determined by consulting FIG. 1. The mathematics involved in computing final magnifications is relatively simple.

*(4) ILLUSTRATIONS LESS THAN FULL PAGE IN WIDTH*

While we do not recommend using less than full page width for illustrations, exceptions do exist where a small figure does not lend itself to the general rule. Any figure can be computed for reduction and fitted to the MYCOTAXON manuscript page by using the examples above and by consulting FIG. 1.

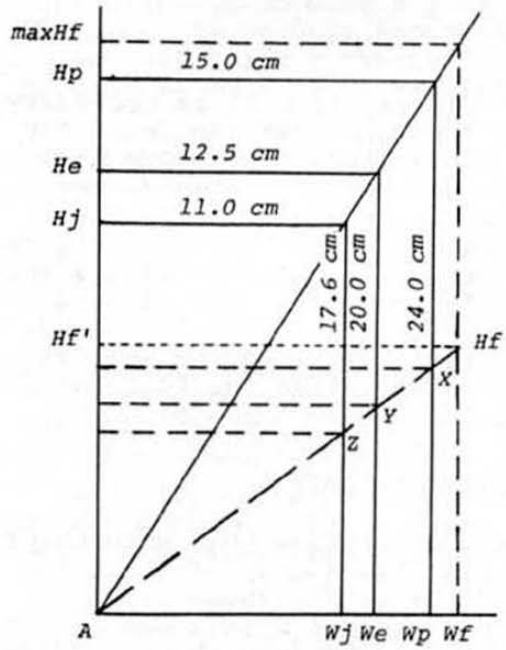


FIG. 1. *THE DIAGONAL METHOD OF PLATE PREPARATION.* Solid rectangles are established dimensions of *copy areas* for MYCOTAXON. A-Wj = *journal width* of printed copy = 11 cm. A-Hj = *journal height* of printed copy = 17.6 cm. A-We = permitted *Elite-typing width* = 12.5 cm. A-He = permitted *Elite-typing height* = 20 cm. A-Wp = permitted *Pica-typing width* = 15 cm. A-Hp = permitted *Pica-typing height* = 24 cm. A-Wf = actual *figure width*. A-maxHf = *maximum permitted height of a figure* A-Wf wide = 1.6 × A-Wf. A-Hf' = Wf-Hf = observed *height of figure* A-Wf wide. Wp-X = derived (measurable) *height* to be kept blank on a *Pica-typed manuscript* to allow insertion by the printer of figure A-Wf-Hf-Hf'. We-Y = derived (measurable) *height* to be kept blank on an *Elite-typed manuscript* for the same purpose. Wj-Z = *printed height* of such a figure.

*(5) FIGURES SET LENGTHWISE ON THE PAGE*

Occasionally a figure does not lend itself to a printed width of 11 cm, whereas it would adapt to being printed lengthwise on the page, where 17.6 cm is available for the width. There is no objection to this; one merely rotates the rectangles in FIG. 1 90° to the right. The legend is then typed the full length of the rectangle, rather than the width, if there is room for the legend on the same page.

*LETTERING AND NUMBERING YOUR PLATES*

This process can be done with India ink, whether on line drawings or photographs. Avoid hand-lettering, which almost always looks crude. We recommend the use of either a good lettering device or the use of press-on or of transfer letters now available from many commercial concerns in a wide variety of typefaces and sizes. These should be in black, or for use on dark portions of photographs, in white. A special sheet of transfer letters and symbols of parti-

cular convenience for biologists is called BIOPLATE. This contains a large proportion of the most commonly used letters and numbers for plates (in several sizes), various symbols useful in making graphs and maps, arrows, and even Greek letters that are seldom seen on normal transfer sheets. They are manufactured for us by a leading American firm, Prestype, Inc. They are available through the Managing Editor (see the back cover of the most recent issue of MYCOTAXON for the current prices).

*ASSISTING YOUR TYPIST*

After you have prepared your plates, it will be necessary for your typist to know exactly how much space to leave for insertion of the figure in the typed manuscript. One easy help is to construct a colored paper rectangle the correct size for the Elite or Pica manuscript paper by using the diagonal method of FIG. 1. If there is more than one figure, be sure to number each colored rectangle with the figure numbers to avoid any questions. Note that often the colored rectangle will be *larger* than your figure (*e.g.*, if you do not reduce at all, or only slightly), or it may be *smaller* (when your figure is to be reduced more than the Elite or Pica text reduction).

STEP 4. TYPING THE CAMERA-READY FINAL COPY

Your typist is the key to how attractive your manuscript will be. See that your typist has a copy of these instructions at hand, and that he or she knows exactly what is required. All typing must be done with a *carbon ribbon* to ensure good photographic reproduction with photo-offset lithography. The use of a fabric ribbon results in such poor reproduction that an Editor will be forced to reject manuscript so prepared. Best results are obtained with an electric typewriter. Hand-operated machines may be used if the typist has an even typing touch.

§1. *All* manuscript submitted to MYCOTAXON must be prepared so that the typed area is *wholly* within a rectangle, the dimensions of which are determined by the size of the typeface of the typewriter. The very great majority of typewriters are either Pica size (12 points, in printers' terminology), or the smaller Elite size (10 points). If the body of your paper is to be typed on a Pica-size machine, the rectangle within which all lettering must be kept is 24 × 15 cm. If it is an Elite-size typewriter, the rectangle is 20 × 12.5 cm. There should be *no exceptions*, and manuscripts that do not conform to this rule will be rejected. A very few typewriters have a typeface larger tha 12 points; for these, use the Pica-size rectangle. Do not use a typewriter with a typeface smaller than Elite size (10 points). As a convenience to prospective authors, we have prepared *special manuscript paper* with the rectangles ruled in light blue ink (which will not photograph). These may be obtained from the Managing Editor in packages of 50 sheets at our cost (consult

the back cover of the most recent issue of MYCOTAXON for the current price.) While this manuscript paper is not necessary, it will be a great convenience to your typist; or you can rule your own rectangle on typing paper, using a *very light blue pencil* only. For many Pica typewriters the rectangle will accommodate a line 58 to 60 characters wide, and a page will be approximately 57 single-spaced lines in height. For many Elite typewriters the smaller rectangle will also accommodate a line 58 to 60 characters wide, but the page may be only about 48 single-spaced lines high (because most Elite typewriters use the same 12 point line spacing as do Pica typewriters).

§2. *Clean* the typing faces of your typewriter thoroughly before beginning to type. A dirty typeface yields poor results, and exactly what you type will be reproduced.

§3. *Don't erase* when preparing final copy, since erasures often show when the copy is photographed. Also do not strike over a letter a second time, since this results in a blacker than usual letter which clearly shows up in the printed copy. It is best to paint over any errors with typewriter correction fluid, and then retype the word or line a second time. Or, retype the word or line on a separate piece of paper, cut this out and glue it carefully onto the manuscript, using rubber cement, to cover the incorrectly typed word(s).

§4. All articles in MYCOTAXON will be provided by the Managing Editor with a journal identification at the head of the first page, like the one on this article (page 3). It is imperative that the typist leave sufficient blank space at the top of the title-page rectangle for this purpose. For Pica typewriting, leave 2.4 cm blank; for Elite typing, leave 2 cm blank. (The manuscript paper we have prepared and mentioned above [§1] has title guide marks.) The typist should center the title the appropriate distance down the title page of the manuscript, all in CAPITAL letters. Use no underlining in the title. Leave the next two lines blank. The name(s) of the author(s) must be centered, in CAPITAL letters, on the next line, followed by one blank line. Then the author's address should appear, either in upper and lower case *Italics* (as was done with this article), or in upper and lower case Roman letters. Two more blank lines should be used before beginning the summary or other text matter. An abstract or summary placed ahead of the text may be typed narrower that the main text if desired (see also §8, below).

§5. The first page (title page) of all articles (except those only one page in length) will always be an odd-numbered, *right-hand page*. Keep this in mind when planning the insertion of illustrations, particularly when the illustration is so large that its legend must appear on the facing page. An illustration appearing on manuscript page 9 requires its legend either on the same page or on manuscript page 8, its *facing page*, not on manuscript page 10 (which will always print on the back of manuscript page 9).

§6. The body of the text must be typed single-spaced. It is permissable, and preferable, to use 1½ or 2 spaces between paragraphs to help set them off.

§7. In the upper portion of each sheet of your manuscript place the name of the author and the manuscript page number. Keep this as far away from the text as possible. The *final* page numbers for the journal will be inserted by the Managing Editor above your typed rectangle. (If it is necessary for an author to refer in his text to another part of the same paper by the use of a page number, leave that page number out, and provide sufficient space so that the Managing Editor can insert the page reference [up to 3 numbers!] after he has assigned final page numbers. An obvious difficulty is that he may not be able to match exactly the same type style as you have used. You will also need to alert him at the time the manuscript is submitted, *e.g.*, "Page number must be inserted on MS pg. 10, line 14, referring back to MS pg. 6," so that he will be certain to insert the correct final page number at that point.)

§8. You are certainly not restricted to the use of one size of typeface in your article. Indeed, a larger typeface is most useful for the title, and for some headings. You can also s p a c e words for emphasis. Your decision on whether to use a Pica or an Elite rectangle size is based on which typewriter you use for the main text matter. An Elite typeface for the summary, Latin diagnoses, references cited, etc. is wholly appropriate in a Pica-typed manuscript.

§9. The great majority of typewriters have each letter of equal width, whereas in conventional typesetting the letter "i" for example is much narrower than the letter "M." There are a few typewriters that have *proportional spacing*, with letters of several widths, so that the final product looks much more like conventional printing that does the usual typewritten copy. The title of this article was typed on such a proportional spacing machine. Such machines produce more professional-looking copy, but are a luxury not available to many potential contributors.

§10. A very few typewriters allow you to type with different typefaces on the same machine. The most common of these, perhaps, is the IBM "Selectric" typewriter, in which the typing element is a removable ball that can be interchanged with others having a different type style or size of type. (IBM "Selectric" typefaces marked "10 pitch" are Pica size; those marked "12 pitch" are Elite size.) This article, with the exception of the title, is typed on such a machine.

§11. Most journals and books have not only their left, but also their right margins even, which is attained by the use of variable spacing between words. With proportional spacing typewriters it is feasible to produce such copy, technically termed "with a justified right margin," if one is a skilled typist. The copy is typed once, and then proportional spacing is added between words in a second, final typing. Somewhat similar results can even be obtained on a conventional spacing typewriter. If you will examine the legend to FIG. 1, on page 7, you will note that it is justified. Some spaces between words are single spaces, others 1½ spaces, still others 2 spaces, etc. We do *not* recommend that you ask

your typist to produce justified copy with an ordinary typewriter, since this is a very time-consuming task and scarcely merits the work involved. Authors who have access to type composing machines that produce right-justified copy are of course free to submit their manuscripts in that form.

§12. The typist should consult the author concerning the position on the page to be occupied by any illustration and its legend. Careful placement of the figures will result in an attractive paper. When many figures occur, consider also the placment of figures on the facing page, and how their position will balance with the figures on the page with which you are now working. While figures are normally inserted on the same page or that next following their first mention in the text, aesthetics may dictate otherwise.

§13. Since footnotes appear at the bottom of pages, and legends either at the bottom of the figure or on the facing page, the typist will need to type out the full footnote or legend ahead of time in order to allow sufficient space in the text for these to appear where they belong.

§14. If an author discovers that he simply cannot obtain the services of a typist capable of producing good, camera-ready copy, the Managing Editor is willing to find a professional typist who can type the manuscript under his supervision, if the author is prepared to pay for such services. Preparation of plates, however, *must* be done by the author. Those wishing to proceed in this manner should send a draft of their paper to the Managing Editor, who will obtain an estimate of the costs for professional typing. Such preparation may delay publication of the article to the following issue.

## STEP 5. ABOUT REPRINTS OF YOUR ARTICLE

Most authors want to order reprints of their articles. For papers in MYCOTAXON it will be possible for authors to obtain reprints very rapidly. As soon as an issue of MYCOTAXON has been printed, the Managing Editor will mail the original photo-offset negatives to the senior or only author. The author can take these to his nearest printing shop that does photo-offset work and they can reproduce his paper directly from these negatives. (They can also copy directly from the printed journal, but at times a slight loss in quality of reproduction occurs with that method.) Since some authors will wish to provide a cover for their reprints, a special title sheet designed for their particular paper will also be sent along with the original negatives.

Some authors may prefer to have their reprints made by the same printer who does the journal, instead of at their own local print shop. The printer has provided a schedule of reprint costs, which will be sent to the author at the time that acceptance notice is mailed, which will allow you also to compare his prices with those of your local printer. Reprint orders should be sent to the Managing Editor, but note that payment for the reprints should be made directly to the printer.

## STEP 6. SUBMITTING YOUR MANUSCRIPT

Keep in mind that your manuscript will be reproduced exactly as it is sent. Cleanliness is an absolue essential. Please rveiew the following procedures and be sure that you have completed them all:

(1) It is necessary to proofread, at least *twice*, the typist's final single-spaced camera-ready copy against the manuscript you gave the typist. Read it aloud, with another person, reading every word slowly, every punctuation mark, every underline, etc. Any errors should then be corrected by your typist. Proofread those corrections, too!

(2) Make a good photocopy of your completed manuscript to keep for your own records and as insurance against loss in the mails.

(3) Prepare your *covering letter*, addressed to the appropriate Editor, which should include the following:

(a) your full name and mailing address
(b) date of mailing
(c) title of your article
(d) total number of manuscript pages (includes pages devoted wholly or partly to illustrations)
(e) name(s) and address(es) of the reviewer(s) to whom you sent the manuscript for pre-submission review. You may, if you wish, attach copies of such reviews directly to the covering letter.
(f) any instructions on cross-reference pages (Step 4, §7)
(g) neither manuscripts nor plates will be returned to the author, whether accepted or rejected, unless specifically requested at the time of submission and unless sufficient US postage stamps or UNESCO coupons to cover the cost of their return are enclosed with the covering letter.

(4) Wrap your manuscript and plates carefully. Be sure your name and the figure numbers are written with a *soft* pencil on the *back* of each mounted plate. Insert a clean piece of tissue between each plate, to protect the drawn or photographed surface. Use heavy, protective cardboard, and place your name on the outside of the package. Mail your plates and manuscript together in one package to the appropriate Editor. The covering letter should be mailed to the same Editor, preferably attached securely to the same package. These should be sent by REGISTERED MAIL.

(5) Within 2 weeks after an Editor has received your manuscript, he will decide whether it is acceptable, and will notify you of acceptance or rejection, or in rare instances of his intention to contact a pre-submission reviewer before final decision. Poorly typed papers will necessarily be rejected on technical grounds, even when the scientific content is worthy of publication. Articles will normally appear in the next succeeding issue, *i.e.*, publication should occur within 1 to 4 months of submission of manuscript.

MYCOTAXON

Vol. I, No. 1, pp. 13-40 July-September 1974

# THE GENUS MASSOSPORA, ENTOMOPATHOGENIC FOR CICADAS, PART I, TAXONOMY OF THE GENUS[1,2]

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SUMMARY

Major collections of cicadas in the western hemisphere were searched for specimens infected with *Massospora*. This effort resulted in the discovery of eight new species herein described as: *M. dorisiana; M. ocypetes; M. tettigates; M. carineta; M. diminuta; M. platypedia; M. diceroprocta;* and *M. fidicina*. The clearer understanding of the genus *Massospora* gained through this study has permitted an emendation of the generic description. The new name *Entomophthora porteri* is proposed for *M. tipulae* since it properly belongs in the genus *Entomophthora* and retention of the specific epithet would create a homonym.

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1 Insect Pathology Research Institute, Sault Ste. Marie Ontario Contribution No. 277.

2 This paper is based in part on a thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, Cornell University, Ithaca, New York. Supported in part by an NIH Pre-Doctoral Fellowship.

# INTRODUCTION

Following the discovery of the fungus *Massospora levispora* Soper (1963) in populations of the northern cicada *Okanagana rimosa* (Say), investigations were initiated to determine the nature of *Massospora* pathogens. This study was developed along three lines of research. First, a search of numerous cicada collections at various museums was made in an attempt to locate *Massospora* infected individuals. This search was intensified in 1967 when a collecting trip to the Caribbean, Central, and South America was undertaken. These efforts proved very successful and a number of new *Massospora* species were discovered. This has allowed for a more complete understanding of the taxonomy of this group. Concurrent with this effort, the second line of research involved a detailed study of the biology of *O. rimosa* and its pathogen, *M. levispora*. This was supplemented by studies of *Massospora cicadina* Peck on the 13 and 17-year cicadas, *Magicicada* spp. Field trips were made to Illinois and Iowa to observe the 13 and 17-year cicada emergence in 1963 and Ohio to observe 17-year cicada emergences during 1965 and 1968. The third area of research was an epizootiological investigation of *M. levispora* in an isolated population of *O. rimosa*. Data for this portion of the investigation were collected during emergence of large numbers in 1967 and 1969. The results of these investigations are to be presented in three papers: (1) Taxonomy of the genus; (2) Biology of *Okanagana rimosa* and its pathogen, *Massospora levispora*; and (3) Epizootiology of *Massospora levispora* in an isolated population of *Okanagana rimosa*.

The genus *Massospora* was established by Peck (1879) with the description of *M. cicadina*. He placed this genus in the Coniomycetes near the genus *Protomyces*. Forbes (1888) and Thaxter (1888) concluded independently that *Massospora* belonged to the Entomophthoraceae. This was confirmed by the detailed observations of Speare (1921) and Goldstein (1929). *Massospora cicadina* was found to be a pathogen of adult 17-year cicadas, *Magicicada septendecim* (L.). Subsequently, it has been found to attack all species of *Magicicada* in the eastern and midwestern United States (Soper, 1963). Two other *Massospora* species have been observed attacking cicadas.

Ciferri *et al.* (1957) described *M. spinosa* Ciferri, Machado and Vital from adult cicadas of *Quesada gigas* (Olivier) from northeastern Brazil. Soper (1963) described *Massospora levispora* Soper from adult cicadas of the species *Okanagana rimosa* (Say) from northern Ontario. Other fungal species attributed to *Massospora* have since been relegated to different entomogenous genera. *Massospora cleoni* Wize, and *Massospora richteri* Bresadola and Startz were transferred to *Entomophthora* by Bubak (1903, 1906, 1916). Recently MacLeod and Müller-Kögler (1970) transferred *Massospora tipulae* Porter to the genus *Entomophthora*. *Massospora staritzii* Bresadola has been placed in the genus *Sorosporella* by Speare (1920) and recently MacLeod and Müller-Kögler (1970) expressed the opinion that Bubak (1916) has correctly transferred this species to the genus *Entomophthora*.

It is now evident that the three valid species, *M. cicadina*, *M. spinosa*, and *M. levispora*, together with eight new species described in this paper, constitute a small unique group of entomogenous fungi. The genus *Massospora* is confined to the terminal portion of the abdomen attacking primarily the genitalia of adult cicadas. They have been collected in North America from northern Ontario, Canada south to the Florida Keys and west to Nevada; in the Caribbean from Cuba; in Central America from Mexico and Honduras; in South America from Argentina, Brazil, Chili, Venezuela; and from southeast Asia in Japan. *Massospora* species have been found to attack only cicadas that are gregarious and occur in large numbers. Most of the major cicada collections in the United States and South America have been searched for fungus infected specimens and no solitary cicadas have been found infected even though eight new *Massospora* species were discovered. The information gained during this study now allows for a more detailed description of the genus.

*Massospora* Peck emend. Soper

31st Rept. N. Y. State Museum Nat. Hist. p. 44. 1879. Pathogenic to adult cicadas, fungus growth confined to abdomen of host; spores of two types generally do not occur simultaneously or consecutively within the same

insect; conidia usually binucleate, sometimes uninucleate or multinucleate, arising within irregular cavities formed within the host abdomen, exposed by the sloughing off of the abdominal segments, cavity wall rupture and release of conidia at maturity, not forcibly ejected from conidiophores; resting spores globose, epispore reticulated, arising from hyphal bodies within the host's abdomen but not in chambers. (Fig. 1 and 2).

Type species: *Massospora cicadina* Peck.

This genus can be easily separated from the other entomogenous genera of the Entomophthoraceae in several respects. The conidia of *Massospora* are produced in chambers within a mycelial mass whereas in other genera they are forcibly ejected from conidiophores. All *Massospora* species produce reticulated resting spores whereas most Entomophthoraceae produce smooth walled resting spores or if ornamented, then not reticulated. Also, so far as known, *Massospora* species grow only in the abdomen of cicadas.

The herbaria referred to in this paper have been abbreviated as follows: BPI - National Fungus Collection, Beltsville, Maryland; CUP - Cornell University, Ithaca, New York; DAOM - Canada Department of Agriculture, Ottawa, Ontario, Canada; FH - Farlow Herbarium, Harvard University, Cambridge, Mass.; URM - Institute of Mycology, Federal University, Recife, Brazil; MICH - University of Michigan, Ann Arbor; and NYS - New York State Museum, Albany, New York.

## PREVIOUSLY KNOWN SPECIES

1. *Massospora cicadina* Peck, 31st Rept. N. Y. State Museum Nat. Hist. p. 44. 1879.

Conidia verrucose, ovoid, papilla noticeable but not prominent, 10 - 17μ x 14 - 20μ (av. 15.5μ x 18.5μ), binucleate, creamy white in mass; resting spore reticulation forming relatively uniform chambers, ridges of reticulation with small rounded projections, width and height of projections about equal, 33.5μ x 47.5μ (av. 40.5μ), tetranucleate, brown in mass. (Fig. 3a,b).

*Holotype*: UNITED STATES: New York: Livingston, Columbia Co., and Albany: In the abdomen of an adult 17-year cicada, *M. septendecim*. Conidial stage. June 1877, *Coll. Peck*. NYS.

*Hosts:* HOMOPTERA: *Magicicada septendecim*, *Magicicada cassini* (Fisher), *Magicicada septendecula* Alexander and Moore, *Magicicada tredecim* (Walsh and Riley), *Magicicada tredecassini* Alexander and Moore, and *Magicicada tredecula* Alexander and Moore (Cicadidae), (Soper, 1963).

This species has been reported from the cicada *Platypleura kaempferi* F. in Japan (Kobayasi, 1951) and from the cicada *Diceroprocta biconica* Walker in Cuba (Weiser and Stary, 1967). These observations were made of cicadas infected with reticulated resting spores. Undoubtedly they were species of *Massospora* but their identification as *M. cicadina* is questionable.

2. *Massospora spinosa* Ciferri, Machado, and Vital, Ist. Bot. Reale Univ. Reale Lab. Crittog. Pavia Atti, Ser. 5, 14: 17. 1957.

Conidia, verruculose, ovoid to ellipsoidal, slightly crenate in cross section, papilla indistinct, 6.4 - 9.6μ x 9.6 - 22.5μ (av. 8.3μ x 15.2μ), binucleate with nuclei bipolar, brown in mass; resting spore reticulation forming relatively uniform chambers, ridges of reticulation with small projections usually bluntly pointed to truncate, 35-45μ (av. 38.5μ), brown in mass. (Fig. 4).

*Holotype:* BRAZIL: Paraiba: Areia: Campus of Escola de Agronomia do Nordeste: Growing in the abdomen of an adult cicada, *Q. gigas*, Det. T. E. Moore. Resting spore stage. *Coll. Machado 5343*. URM.

*Other specimens examined:* Same data as holotype *Coll. Machado 3574, 3575, 3576* and *5345*. URM. MEXICO: Apodaca NL: Growing in the abdomen of an adult cicada, *Q. gigas* Det. T. E. Moore. Conidial stage. 10 Oct. year unknown. *Coll. A. Rumay Jr.* CUP. VENEZUELA: Caracas: Campus of Instituto de Zoologica Tropical, Universidad Central de Venezuela: Growing in the abdomens of adult cicadas, *Q. gigas*, Det. T. E. Moore. Resting spore and conidial stages. 14 April 1967, *Coll. Soper*. CUP, BPI, FH.

Collection *Machado 5345* was labeled *Allomyces* sp. This is apparently the *Allomyces* reported by Ciferri et al. (1957) on cicadas. It is, in fact, the conidial stage of *M. spinosa*.

*Hosts:* HOMOPTERA: *Quesada gigas* (Cicadidae).

The resting spores of this species are similar to *M. cicadina* but the sculpturing on the ridges of the reticulations is different. The small papillae in *M. spinosa* are shorter and less rounded. The spores are also slightly smaller averaging 38.5μ vs. 40.5μ. The conidia are very dissimilar being ovoid to ellipsoidal with nuclei located at the ends of the spore in *M. spinosa* whereas they are ovoid with random placement of nuclei in *M. cicadina*. The conidia in *M. spinosa* are smaller averaging 8.3μ x 15.2μ vs. 15.5μ x 18.5μ in *M. cicadina*.

3. *Massospora levispora* Soper, Can. J. Bot. 41: 875. 1963.

Conidia smooth walled, ellipsoidal to ovoid, papilla prominent, 6.0 - 11.0μ x 9.5 - 23.0μ (av. 8.0μ x 15.0μ), binucleate, occasionally trinucleate or uninucleate, located at random within the spore, creamy white in mass; resting spore reticulation broad irregular bearing many small rounded papillae, 27.5 - 40.5μ (av. 34.0μ) yellowish brown in mass. (Fig. 3c, d).

*Holotype:* CANADA: Ontario: Algoma District: 4 miles east of Searchmont near Whitman Dam: Growing in abdomen of adult female cicada, *Okanagana rimosa*. Conidial stage. 28 June 1962, *Coll. Soper*. DAOM 90058.

*Paratype:* Same locality data as holotype. Growing in abdomen of male cicada, *O. rimosa*. Resting spore stage. 5 July 1962, *Coll. Soper*. DAOM 90059. Both spore stages deposited, BPI 71717 and 71718, FH, MICH, and CUP. UNITED STATES: California: Mono County: East shore Black Lake: Growing in abdomen of male cicada, *Okanagana sperata* Van Duzee, Det. T. E. Moore. Conidial stage. 6 July 1961, *Coll. A. Beck*. CUP.

*Hosts:* HOMOPTERA: *Okanagana rimosa* and *Okanagana sperata* (Cicadidae).

The resting spores of *M. levispora* can be easily

distinguished from those of other *Massospora* species. The irregular reticulated epispore bearing many small papillae is unique. The conidia can be separated from other species on the basis of the smooth walls, distinct papilla and random location of the two to three nuclei. (cf. Soper, 1963 Fig. 4).

## NEWLY DESCRIBED SPECIES

4. *Massospora dorisiana* Soper, sp. nov.

Conidia verruculosa, apparenter transectione crenata, obovata aut ellipsoidea ad navicularia, late acuta apice, base paulum truncata 9.6 - 12.8μ x 16.1 - 28.9μ (med. 10.8μ x 21.8μ) binucleata bipolaribus nucleis, in cumulo cremeoalba; dorminentes sporae ignotae.

Conidia verruculose appearing crenate in cross section, obovate or ellipsoidal to navicular, broadly acute at the tip, slightly truncate at base, 9.6 - 12.8μ x 16.1 - 28.9μ (av. 10.8μ x 21.8μ), binucleate with bipolar nuclei, creamy in mass; resting spores unknown. (Fig. 5a).

*Holotype:* BRAZIL: Paraiba: Areia: Campus of Escola de Agronomia do Nordeste: Growing in the abdomen of an adult cicada, *Dorisiana semilata* (Walker), Det. T.E. Moore. Conidial stage. March 1955, *Coll. Machado 5346*. URM.

*Name:* This species is named for the genus of cicada which it attacks, *Dorisiana*.

*Host:* HOMOPTERA: *Dorisiana semilata* (Cicadidae).

The conidia are very dissimilar from other *Massospora* species. They are navicular with nuclei located at the ends of the spore and are quite large averaging 10.8μ x 21.8μ.

5. *Massospora ocypetes* Soper sp. nov.

Conidia verruculosa, ovoidea ad ellipsoidea, latis definitis papilla, 6.5 - 9.0μ x 9.0 - 19.4μ (med. 7.0μ x 12.0μ) nuclei indefiniti videntur ut massa brunnea; reticulatio dormientis sporae uniformiores loculas formans, in cristis nullae papillae, 28.9μ - 41.7μ (med. 34.3μ) videntur ut massa brunnea.

Conidia verruculose, ovoid to ellipsoidal, with broad distinct papilla, 6.5 - 9.0μ x 9.0 - 19.4μ (av. 7.0μ x 12.0μ) brown in mass, nuclei indistinct; resting spore reticulation forming relatively uniform chambers, lacking papillae on ridges, 28.9μ - 41.7μ (av. 34.3μ) brown in mass. (Fig. 6).

*Holotype:* ARGENTINA: Gualeguaychu: R. A. Entre Rios: Growing in the abdomen of an adult cicada, *Dorisiana bonaerensis* (Berg), Det. R. Froeschner. Fungus in resting spore stage. December-March, year unknown, *Coll. H. Rossi.* CUP.

*Paratypes:* Same collection data as holotype. Conidial and resting spore stages, CUP, BPI, and FH.

*Name:* This species is named for Ocypete, one of the Harpies who infected everything she touched.

*Host:* HOMOPTERA: *Dorisiana bonaerensis* (Cicadidae).

The resting spores of *M. ocypetes* can be distinguished from those previously described by the lack of distinct papillae on the reticulations. They are also smaller averaging 34.3μ vs. 38.0μ for *M. dorisiana*, 38.5μ for *M. spinosa* and 40.5μ for *M. cicadina*. The conidia are very similar to *M. levispora* but the reticulation on the resting spores leaves little doubt that they are different species.

Dr. A. Willink, Miguel Lillo Foundation, Tucuman, Argentina, has related a very interesting folk superstition concerning this species. The natives living in the Entre Rios area believe that cicadas have the power to heal themselves. When their abdomens fall off, the cicadas pack them with mud to prevent bleeding. These observations correspond, of course, to the maturation of the conidial stage of *M. ocypetes*.

6. *Massospora tettigates* Soper sp. nov.

Conidia parietibus laevibus, ovoidea, papilla indefinita, 6.4 - 8.3μ x 9.0 - 15.5μ (med. 8.3μ x 13.0μ), multinucleata, cum 2 ad 6 nucleis, videntur recentia sicut massa ochroleuca, nigrescentia aetate; dormiens spora latis reticulationibus, papillae minutae et idefinitae, 28.9 - 41.7μ (med. 36.3μ), videntur ut massa ochracea.

Conidia smooth walled, ovoid, papilla indistinct, 6.4 - 8.3μ x 9.0 - 15.5μ (av. 8.3μ x 13.0μ), multinucleate with 2 to 6 nuclei, creamy white in mass when fresh turning black with age; resting spore with broad reticulations, papillae minute and indistinct, 28.9 - 41.7μ (av. 36.3μ), light brown in mass. (Fig. 7).

*Holotype:* CHILI: Santiago: 1800-2000 m. Camino a Farellones: Growing in abdomen of adult cicada, *Tettigates* sp. Resting spore stage present. 21 December 1969, *Coll. L. E. Pena G.* CUP.

*Paratypes:* Same collection data as holotype. Resting spores and conidial stages present, CUP, FH and BPI.

*Name:* The species name is based on the genus of cicada which serves as its host, *Tettigates*.

*Other specimens examined:* CHILI: Aconcagua Province: Jahuel: Lat. 37° 50' South, long. 71° 44' East, near Mulcher on the Rio Bio. Growing in abdomen of cicada, *Tettigates* sp. Conidial stage. 23 December 1963, *Coll. Pino*. Penehue: 1381 m. In abdomen of adult *Tettigates* sp. (different than host of Holotype). Resting spore stage. 10 January 1946, *Coll. L. E. Pena G.* CUP.

*Host:* HOMOPTERA: *Tettigates* spp. (Cicadidae).

The resting spores of *M. tettigates* are easily recognized by their broad reticulations. No other species of *Massospora* even closely resembles *M. tettigates* in this respect. The smooth conidia of this species can be distinguished from *M. levispora* by the absence of a distinct papilla and multinucleate condition. The conidia of *M. tettigates* tend to be broadly ovoid as opposed to the ovoid to ellipsoidal conidia of *M. levispora*.

7. *Massospora carineta* Soper sp. nov.

Conidia verrucosa, globosa ad subglobosa, nulla papilla, 9.0 - 11.6μ (med. 10.0μ), binucleata, videntur ut massa brunnea; dormientes sporae ignotae.

Conidia verrucose, globose to subglobose, papilla absent, 9.0 - 11.6μ (av. 10.0μ), binucleate, brown in mass; resting spores unknown. (Fig. 5b).

*Holotype:* BRAZIL: Sao Paulo: Barueri: Engenho Tres Pedras: Growing in the abdomen of an adult cicada *Carineta* sp. Conidia present. 25 June 1950, *Coll. O. P. Keller.* CUP.

*Paratypes:* BRAZIL: Sao Paulo: Barueri: Growing in the abdomen of cicada, *Carineta* sp. Conidia present. 26 April 1956, BPI and FH. Osasco: Growing in the abdomen of a cicada, *Carineta* sp. Conidial stage present. 27 February 1951, *Coll. O. P. Keller.* CUP.

*Other Specimens Examined:* ARGENTINA: Misiones: Growing in the abdomen of *Carineta* sp. Conidia present. January 1956. CUP.

*Name:* The cicada genus *Carineta* was used as a basis for this specific name to indicate its host.

*Host:* HOMOPTERA: *Carineta* sp. (Cicadidae).

Only *M. carineta* is known to have globose conidia.

8. *Massospora diminuta* Soper sp. nov.

Conidia ignota; dormientis sporae reticulatio cum multis latis truncatis papillis, 22.5μ - 32.1μ (med. 27.0μ).

Conidia unknown: resting spore reticulation with many broad truncate papillae 22.5μ - 32.1μ (av. 27.0μ). (Fig. 8a, b).

*Holotype:* BRAZIL: Amapa: Rio Tracajatuba: Growing in abdomen of an adult, *Cicada* sp.? Resting spores present, December 1964. CUP.

*Name:* The species name is based on the Latin diminutivus (small) since this is both the smallest cicada known to be attacked by *Massospora* and the smallest *Massospora* resting spore described.

*Host:* HOMOPTERA: *Cicada* sp.?(Cicadidae).

The resting spore of *M. diminuta* can be distinguished from all other *Massospora* species by the small size, average 27.0μ.

9. *Massospora platypedia* Soper sp. nov.

Conidia laevia, late ellipsoidea, papilla lata et definita, 5.2 - 7.7μ x 6.5 - 12.9μ (med. 6.0μ x 9.9μ) binucleata nucleis bipolaribus, videntur ut massa cremeo-alba; dormientes sporae ignotae.

Conidia smooth, broadly ellipsoidal, papilla broad and distinct, 5.2 - 7.7μ x 6.5 - 12.9μ (av. 6.0μ x 9.9μ), binucleate with nuclei bipolar, creamy white in mass; resting spores unknown. (Fig. 5c).

*Holotype:* CALIFORNIA: Shasta Co.: Redding: Growing in the abdomen of an adult cicada, *Platypedia putnami* var. *keddiensis* Davis, Det. T. E. Moore. Conidial stage present. 15 June 1956. *Coll. W. Wiard.* CUP.

*Paratype:* Same data as holotype. Conidial stage present, BPI, CUP, and FH. Growing in abdomen of *P. putnami* var *putnami* (Uhler), Det. T. E. Moore. Conidial stage present. 9 June 1942, *Coll. J. L. S.* CUP. NEW MEXICO: Tajique: Growing in abdomen of *P. putnami* var. *lutea* Davis, Det. T. E. Moore. Conidial stage present. 25 June 1941, *Coll. E. L. Todd.* CUP. UTAH: Zion National Park: Growing in the abdomen of *P. putnami* var. *keddiensis* Davis, Det. T. E. Moore. Conidial stage present. 24 June 1949, *Coll. W. H. Lange.* CUP.

*Name:* The species name is based on the genus name of the host cicada *Platypedia.*

*Host:* HOMOPTERA: *Platypedia putnami* var. *putnami,* var. *keddiensis,* and var. *lutea,* (Cicadidae).

This species can be distinguished from *M. levispora* which also has smooth walled conidia by the bipolar placement of its two nuclei. The conidia of *M. platypedia* are of more uniform shape being broadly ellipsoidal. Although the papillae are distinct, they are not as prominent as in *M. levispora.*

10. *Massospora diceroprocta* Soper sp. nov.

Conidia verruculosa, anguste ellipsoidea aut fusiforma ad ellipsoidea aut obovata, papilla indefinita, 6.5 - 7.7μ x 11.6 - 20.6μ (med. 6.8μ x 17.1μ) marores sporae utroque fine accuminatae, binucleatae cum nucleis bipola-

ribus, videntur recentia ut massa violacea; dormientes sporae ignotae.

Conidia verruculose, narrowly ellipsoidal or fusiform to ellipsoidal or obovate, papilla indistinct, 6.5 - 7.7μ x 11.6 - 20.6μ (av. 6.8μ x 17.1μ), larger spores acuminate at both ends, binucleate with nuclei bipolar, violet in mass when fresh; resting spores unknown. (Fig. 5d).

*Holotype:* TEXAS: Laredo: Growing in the abdomen of an adult *Diceroprocta delicata* (Osborn), Det. R. Froeschner. Conidial stage present. 26 August 1971, *Coll. J. A. Palmer.* CUP.

*Paratype:* Same data as holotype. Conidial stage present. BPI. TEXAS: Hidalgo County: Alamo: Growing in abdomens of cicadas *D. delicata* and *D. cinetifera.* Det. R. Froeschner. Conidial stage present. 25 August 1970, *Coll. D. Dalager.* BPI. Mission: Growing in the abdomen of *Diceroprocta cinetifera* var. *viridicosta* Davis. Det. T. E. Moore. Conidial stage present. Date and Coll. unknown. CUP: Weslaco: Growing in the abdomen of *D. delicata.* Det. T. E. Moore. Conidial stage present. 21 July 1930, *Coll. S. W. Clark.* CUP.

*Name:* This species is named for the genus of cicada on which it is found, *Diceroprocta.*

*Other specimens examined:* Two specimens of *Diceroprocta* have been located which harbor resting spores of *Massospora* species. These resting spores are very similar to *M. cicadina.* They are on species of *Diceroprocta* other than those on which the type of *M. diceroprocta* is based. Also, they are from areas remote from its type locality which is the Rio Grand Valley, Texas. For these reasons, they have not been described as *M. diceroprocta.* The collection data on these specimens are as follows: LOUISIANA: Location unknown: Growing in abdomen of *Diceroprocta vitripennis* (Say). Det. T. E. Moore. Resting spores present, 31.0μ - 44.0μ (av. 40.2μ). July 1885. CUP. FLORIDA: Key Largo: Growing in abdomen of *D. biconica* (Walker). Det. T. E. Moore. Resting spores present, 32.3μ - 40.0μ (av. 35.5μ). 9 August 1930, *Coll. R. H. Beamer.* CUP. The resting spores from these two species are shown in Fig. 9. Although the ornamentation on the reticulations are similar, (Fig. 9b, d), the

ridges themselves appear different. Those of the *D. vitripennis* specimen are broader than those from *D. biconica* (Fig. 9a, c). Also, the resting spores from *D. vitripennis* average larger, 40.2μ vs. 35.5μ which is similar to *M. cicadina*, i.e., 40.5μ.

*Host:* HOMOPTERA: *Diceroprocta cinetifera* var. *viridicosta* and *Diceroprocta delicata* (Cicadidae).

The conidia of *M. diceroprocta* are quite different from any other known *Massospora*. The ellipsoidal to fusiform shape separates them from all others. Only *M. dorisiana* has conidia close to this species but these are broader and much larger 10.8μ x 21.8μ vs. 6.8μ x 17.1μ.

11. *Massospora fidicina* Soper sp. nov.

Conidia verruculosa, ovoidea, aliquando subglobosa, papilla indefinita, 7.7 - 9.0μ x 9.0 - 14.2μ (med. 8.2μ x 11.1μ), uninucleata, videntur sicut massa cremeo-alba; dormiens spora tenuibus reticulationibus, margines cum multis truncatis papillis, papillae longitudine pares latitudini aut maiores 35.5μ - 41.3μ (med. 37.9μ) videntur sicut massa ochrea.

Conidia verruculose, ovoid, occasionally subglobose, papilla indistinct, 7.7 - 9.0μ x 9.0 - 14.2μ (av. 8.2μ x 11.1μ), uninucleate, creamy white in mass; resting spore with fine reticulations, ridges bearing many truncate papillae, papilla length equal to, or greater than, width, spores 35.5μ - 41.3μ (av. 37.9μ) light brown in mass. (Fig. 10).

*Holotype:* HONDURAS: Guaimas District: Tela: Growing in abdomen of an adult *Fidicina* sp. Resting spore stage present. 1 June 1923, *Coll. T. H. Hubbell.* CUP.

*Paratype:* Same data as holotype. Resting spores present, BPI. MEXICO: Chiapas: 11 mi. north of Arriaga: Growing in abdomen of *Fidicina* nr. *pronoe*. Det. T. E. Moore. Conidial stage present. 2 June 1941, *Coll. I. J. Cantrall.* CUP.

*Name:* The species name of this *Massospora* is based on the generic name of its host *Fidicina*.

*Host:* HOMOPTERA: *Fidicina* sp. (Cicadidae).

The conidia of this species are similar to *M. platypedia* in shape. They can be distinguished by being verruculose vs. smooth, uninucleate vs. binucleate, and slightly larger, 8.2μ x 11.1μ vs. 6.0μ x 9.9μ. The resting spores of *M. fidicina* are similar to those of *M. spinosa* both being approximately 38μ in diameter. The papillaeon reticulations of *M. fidicina* are wide and truncate while those of *M. spinosa* are generally rounded, although occasionally truncate.

## EXCLUDED SPECIES

*Massospora tipulae* is generally considered a species of *Entomophthora* (MacLeod and Müller-Kögler, 1970). The placement in this genus is correct, but since there exists the species *Entomophthora tipulae* Fresenius, 1856, MacLeod and Müller-Kögler have created a homonym. The holotype of *M. tipulae* was obtained from BPI and an emended description based on this material is provided below.

> *Entomophthora porteri* nom. nov. (Basionym: *Massospora tipulae* Porter, J. Elisha Mitchell Sci. Soc. 58: 65. 1942, non *E. tipulae* Fres. 1856).

Conidial stage unknown; resting spores bearing many finger-like projections, globose to subglobose, 36.1μ - 45.2μ (av. 38.8μ), dark brown, black in mass, cup-like appendage at point of attachment; hyphal bodies colorless, various shapes, commonly elongate, 19.4 - 32.2μ x 90.3 - 116.1μ. (Fig. 8c, d).

*Holotype:* TENNESSEE: Knoxville: Cherokee Farm: Growing in body of adult cranefly, *Tipula triplex* var. *colei* Alexander. Resting spore stage. 21 April 1938, *Coll. A. C. Cole* and *C. Huffacker*. BPI as no. 4400 Flora of Tennessee.

*Host:* DIPTERA: *Tipula triplex* var. *colei* (Tipulidae).

*Name:* This species is named after Dr. J. P. Porter who originally recognized this fungus as new to science (Porter, 1942).

## SYNOPTIC KEY TO SPECIES

The following synoptic key was devised to assist in the identification of cicadas infected with *Massospora*. The method used to employ this type of key was explained in detail by Korf (1972). Any of the listed characteristics may be used as a first possible entry into the key. This will usually lead to a choice among several species. Additional characters are then examined until a unique combination is found for one species. If the specimen to be keyed is in the resting spore state, then generally it will be necessary to utilize scanning electron microscopy to make a definative determination. The underlined numbers indicate species showing only one of the alternatives in any character grouping. For the purposes of this key, the undescribed species occurring in cicadas *Diceroprocta* spp. have been assigned numbers i.e., 13. *D. biconica* and 14. *D. vitripennis*.

### CONIDIAL CHARACTERS

1-1. *Conidial shape*

a. ellipsoidal 2, 3, 4, 5, 9, 10
b. fusiform 10
c. globose 7
d. navicular 4
e. obovate 4, 10
f. ovoid 1, 2, 3, 5, 6, 11
g. subglobose 11, 7

1-2. *Conidial wall ornamentation*

a. absent 3, 6, 9
b. verrucose 1, 2, 7
c. verruculose 4, 5, 10, 11

1-3. *Number of nuclei*

a. one 3, 11
b. two 1, 2, 3, 4, 6, 7, 9, 10
c. three 3, 6
d. four or more 6

1-4. *Arrangement of nuclei*

a. bipolar 2, 4, 9, 10
b. random 1, 3, 6, 7

1-5. *Conidial length*

a. less than 8μ 9
b. 8 to 10μ 2, 3, 5, 6, 7, 9
c. 10 to 15μ 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
d. 15 to 20μ 1, 2, 3, 4, 5, 6, 10
e. more than 20μ 2, 3, 4, 10

## RESTING SPORE CHARACTERS

2-1. *Ornamentation of resting spore reticulum*

a. papillae absent 5
b. papillae minute 6
c. papillae rounded 1, 2, 3, 13, 14
d. papillae truncate 2, 8, 11, 13, 14

2-2. *Ridges of reticulum*

a. broad forming small chambers 6
b. irregular forming indistinct chambers 3
c. narrow forming distinct chambers 1, 2, 5, 8, 11, 13, 14

2-3. *Resting spore diameter*

a. less than 25μ 8
b. 25 to 30μ 3, 5, 6, 8
c. 30 to 45μ 1, 2, 3, 5, 6, 11, 13, 14
d. more than 45μ 1

## HOST

3-1. *Genus of cicada attacked*

a. *Carineta* 7
b. *Cicada*? 8
c. *Diceroprocta* 11, 13, 14
d. *Dorisiana* 4, 5

e. *Fidicina* 11
f. *Okanagana* 3
g. *Platypedia* 9
h. *Quesada* 2
i. *Tettigates* 6

## ACKNOWLEDGEMENTS

Drs. T. E. Moore, University of Michigan, and R. Froeschner, Smithsonian Institute, provided the identifications of the cicada species cited in this paper. Dr. D. Tatem, University of Maine, provided the Latin translations of the species descriptions. Their help is gratefully acknowledged.

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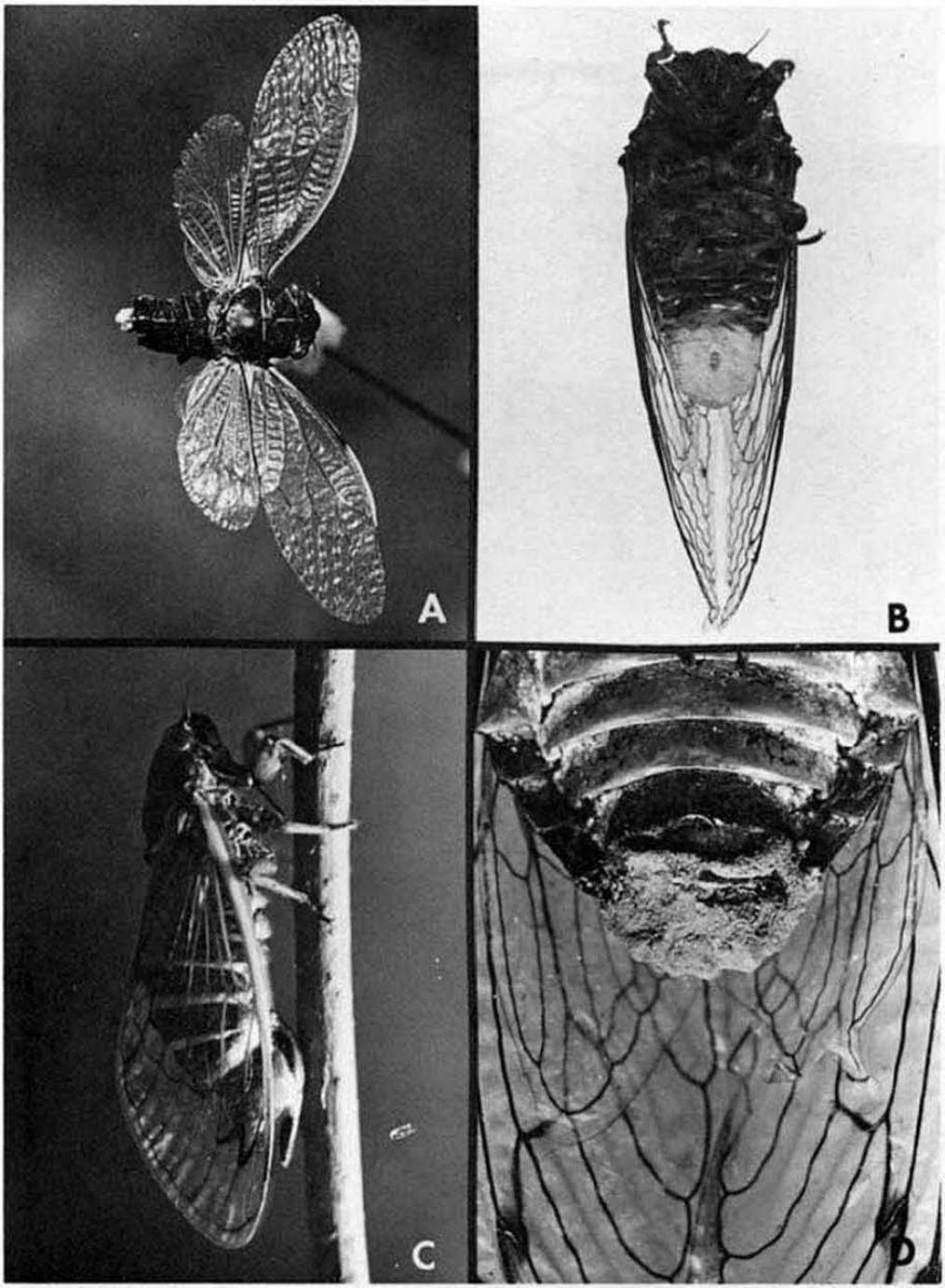


Figure 1. Cicadas infected with conidial stage of *Massospora*: (A) *Platypedia putnami* infected with *M. platypedia* 2.5 x; (B) *Okanagana rimosa* infected with *M. levispora* 2.5 x; (C) *Magicicada septendecim* early stage of *M. cicadina* 2 x; and *Quesada gigas* infected with *M. spinosa* 4 x.

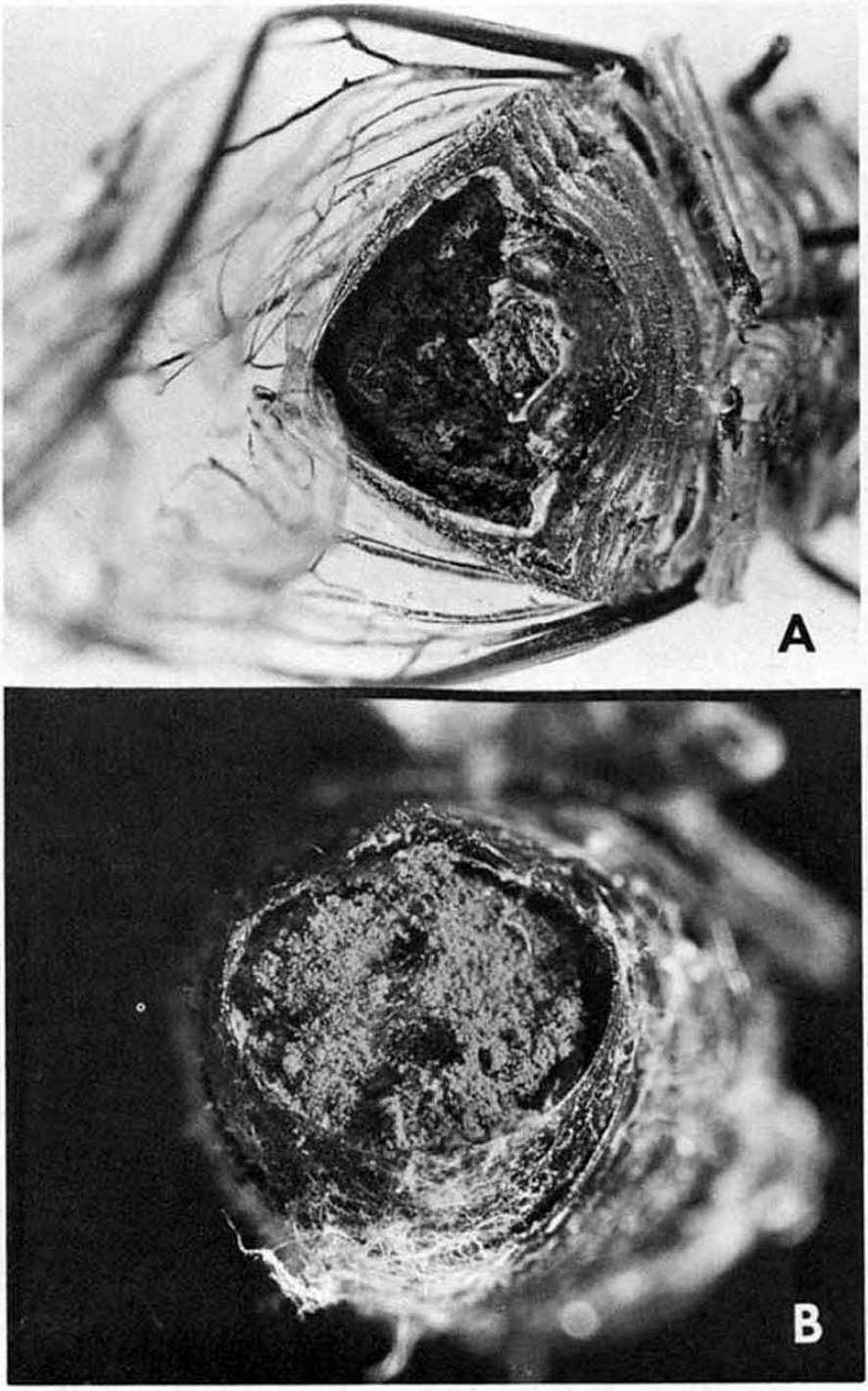


Figure 2. Cicadas infected with resting spore stage of *Massospora*: (A) *Quesada gigas* infected with *M. spinosa* 3 x; and (B) *Magicicada septendecim* infected with *M. cicadina* 4 x.

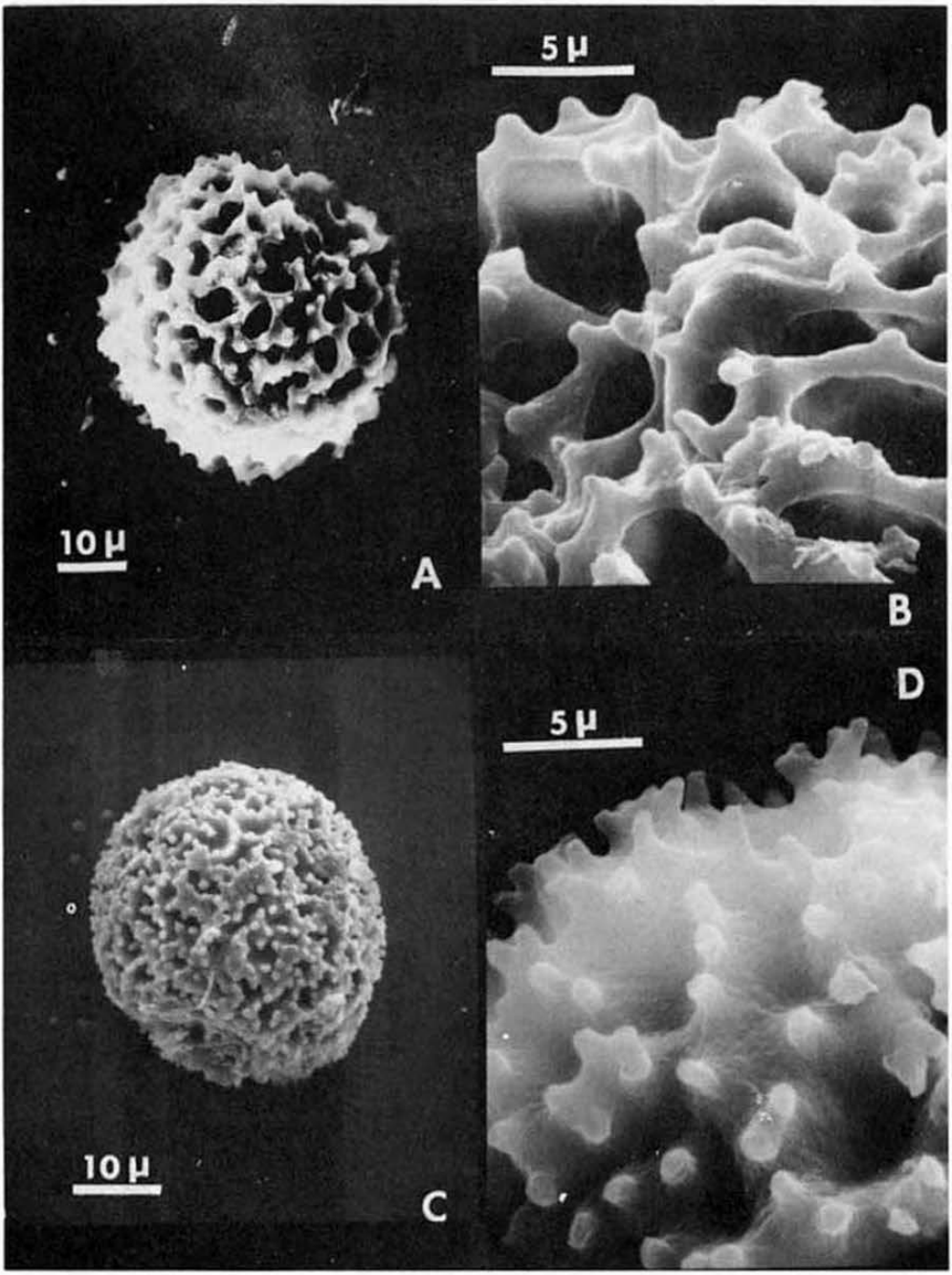


Figure 3. Scanning electron micrographs of resting spores: (A) and (B) *M. cicadina;* (C) and (D) *M. levispora.*

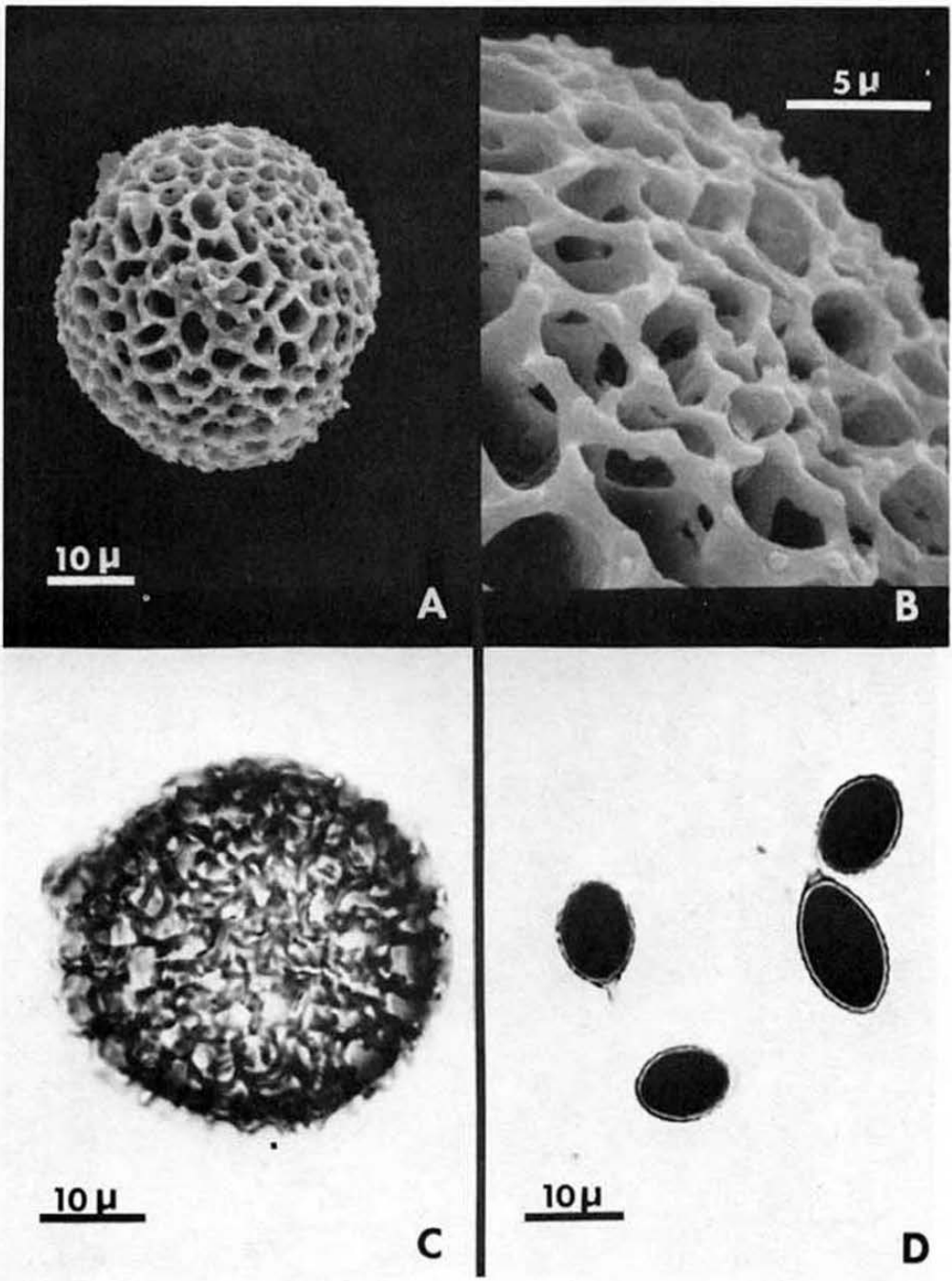


Figure 4. Spore stages of *M. spinosa:* (A) and (B) scanning electron micrograph of resting spore; (C) resting spore as seen through light microscope; and (D) conidia.

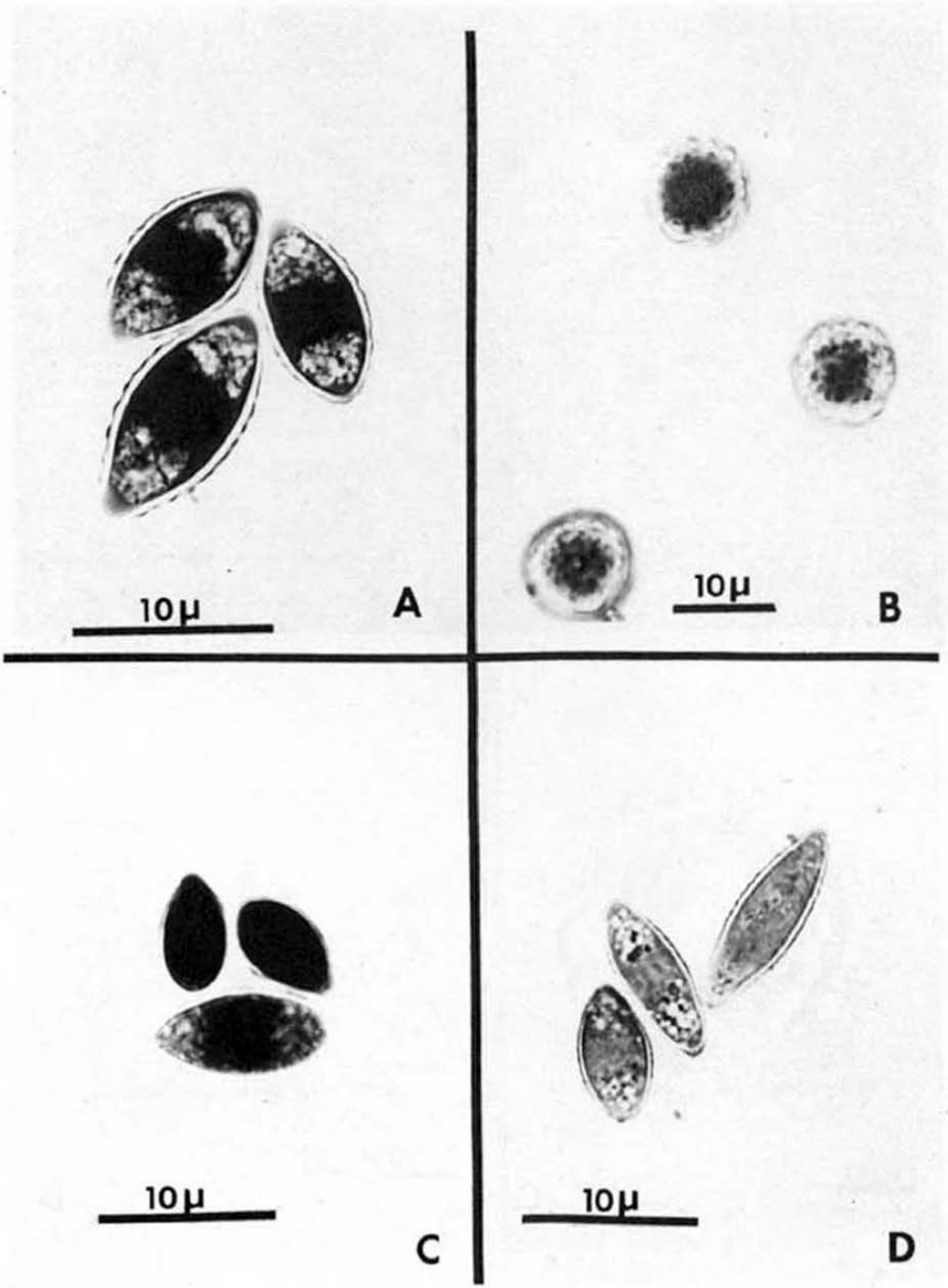


Figure 5. Conidial stages of *Massospora:* (A) *M. dorisiana;* (B) *M. carineta;* (C) *M. Platypedia;* and (D) *M. diceroprocta.*

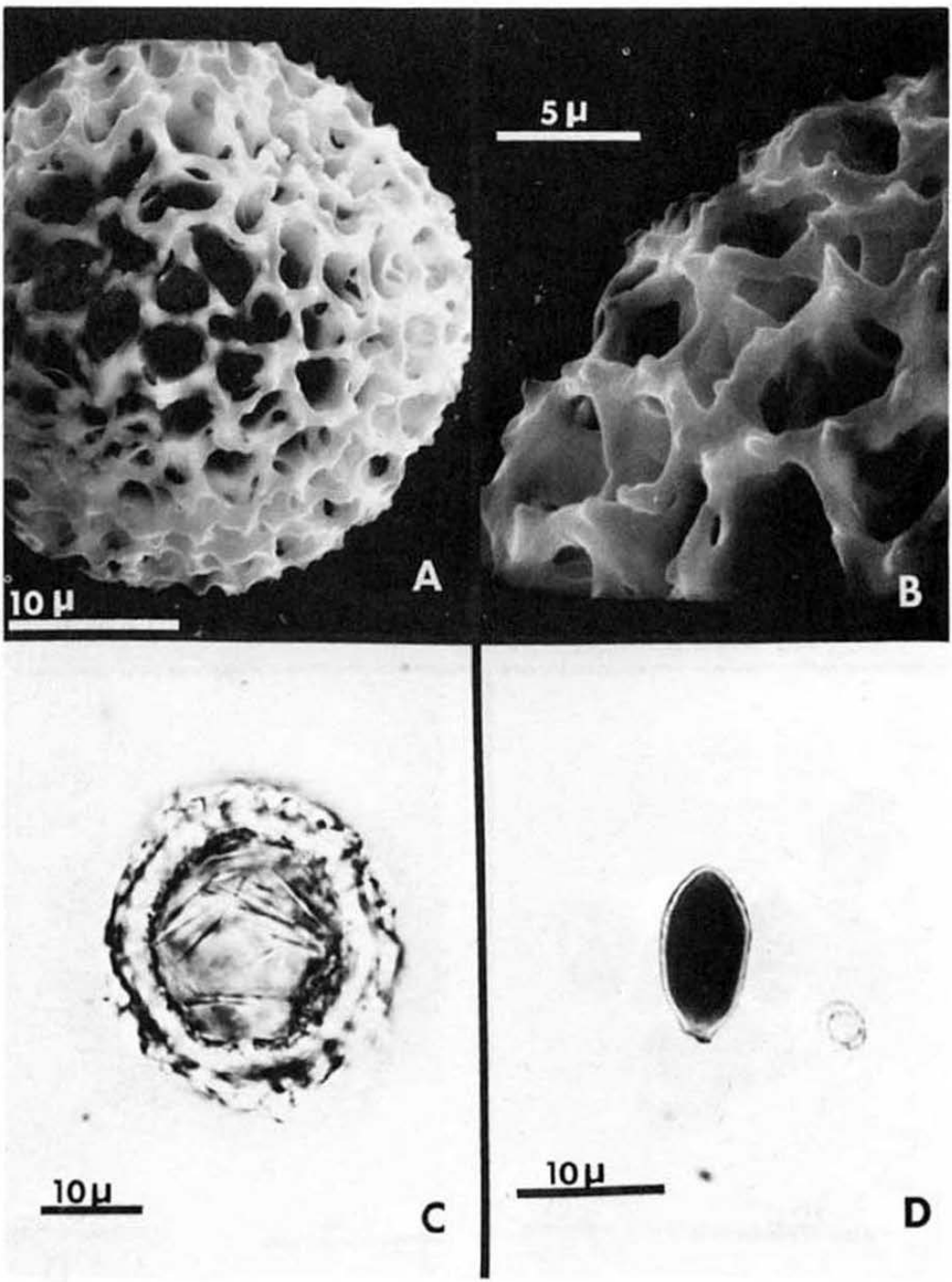


Figure 6. Spore stages of *M. ocypetes*: (A) and (B) scanning electron micrographs of resting spore; (C) resting spore as seen through light microscope; and, (D) conidia.

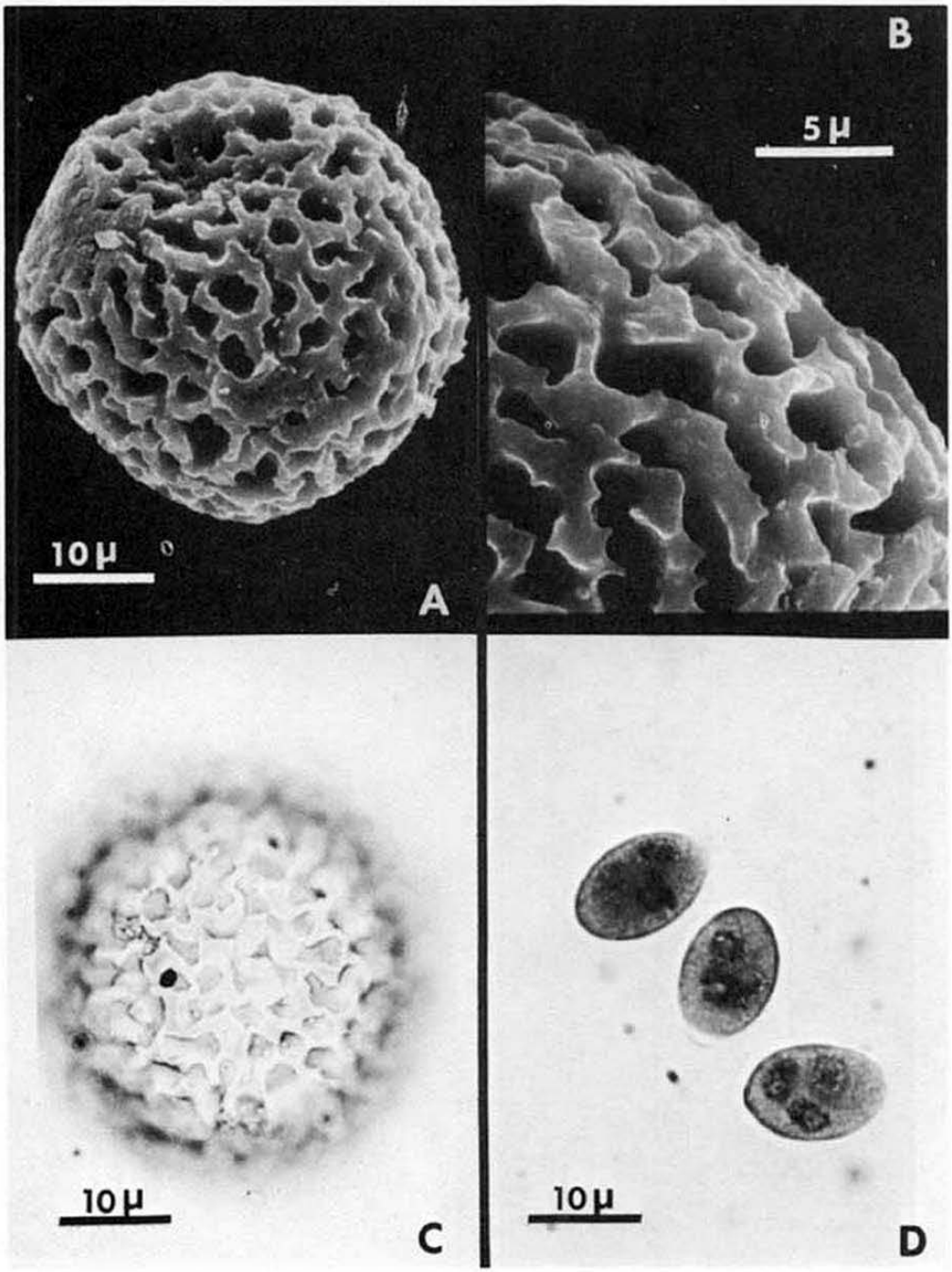


Figure 7. Spore stages of *M. tettigates*: (A) and (B) scanning electron micrographs of resting spore; (C) resting spore as seen through light microscope; and (D) conidia.

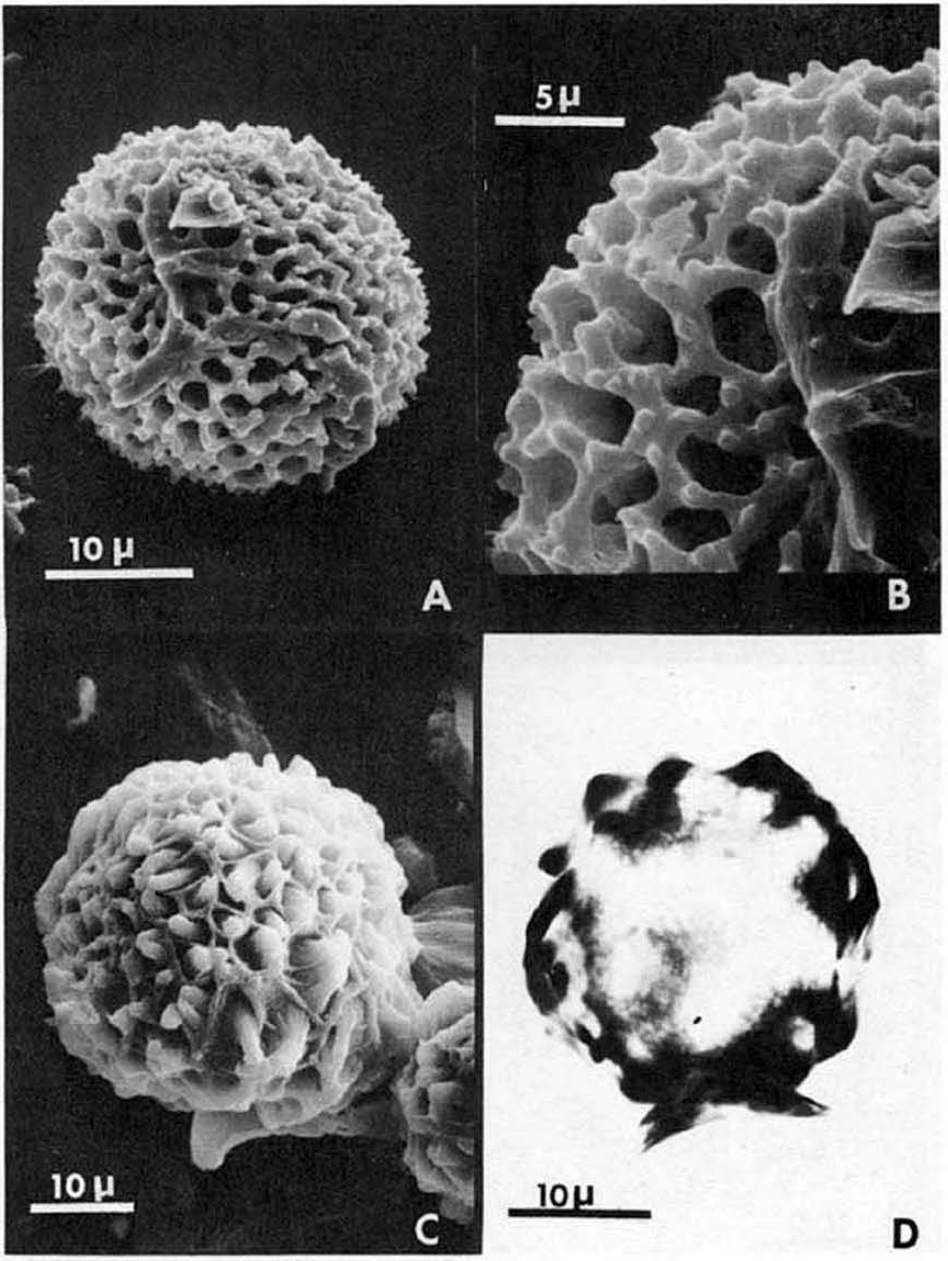


Figure 8. Resting spores: (A) and (B) scanning electron micrograph of *M. diminuta;* (C) scanning electron micrograph of *Entomophthora porteri* resting spore; and (D) appearance of *E. porteri* resting spore through light microscope.

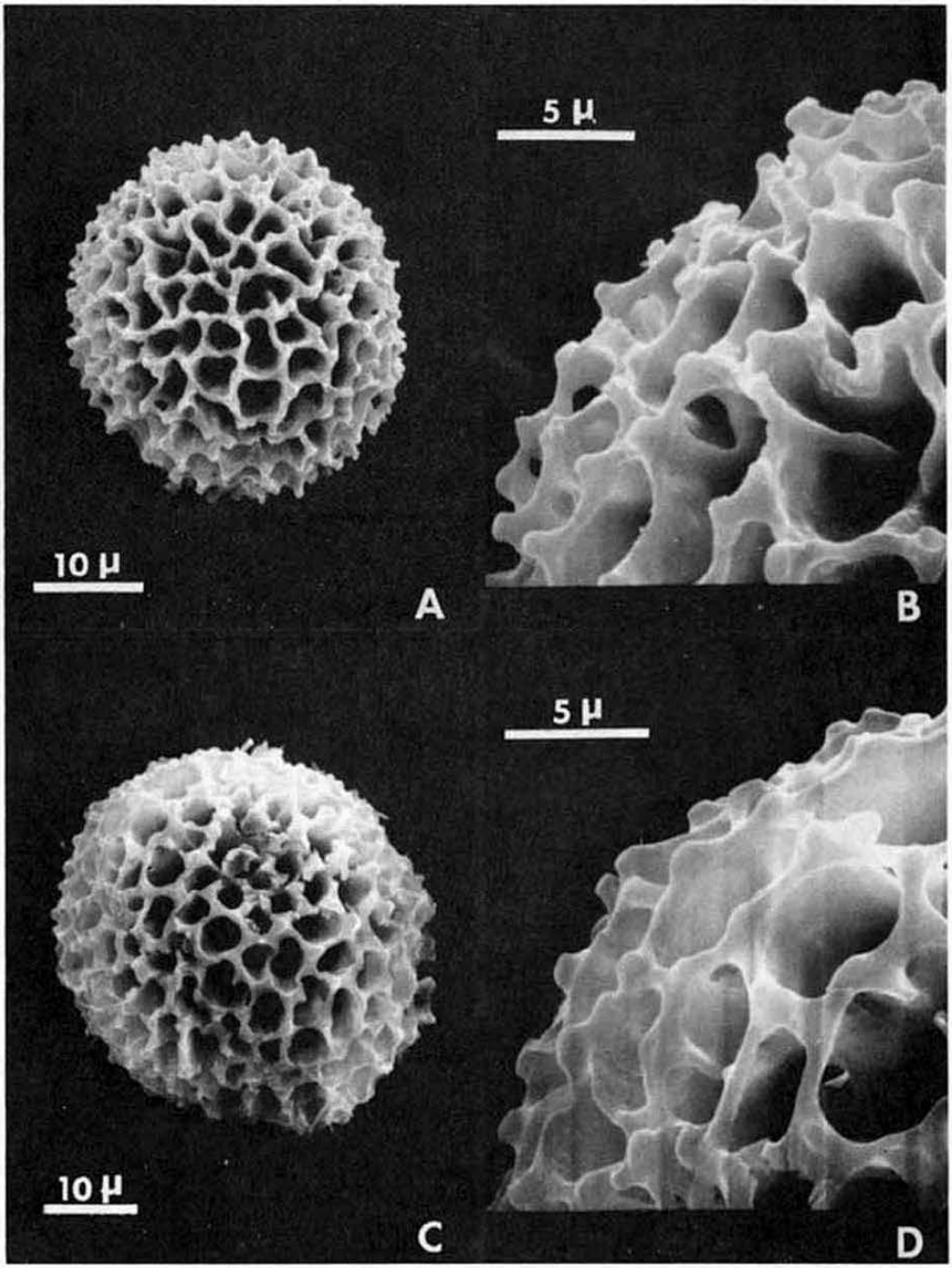


Figure 9. Scanning electron micrographs of *Massospora* resting spores from *Diceroprocta* spp.: (A) and (B) *D. biconica;* (C) and (D) *D. vitripennis.*

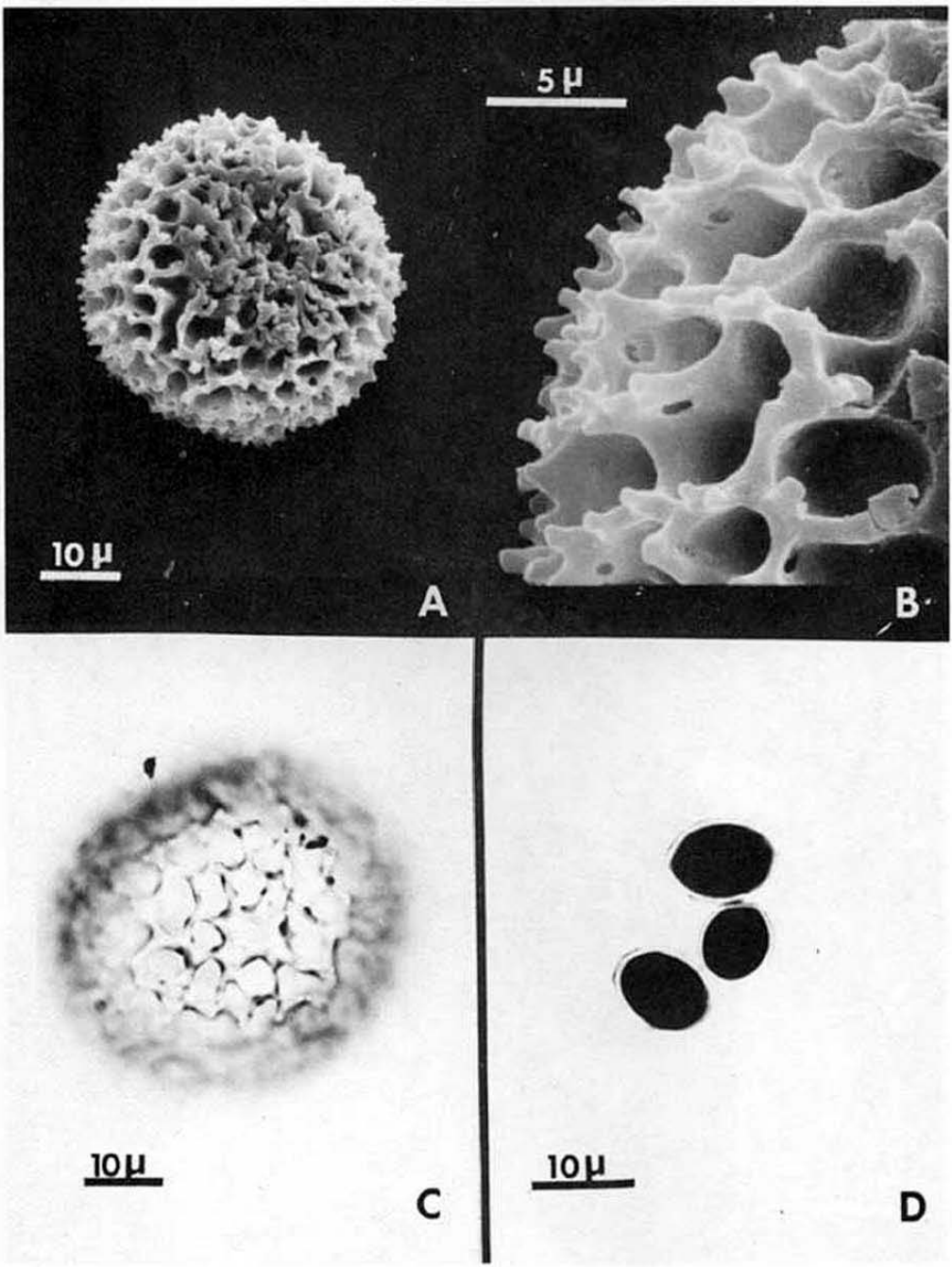


Figure 10. Spore stages of *M. fidicina*: (A) and (B) scanning electron micrographs of resting spore; (C) resting spore as seen through light microscope; and (D) conidia.

MYCOTAXON

Vol. I, No. 1, pp. 41-44 July-September 1974

# TAXONOMIC STUDIES IN THE PHACIDIALES: STICTIS MARITIMA AND THE GENUS LASIOSTICTIS

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*SUMMARY*

The genus *Lasiostictis*, typified by *Lasiostictis conigena* (Sacc. & Berlese) Sacc., is sufficiently distinct from *Stictis*, *Coccomyces*, and *Naemacyclus* to be retained as a genus of the Phacidiaceae. *Stictis maritima* Rolland and *Stictis fimbriata* Schw. are synonymns. *Lasiostictis fimbriata* (Schw.) Bäuml. is the correct name for the only species in the genus.

Saccardo erected the genus *Lasiostictis* in 1889 to include the single species *L. conigena* (Sacc. & Berlese) Sacc. In doing so he raised the infrageneric taxon (rank not specified) of Saccardo and Berlese (1885) to generic rank. The species grows on cone scales of *Pinus* sp. and is distinguished from *Stictis* proper (sensu Saccardo) by its hairy margin. Rehm (1896) recognized that the species was probably synonymous with *Stictis fimbriata* Schw., based on North American material on cone scales of *Pinus*, but concluded that Saccardo and Berlese had mistaken the frayed edge of the apothecium for hairs and that no basis existed for seggregating *S. fimbriata* from *Stictis*.

Petrak (1947) re-examined the species and observed that the asci were uniformly thin-walled and pointed apically, unlike those of *Stictis*. He chose to ignore the marked differences in excipular structure and suggested that *S. fimbriata* was no more than a growth form of *Naemacyclus niveus* (Pers.) Fckl., which grows on needles of the same host. The asci and spores of *N. niveus* indeed resemble those of *S. fimbriata* but this is scarcely sufficient reason for considering the two taxa conspecific. Although the hosts are the same, the substrates of the two fungi (needles and cone scales respectively) are quite dissimilar.

While examining collections of *Stictis* spp. made by R. P. Korf in Corsica, I encountered a specimen identified in the field as *Stictis maritima* Rolland. The species was originally described from there. The fungus agreed in all respects with Rolland's description and with a redescription by Müller and Hütter (1962) who transferred Rolland's species to *Coccomyces*. It was again reported from Corsica by Romagnesi (1973). The fungus grows immersed in cone scales of *Pinus maritima* L. and resembles a *Stictis;* the asci, how-

ever, are somewhat pointed and uniformly thin-walled, and there is a well-differentiated covering layer over the disc. When rehydrated the excipulum becomes reflexed, exposing the prominently hairy inner face of the covering layer. The reader is referred to the text of Müller and Hütter's article for a thorough redescription of *S. maritima*, the salient points of which are summarized above.

I rehydrated and examined superficially the material available in CUP, principally from the herbarium of E. J. Durand, of *Stictis fimbriata* Schw., and authentic material of *Lasiostictis conigena*. All specimens appeared under 25x magnification to have a more or less hairy margin. Schweinitz's type specimen and Saccardo's material contained so few apothecia that it did not seem advisable to section them, since published accounts of ascus and ascospore dimensions agreed with each other and with my observations on the other available material. Satisfactory sections of Korf's Corsican specimen, and collections by Sydow (Germany), Zahlbruckner (Hungary), and Ellis (USA) were obtained by imbedding in mucilage and sectioning at 20µm on a freezing microtome.

Maire(1930), commenting on *Lasiostictis fimbriata*, suggested that *Stictis maritima* was closely related. Judging both from the specimens examined and from Müller and Hütter's descriptions and figures, *Stictis fimbriata* and *S. maritima* are synonymous. The collections are variable in the extent of periphysoidal hair developement. Krieger's Fungi Saxonici *876* and Ellis's North American Fungi *72*, which Rehm examined, are less obviously hairy than the Hungarian or Corsican material, which may explain why Rehm, and other authors, for example Nannfeldt (1932), who examined specimens from northern Europe and North America, doubted that Saccardo and Berlese were justified in erecting the genus *Lasiostictis*.

Müller and Hütter's placement of *S. maritima* in the Phacidiales appears to be tenable, but there are numerous points of difference between it and *Coccomyces*. Figure 1 illustrates a detail of the marginal tissue of Zahlbruckner's Hungarian material. When the apothecium is closed, as in young or dry specimens, the hyphae of the covering layer have a definite vertical orientation. The ascus apex blues faintly in iodine and the spores do not appear to have a gelatinous coating. These three characters would refer *Lasiostictis* to the Phacidiaceae in the classification of Terrier (1942), rather than to the Hypodermataceae [=Rhytismataceae (Korf, 1973)] where *Coccomyces* is usually placed.

*SYNONYMY.*

*Lasiostictis fimbriata* (Schw.) Bäuml. *In* Ann. K. K. Naturh. Hofmus. Wien *XVI*. 1901. (N.V.)

*Stictis (Lasiostictis) conigena* Sacc. & Berl. Atti Reale Ist. Veneto Sci., Lett., Arti VI *3:* p. 734. 1885.

*Lasiostictis conigena* (Sacc. & Berl.) Sacc. Sylloge *8*, p. 696.1889.

*Stictis fimbriata* Schw. Syn. Fung. Amer. Bor. p.179. 1834.

*Stictis maritima* Rolland Bull. Soc. Mycol. France *14*, p.84. 1898.

*Coccomyces maritimus* (Rolland) Müller & Hütter Rev. Myc. *27* p. 71. 1962.

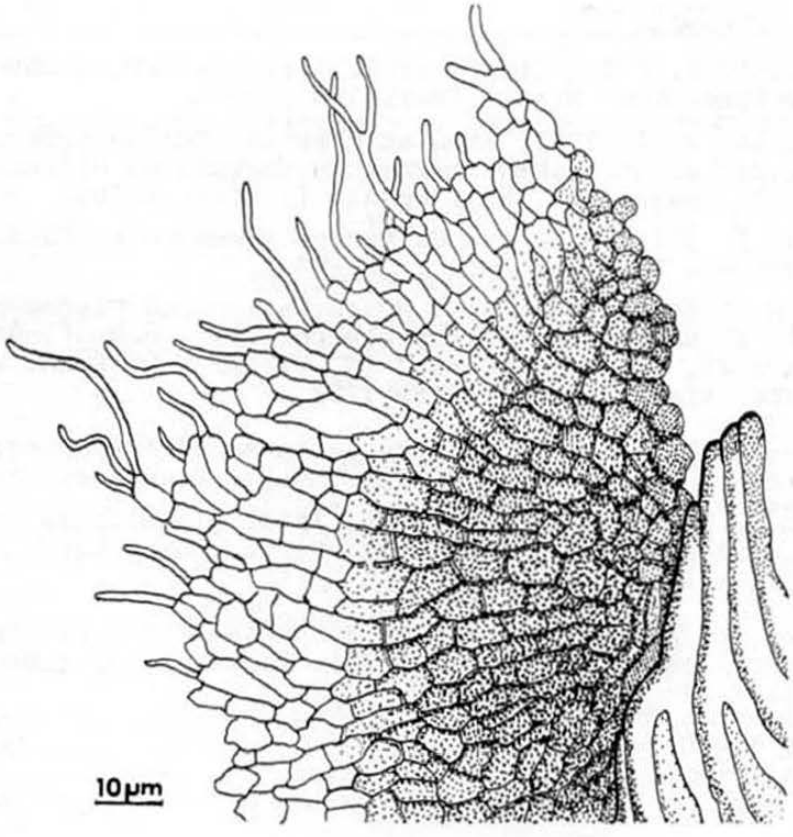


Figure 1. *Lasiostictis fimbriata.* Detail of margin. Drawn from CUP-D 107-47 with the aid of a Wild drawing tube.

Collections examined: As *Stictis maritima:* Corsica: on cone scales of *Pinus nigra,* Korf, 1972 (CUP *53244*); As *Lasiostictis conigena:* France: on cone scales of *Pinus sylvestris,* Hariot, 1906 (PAD); As *Stictis fimbriata:* Germany: on *Pinus sylvestris,* Sydow, Myc. Germ. *706,* (CUP-D *107-53*); Switzerland: On *Pinus sylvestris,* Krieger, Fungi Saxonici *1893* (CUP); Hungary: On cone scales of *Pinus sylvestris,* Zahlbruckner (CUP-D *107-47*); USA: On *Pinus,* Schweinitz, part of type (CUP-D *107-48*); on scales of pine cones, Ellis, N. A. F. (CUP-D *107-51*); on pine cones, Meschutt, (CUP *6693*).

The author wishes to thank Professor M. Orsenigo (PAD) for loaning specimens, and Professor R. P. Korf (CUP) for assistance in preparing the manuscript.

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MYCOTAXON

Vol. I, No. 1, pp. 45-50 July-September 1974

# LOMENTOSPORA PROLIFICANS, A NEW HYPHOMYCETE FROM GREENHOUSE SOIL

by

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Abstract

*Lomentospora prolificans* n. gen. n. sp., a new sympoduloblastic hyphomycete, originating from greenhouse soil in Belgium, is described. Its most distinctive feature is the long beaded rachis of its inflated conidiogenous cells.

This new hyphomycete has been isolated from greenhouse soil originating from mixed forest litter at Heverlee, Belgium, by plating soil suspensions on cellulose agar and keeping the plates for more than two months at room temperature.

The fungus is unusual in its clustured, flask-shaped conidiogenous cells prolongating in a long, nodulous or beaded, delicate rachis bearing numerous caducous conidia. None of the genera in the series of the sympoduloblastosporae appears to show such characters.

## DESCRIPTION

*Lomentospora* gen. nov.

Hyphomycetes, sympoduloblastosporae. Hyphae hyalinae vel fuscobrunneae, septatae, ramosae, saepe aggregatae. Cellulae conidiogenae sympodiales, singulae vel catervatae, basipetaliter ex ramis vel cellulis hypharum efformatae, inflatae, lageniformes, proliferantes in apice in longa, flexuosa, nodulosa, tenue rachide simul cum successiva productione conidiorum. Conidia holoblastica, singula et successiva in apice rachidis ennata, ovoidea vel elliptica, sessilia vel in denticulis.

Species typica: *L. prolificans* spec. nov.

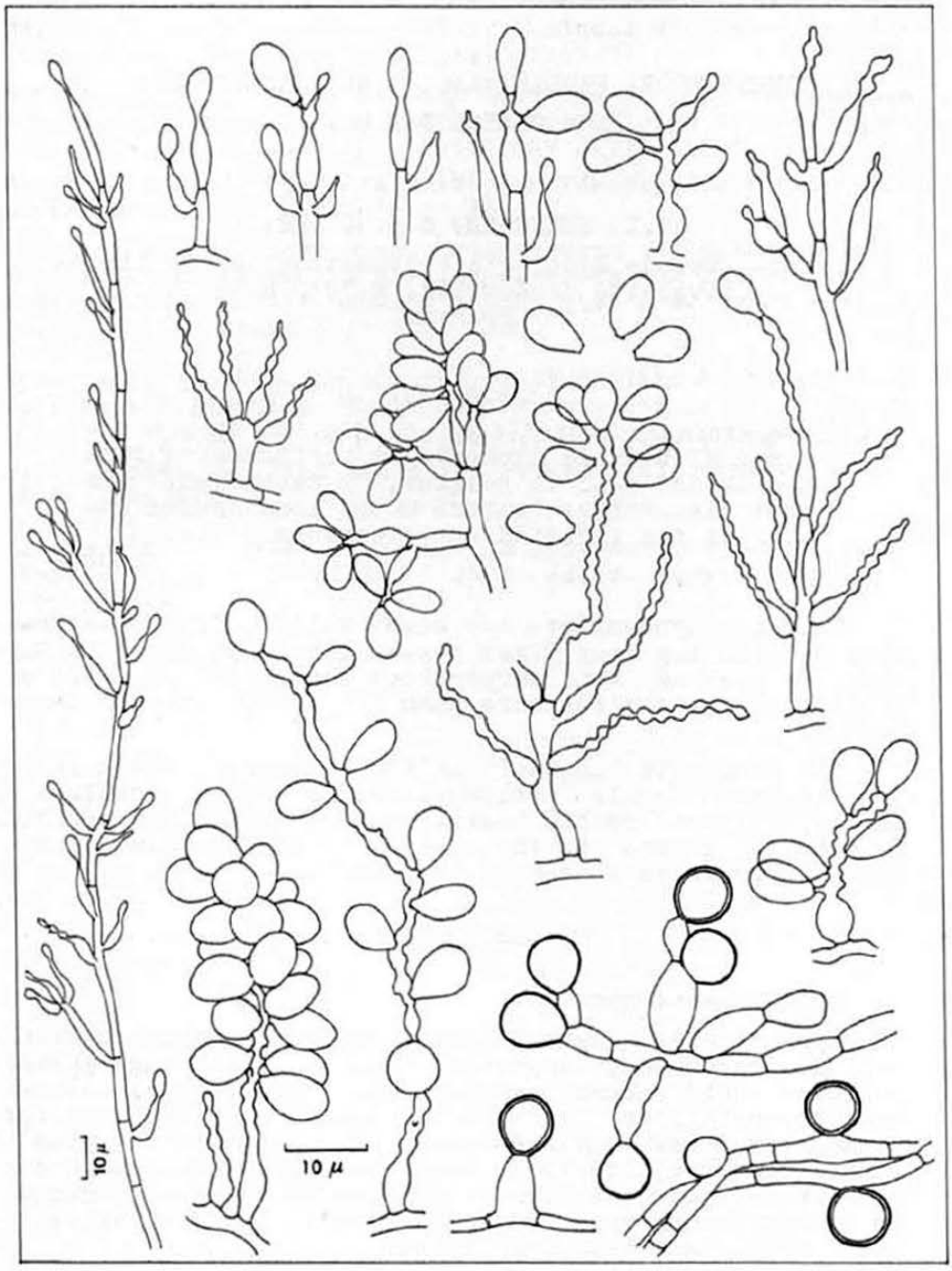


Fig. 1. *Lomentospora prolificans* . Fertile hypha, conidiophores, conidia and chlamydospores in type culture, × 500 and 1000.

*Lomentospora prolificans* spec. nov. (Fig. 1 & 2)

Coloniae moderate crescentes, primum griseoalbae, deinde griseobrunneae vel fuscobrunneae, copiose sporulantes, nigrescentes in reverso. Hyphae hyalinae vel fuscae, septatae, regulares, tenuitunicatae, 1-2 µ diam., singulae vel aggregatae. Conidiophori ex una vel pluribus cellulis conidiogenis basipetaliter successive productis in apice et lateralibus hypharum et brevium 8-20 µ ramorum. Conidiogenae cellulae sympodiales, inflatae, hyalinae, tenuitunicatae, 4-10x2-6µ, proliferantes in apice simul cum successiva et acropetale productione conidiorum, rachide usque 70 µ longa, flexuosa, nodulosa, 1-2 µ diam., cicatricibus conidiorum saepe obscuris, non incrassatis. Conidia holoblastica, singula in apice rachidis successive ennata, spicatim disposita, ovoidea vel elliptica, 5-10 × 4-6 µ, attenuata ad basile septum, pallide brunnea, crassotunicata, levia, saepe cum minuto fragmento denticulorum rachidis. Chlamydospora in substrato formata ex abnormale conidiogenese, globosa, usque 8 µ diam., brunnea, crassotunicata cum lato basale septo.

Habitat in viridicarii humo, e sylvario humo composito, Heverlee, Belgio. Typus siccus in herbario G.L.H.18141 et vivens in MUCL 18141, Universitate lovaniense; isotypus in CBS 467.74, Baarn.

Colonies relatively slow growing, 2.5-4.5 cm diam. in 12 days depending upon the nutrient, prostrate or fluffy, white to gray white when young, turning quickly grayish brown to dark brown when sporulating, reverse pale to black with some shades of mauve or blue. Hyphae hyaline to light brown, septate, regular, thin-walled, narrow, 1-2 µ diam., single or aggregated in creeping or aerial strands. Conidiophores composed of one or more conidiogenous cells developed successively and basipetally, either on short, 8-20 × 1.5-3 µ, lateral branches of the hyphae or from the distal end or the sides of the terminal and intercalary cells of the same hyphae. Conidiogenous cells sympodial, flask-shaped, hyaline, thin-walled, narrowing at the tip, varying in size, small in poor culture media, larger in rich ones, 4-10 x 2-6 µ; proliferating, after the production of the first apical conidium, successively and acropetally with the production of each new conidium by swelling and budding at a point close to the attachment of the previous conidium, forming a long, delicate, flexuous rachis, up to 70 µ in length, 0.8-1.5 µ in width, sometimes geniculate, but most commonly showing regular swellings up to 2 µ diam. at the point of proliferation of the axis near the attachment of the conidia, with scars of conidial attachment wide, sometimes prominent as a denticle, but most often inconspicuous. Conidia holoblastic , numerous, borne singly but successively at the apex of the conidiogenous cell, from a long pedicellate bud, ovoid to elliptical, narrowing and truncate at the 1.5-2 µ wide basal septum, relatively thick-walled, light brown, smooth, dry, caducous, sometimes with a frill of the conidiogenous

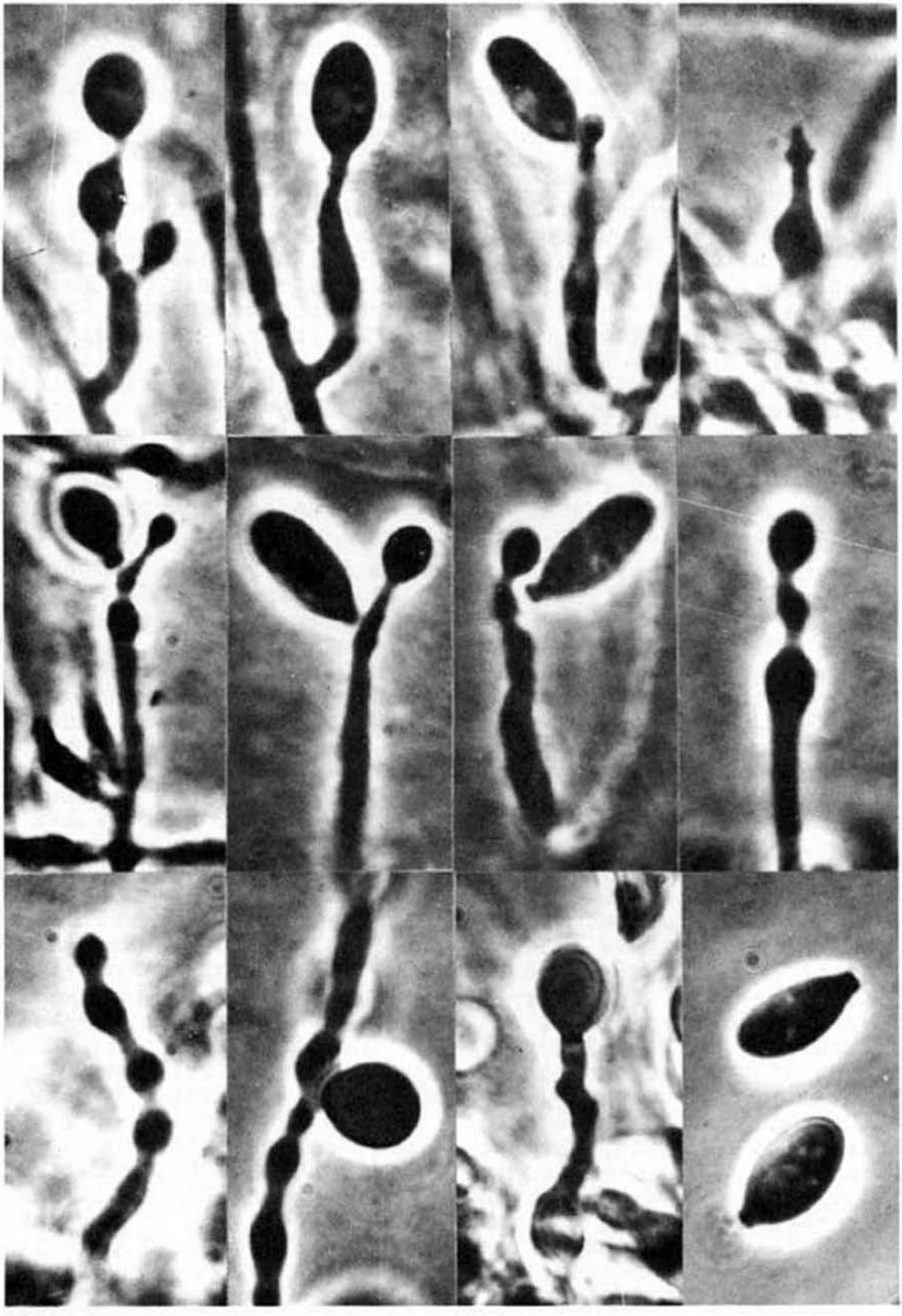

Fig. 2. *Lomentospora prolificans* . Conidial development, from type, × 2000.

cell at the base. Atypical conidia turning to chlamydospores, developed in the substratum, either on atypical conical, globose or flask-shaped, stipitate or intercalary conidiogenous cells or directly on the hyphal cells, globose, up to 8 µ diam., thick-walled, dark brown, smooth, with a wide basal septum.

No perfect state known.

Habitat in greenhouse soil, prepared from mixed forest litter, Heverlee, Belgium. Type in Herb. G.L.H. 18141 and as living culture MUCL 18141, in the culture collection of the University of Louvain; isotype in CBS 467.74, Baarn.

Cultural characteristics at room temperature after 12 days (*):

(a) on 2 % PDA, 1-10 % MA or MYA, 4 % MDPA, 1 % GCNA : colonies 2.5-3.0 cm in diam.; surface zonate, plain, velvety, with center effuse to funiculose, mouse gray to avellaneous gray or dark olivaceous, gray brown to brown when dried; heavily sporulating; showing light coloured sectors; submerged hyphae narrowly zonate and radiate, olivaceous; margin irregular, thin, submerged, translucent; reverse olivaceous black to blue black.

(b) on 1-4 % DYAA: colonies 3.5 cm in diam. with abundant mycelial growth; surface effuse to lanose, zonate, light to dark mouse gray, center darker; moderately sporulating; margin thin, whitish gray to olivaceous; reverse olivaceous black.

(c) on 2 % PSA, CZA, CPA, CMCA, CFA, OA : colonies 2.5 cm in diam., reaching 4.5 cm on OA; translucent to milky, with aerial hyphae absent or scanty and white on CZA, PSA and CPA, tufted, whitish and turning mouse gray with some conidial production on CMCA, CFA and OA; margin wavy, thin; reverse orange gray to greenhish gray; zone clearing in the medium around the colonies on PDA and CPA.

The soil isolate of the fungus grows well and sporulates on most of the media except on CZA, CPA and PSA. On these culture media, scattered white floccose hyphal masses have appeared which on subculturing in 2 % MYA maintained their white appearance. On the other media, sectors are also observed, which on cultivation on various media produce lighter coloured or almost white tufted colonies.

## DISCUSSION

*Lomentospora prolificans* is remarkable for its produc-

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(*) MYA, malt agar with yeast extract; MDPA, malt dextrose peptone agar; GCNA, glycerol caseine nitrate agar; DYAA, dextrose yeast asparagine agar; PSA, potato sucrose agar; CZA, Czapeck agar; CPA, carrot potato agar; CMCA, carboxymethylcellulose agar; CFA, cellulose fiber agar; OA, oat agar; percentages indicating the sugar contents.

tion of numerous conidia on a long, delicate, beaded, lomentum-like rachis of the conidiogenous cell.

The new genus *Lomentospora* is distinguished from other genera of the sympoduloblastosporae by the following features: (1) the basipetal production of successive conidiogenous cells on a hyphal branch or a hyphal cell; (2) the lageniform body of the conidiogenous cell; (3) the long flexuous, narrow rachis, prolongating the conidiogenous cell; (4) the beaded, lomentum-like form of the rachis, which results from the swelling of the new growing point producing the new conidial bud; (5) sometimes evident but often obscure unthickened denticles on the rachis; (6) the coloured, ovoid conidia; (7) the caducity of the conidia.

One of the most related genera appears to be *Beauveria* Vuill., with its flask-shaped conidiogenous cells arising in a cluster on a common supporting cell. But *Beauveria* obviously differs from *Lomentospora* by the typical zig-zag form of its rachis (De Hoog, 1972).

Similarly, *Tritirachium* Limber shows slightly inflated conidiogenous cells, with a zig-zag rachis bearing no prominent scars or cicatrices. *Rhinocladiella* Nannf. shows a relatively short rachis ornamented with narrow unthickened denticles. The absence of thickened denticles is also observed in *Geniculisporium* **Chesters** & Greenhalgh and in *Raffaelea* v.Arx & Hennebert, in which the conidium is delimited by a relatively wide basal septum; but the resulting rachis still shows a zig-zag formation.

In *Lomentospora*, the rachis is regularly knotty or beaded, swollen more or less at regular intervals. The development of these swellings can be explained by the concentration of active cytoplasm, recognized by its cyanophilic character, in the new growing point at the apex of the conidiogenous cell. These swellings are evidence of the successive conidiogenous loci of the sympodial conidiogenous organ.

ACKNOWLEDGMENTS

The authors wish to thank Dr M.B. Ellis and Dr B.C.Sutton, Kew and Dr G.S. De Hoog, Baarn, for their valuable remarks.

LITERATURE

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MYCOTAXON

Vol. I, No. 1, pp. 51-62 July-September 1974

# BISPORELLA, A GENERIC NAME FOR HELOTIUM CITRINUM AND ITS ALLIES, AND THE GENERIC NAMES CALYCELLA AND CALYCINA

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*SUMMARY*

A nomenclatural study on typification of the generic name *Calycella*, used for several common yellow species of *"Helotium"* in recent treatments, led to discovery that the year-older name *Bisporella* ought to be adopted for it. *Calycella* must also be abandoned for another reason: it is a nomenclatural synonym of the much older name *Calycina;* both are typified by *Peziza herbarum*, a species not closely related to *Helotium citrinum* and presently treated in *Hymenoscyphus*. New combinations are proposed for the type species of *Bisporella*, now to be called B. pallescens instead of *B. monilifera*, and for B. citrina, B. sulfurina, and B. strumosa.

## I. CALYCELLA AND CALYCINA

### A. *Assignment of Helotium citrinum to the genus Calycella sensu Boudier*

One of the most common, small yellow Discomycetes occurring in large numbers on rotting wood and branches throughout the temperate regions was for many years called *Helotium citrinum* (Hedw. ex Purton) Fr. The Discomycete generic name *Helotium* Pers. ex St.-Amans, accepted by Fries (1822) only at an infrageneric level, competes with the Basidiomycete generic name *Helotium* Tode ex Leman, which was later accepted by Fries (1832). The Discomycete name must necessarily be abandoned (Dennis, 1962, 1964; Donk, 1962).

The microanatomical structure of the apothecia of *Helotium citrinum* is unlike that of species of either of the two genera that now have replaced *Helotium: Hymenoscyphus* and *Cudoniella*. The ectal excipulum is composed of gelatinized hyphae or of hyphae embedded in a gelatinous matrix, running at an angle almost perpendicular to the outer surface. Though a few authors (*e.g.*, Seaver, 1951; Kursanov, 1954; Naumov, 1964) have retained this species in *Helotium*, in most modern classifications it has instead been regularly referred to the genus *Calycella*, as *C. citrina* (Hedw. ex Purton) Boud. (Boudier, 1885, 1907a, 1907b; Quélet, 1886; Le Gal, 1938, 1953; Grelet, 1947; Ramsbottom and Balfour-Browne, 1951; Dennis, 1956, 1960, 1968; Svrček, 1962; Moser, 1963; Berthet, 1964;

Svrček and Kubička, 1964; Thind and Saini, 1967; Raĭtviĭr, 1968; Gamundí, 1971; Korf, 1973). The genus *Calycella* has been referred to the Ombrophilaceae (Boudier, 1885, 1907a; Le Gal, 1938; Grelet, 1947), to the Helotiaceae subf. Helotioideae (Le Gal, 1953; Dennis, 1960, 1968), to the Helotiaceae subf. Phialeoideae (Dennis, 1956), and to the Leotiaceae subf. Hymenoscyphoideae (Korf, 1973).

*B. Typification of Calycella*

When Boudier (1885) created the genus *Calycella,* he referred to it as "*Calycella* (Fr.)," with the observation, "Parmis les plus connus je citerai: *C. citrina* Batsch, *sulfurina* Quél." The citation of Fries as authority for the genus leaves no doubt that Boudier merely raised *Helotium* [sect.?] *Calycella* Fries (1849) to generic rank, and that one of Fries's original species ought to be selected as the lectotype of the infrageneric taxon and its derived genus. While it would seem that *C. citrina* is a logical choice [since *C. sulfurina* (Quél.) Boud. was not in Fries's treatment], we are not forced to select either of the species Boudier mentioned (he named only two of the most common species he intended to include), but rather we should look to those included by Fries.

Close examination of Fries's 1849 publication discloses that *Helotium* [sect.?] *Calycella* is an avowed substitute and merely a renaming of his own (Fries, 1822) *Peziza* 'tribus' *Calycinae,* to which clear reference is made. Comparison of the two taxa reveals that these are essentially parallel. Moreover, Fries's *Calycinae* is in turn based upon Nees von Esenbeck's (1817) *Peziza* stirps *Pezizae pedicellatae* 'familia' *Calycinae,* unequivocal reference to that treatment being given by Fries (1822). Boudier's genus, as well as Fries's section (?) and earlier 'tribus' are thus all tied back to Nees's original taxon, which contained but four species, from among which a type should be selected.

*Helotium* [sect.?] *Calycella* was apparently first lectotypified by Höhnel (1918), who designated *Peziza herbarum* (Pers. ex Gray) Pers. as the type. This is, perhaps only by chance, one of Nees's original species, and was a member of both Fries's 'tribus' *Calycinae* and his section (?) *Calycella.* So far as we are aware, no author has yet designated a lectotype species for *Calycella* (Fr.) Boud. at the generic level, but Höhnel's typification is binding at any rank.

There are two other Discomycete genera published later, with the same name. When Quélet (1886) used the generic name *Calycella,* he attributed it to himself, not mentioning either Fries or Boudier. His genus included many species of diverse relationships by today's standards; to the best of our knowledge it has never been lectotypified. We hereby designate *C. pallescens* (Pers. ex Gray) Quél. as the lectotype of this later homonymic name. The third genus bearing the same name is *Calycella* (Sacc.) Sacc. in Sacc. & Syd. (Saccardo, 1899). This is based upon *Helotium* subg. *Calycella* Saccardo (1889) which has no obvious taxonomic relation-

ship to either Boudier's or Quélet's genus. Saccardo's generic name was lectotypified by Clements and Shear (1931) with *C. alutacea* (Berk. & Br.) Sacc. ex Clem. & Shear.

*C. The genus Calycina sensu Seaver*

S. F. Gray (1821) took the same 'familia' *Calycinae* of Nees (1817) mentioned above, and created a genus of it, *Calycina* (Nees) ex Gray. He included two of Nees's four original species [*C. pallescens* (Pers.) ex Gray and *C. herbarum* (Pers.) ex Gray] and added three others. This generic name remained almost forgotten until revived by Otto Kuntze (1898), whose treatment was ignored by other authors. Seaver (1934, 1942, 1951) later used it for a group of species now placed in the Sclerotiniaceae, which White (1941) referred to *Rutstroemia*. Seaver (1934) chose *C. firma* (Pers.) ex Gray as the type species, following the American Code's first-species rule. That species is, however, ineligible, as Dumont (1972) has pointed out, since it was not one of Nees's original species, and Gray had attributed the generic name to Nees. None of the original species appear to be Sclerotiniaceous, and the name *Calycina* therefore cannot be used in the sense of Seaver.

*D. Typification of Calycina*

The only valid typification of *Calycina* that we have been able to discover is that by Dumont (1972), who designated *Peziza herbarum* as the type. This same species is, as noted above, also the lectotype species of *Calycella* (Fr.) Boud. Both generic names are tied not only by their nomenclatural history, but by the fact that both (perhaps fortuitously) have the same lectotype species. *Calycella* (Fr.) Boud. 1885 is necessarily a later nomenclatural synonym of *Calycina* (Nees) ex Gray 1821.

The genus *Calycina*, typified by *C. herbarum*, is certainly not a taxonomic synonym of the genus *Calycella* as Boudier and more recent authors have conceived it. *Calycina herbarum* is treated by such authors in *Hymenoscyphus* (or *Helotium*), and is characterized by thin-walled, brick-shaped excipular cells running parallel to the outer surface, with an absence of gelatinized walls. Most taxonomists will probably continue to treat *Calycina* merely as a synonym of *Hymenoscyphus*. Since both generic names date from the same work (Gray, 1821), they were intentionally synonymized by Dumont (1972) and *Hymenoscyphus* chosen as the correct name for such a combined genus. When and if *Hymenoscyphus* is successfully broken into smaller and more natural genera, *Calycina* could be revived for a segregate genus with species allied to *C. herbarum*, while *Hymenoscyphus* would be restricted to species more closely related to its type species, *H. fructigenus* (Pers. ex Mérat) Gray.

*E. A partial synonymy for the generic name Hymenoscyphus*

In order to place both *Calycina* and *Calycella* (Fr.) Boud. in their present taxonomic synonymy with *Hymenoscyphus*, we

provide here a partial synonymy covering only these and early synonyms. Some later-described genera doubtless also belong in the synonymy, but are not considered here.

HYMENOSCYPHUS (Nees) ex Gray, Nat. Arr. Brit. Pl. 1: 673. 1821 [Nees not cited, a *lapsus calami*[1]; lectotype species: *Hymenoscyphus fructigenus* (Pers. ex Mérat) Gray, provisionally and later formally designated by Dennis (1962, 1964)].

≡ [*Peziza* "Pers." 'familia' *Hymenoscyphi* Nees, Syst. Pilze und Schwämme, Ueberbl. 71. 1817 (devalidated: pre-starting point; also rank misplaced, Art. 33).]

≡ *Peziza* L. ex St.-Amans 'trib.' *Hymenoscyphae* (Nees ex Gray) Fr., Syst. mycol. 2(1): 116, 117. 1822 (valid, despite misplaced rank, exception to Art. 33); non *Peziza* [sect.?] a. *Hymenoscyphae* Fr., Summa veg. Scand., sect. post. 353. 1849 (excludes all of Nees's original species).

≡ *Peziza* L. ex St.-Amans subg. *Hymenoscypha* (Nees ex Gray) Berk., Smith's Engl. Flora 5(2): 200. 1836.

≡ *Hymenoscypha* (Nees ex Gray) Phill., Man. Brit. Discom. 111. 1887 (ut "Fries").

≡ *Helotium* Pers. ex St.-Amans [subg.?] B. *Hymenoscypha* (Nees ex Gray) Rehm, Rabenh. Kryptogamenfl. Deutschl., Oesterr. Schweiz II 1(3)[39]: 781. 1893; non *Phialea* (Fr. ex Fr.) Gill. [subg.?] B. *Hymenoscypha* Sacc., Syll. fung. 8: 270. 1889.

= [*Peziza* "Pers." 'familia' *Calycinae* Nees, Syst. Pilze und Schwämme, Ueberbl. 69. 1817 (devalidated: pre-starting point; also rank misplaced, Art. 33).]

≡ *Calycina* (Nees) ex Gray, Nat. Arr. Brit. Pl. 1: 669. 1821 [lectotype species: *Calycina herbarum* (Pers.) ex Gray, designated by Dumont (1972)].

≡ *Peziza* L. ex St.-Amans 'trib.' *Calycinae* (Nees ex Gray) Fr., Syst. mycol. 2(1): 116, 128. 1822 (valid, despite misplaced rank, exception to Art. 33).

≡ *Peziza* L. ex St.-Amans subg. *Calycina* (Nees ex Gray) Berk., Smith's Engl. Flora 5(2): 202. 1836.

≡ *Helotium* Pers. ex St.-Amans [sect.?] b. *Calycella* Fr., Summa veg. Scand., sect. post. 355. 1849 [a name change, and avowed substitute; lectotype species: *Helotium herbarum* (Pers. ex Gray) Fr., designated by Höhnel (1918)].

≡ *Helotium* Pers. ex St.-Amans subg. *Calycella* (Fr.) Sacc., Bot. Centralbl. 18: 217. 1884; non *Helotium* subg. *Calycella* Sacc., Syll. fung. 8: 248. 1889 → *Calycella* (Sacc.) Sacc. in Sacc. & Syd., Syll. fung. 14: 31. 1899.

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[1] Gray (1821) clearly raised Nees's 'familia' names to generic rank, *e.g.*, *Calycina* (Nees) ex Gray, *Dasyscyphus* (Nees) ex Gray, *Macroscyphus* (Nees) ex Gray are the three genera immediately preceeding *Hymenoscyphus* in Gray's treatment. The lack of a reference to Nees for this one generic name is surely a typographical error. Even the order was the same in Nees's work: *Calycinae, Dasyscyphi, Macroscyphi, Hymenoscyphi.*

≡ *Calycella* (Fr.) Boud., Bull. Soc. Mycol. France 1: 112. 1885; non *Calycella* Quélet 1886, nec *Calycella* (Sacc.) Sacc. in Sacc. & Syd. 1899.

## II. BISPORELLA

### A. *The generic name Bisporella replacing Bispora Fuckel non Corda*

Fuckel (1870) found a yellow Discomycete growing amongst a dematiaceous mould, and concluded that one was parasitic on the other or that the two represented states of the same organism. He identified the mould correctly as *Bispora monilioides* Corda, with its characteristically 2-celled conidia. Septate ascospores are unusual among the species Fuckel ranged in his Pezizei. "Wie erstaunte ich aber, als ich zu Hause die Schlauchsporen unter dem Mikroskop sah!" was his response to noting 2-celled ascospores. Rather than creating a new generic name for the Discomycete, Fuckel "emended" Corda's genus *Bispora* and transferred it to the Ascomycetes. He named the Discomycete *Bispora monilifera* Fuckel, retaining the name *B. monilioides* for the imperfect state. Since the type of Corda's genus was a member of the Dematiaceae, and hence without ascospores, such a transfer is not permitted under the present Code of Nomenclature (Art. 59). [This was not the first time that such a transfer was attempted, however, since the brothers Tulasne (1865) had similarly "converted" the stilbaceous genus *Coryne* into a Discomycete, not corrected until Groves and Wilson (1967) proposed *Ascocoryne* for the ascigerous state.]

Saccardo (1884) recognized that Fuckel was incorrect in attempting to emend Corda's genus, and proposed the generic name *Bisporella* Sacc. for the discomycetous portion of the life cycle. Fuckel's genus *Bispora* may have been adopted only twice subsequently, by Fuckel (1871) and by Lambotte (1887, fig. 58). Saccardo's generic name has also seen little use except by Bommer and Rousseau (1884, 1891), Saccardo (1889), Mussat (1901), and as a subgenus of *Helotium* by Lindau (1897).

### B. *Bisporella, a taxonomic synonym of Calycella sensu Boudier*

*Bisporella monilifera* (Fuckel) Sacc. is the only species to have been placed thus far in the genus. Though *Bisporella* has not infrequently appeared in synonymies under the generic name *Helotium*, it was not until 1956 that Dennis recognized that the Fuckel species is congeneric with *Calycella citrina*. Dennis (1956) transferred the species, providing the combination *C. monilifera* (Fuckel) Dennis. Neither in that paper, nor in later publications (Dennis, 1960, 1964, 1968) does he indicate why he failed to adopt the generic name *Bisporella* Sacc. 1884, having a year's priority over *Calycella* (Fr.) Boud. 1885, the name he accepted.

Unfortunately Dennis (1956) transferred Fuckel's epithet, and did not adopt a much older epithet known to him. In his discussion of *C. monilifera*, Dennis has a rather long series of comments on *Peziza pallescens* Pers. He noted that Persoon (1799) had merely renamed *Peziza lenticularis* Hoffman (1795), which "is clearly the fungus which has commonly been called *Helotium moniliferum*." Dennis did not adopt "the epithet *pallescens* Pers., however, because the fungus preserved under that name in Persoon's herbarium (No. 910.261-396.90 O.H.) is something quite different."

We agree that Hoffman's figure is unmistakably the same fungus that Fuckel described. We also agree that Persoon (1799) did not erect a new species, but only provided a new name for *P. lenticularis* Hoffm., which he cited as a synonym of his new name, *P. pallescens*. He was avoiding homonymy with the next species he described, *P. lenticularis* Bull. We hold, therefore, that one should first search for a Hoffman specimen to typify the species which Persoon renamed.

Since Hughes (1958) noted that he had examined the type specimen of *Dematium antennaeforme* Hoffm. (the conidial fungus illustrated as accompanying *P. lenticularis* Hoffm.), we obtained the two Hoffman specimens under this name from the Berlin Botanisches Museum to see if there were any apothecia present, or if there was material filed there under *P. lenticularis*. No material was discovered there under the Discomycete name, and the two packets we did examine of Hoffman's *Dematium* are unfortunately devoid of apothecia.

We next turned to the Persoon herbarium, at Leiden. Merely because a specimen is present there does not automatically make such a specimen a Persoon type, however, since we are informed by Dr. R. A. Maas Geesteranus of the Leiden Rijksherbarium that many of the collections there represent material collected late in Persoon's career, during his stay at Paris. The specimen referred to by Dennis had apparently been erroneously placed in the cover of *Peziza lenticularis* Bulliard [sic]. It bears the label: "*Peziza ? lenticularis* Hoffm. — *pallescens*. Syn. pl." but bears no date or indication of when or where it may have been collected. We agree with Dennis's conclusion that this specimen does *not* represent the fungus illustrated by Hoffman, nor the fungus described by Persoon and by Fuckel.

A second collection in the Persoon herbarium at Leiden, No. 910.256-842.90 O.H., is, however, most significant. It is labelled: "*Peziza pallescens* P., Junghuhn leg. — Germania," and contains apothecia and the *Bispora* conidial fungus of the type illustrated by Hoffman and described by Fuckel. This specimen was apparently not seen by Dennis, as no annotation slip of his accompanies it. Though it may represent the actual material Persoon had in hand in 1799, there is no date associated with it either. We hereby designate this specimen as the neotype specimen of *Peziza pallescens* Pers. It agrees in all respects with the type specimen of *Bispora monilifera* Fuckel, on deposit at the Conservatoire et Jardin Botanique in Geneva, which we have also examined.

*C. Some preliminary thoughts on the ecology of Bisporella*

Whether or not *Peziza pallescens* and the conidial fungus *Bispora monilioides* are genetically connected must await cultural studies that have not, to our knowledge, ever been completed. Dematiaceous states of members of the Leotiaceae are exceptionally rare. We tend to wonder, along with Fuckel (1870), whether the apothecia might not represent a fungus parasitic on the Hyphomycete.

This feeling is strengthened by the observation that several related species, formerly placed in *Calycella*, often occur on other fungi. *C. sulfurina* is not uncommon on stromatic Pyrenomycetes, and *C. strumosa* (Ell. & Everh.) Dennis also occurs on old fungus stromata. Still another species, for which we have been unable to discover a species name, is common in North America on old fruitbodies of *Daedaleopsis confragosa* (Bolt. ex Fr.) Schroet. and occasionally on other polypore basidiocarps. In some of the same collections apothecia are also found on the nearby wood, raising the question as to whether they are growing there saprophytically or are growing on the mycelium of the Pyrenomycete or Basidiomycete within the wood. If so, it is possible that other species of *Bisporella* (= *Calycella* sensu Boudier) that are not associated with obvious ascocarps or basidiocarps may in fact be pathogenic on fungi invading the woody substrate rather than being saprophytes.

*D. The formal taxonomy of Bisporella, and a few transfers*

Since *Calycella* clearly cannot be retained for the common yellow species we so often encounter, and these cannot satisfactorily be referred to either *Helotium* or *Hymenoscyphus*, we propose to adopt *Bisporella* for them. Boudier and many others who have ignored *Bisporella* have, it should be noted, ranged its type species in *Calycella*, either as *C. pallescens* or as *C. monilifera*. We are aware that the genus may turn out to be rather large; we have found over 50 names that have been combined under *Calycella*. For the time being we are contenting ourselves with presenting the formal nomenclator for the genus and with transferring only four species to it. One of these transfers is a necessary new combination for the generic type species.

BISPORELLA Saccardo, Bot. Centralbl. 18: 218. 1884 (a name change).

≡ *Bispora* Fuckel, Jahrb. Nassauischen Vereins Naturk. 23-24: 310. 1870 (a later homonym; holotype species: *B. monilifera* Fuckel); non *Bispora* Corda 1837.

≡ *Helotium* Pers. ex St.-Amans subg. *Bisporella* (Sacc.) Lindau, Natürl. Pflanzenf. I 1(1): 207. 1896.

= *Calycella* Quél., Enchir. fung. 305. 1886 [a later homonym; lectotype species: *C. pallescens* (Pers. ex Gray) Quél., designated here]; non *Calycella* (Fr.) Boud. 1885, nec *Calycella* (Sacc.) Sacc. in Sacc. & Syd. 1899.

*MISAPPLICATIONS:* *Calycella* (Fr.) Boud. sensu Boudier non Fries.

*HOLOTYPE:* *Bispora monilifera* Fuckel [= *Bisporella pallescens* (Pers. ex Gray) Carp. & Korf].

1. Bisporella pallescens (Pers. ex Gray) Carp. & Korf, *comb. nov.*

≡ [*Peziza lenticularis* Hoffm., Deutschl. Flora oder Botan. Taschenb., Zweite Teil, pl. 13, f.4-5. 1795 (devalidated: pre-starting point; also later homonym); non *Peziza lenticularis* Bull. 1791 (devalidated: pre-starting point; sanctioned by Fries, Syst. mycol. 2(1): 133. 1822, Art. 13f).]

≡ [*Peziza pallescens* Pers., Obs. Mycol. 2: 85. 1799 (a name change; devalidated: pre-starting point).]

≡ *Calycina pallescens* (Pers.) ex Gray, Nat. Arr. Brit. Pl. 1: 670. 1821.

≡ *Peziza pallescens* (Pers. ex Gray) Pers., Mycol. Eur. 1: 294. 1822 (sanctioned by Fries, Syst. mycol. 2(1): 132. 1822, Art. 13f).

≡ *Helotium pallescens* (Pers. ex Gray) Fr., Summa veg. Scand., sect. post. 355. 1849.

≡ *Niptera pallescens* (Pers. ex Gray) Fuckel, Jahrb. Nassauischen Vereins Naturk. 25-26: 334. 1871.

≡ *Calycella pallescens* (Pers. ex Gray) Quél., Enchir. fung. 306. 1886.

≡ *Helotium citrinum* (Hedw. ex Purton) Fr. var. *pallescens* (Pers. ex Gray) Massee, Brit. fungus-fl. 4: 239. 1895.

= *Bispora monilifera* Fuckel, Jahrb. Nassauischen Vereins Naturk. 23-24: 310. 1870.

≡ *Peziza monilifera* (Fuckel) Cooke, Grevillea 4: 111. 1876.

≡ *Bisporella monilifera* (Fuckel) Sacc., Bot. Centralbl. 18: 218. 1884.

≡ *Hymenoscyphus moniliferus* (Fuckel) Phill., Man. Brit. Discom. 130. 1887 (ut *Hymenoscypha monilifera*).

≡ *Helotium moniliferum* (Fuckel) Rehm, Rabenh. Kryptogamenfl. Deutschl., Oesterr. Schweiz II 1(3)[39]: 790. 1893.

≡ *Calycella monilifera* (Fuckel) Dennis, Mycol. Pap. 62: 44. 1956.

2. Bisporella citrina (Batsch ex Fr.) Korf & Carp., *comb. nov.*

≡ [*Peziza citrina* Batsch, Elench. fung. contin. 2: 95, pl. 39, f. 218. 1789 (devalidated: pre-starting point); non *Peziza citrina* (Hedw.) With. 1796.]

≡ *Peziza citrina* Batsch ex Fr., Syst. mycol. 2(1): 131, 609. 1822; non *Peziza citrina* (Hedw.) With. ex Purton 1821 (devalidated: not sanctioned by Fries, Art. 13f), nec *Peziza citrina* Schw. 1822 (devalidated: not sanctioned by Fries, Art. 13f).

≡ *Calycella citrina* (Batsch ex Fr.) Boud., Bull. Soc. Mycol. France 1: 112. 1885; non *Calycella citrina* (Hedw. ex Purton) Quél. 1886 (later homonym).

= [*Octospora citrina* Hedw., Descr. adumb. microscopico-anal. muscorum frondosorum 2: 28, pl. 8B. 1789 (devalidated: pre-starting point).]

≡ [*Peziza citrina* (Hedw.) With., Arr. Brit. Pl., ed. 3, 4: 347. 1796 (devalidated: pre-starting point; also later homonym); non *Peziza citrina* Batsch 1789.]

≡ *Peziza citrina* (Hedw.) With. ex Purton, App. Midl. Fl. 3: 457. 1821 (devalidated: not sanctioned by Fries, Art. 13f); non *Peziza citrina* Schw. 1822 (devalidated: not sanctioned by Fries, Art. 13f; also later homonym), nec *Peziza citrina* Batsch ex Fr. 1822 (later homonym, but sanctioned by Fries, Art. 13f).

≡ *Calycina citrina* (Hedw. ex Purton) Gray, Nat. Arr. Brit. Pl. 1: 670. 1821.

≡ *Helotium citrinum* (Hedw. ex Purton) Fr., Summa veg. Scand., sect. post. 355. 1849.

≡ *Calycella citrina* (Hedw. ex Purton) Quél., Enchir. fung. 306. 1886 (later homonym); non *Calycella citrina* (Batsch ex Fr.) Boud. 1885.

= *Phialea citrina* (Fr.) Gill., Champ. Fr., Discom. 109. 1881 [basionym uncertain: either *Peziza (Phialea) citrina* Batsch ex Fr. 1822, or *Helotium citrinum* (Hedw. ex Purton) Fr. 1849].

3. Bisporella sulfurina (Quél.) Carp., *comb. nov.*

≡ *Helotium sulfurinum* Quél., Grevillea 8: 116. 1880.

≡ *Calycella sulfurina* (Quél.) Boud., Bull. Soc. Mycol. France 1: 112. 1885.

≡ *Calycina sulfurina* (Quél.) Kuntze, Rev. Gen. Pl. 3[2(2)]: 449. 1898.

4. Bisporella strumosa (Ell. & Everh.) Korf, *comb. nov.*

≡ *Helotium strumosum* Ell. & Everh., J. Mycol. 4: 56. 1888.

≡ *Pseudohelotium strumosum* (Ell. & Everh.) Sacc., Syll. fung. 8: 300. 1889.

≡ *Calycella strumosa* (Ell. & Everh.) Dennis, Persoonia 3: 68. 1964.

NOTES: Dennis (1964) described and illustrated the ascospores as non-septate. They are, in the portion of the type specimen we have examined (CUP-D 8494), distinctly one-septate at maturity (FIG. 1). The original description by Ellis and Everhart had the spores with "indications of a medial septum." This species occurs on old stromatic tissues identified by them as *Dichaena strumosa* Fr. on living *Quercus coccinea*. We have been unable to identify the host

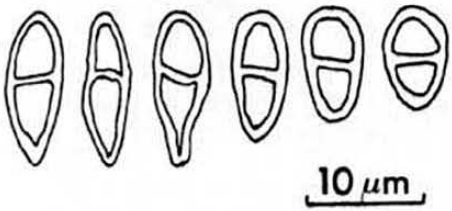


FIG. 1. Mature ascospores of *Bisporella strumosa*.

fungus with certainty. The ascospores of *B. strumosa* are, as Dennis (1964) noted, much broader than those of *B. sulfurina*, common on stromatic Ascomycetes in Europe.

ACKNOWLEDGEMENTS

We wish to thank the Directors and Curators of the herbaria at Berlin (B), Geneva (G), and Leiden (L) for their loans of type materials upon which these studies were based. We also thank Prof. G. L. Hennebert of the Université de Louvain for many stimulating discussions, during his recent stay at Cornell University as a Visiting Scientist, regarding some of the nomenclatural problems we encountered.

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MYCOTAXON

Vol. I, No. 1, pp. 63-64 July-September 1974

# BOOK REVIEWS

by

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B-P-H, BOTANICO-PERIODICUM-HUNTIANUM, édité par George M. H. LAWRENCE, A. F. Günther BUCHHEIM, Gilbert S. DANIELS et Helmut DOLEZAL. Hunt Botanical Library, Pittsburgh, Pa., 1063 p., 1968. Distribué par Stechert-Hafner, New York.

Ce compendium d'informations bibliographiques standardisées de plus de 12.000 périodiques de 45 langues et traitant des sciences botaniques est un outil indispensable à tout botaniste, chercheur, bibliothécaire dans ses réfereneces à la littérature scientifique.

Les informations sont répertoriées alphabétiquement sous forme d'une abréviation non ambique de chaque périodique, suivie de l'intitulé entier, du lieu de publication, des volumes parus, des dates et des changements d'intitulé. Les abréviations différentes rencontrées dans la littérature scientifique sont aussi répertoriées avec renvoi à l'abréviation adoptée.

Dans la citation de références comme pour la recherche d'une abréviation ou d'un intitulé, cet ouvrage est un guide précieux.

THE FUNGI, AN ADVANCED TREATISE. Vol. IV A. A TAXONOMIC REVIEW WITH KEYS: ASCOMYCETES AND FUNGI IMPERFECTI, xviii + 621 p., 1973. Vol. IV B. A TAXONOMIC REVIEW WITH KEYS: BASIDIOMYCETES AND LOWER FUNGI, xxii + 504 p., 1973, édité par G.C. AINSWORTH, F.K. SPARROW et A.S. SUSSMAN, Academic Press, New York et London.

Ces deux volumes constituant le quatrième tome de THE FUNGI, un traité de grande réputation, fournissent un aperçu taxonomique, avec clés et illustrations de tous les champignons par les spécialistes de chaque groupe.

Le premier volume traite des Ascomycètes et Fungi imperfecti: les Endomycétales et autres levures (J.W. Kreger-van Rij), les Protomycétales et Taphrinales (C.L. Kramer), les Eurotiales (D.I. Fennell), les Pyrenomycètes: Erysiphales (C.E. Yarwood), Méliolales, Coronophorales et Sphaeriales (E. Müller et J.A. von Arx), les Loculoascomycètes (E.S. Luttrell), les Laboulbéniomycètes (R.K. Benjamin), les Discomycètes et Tubérales (R.P. Korf), les Hyphomycètes (W.B. Kendrick et J.W. Carmichael) et les Coelomycètes (B.C. Sutton).

Le second volume couvre les champignons inférieurs et les Basidiomycètes: les Acrasiomycètes (K.B. Raper), les Myxomycètes (C.J. Alexopoulos), les Mastigomycètes, Chytridiomy-

cètes et Lagénidiales (F.K. Sparrow), les Plasmodiophoromycètes et les Péronosporales (Grace M. Waterhouse); les Saprolégniales et Leptomitales (M.W. Dick); les Mucorales (C.W. Hesseltine et J.J. Ellis), les Entomophthorales (G.M. Waterhouse), les Zoopagales (C.L. Duddington) et Trichomycètes (R.W. Lichtwardt); les Urédinales (G.F. Laundon) et Ustilaginales (R. Durán); les Phragmo- et Holobasidiomycetidae (R.F.R. McNabb et P.H.B. Talbot), les Aphyllophorales (P.H.B. Talbot, R.H. Petersen, K.A. Harrison et D.N. Pegler pour leur groupe respectif), les Agaricales (A.H. Smith) et les Gasteromycètes (D.M. Dring).

Il s'agit là d'un ouvrage clé qui sera très apprécié du spécialiste comme des débutant, car il contient une documentation abondante et de qualité et introduit à une connaissance plus large des champignons.

FUNGI. Vol. 3. POLYPORACEAE II (pileate), MUCRONOSPORACEAE II (pileate), GANODERMATACEAE, BONDARZEWIACEAE, BOLETOPSIDACEAE, FISTULINACEAE, par Stanislas DOMANSKI, Henryk ORTOS et Alina SKIRGIELLO. Edition revisée, Warszwa, Pologne, 332 p., 109 fig. 27 pl. Traduction anglais par A. Radziwitt, US National Center for Scientific, Technical and Economic Information, Washington.

La première édition de ce volume, parue en 1967 en polonais, sous le titre GRZYBY (Fungi), fait suit aux deux volumes, 1. BOLETALES, par A. Skirgiello (1960), et 2. POLYPORACEAE I, MUCRONOSPORACEAE I (Resupinate) par S. Domanski (1965).

147 espèces de Pologne appartenant à 47 genres sont décrites d'une manière méthodique et moderne et selon la nomenclature la plus récente. Les descriptions donnent une analyse détaillée des hyphes du carpophore et des organes de l'hyménium, et aussi l'habitat, la distribution et la comestibilité. 27 planches de bonnes photographies. Un bon livre pour l'identification plus moderne des champignons.

MICROFUNGI OF THE SOLOMON ISLANDS AND PAPUA-NEW GUINEA, par Takashi MATSUSHIMA, Shionogi Res. Lab., Shionogi Co., Kobe, Japan, 78 p., 169 fig., 48 pl., 1971.

L'auteur donne la description de 201 Fungi Imperfecti et 33 Ascomycètes, dont un grand nombre d'espèces nouvelles. D'un grand intérêt taxonomique, cet ouvrage excelle aussi par la qualité des dessins et des microphotographies.

ETUDE DES PHENOMENES DE REPRODUCTION LIES AU VIEILLISSEMENT ET AU RAJEUNISSEMENT DES CULTURES DE CHAMPIGNONS, par M. TAKASHIO. Thèse, Université de Liège, 152 p., 86 fig., 1973 (tiré de Ann. Soc. Belge Med. Trop. 53: 427-580, 1973).

Dans cette étude, l'auteur a établi par le croisement de souches de *Arthroderma simii* et *A. benhamiae* avec d'autres de *Trichophyton metagrophytes* et *T. interdigitale*, que le complexe *T. metagrophytes* appartient à *Arthroderma simii*, *A. benhamiae* et *A. vanbreuseghemii* n. sp.

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