# A MONOGRAPH OF THE CHAETOMIACEAE

By

L. M. Ames

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## FOREWORD

The Army is pleased to make the results of Dr. Ames' studies on the taxonomy of a special group of cellulose-destroying fungi available to the scientific community in the form of this second monograph of the United States Army Research and Development Series.

The severe damage caused by cellulose-destroying micro-organisms to many types of military materiel required the development of effective methods of prevention. One of the initial steps in the Army's program involved the identification of the causative organisms. Among the most important of these agents of destruction are species belonging to the *Chaetomiaceae* family.

The known species of the *Chaetomiaceae* have been systematically brought together in this monograph. Many of them have been described accurately for the first time. Others, isolated from military materiel from combat areas, are new to science. Such a document should prove valuable to research laboratories throughout the United States and other countries where studies are being pursued on the taxonomy and physiology of micro-organisms, as well as the prevention of their deteriorative action.

The experimental work represented in this monograph is the product of many individuals, who have collaborated generously with the Army. To them I wish to express our appreciation. At the same time, however, I would like to acknowledge the intensive devotion of Dr. Ames over many years to this significant piece of work. Much of it had been carried out in his personal laboratory and at home during the very late hours of the night. A major impetus to the work had been provided by the Secretary of the Army's Research and Study Fellowship.

ARTHUR G. TRUDEAU,
*Lieutenant General, U.S. Army,*
*Chief of Research and Development.*

## Introduction and Acknowledgments

My interest in the *Chaetomiaceae* began in 1927 while studying the sexual behavior of various species of *Schizothecium* (*Pleurage*), *Fimetaria, Ascobolus,* and *Chaetomium* under Dr. E. A. Bessey at Michigan State University (then Michigan Agricultural College). At that time a dozen species of *Chaetomium* were acquired; these formed the nucleus of my still growing collection. Occasionally, during the following years, a few collections were made while continuing to study the sexuality of fungi at Cambridge, Massachusetts.

While discussing my results of single spore culture matings of *Schizothecium anserina* (*Pleurage anserina* (Ces.) Knz.) which indicated that each single uninucleate ascospore culture was hermaphrodotic and self-sterile but reciprocally fertile when properly mated, Dr. R. Thaxter looked over the top of his glasses and said, "Yes, I have known this for years"; then he gave me a test tube culture of a fungus and said that it should prove interesting. I have maintained the culture for years, but with my mind occupied with studying sexuality in fungi, the interesting taxonomic aspect of Thaxter's culture was overlooked until a similar culture was described under the new genus *Lophotrichus* by Benjamin in 1949 as *L. ampullis* Benj. I have no doubt but that Dr. Thaxter anticipated the establishment of a new genus in the *Chaetomiaceae* to accommodate this and related species.

For a number of years the use of conventional laboratory facilities was rarely available but with a 22-quart pressure cooker to serve as an autoclave and using a microscope belonging to the Department of Agriculture my cultures were maintained and gradually increased at home. Fortunately, my wife, a botanist, did not raise too many objections even though some "dishes" were not objects of art and some visitors were not favorably impressed after looking at the contents.

Later in 1943, Dr. Glenn A. Greathouse asked for a variety of *Chaetomium* species to test their ability to decompose cellulose while using, separately, four sources of nitrogen in prepared media. Sixteen species were supplied, three of which were then recognized as new species and published with original descriptions. (49) In December 1944, I began work in the newly established Fungus Control Laboratory, Fort Belvoir, Virginia, and brought my entire *Chaetomium* collection for use in various phases of deterioration research. Isolations of certain rot-producing fungi found on samples of military material and equipment obtained from various Pacific and other areas continued to increase the collection which now included the genus *Ascotricha*. The collection was further increased through receipt of pure cultures sent in by co-workers in other military and civilian laboratories.

At the time this monographic work was proposed it was considered of importance to the Armed Forces for use in laboratories carrying on prevention of deterioration work, offering a means of identification which is necessary for accurate communication. The organisms included in this study are highly efficient in decomposing, not only cellulose but many other substances of military importance.

The billions of dollars annual loss resulting from microbiological deterioration, in large measure by cellulose-destroying fungi, is offset, paradoxically, by the untold value of these same fungi in the fields of agriculture, horticulture, and forestry in enriching the soil; in the field of medicine in producing antibiotics, while the relative ease with which they can be manipulated in pure culture offers new or scarcely exploited means for research leading to the enrichment of our resources. This monograph will offer a means of identifying a few "V.I.P." fungi of special concern as causative agents in microbiological decomposition of cellulose materials.

My taxonomic work done up to 1956 was primarily an extracurricular activity, and, although the need for collecting the scattered descriptions under one cover was recognized, full time was needed to study living cultures and exsiccati in this and foreign countries. This opportunity came late in 1956 with the award of a "Secretary of the Army's Research and Study Fellowship" to spend a year engaged in research on cellulose-destroying fungi which included two months in various countries in Europe studying type specimens and other collections. Those who have worked with specimens of *Chaetomium* must be aware of the more or less unsatisfactory condition of most old, dry herbarium material. Unless the specimens are carefully protected by pill boxes or other equally protective containers, the characteristic appendages and perithecia become broken and in many cases are no longer recognizable. In some type specimens found on rabbit pellets, the pellets

remain but most of the fungus had been broken beyond recognition. Other specimens on various materials such as straw, paper, etc., had been crushed, some beyond recognition, others can still be recognized. It is almost the exception to find exsiccati material so protected that identification is possible. During this present study most of the species illustrated have been grown in pure culture and much effort has been spent to preserve ample specimens in pill boxes and on slides.

In preparing this present monograph it has not been my intention to consider the subject in all its aspects, phylogenetic, cytological, and other, but this work had envisioned bringing together under one cover the technical descriptions of most of the known species of the *Chaetomiaceae* and as many as possible that have hitherto been undescribed. More species could have been included had communications between some countries been accomplished. Too, there comes a time when a manuscript must go to press regardless of the appearance of several new species in cultivating boxes—so there is more to come.

Such value as this monograph possesses is, therefore, largely due to the courtesy of correspondents, the many people and organizations that have given a helping hand, supplied equipment, materials, transportation, and numerous other contributions. To all who have been so kind and helpful I wish to express my great obligation.

To the committee members and staff of the Secretary of the Army's Research and Study Fellowship who, through the Fellowship, gave the opportunity and resources to make this monograph possible, I am greatly indebted and offer my sincere thanks.

For the time and secretarial help given me by the Army Research Office in the final stages of completing the manuscript, and for the technical labor given for its final publication, I am deeply grateful. To those who have given time, material, and cultures toward the overall preparation of this work I give my heart-felt thanks. I wish to acknowledge my indebtedness to Dr. E. A. Bessey for his early encouragement of this study. My thanks to Dr. G. W. Martin, who has contributed many pure cultures, and who, together with Dr. W. W. Diehl, critically read my manuscript and gave many valuable suggestions and made essential corrections. My thanks to Miss M. M. Kenney and Mrs. E. C. Heylmun for correcting my Latin descriptions; to Dr. T. E. Brooks for nine beautiful pure cultures of *Lophotrichus;* to the following who have sent pure cultures and culture material: Dr. A. J. Skolko, Dr. J. W. Groves, Dr. S. J. Hughes, Dr. R. H. Benjamin, Dr. Ralph Emerson, Miss Aasa Omvik, Dr. R. T. Hanlin, Mme. J. Nicot, Dr. J. Meyer, Dr. P. Martens, Mr. V. J. Bagdon, Dr. K. S. Sergejeva, Dr. W. Badura, Dr. O. Hägerup, Dr. M. S. Christiansen, Dr. H. J. Swart, Dr. W. Robyns, Dr. J. A. Stevenson, Mrs. A. J. Watson, Dr. G. C. Ainsworth, Dr. M. B. Ellis, Dr. E. W. Mason, Dr. Johanna Westerdijk, Dr. G. E. Bunschoten, A. L. von Beverwijk, M.O., Dra. A. C. Stolk, Dr. M. B. Schol-Schwarz, Dra. M. A. M. Schipper, Dr. M. A. Donk, Dr. R. A. Maas-Geesteranus, Dr. J. A. Nanfeldt, Dr. C. Bachlai, Dr. F. Petrak, Dr. B. Lee, Dr. W. H. Weston, Jr., Dr. W. B. Cooke, Dr. R. G. H. Siu, Dr. E. C. Tullis, Dr. L. White, Dr. C. Yeager, Dr. J. C. Gilman, Dr. C. T. Rogerson, Dr. C. G. Duncan, Dr. J. H. Miller, Miss L. G. Isfort, and to many other people, my deepest appreciation.

## TAXONOMY

| | |
|---|---|
| Class | *Ascomycetes* |
| Order | *Chaetomiales* |
| Family | *Chaetomiaceae* |
| Genera | *Chaetomium* |
| | *Ascotricha* |
| | *Lophotrichus* |

## CONTENTS

## CULTIVATION AND PRESERVATION

Most of the species herein described have been grown in pure culture thus making it possible to observe their characteristics from initial growth to old age. Slides of the various stages were made, using Patterson's mounting fluid with or without a selection of dyes, and sealing the cover-slip with clear or colored finger nail polish (cellulose acetate). Crystals on the hairs were observed in water mounts. Dried specimens were placed in pill boxes which protect the characteristic appendages of the perithecia; the specimens thus preserved will be deposited in various herbaria for future reference. It is the exception to find in herbaria exsiccati material adequately protected. Most often specimens are found mounted unprotected on a sheet, or enclosed in a folded paper which presses on the specimens causing the perithecia to collapse, greatly damaging the ornamented hairs; in many cases, the specimens can no longer be identified with certainty. There seems to be evidence that some new species names have, in the past, been based on immature or damaged specimens. Since all species thus far studied are easily cultivated on various media it seems essential that they should be studied in all phases of their development in order to describe their true characteristics. The culture medium used for cultivating the species treated in this monograph is suitable for all the species of the genera thus far isolated, provided, as was done with all cultures, that a strip or block of sterilized paper (white, spongy blotting paper was used) is placed on the medium as a source of cellulose. Some species require the cellulose to obtain their normal size and ornamental hair characteristics considered as typical; many other species produce normal-appearing perithecia when grown on culture media without adding paper. There is a tendency for some species to produce perithecia submerged in the media; when growing submerged they are usually devoid of the ornamental hairs. An increasing number of species are found which produce numerous aleuriospores or chlamydospores in the nutrient media, and one species produces dark knots of cells or variously shaped bulbils.

Most species grow well at room temperature, 28° C., but a small group require relatively high temperatures to produce their sexual fruiting bodies; these are true thermophiles, requiring temperatures from approximately 45° to 50° C. or higher (temperature range not determined).

### CULTURE MEDIA

The use of artificial culture methods makes it possible to isolate and study the habits of the individual species in pure culture. Most species of the *Chaetomiaceae* will grow readily upon a wide range of culture media and on naturally occurring substrates. The preparation of the culture media used in this study does not require critical measurements of nutrients to obtain good growth but a relatively lean diet is preferred to prevent excessive mycelial growth and to obtain an abundance of fruiting bodies. The formula used has the advantage of being easy to prepare and duplicate, and is acceptable to all species of this group so far isolated when sterilized paper is added as a source of cellulose.

### POTATO-MALT AGAR

Potatoes (*Solanum tuberosum*) are washed, pared and sliced. 60 grams of sliced potatoes in about 250 ml distilled water are brought to a slow boil until cooked soft. The clear liquid is then decanted and poured into a 2-liter flask containing 10 grams of Fleischman's Dry Malt Syrup and 1.5% Difco Bacto-Agar, fine granular form. The flask is then filled to volume with distilled water. The medium is heated for twenty or thirty minutes in the autoclave at 120° C., after which it is ready for use. On the surface of the sterilized media in Petri plates strips or squares of sterilized white blotting paper are added as a source of cellulose. In test tubes the strips of blotting paper are added prior to autoclaving. Uniform composition is not claimed, but cultures of the same species when grown upon successive lots of this medium show negligible differences, if any, in morphology.

## THE ORDER CHAETOMIALES

The order *Chaetomiales* as described by Martin, G. W., in a personal communication, follows:

Perithecia superficial, membranous, ostiolate apex blunt, narrow or beaked, usually dark or dull in color, bearing conspicuous hairs on body and on beak when latter is present; paraphyses present only in early stages, disappearing at maturity; asci clavate or cylindrical, with thick gelatinous walls, deliquescent before maturity of ascospores; ascospores usually dark, unicellular, maturing in the jelly of the perithecial cavity

and forced out in a cirrhus embedded in mucus. Includes the single family *Chaetomiaceae*, with the characters of the order.

## THE FAMILY CHAETOMIACEAE

*The Family Chaetomiaceae Winter*, in Rabenhorst's Kryptogramen Flora von Deutschland, Oesterreich und der Schweiz. Erster Band Pilze 1887—Leipzig. was described by Winter as follows: "Perithecien oberflächlich, frei, einem oberflächlich wachsenden mycel aufsitzend meist mit Mündung und apikalem Haar— oder Borstenschopf, braun, ziemlich gebrechlich. Asci keuglig oder cylindrisch, 8-sporig, sehr vergänglich, ohne Paraphysen. Sporen einzellig, braun."

## KEY TO THE GENERA OF THE CHAETOMIACEAE

A. Perithecia typically superficial.

a. Perithecial wall fragille; terminal hairs not jointed. *Chaetomium*----------p. 2.

aa. Perithecial wall hard, brittle; terminal hairs jointed, ampullate. *Ascotricha*----------p. 47.

AA. Perithecia typically submerged or partly submerged in substrate; perithecial wall membranaceous, fragile, terminal hairs thick-walled or relatively so. *Lophotrichus*----------p. 51.

## THE GENUS CHAETOMIUM

*Chaetomium* Kunze, ex Fries, Systema Mycologicum 3: 253; 1829.

The genus *Chaetomium* was established by Gustav Kunze (59) who in 1817 published a description of a hitherto unknown genus to which he gave the name *Chaetomium* ( χαίτωμα , the plume of a helmet) and described the first species under the name *Chaetomium globosum* Kze., placing it in the *Sphaeriaceae*.

The genus was characterized by Kunze in Myc. Hefte 1: 15, 1817, as follows:

"Sporangium subglobosum, membranaceous, pilis opacis undique obeseum, demum in medio sese aperiens. Sporidia pelucida, massae gelatinosae immixta."

A second species, *Chaetomium elatum* Kze. Deutsch. Schw. 8: 3, was described in 1818. Both were validated by Fries, Systema Mycologicum 3: 254, 255. 1829.

Certain characteristics of Kunze's species *C. globosum* and *C. elatum*, are recognized as common to our presently recognized species, namely that the perithecial wall is membranaceous and that it is at length pierced by an opening at the apex, and ornamented with generally opaque hairs. Due, undoubtedly, to optical equipment of low power magnification Kunze failed to discern the asci, but he observed the spores mingled in a gelatinous mass which, swelling under the influence of moisture, pushed through an apical pore. He observed that the pore closed when it was dry and when wet opened again as the spore-gelatinous mass, expanding greatly by imbibed moisture, pushed through the opening.

Kunze was familiar with several other species of his new genus but with the exception of the two species mentioned above, no additional species of the genus were published by him.

Following Kunze's work no contributions of value were made until 1837. Up to this time writers had overlooked the presence of asci, and in many descriptions of new forms overlooked their possession of an ostiole which had been distinctly described by Kunze.

A significant contribution to the knowledge of the internal structure of *Chaetomium* was presented with the publication of Corda's Icones (26, 27, 28) in 1837, 1838 and 1840. The author amended the original description of the genus as follows: "Peridium membranaceous, at length opening at the apex by a pore, clothed on the outside with opaque hairs, supported by a more or less well-developed, fibrous hypothallus: spores grouped together, ascomorphic, pedicellate, at length discharged as simple powdery spores. Pedicels without mucous." From this amended description a much more accurate conception of the characteristics of the genus is formed.

Concerning the internal structure which other authors described as a gelatinous mass, Corda distinguished the sac-like structures which he called asci, believing, according to his description, that they functioned as pedicels on which the spores were born. Corda's descriptions are supplemented by drawings, quite elaborate for his time, which make it possible to recognize several of his species, two of which are now retained in the genus, while of the others he described, five have been treated as synonyms, and two referred to other genera, or excluded.

Following Corda's work and prior to the appearance of Zopf's monograph in 1881, more than thirty new species made their appearance. Only a few authors furthered the knowledge of the genus; among these Fries (44) in 1849 noted the fact that in *Chaetomium* the spores are enclosed in a typical ascus, a fact which can be easily overlooked because of their early deliquescence in many species, and, too, because of their transparent or translucent nature. It is safe to believe that Fries was the first to fully perceive the true char-

acter of the internal spore-bearing structure of the perithecium.

Reference has already been made to Zopf's monograph which was published in 1881; this monograph set a high standard with respect to his excellent illustrations and his clear, complete descriptions. In his monograph Zopf described his species under two subgenera. *Chaetomium* and *Chaetomidium*. It will be recalled that *Chaetomium* species are typically ostiolate and those of *Chaetomidium* are non-ostiolate, and are not included in the *Chaetomiaceae* as presently understood. Under *Chaetomium* he described as new *C. spirale*; redescribed and figured his own species *C. bostrychodes*; renamed, described and figured Kunze's *C. globosum* under the name *C. Kunzeanum*; described *C. elatum* Kze, described *C. murorum* and *C. indicum*; described *C. cuniculorum* Fckl., *C. crispatum* Fkl., and *C. pannosum* Wallr. Under *Chaetomidium* he figured and described *C. fimeti* Fckl.

During the period from 1881 to the year 1910, scattered publications appeared from many authors. Among the names of species appearing during this period that of *Chaetomium contortum* described by C. H. Peck (78) in 1896, and *C. simile* by Massee *and* Salmon (69) in 1902, are recognized as valid today. During the year 1910 two publications on the taxonomy of the genus *Chaetomium* appeared. Miss Helen L. Palliser (76) published her revision of the *Chaetomiaceae* of North America, and Bainier (6), published a monograph of *Chaetomidium* and *Chaetomium*. Of the three species Palliser described as new only *C. cochliodes* is now retained as valid. Three species described by Bainier, *C. torulosum*, *C. caprinum* and *C. tortile* have been recognized as valid by previous authors; *C. megalocarpum* is recognized as valid in the present study.

In 1915 Chivers published his illustrated monograph of the genera *Chaetomium* and *Ascotricha* in which he lists 114 species and 14 varieties previously referred to these genera, recognizing only 28 species, of which 11 were described by him. Following Chivers' monograph a variety of authors have contributed new species to the genera and a new genus to the family *Chaetomiaceae*. Tschudy (1937) (119) described *C. ochraceum*, *C. cancroideum* and *C. globosum* Kze. var. *affine*. Greathouse and Ames (1945) (49) added *C. pachypodioides*, *C. dolichotrichum* and *C. microcephalum*. A species producing four-spored asci, *C. tetrasporum*, was described by Hughes (1946) (54). A new genus, *Lophotrichus* was described by Benjamin (1949) (8a) with two species, *L. martini* and *L. ampullus*. Several species of *Chaetomium* isolated from military material and equipment were published by Ames (1949) (2) under the following names: *C. turgidopilosum*, *C. cristatum*, *C. gangligerum*, *C. velutinum*, *C. atrobrunneum*, *C. seminudum*, *C. cupreum*, *C. causiaeformis*, and *C. succineum*. For the first time a thermophilic *Chaetomium* was published by La Touche (1950) (61) under the name *C. thermophile*. Ames (1951) (4) added two species of *Ascotricha*, *A. xylina* and *A. guamensis*. From among seed borne-fungi Skolko and Groves (1948–1953) (104–105) added the following species of *Chaetomium: C. erectum*, *C. reflexum* and *C. atrosporum*. Krzem. and Badura (1954) (58), added *C. longicolleum* and *C. minutum*. Omvik (1955) described *C. homopilatum* and *C. flavum*. Sergejeva (1956) (103) described *C. crispatoideum*, *C. angustispirale*, *C. perlucidum* and *C. semen-citrulli*. Additional authors and their contributions are described elsewhere in the monograph.

## DEVELOPMENT OF TAXONOMIC CONCEPTS

It is evident from the preceding discussion that the taxonomic descriptions of the genus *Chaetomium* have undergone change as observations have added, from time to time, facts previously overlooked or not recorded.

Kunze observed the ostiole but did not see the manner in which the spores were produced in his new species. At a later date Corda amended Kunze's original description of the genus, observing that the spores were grouped together and distinguished the sac-like structures which he called asci, apparently thinking that they functioned as pedicels on which the spores were borne. Following Corda's work Fries, in 1849, observed that the spores of *Chaetomium* are enclosed in a typical ascus. Up to this time the ascus of species described were clavate in shape and contained eight ascospores. In 1869 Fuckel described *C. crispatum* in which the ascospores were borne in cylindrical-linear asci. In 1946 Hughes described the 4-spored species *C. tetrasporum*. The production of numerous dark-colored bulbils were observed as characteristic of *C. gangligerum* Ames, 1949, and in the same publication Ames described aleuriospores and chlamydospores in *C. seminudum*.

The description of a genus is based on the characters of the species; it is quite natural that, theoretically, we must know all the species of a genus before we can give a full description of its pattern of variation. In turn as related genera are discovered, such as happened by delimiting the genera *Ascotricha*, Berkeley (1838) and *Lophotrichus*, Benjamin (1949), and as additional species are described, the concept of the family *Chae-*

*tomiacae* become clearer, while the relations and distinctions between the several genera and species become more precise and more understandable. The present treatment is proposed to that end, but it is recognized that as new species are discovered and recorded the family and genera—and even species—as here comprehended cannot be considered static or fixed but subject to further interpretation and emendation.

## CHARACTERS OF THE GENUS CHAETOMIUM

Perithecia superficial, spherical, subglobose, elongated or vase-shaped, translucent when young, when mature more or less colored, a few remaining translucent, most becoming more or less opaque, ostiolate, with blunt, narrow or beaked apex. Perithecial wall membranaceous, fragile, brittle with age, distinctly cellular, ornamented with appendages in the form of diversely modified and variously colored hairs. Mycelium consists of sparsely or densely branching fungus threads radiating in a network from the point of origin. The fungus hyphae are predominantly white, but may be yellow, yellowish-green, reddish, or copper-colored, due to pigments in the protoplasm or adhering crystals. Some species produce aleuriospores or chlamydospores, rarely bulbils or conidia. Asci gelatinous-walled, delicate, stalked, club-shaped, linear-cylindrical, evanescent, deliquescing before the ascospores are mature or sometimes persisting to their maturity before deliquescing, the majority are 8-spored, some species are regularly 4-spored. Ascospores single-celled, slightly or darkly colored, most frequently olive-brown, occasionally bright colored, typically lemon-shaped but occurring in a variety of shapes sizes and colors.

Type species: *Chaetomium globosum* Kunze ex Fries. Systema Mycologicum 3: 255. 1829.

In the following key, species determination is based primarily on the following characters:

a. Conspicuous characters of the hairs.
b. Size, shape, and structure of the perithecia.
c. Size, shape, and conspicuous characters of the ascospores.
d. Conspicuous characters of the asci.
e. Temperature requirements for fruiting.

To a lesser degree the following characters are used in characterizing the species:

a. The characteristics of the rhizoids.
b. The color of the perithecia, hairs, ascospores and, in culture the color of the agar medium.
c. Solubility of pigments in water, alcohol or other solvents.
d. The presence or absence of cirrhi. It is recognized that extrusion of the ascospores is influenced by moisture conditions; some species almost always produce cirrhi, others almost never do.
e. The presence or absence of aleuriospores, chlamydospores or bulbils in nutrient agar cultures.

*The species are arranged in alphabetical order.*

## KEY TO CHAETOMIUM

For convenience the species are divided into groups. This is a strictly arbitrary grouping of species; it is not in any way intended to suggest that these groups represent natural affinities.

| | | |
|---|---|---|
| A. Terminal hairs distinctly branched. | | B |
| A. Terminal hairs unbranched; rarely somewhat branched in Group VIII. | | G |
| B. Terminal hairs dichotomously branched. | Group I | |
| B. Terminal hairs not dichotomously branched. | | C |
| C. Terminal hairs typically branched at right angles. | Group II | |
| C. Terminal hairs not branched at right angles. | | D |
| D. Terminal hairs coiled. | | E |
| D. Terminal hairs not coiled. | | F |
| E. Coiled hairs intermingled with other types. | Group III | |
| E. Coiled hairs not intermingled with other types. | Group IV | |
| F. Terminal hairs flexuous. | Group V | |
| F. Terminal hairs not flexuous. | Group VI | |
| G. Terminal hairs straight, wavy or arcuate. | | H |
| G. Terminal hairs coiled or contorted. | | I |
| H. Terminal hairs straight, slightly curved or wavy. | Group VII | |
| H. Terminal hairs undulate to arcuate with occasional branched tips. | Group VIII | |
| I. Terminals hairs uniformly coiled or contorted. | Group IX | |
| I. Coiled or contorted hairs mixed with other types of hairs. | Group X | |

## GROUP I

### TERMINAL HAIRS DICHOTOMOUSLY BRANCHED

a. Asci club-shaped; species not thermophilic. b
a. Asci linear-cylindric; species thermophilic. k
b. Ascospores narrow-fusiform. *C. fusum*
b. Ascospores lemon-shaped or ovoid. c
c. Ascospores lemon-shaped, large. d
c. Ascospores ovoid, apiculate or not, often small. e
d. Ascospores apiculate; terminal hairs uniformly branched, with sharp tips. *C. elatum*
d. Ascospores rounded on ends or subapiculate; terminal hairs irregular and ragged. *C. virgecephalum*
e. Ascospores not apiculate, terminal hairs of three types. *C. africanum*
e. Ascospores apiculate or subapiculate; terminal hairs of one or two types. f
f. Terminal hairs all of one type. g
f. Terminal hairs of two types. j
g. Ascospores large, to 13.5 long; terminal hairs pincer-like at tips. *C. cancroideum*
g. Ascospores smaller; terminal hairs not pincer-like at tips. h
h. Terminal hairs arcuate, strongly reflexed. *C. reflexum*
h. Terminal hairs branched at wide angles. i
i. Terminal branches reflexed, the tips remaining smooth and rigid. *C. indicum*
i. Terminal branches not reflexed, the tips delicate, thin, collapsing, then appearing blunt. *C. erectum*
j. Branched hairs acutely angled, often inflated between septa, combined with long, unbranched, stiff, sharp-pointed hairs. *C. funicolum*
j. Branched hairs with long internodes, wide-spreading and often slightly reflexed, accompanied by very long, graceful, 1-2-forked hairs. *C. dolichotrichum*
k. Ascospores irregularly almond-shaped, 9–11$\mu$ long, occasionally replaced by giant ascospores; terminal hairs irregularly dichotomous, rich light brown. *C. virginicum*
k. Ascospores irregularly subglobose; 7–8$\mu$ long; terminal hairs irregularly dichotomous, dark olivaceous. *C. thermophile*

## GROUP II

### TERMINAL HAIRS BRANCHED AT RIGHT ANGLES OR NEARLY SO

a. Terminal hairs stiff, spine-like, with blunt ends; ascospores small, ovate. *C. spinosum*
a. Terminal hairs long, delicate; ascospores not ovate. b
b. Terminal hairs light brown to cream-colored; ascospores lemon-shaped, subapiculate. *C. mollipilium*
b. Terminal hairs dark brown; ascospores almond-shaped or ellipsoid. *C. atrobrunneum*

## GROUP III

### TERMINAL HAIRS COILED, TWISTED AND BRANCHED BUT INTERMINGLED WITH OTHER HAIR TYPES

a. Ascospores quadrangular. *C. quadrangulatum*
a. Ascospores lemon-shaped to ovoid or globose. b
b. Ascospores ovoid to globose, under 7$\mu$ long; perithecia vase-shaped, up to 750$\mu$ tall, the upper portion of markedly elongate cells. *C. caprinum*
b. Ascospores lemon-shaped, over 7$\mu$ long; terminal hairs of three types. c

c. Perithecia subglobose; terminal hairs (1) coiled, twisted, occasionally branched; (2) wavy, unbranched; (3) nearly straight or wavy and branched. *C. angustispirale*

c. Perithecia barrel-shaped; terminal hairs (1) straight, long, tapering to a sharp point; (2) slender, flexed, terminating in 2–7 spirals; (3) stout, coarse spirals, some with side branches. *C. angustum*

## GROUP IV

### TERMINAL HAIRS ALL COILED AND BRANCHED

a. Asci club-shaped. b

a. Asci linear-cylindrical. e

b. Perithecia vasiform, tall. c

b. Perithecia globose or broadly ovoid. d

c. Perithecia narrow at apex, to 650$\mu$ tall; terminal hairs stout, 7–9$\mu$ in diam., short, terminating in compact coils. *C. robustum*

c. Perithecia broad at apex, to 460$\mu$ tall, terminal hairs long, spreading, extending far beyond spore-mass head. *C. pachypodioides*

d. Perithecia globose, up to 240$\mu$ diam.; ascospores almond-shaped, 11–16.5$\mu$ long; terminal hairs coiled, twisted or in spirals. *C. semen-citruli*

d. Perithecia broadly ovoid, often with blunt, pointed base; ascospores ellipsoid, to 7.4$\mu$ long, often containing an elliptical refractive area; terminal hairs regularly coiled, some unbranched, heads often readily detach from perithecia at maturity. *C. bostrychodes*

e. Ascospores almond-shaped, rounded at ends or one end apiculate; perithecia globose, shaggy, up to 125$\mu$ diam.; terminal hairs bulbous at base, loosely spiraled or with 1–2 coils at end, sometimes anastomosing. *C. incomptum* f

e. Ascospores lemon-shaped or irregularly ovoid; terminal hairs not bulbous at base.

f. Ascospores lemon-shaped, the ends rounded or subapiculate, 7.5–9.2$\mu$ long, terminal hairs densely coiled, some unbranched, not notably paler below. *C. congoensis*

f. Ascospores irregularly ovoid, 5–7.5$\mu$ long, terminal hairs, narrow, pale below, thicker and darker above, forming a dense, small, compact head. *C. leucophora*

## GROUP V

### TERMINAL HAIRS TERMINATING IN SEVERAL BRANCHED, DELICATE, FLEXUOUS ENDS

a. Asci club-shaped. b

a. Asci linear-cylindrical. l

b. Terminal hairs of one type. c

b. Terminal hairs of two types. j

c. Perithecia vasiform. d

c. Perithecia globose or subglobose. f

d. Perithecia to 240$\mu$ tall, terminal hairs 2–4 branched, lateral hairs spine-like. *C. torulosum*

d. Perithecia to 500$\mu$ tall. e

e. Perithecia with slim, long necks; hairs few terminally and laterally. *C. ampullare*

e. Perithecia with wide necks; terminal hairs forming a dense head. *C. iricolor*

f. Perithecia with a distinct neck. g

f. Perithecia without a distinct neck. h

g. Perithecia to 400$\mu$ tall; terminal hairs with 3–6 flexuous branches. *C. sphaerale*

| | | |
|---|---|---|
| g. | Perithecia to 250$\mu$ tall; terminal hairs with 3–10 or more branches with thread-like ends. | *C. pinnatum* |
| | h. Ascospores irregularly spherical, 13–16.5 x 12–14$\mu$, very dark. | *C. megalocarpum* |
| | h. Ascospores ovate or almond-shaped, smaller and paler. | i |
| i. | Ascospores dilute brown, pale green when young, 8–11$\mu$ long. | *C. fibripilium* |
| i. | Ascospores brown, 5–6$\mu$ long. | *C. nigricolor* |
| | j. Perithecia vasiform with a distinct neck; terminal hairs slender, of two sorts, (1) long, thin, septate, straight or slightly arcuate with thin tips (2) a delicate, very pale reticulum of very slender anastomosing branches, 1–2$\mu$ diam., thread-like; spores 6–8 x 4–7$\mu$. | *C. reticulopilium* |
| | j. Perithecia globose or subglobose; robust hairs present; spores larger. | k |
| k. | Perithecia to 700$\mu$ in diam.; terminal hairs (1) many, long, black, stiff, occasionally bifurcate (2) delicate, finely branched, fluffy. | *C. teratoidum* |
| k. | Perithecia to 300$\mu$ in diam.; terminal hairs (1) few, long, black, stiff, tips branched, frequently anastomosing; (2) delicate, finely branched, fluffy. | *C. cuniculorum* |
| | l. Asci normally containing 4 ascospores; terminal hairs twisted, kinked or irregularly spiraling. | *C. tetrasporum* |
| | l. Asci containing 8 ascospores, terminal hairs ribbon-like, somewhat twisted, undulate. | *C. senegalensis* |

## GROUP VI

### TERMINAL HAIRS ARCUATE, AND IRREGULARLY BRANCHED AT TIPS OR THICK, SHORT, IRREGULARLY BRANCHED HAIRS ACCOMPANIED BY LONG UNBRANCHED HAIRS

| | | |
|---|---|---|
| a. | Perithecia transluscent, delicate, up to 110$\mu$ tall; terminal hairs (1) thick, irregularly branched, forming a dense head; (2) long, arcuate, extending far beyond head. | *C. causiaeformis* |
| a. | Perithecia opaque, up to 200$\mu$ tall; terminal hairs arcuate, the primary hairs at maturity proliferating at tips into knobby branches. | *C. venezuelense* |

## GROUP VII

### TERMINAL HAIRS STRAIGHT, SLIGHTLY CURVED OR WAVY

| | | |
|---|---|---|
| a. | Terminal hairs short, stiff and spine-like or very long. | b |
| a. | Terminal hairs not stiff and spine-like. | h |
| | b. Terminal hairs short. | c |
| | b. Terminal hairs very long. | g |
| c. | Ascospores triangular. | *C. trigonosporum* |
| c. | Ascospores lemon-shaped, oval or almond-shaped. | d |
| | d. Ascospores lemon-shaped. | e |
| | d. Ascospores almond-shaped or ovoid. | f |
| e. | Terminal hairs tufted about the ostiole, short; perithecia elongated, barrel-shaped. | *C. brevipilium* |
| e. | Terminal hairs evenly distributed, short; perithecia broadly vase-shaped. | *C. homopilatum* |
| | f. Ascospores almond-shaped, to 10$\mu$ long; perithecia vase-shaped, 230$\mu$ tall. | *C. seminudum* |
| | f. Ascospores ovoid, depressed, to 8.5$\mu$ long; perithecia vase-shaped, to 125$\mu$ tall. | *C. minutum* |
| g. | Terminal hairs to 2100$\mu$ long, forming a narrow neck-like structure. | *C. longirostre* |
| g. | Terminal hairs to 800$\mu$ long, forming a relatively wide neck-like structure. | *C. longicolleum* |
| | h. Terminal hairs slightly recurved at base, tips incurved, not dense. | *C. aureum* |
| | h. Terminal hairs slender, straight or wavy. | i |
| i. | Ascospores irregularly ovoid, to 19–24$\mu$ long. | *C. britannicum* |

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| | | | |
|---|---|---|---|
| i. | Ascospores lemon-shaped, brown or bright colored, not exceeding 17$\mu$ in length. | | j |
| | j. Ascospores pink to red in mass. | *C. cruentum* | |
| | j. Ascospores brown. | | k |
| k. | Ascospores to 16$\mu$ long, apiculate; perithecia to 330$\mu$ tall. | *C. olivaceum* | |
| k. | Ascospores smaller, to 10.2$\mu$, apiculate; perithecia to 280$\mu$ tall. | *C. globosum* | |

## GROUP VIII

### TERMINAL HAIRS UNDULATE TO ARCUATE, SIMPLE, OR, IN TWO SPECIES, OCCASIONALLY BRANCHED

| | | | |
|---|---|---|---|
| a. | Terminal hairs all unbranched. | | b |
| a. | Terminal hairs mostly unbranched, but some forked. | | j |
| | b. Perithecia subglobose to ovate. | | c |
| | b. Perithecia globose. | | g |
| c. | Ascospores narrow-ellipsoid; terminal hairs at maturity slender, graceful, with circinate tips. | *C. murorum* | |
| c. | Ascospores oviod to subglobose. | | d |
| | d. Ascospores small, not exceeding 6$\mu$; terminal hairs very slender, forming a compact head. | *C. ochraceum* | |
| | d. Ascospores larger, 10$\mu$ or more long. | | e |
| e. | Ascospores varying from subglobose to lemon-shaped, not exceeding 10.5$\mu$ long. | *C. globosum* | |
| e. | Ascospores more uniform in shape, larger. | | f |
| | f. Ascospores distinctly apiculate, up to 16$\mu$ long; terminal hairs wavy. | *C. olivaceum* | |
| | f. Ascospores ovoid to lemon-shaped, to 15$\mu$ long; terminal hairs robost, up to 7.5$\mu$ in diameter, the tips circinate, 2–3 times recurved. | *C. circinatum* | |
| g. | Terminal hairs with bulbous bases, short, arcuate to irregularly undulate. | *C. erraticum* | |
| g. | Terminal hairs without bulbous bases. | | h |
| | h. Ascospores almond-shaped; terminal hairs with 2–3 wide undulations, the tips incurved, often crook-shaped. | *C. alba-aurenulum* | |
| | h. Ascospores ovoid. | | i |
| i. | Ascospores irregularly ovoid; terminal hairs with 3–4 graceful undulations, the tips often irregularly contorted. | *C. perpulchrum* | |
| i. | Ascospores narrow-ovoid; terminal hairs very long, undulate about the head, the wavy tips far extended. | *C. anguipilium* | |
| | j. Perithecia elongate, barrel-shaped, up to 490$\mu$ tall; terminal hairs black, occasionally forked, undulate below, with long spike-like tips. | *C. spiculipilium* | |
| | j. Perithecia subglobose to ovate, not exceeding 240$\mu$ in height; terminal hairs mostly unbranched, with a few divergently branched near the tips. | *C. gracile* | |

## GROUP IX

### TERMINAL HAIRS COILED OR CONTORTED

| | | | |
|---|---|---|---|
| a. | Terminal hairs coiled. | | b |
| a. | Terminal hairs contorted. | | c |
| | b. Terminal hairs coiled with 10–18 turns. | | c |
| | b. Terminal hairs coiled with 1–10 turns. | | d |
| c. | Coils with almost uniform turns. (Occasionally a few abortive branches occur). | *C. aterrimum* | |

| | | | |
|---|---|---|---|
| c. | Coils not uniform in diam., but corkscrew in shape. | *C. spirale* | |
| | d. Perithecia egg-shaped or barrel-shaped. | | e |
| | d. Perithecia subglobose to globose. | | g |
| e. | Perithecia egg-shaped; terminal hairs very long, ends loosely spirally coiled, drooping. | *C. convolutum* | |
| e. | Perithecia barrel-shaped. | | f |
| | f. Terminal hairs slender, spirally coiled, short, tips often thread-like giving a fuzzy appearance. | *C. subspirale* | |
| | f. Terminal hairs medium coarse, coiled above with large loops which decrease in diameter to narrow blunt tips. | *C. pulchellum* | |
| g. | Perithecia globosis with a conspicuous dark area around the ostiole. | *C. perpulchrum* | |
| g. | Perithecia subglobose; without dark area around ostiole. | | h |
| | h. Ascospores long, to 18$\mu$. | | i |
| | h. Ascospores relatively short, less than 13$\mu$ long. | | l |
| i. | Ascospores fusiform, to 16$\mu$ long; terminal hairs incurved, tips convolute. | *C. fusiforme* | |
| i. | Ascospores not fusiform. | | j |
| | j. Ascospores strongly umbonate to 15.5$\mu$ long; terminal hairs of three types. | *C. flavum* | |
| | j. Ascospores slightly umbonate, to 18$\mu$ long, terminal hairs of one type. | | k |
| k. | Perithecia without a neck; terminal hairs ending in 3–7 coils, occasionally more, blunt at tips. (Bulbils are produced in nutrient agar.) | *C. gangligerum* | |
| k. | Perithecia with a distinct neck; terminal hairs ending in 2–3 large loops or several sinuous coils. | *C. succineum* | |
| | l. Ascospores cymbiform. | | m |
| | l. Ascospores lemon-shaped. | | n |
| m. | Producing a yellowish pigment which is soluble in water. Terminal hairs strongly curved, slender, not bulbous at base, 1–3 spirally convolute at tips. | *C. trilaterale* | |
| m. | Species produces copper-colored pigment which is insoluble in water. Terminal hairs stiff, bulbous at base, heavily incrusted with copper-colored crystals, arcuate from base, terminating in 1–2 spirally concolute tips. | *C. cupreum* | |
| | n. Terminal hairs inflated in the middle area, rigid, tips narrow and recurved. | *C. turgidopilosum* | |
| | n. Terminal hairs not inflated, mostly recurved or some circinate, curved, frequently producing stubby branches. | *C. distortum* | |
| o. | Perithecia globose, with a dark area around the ostiole. | *C. perpulchrum* | |
| o. | Perithecia subglobose, without dark area around ostiole. | | p |
| | p. Terminal hairs intricately contorted, at times coiling into regular spirals, then twisting in the opposite direction. | *C. tortile* | |
| | p. Terminal hairs in loops, loops separated by long, graceful arches. | *C. simile* | |

## GROUP X

### TERMINAL HAIRS COILED OR CONTORTED, UNBRANCHED BUT INTERMINGLED WITH OTHER HAIR TYPES

| | | | |
|---|---|---|---|
| a. | Asci linear-cylindrical. | | b |
| a. | Asci club-shaped. | | e |
| | b. Terminal hairs spiraled or loosely spiraled. | | c |
| | b. Terminal hairs short-looped. | | d |
| c. | Terminal hairs with 4–7 close spirals accompanied with a few long, flexusous hairs, forming a relatively compact head. | *C. brasiliense* | |
| c. | Terminal hairs with loose spirals accompanied with long, wavy, slender hairs, forming an open head. | *C. mollicellum* | |
| | d. Terminal hairs closely looped with a series of thick and thin segments, intermingled with straight unbranched hairs. | *C. contortum* | |

d. Terminal hairs loosely looped, uniform in diameter but terminating in much enlarged tips; intermingled with long, spine-like hairs. *C. crispatoideum*

e. Perithecia to 575$\mu$ tall, slender. Terminal hairs short, few to several spiral coils, (occasionally a branch is formed), accompanied by a few stiff spines. *C. microcephalum*

e. Perithecia under 350$\mu$ tall, subglobose to somewhat barrel-shaped. f

f. Ascospores fusiform, collapsing with a long furrow, 8–13.3$\mu$ long. Terminal hairs of two types, (1) kinky-wavy, mildly distorted or loosely coiled, (2) long, straight or slightly bent. *C. perlucidum*

f. Ascospores lemon-shaped, apiculate on both ends, 7–10.5$\mu$ long. Terminal hairs forming a dense head of two types, (1) stout, spiraled with 3–4 convolutions, (2) slender, straight or some coiling or irregularly twisted or undulate. *C. cochliodes*

**1. CHAETOMIUM AFRICANUM** sp. nov.

Plate 4, Figs. 6–10

Peritheciis ostiolatis, fuscis, late globosis vel subglobosis, 120–175 x 105–190$\mu$, ad substratum cum rhizoideis brunneis affixis. Pilis terminalibus generium trium: (a) brevibus, dichotomo-ramosis, latitudine latis, apicibus retusis, cum crasis granulis vestitis, fuscis diametro 8–9.5$\mu$; (b) brevibus quam (a) longioribus, dichotomo-ramosis diametro 3–3.5$\mu$, apice retusis cum minimis spiculosis; (c) multo longioribus nigris, interdum irregulater ramosis, brunneis, glabris vel minute spiculosis, obscure septatis. Pilis lateralibus paucis, septatis, brunneis, simplicibus, rectis brevissimis, basi 2.5–3$\mu$ diametro. Ascis clavatis, evanescentibus. Ascosporis olivaceo-brunneis, ovoideis, leviter in uno latere compressibus apicibus rotundatis vel subacutis, 5–7 x 3–4.3$\mu$.

Perithecia dark brown, broadly globose, subglobose, or in some cases wider than tall, 120–175 x 105–190$\mu$, firmly attached to the substratum by abundant dark brown rhizoids. Terminal hairs of three types, (a) relatively short, stout, dichotomously branched, dark brown encrusted with crystals, at base 8–9.5$\mu$ in diameter, (b) medium short, dichotomously branched, brown, moderately covered with crystals, at base 3–3.5$\mu$ in diameter, (c) long, irregularly branched hairs, extending beyond the head, brown, smooth, or minutely roughened, at base 4.5–5$\mu$ in diameter. Lateral hairs few, unbranched, black septate.

Asci club-shaped, evanescent, 8-spored. Ascospores ovoid, rounded at the ends, 5–7 x 3–4$\mu$.

Type locality: Yangembi, Congo Belge.

Habitat: On rat dung

Distribution: Known only from type locality.

Type deposited in the U.S. National Herbarium, Washington, D.C.

This species was isolated from rat dung received from Dr. J. Meyer, 1958.

**2. CHAETOMIUM ALBA-ARENULUM** sp. nov.

Plate 8, Figs. 13–18

Peritheciis ostiolatis, pallide fuscis vel fuscis, cum tenuis parietibus membranaceois, parvis, globosis vel subglobosis, diametro 87–130$\mu$, fermissime 90–100$\mu$ maturis, ad substratum cum rhizoideis tenellis affixis. Pilis terminalibus pallide fuscis, diametro 6.0–6.3$\mu$ basi septatis, cum 2–4$\mu$ latis undulationibus, apicibus retusis, cum flexu hamulo in forma vel cum 1–1½ convolutionibus. Pilis lateralibus, tenellis, non ramosis. Ascis longis, cylindricis, octosporis, 45$\mu$ longitudine, 6.5$\mu$ latitudine, pars sporif. 34$\mu$. Ascosporis maturis pallide fuscis, ovatis vel globoso-ovatis, 5.0–7.0 x 3.8–5.0$\mu$.

Perithecia light chocolate brown color. In culture on nutrient agar the closely growing perithecia are often overgrown with a thin mycelial network. Perithecia ostiolate, brown with parenchymateous walls, small, globose or occasionally subglobose, 87–130$\mu$ in diameter, mostly 90–100$\mu$ in diameter when mature, lightly attached to the substratum with undifferentiated rhizoids. Terminal hairs loosely coiled with two to four wide undulations, at base 6.0–6.3$\mu$ in diameter, unbranched, septate throughout, at blunt tip forming a hook-shaped bend, sometimes forming a loop or loose coil of 1–1½ turns, smooth throughout and light brown in color. Lateral hairs delicate, unbranched, long, septate, light brown, at base 2$\mu$ in diameter, narrowing to a thin tip. Asci cylindrical, 45$\mu$ long by 6.5$\mu$ wide, pars sporif. 34$\mu$. Ascopores monostichous, 8-spored, irregularly oval to oval egg-shaped, 5.0–7 x 3.8–5$\mu$, pale brown in color.

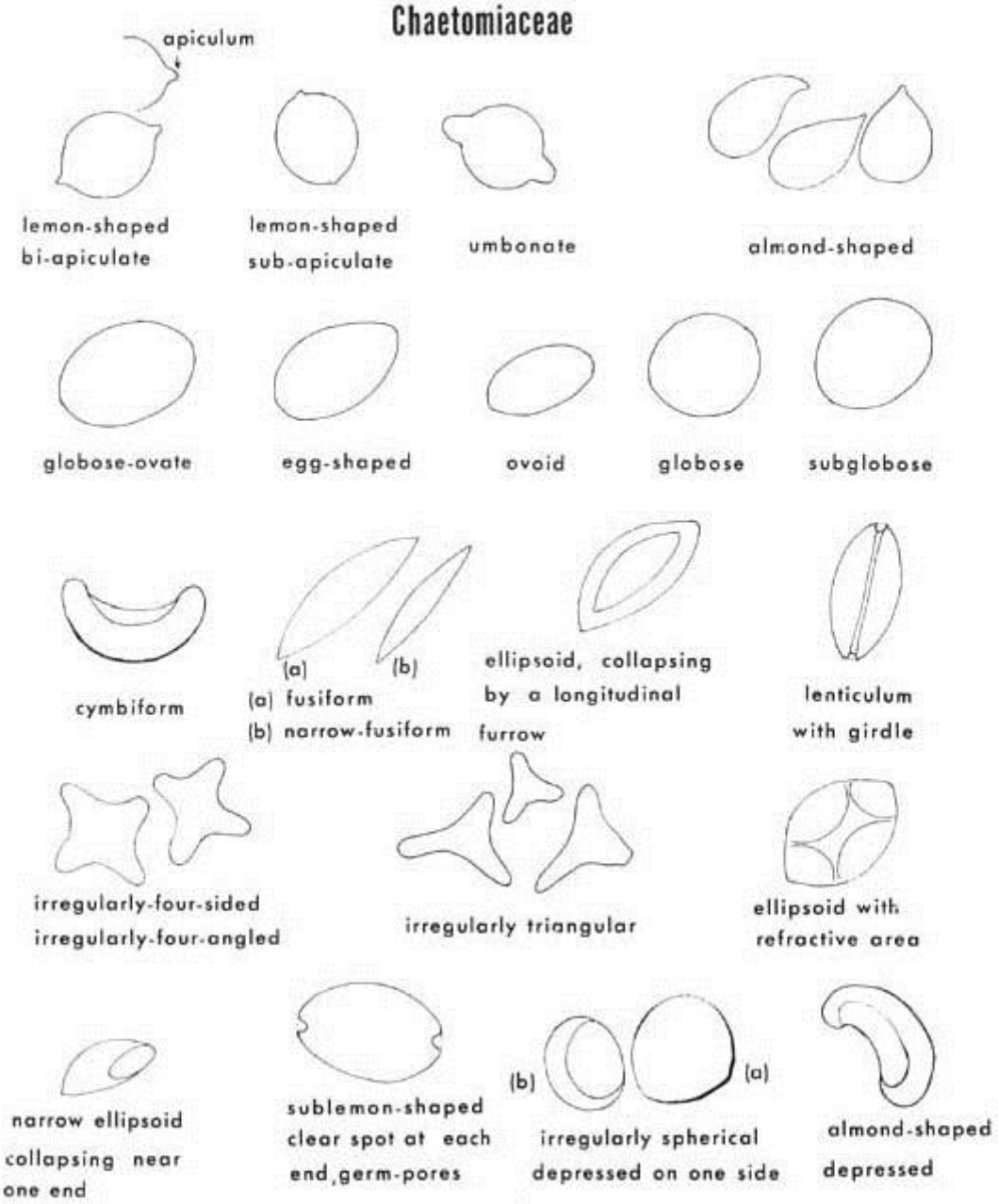
Type locality: White Sands, N. Mex.

Habitat: On dung of small rodents.

Distribution: Known only from type locality.

Type deposited in the U.S. National Herbarium, Washington, D.C.

# Representative Ascospore Forms of the Chaetomiaceae



**3. CHAETOMIUM AMPULLARE** Chivers, Proc. Amer. Acad. 48: 86, 1912.

Plate 22, Figs. 11–14

Perithecia ostiolate, upright, flask-shaped, 450–580 x 135–190$\mu$, dark brown or black at base, fading toward the elongated neck, supporting sparsely scattered golden-yellow hairs, producing at maturity a black mass of ascospores. Terminal hairs smooth, straight or nearly so, very long and graceful, insensibly tapering, distinctly and regularly septate, at base about 7.5$\mu$ in diameter, from base to apex changing successively from golden-brown, golden-yellow, pale yellow, hyaline, terminating in colorless, elongated, more or less collapsed tips, producing in the upper portions slender branches which are frequently septate and only slightly colored at base, hyaline and delicate above, which in turn produce branches of like nature. Lateral hairs comparatively few in number, long, slender, graceful, straight or nearly so, insensibly tapering, at base dark olive-brown, smooth or minutely roughened and about 7.5$\mu$ in diameter, bright yellow above, terminating in rather long, colorless refractive, thin and more or less collapsed tips. Asci club-shaped, 8-spored, 45 x 9.7$\mu$ pars sporif. 23$\mu$. Spores bright olive-yellow, strongly unbonate at both ends, lemon-shaped, 8–9 x 5.5–6.4$\mu$, extruded in irregular clusters.

This species is characterized by the flask-shaped perithecium with a moderately elongated neck, and the sparse elongated hairs which are drawn out into long hyaline, easily collapsible branched threads which may be overlooked under lower magnifications.

Type locality: Lowell, Mass. (Chivers No. 4).

Habitat: On sailcloth (Chivers); on dung (R. Thaxter).

Distribution: Massachusetts; North Carolina.

Type: A. H. Chivers No. 4–1, at Cornell University is probably part of the type collection.

This species is distinguished by the elongated vase-shaped perithecium which tapers to a narrow neck, and by the terminal hairs which taper out to long, hyaline, easily collapsible threads, with branches of the same characteristics. The lateral hairs are few in number, randomly arranged on the perithecium and of the same type as the terminal hairs.

**4. CHAETOMIUM ANGUIPILIUM** sp. nov.

Plate 9, Figs. 1–6

Peritheciis globosis subglobosis, ostiolatis, 140–155 x 130–140$\mu$, translucidis in pueritia, pallidis vel pallidofuscis vel brunneis mutare maturis, ad substratum cum rhizoideis tenellis affixis, sine cirrhis. Pilis non partes dividi, septatis, perlongis, ad 1.2mm., perpallido-brunneis inpueritia, maturis brunneis, diametro 3.8$\mu$ basi ad locus mediis, apice gradation attenuatis, circa ostiolum spiris, tum extendo externus cum undulans in latitium porrectior. Pilis lateralibus septatis, longis, delicatus, perpallido-brunneis, diametro 3–3.7$\mu$ basi, apice gradatim attenuatis. Ascis clavatis, octosporus, 40 x 11$\mu$, parte sporifera 23$\mu$. Ascosporis maturis pallido-fuscis, ovatis vel ellipticus vel globoso-ovatis, utrinque leniter apiculatis vel rotundatis cum apiculum unis, 6–8 x 4.3–5$\mu$.

Brown. Perithecia ostiolate, globose to subglobose 140–155 x 130–140$\mu$, translucent when young, pale to dark-yellow-brown when mature, affixed to the substratum with delicate rhizoids, usually producing a mass of spores in the terminal hairs, seldom producing cirrhi. Terminal hairs not branched, septate, very long, to 1.2 mm. or longer, very pale when young, when mature becoming brown, at the base 3.8$\mu$ in diameter to its middle then gradually narrowing to a narrow tip, the base area of the hairs loop about the ostiole forming a loose head when they extend outward with wide undulations. Lateral hairs septate, long, delicate, very pale-brown, about 2–3.7$\mu$ in diameter at the base and gradually decreasing to a very narrow point. Asci club-shaped, eight-spored, 40 x 11$\mu$, pars sporif. 23$\mu$. Ascospores when mature are pale brown, ovoid, apiculate on both ends, 6–8 x 4.3–5$\mu$.

Type locality: White Sands, N. Mex.

Habitat: On rabbit dung.

Distribution: Known only from the type locality.

Type deposited in the U.S. National Herbarium, Washington, D.C.

**5. CHAETOMIUM ANGUSTISPIRALE** Sergejeva, Botanicheskiye Materialy, Pub. Acad. Sci. USSR, B. L. Komarov Botanical Institute, Moscow—Leningrad, 11:115, 1956.

Plate 13, Figs. 9–15

Brown. Perithecia ostiolate, in mass appearing greenish-brown in color to the naked eye, are broadly ellipsoidal, large in size, 400–510$\mu$ in height, 320–450$\mu$ wide, with many and very long rhizoids at the base, are densely covered on the sides and top with ornamental hairs. Terminal hairs varying greatly in thickness, length, form, color and sculpture are of two types; (a) those that are thick, about 6–6.5$\mu$ in diameter at base, simple or branched and sometimes alternately branched, the long lower part straight, wavy or sinuous, then forming a large spiral 27$\mu$ in diameter, with narrower spirals on repeated branchings, distinctly septate and covered with conspicuous prickles; (b) more slender hairs 3–5$\mu$ in diameter, simple or

branched, shorter in length, straight or coiling into nearly regular, slightly conical, often very long spirals, 12–18$\mu$ in diameter with even narrower spirals (9–12) on repeated branchings, these hairs are numerous, shorter than the thick hairs of type (a), lighter in color and less distinctly septate, but are covered with distinct prickles. Lateral hairs are 3.5–4$\mu$ in diameter at base, resembling the thin top ones in their coloring and sculpture, but shorter and only slightly twisted in the lower part of the perithecium, while near the apex of the perithecium they become longer and helically curved, finally, in the top part they imperceptically merge into the terminal appendages. Asci clavate, 52–60 x 10$\mu$, 8-spored, pars sporif. 30–35$\mu$. Ascospores are flattened, with one side concave and the other side convex, when viewed from the broad surface are elliptical, appiculated at both ends, 11–12 x 8–9$\mu$, light brown to rich brown in color.

Type locality: Tellerman forest, Balashev region, Russia.

Habitat: Isolated from forest litter. (Sergejeva).

This species was received as a pure culture from K. S. Sergejeva; subculture specimens are deposited in the U.S. National Herbarium, Washington, D.C.

*Chaetomium angustispirale* is characterized by the occurrence of conspicuous prickles on the robust terminal hairs and the numerous long spirals of the slender hairs which are likewise covered with small but conspicuous prickles.

**6. CHAETOMIUM ANGUSTUM** Chivers, Mem. Torrey Bot. Club, 14: 206, 1915

Plate 11 Figs. 1–5

Perithecia ostiolate, large, rich olive green, subglobose, with a bluntly pointed base, 280–305 x 240–290$\mu$ forming cirrhi in comparatively few cases, producing a dense mass of dark olive-brown to black, undulate rhizoids. Terminal hairs of three types: (a) straight, long, tapering, dark olive-brown to black at base, light yellow to hyaline at tips, minutely roughened throughout with spines, obscurely septate or continuous, at base about 6.7$\mu$ in diameter; (b) slender, graceful, below straight or only slightly flexed, and about 3.8$\mu$ in thickness, in upper portions coiling spirally with about 5–7 convolutions which are comparatively small in diameter, minutely roughened throughout, sparingly septate or continuous. At base dark olive-brown, fading toward the tips; (c) stout, coarse, roughened throughout, sparingly and obscurely septate, below straight, very dark olive-brown, at base about 7.5$\mu$ in diameter, above spirally coiled at first regularly coiled with 2.3 convolutions, often becoming irregular and retaining only a single coil near the middle of their length from which, frequently one or two branches arise. Lateral hairs very numerous, obscurely and sparsely septate, either stout tapering, dark, olive-brown to black at base and about 6.6$\mu$ in diameter, fading above and becoming pale yellow, hyaline at tips, or slender, olive-yellow and flexed or irregularly, spirally twisted. Asci irregularly club-shaped, 8-spored, 50 x 14$\mu$ pars sporif. 23.$\mu$ Ascospores when young greenish, hyaline, filled with irregular, refractive globules, when mature dark olive-brown, lemon-shaped, apiculate or umbonate, 10 x 8$\mu$ (9.7–10.5 x 7.3–8.1$\mu$).

Type locality: Puerto Rico. (Chivers No. 25).

Habitat: On bat dung.

Distribution: Known only from Chiver's specimens.

Type: Specimen No. 25–1, in herb. A. H. Chivers at Cornell University, Ithaca, N.Y., is probably from the type collection.

Drawings of this species were made from a specimen of Chiver's collection at the Farlow Herbarium, Cambridge, Mass.

*Chaetomium angustum* resembles *C. cochliodes* but has coarser and more loosely coiled terminal hairs, which are intermingled with a few straight or wavy hairs.

**7. CHAETOMIUM ATERRIMUM** Ellis & Everhart, in Palliser, North Am. Flora, (76). 3: 62, 1910

Plate 11, Figs. 12–14.

Gray-black to black. Perithecia ostiolate, ovate or subglobose, 190–300 x 160–230$\mu$, seated on olive-yellow or olive-brown rhizoids, membranaceous, densely clothed with hairs, the terminal ends of which are closely and uniformly coiled. Terminal hairs very rarely producing small abortive branches, dark olive-brown or black, and roughened by minute spines throughout, irregularly septate, at base 5–6$\mu$ in diameter, at tip 8–11$\mu$ in diameter, below straight or slightly flexed, above coiling 10–18 times, averaging about 15, in a long, close, regular, cylindrical spiral, 45–60$\mu$ in diameter. Lateral hairs numerous, long, slender, straight or slightly flexed, septate, graceful, gradually tapering, minutely roughened throughout or only near the base, below olive-yellow or dark olive-brown, 4–5$\mu$ in diameter, above pale yellow or hyaline. Asci club-shaped. Ascospores olive brown, lemon-shaped, slightly apiculate at either end, 6.5–8 x 5.5–6.5$\mu$, when viewed edgewise, compressed, 4.8$\mu$ broad.

Type locality: Rockport, Kans.

Habitat: On damaged wheat, (Bartholomew 448). On rat, dog, and rabbit dung. (Ames).

Distribution: Kansas, New England, Virginia, Tennessee. Specimens of this species are deposited in the U.S. National Herbarium, Washington, D.C.

*Chaetomium aterrimum* may be recognized by the long, uniformly and closely coiled terminal hairs, the coils of which are of uniform diameter, often for 12–18 turns. It closely resembles *C. spirale* which differs principally in having terminal hairs in which the spirals decrease markedly in diameter toward the tips.

**8. CHAETOMIUM ATROBRUNNEUM** Ames, Mycologia 41: 641, 1949

Plate 20, Figs. 7–10

Brown. Perithecia dark brown, small, ostiolate, globose to subglobose, 75–120 x 110$\mu$, with cirrhi or with masses of spores loosely held in the terminal hairs, attached to the substratum with straw-colored rhizoids. Terminal hairs long, graceful, at the base 3.75–4.75$\mu$ in diameter, often branched at wide angles with the main axis, distinctly septate, narrowing in diameter to a relatively sharp tip. Asci clavate, 8-spored, 30 x 10$\mu$, pars sporif. 18$\mu$. Ascospores when mature are a dilute olive-brown, long and narrow, somewhat fusiform, rounded to subacute on the ends, 10–12 x 5.5–7.5$\mu$.

Type locality: Guadalcanal.

Habitat: Molded mattress.

Distribution: Guadalcanal; Japan, (Udagawa).

Type: Deposited in the U.S. National Herbarium, Washington, D.C.

This species was received from Dr. G. W. Martin under his designation J–1041 (3–J3).

*Chaetomium atrobrunneum* is readily recognized by the rich, glossy-brown terminal hairs which are branched at wide angles.

**9 CHAETOMIUM AUREUM** Chivers, Proc. Am. Acad. Arts & Sciences 48: 86, 1912

*Chaetomium minimum* v. Beyma, Antonie van Leeuw. *10:* 42, 1944

Plate 25, Figs. 8–12

Gray or pale olive, becoming yellow, at length golden yellow. Perithecia ostiolate, globose to subglobose often bluntly pointed at the base small, 120–150 x 100–135$\mu$, without differentiated rhizoids, bearing long, slender arched or recurved cirrhus. Terminal hairs straight or slightly recurved, at base about 3.5–4.5$\mu$ in diameter, at tip nearly straight or incurved, regularly septate, minutely roughened and in color ranging from gray to golden yellow, apparently influenced by the nutrient substrate. Lateral hairs slender, straight, or flexed, regularly and distinctly septate, minutely roughened, of nearly equal diameter throughout their length, 3.5$\mu$ in thickness, broadly arched at tips, color gray to olive-yellow. Asci club-shaped, 8-spored, 40 x 10$\mu$, pars sporif. 25$\mu$. Ascospores when young filled with refractive globules, when mature olive-brown, irregularly ovate, apiculate at both ends. 9.4–11 x 4.5–5.6$\mu$.

Color in this species is of a variable character; in culture the mature perithecia may be a golden yellow, pale yellow, or oftentimes a faded gray.

Type locality: New England, (Chivers No. 1)

Habitat: On paper, dung and other materials.

Distribution: New England, Java (R. Thaxtar); Japan (Udagwa); Isolated from various seeds, Canada (Skolko and Groves); Virginia, Tennessee (Ames); Belgian Congo (Meyer).

Specimens are deposited in the U.S. National Herbarium, Washington, D.C.

*Chaetomium aureum* belongs to a group of the genus having small perithecia and more or less arcuate, usually incurved hairs. The name suggests the species characteristic golden-yellow of the mature perithecia but the color is not constant; it usually fades with age and, in cultivation it may or may not develop the golden color, frequently only developing a pale or faded yellow. The species usually can be depended upon to form long cirrhi of ascospores which frequently become so long that they overturn the perithecia.

**10. CHAETOMIUM BOSTRYCHODES** Zopf, Abh. Bot. Ver. Prov. Brandenburg 19: 173, 1887

*Chaetomium caninum* Ellis & Everhart, Jour. Myc. 4: 79, 1888.

*Chaetomium formosum* Bainier, Bull. Soc. Myc. France 25; 215, pl. 20, f. 6–9, 1910.

*Chaetomium formosum*, var. *neglectum* Bainier, l.c. 25; 217 pl. 18, f. 8, 1910.

*Chaetomium formosum, var. ovatum*, Bainier, l.c. 25; 216, pl. 20, f. 1–5, 1910.

Plate 14, Figs. 1–5

Steel gray. Perithecia ostiolate, extremely variable in shape, subglobose to ovoid, with a bluntly pointed base, 165–350 x 130–225$\mu$, frequently producing black, straight, or recurved cirrhi, clothed at the top with loosely coiled white hairs which change to dull brown with age. Terminal hairs roughened with spine-like projections throughout, at base straight or slightly flexed, white when young becoming dark olive brown to black, about 4$\mu$ in diameter, slightly less colored at tops, always more or less spirally coiled, but extremely varied in this respect. The coiling is variable with seldom more than 5–7 convolutions which diminish almost imperceptibly in diameter toward the extremity,

or irregularly, coiled with two or three loose, irregular convolutions, in either case irregularly septate, producing along the convolutions one or more branches, which in turn, are septate and spirally coiled. Lateral hairs not numerous, clearly and evenly septate, tapering, at base dark olive-brown and about 3.8μ in diameter, at tips pale yellow or hyaline, frequently collapsed. Asci short, stout, club-shaped, 8-spored, 50 x 12μ, pars sporif. 24μ. Ascospores when young greenish, hyaline, with granular contents, when mature very pale with olive brown tint., oval to nearly spherical, clearly or obscurely apiculate, or rounded at both ends, frequently with an elliptical, refractive area at each end, a characteristic observed in only a very few other species, 6–8 x 5.4–6.5μ when viewed edgewise, compressed, 4.6–4.8μ broad.

Type locality: Berlin, Germany.

Habitat: On dung of many animals, and on various vegetable substances.

Distribution: Germany, New England, Virginia, Tennessee, Japan, Canada.

Specimens deposited in U.S. National Herbarium, Washington, D.C.

This is, apparently, a cosmopolitan species; it is so variable in form that without comparing a number from different areas one might otherwise be tempted to describe some form as a new species. The ascospores of this species have a characteristic, elliptical refractive area at each end. The whole head, from some isolates, at maturity easily detach from the perithecium.

**11. CHAETOMIUM BRASILIENSE** Batista & Pontual. Bol. Sec. Agr. e Com., Pernambuco 15: 70, 1948.

*Chaetomium hamatum* Batista & Pontual in op. cit. p. 71.

*Chaetomium repondum* Batista & Pontual in op. cit. p. 72.

*Chaetomium velutinum* Ames, Mycologia, 41: 641, 1949. not *C. velutinum* Ellis & Ev., J. Mycol. 1: 90. 1885.

Plate 7, Figs. 15–18

Hairs gray. Perithecia small, subglobose to ovoid, ostiolate, becoming beaked, base oval or pointed, 90–170 x 75–130μ, occasionally producing cirrhi, lightly affixed to the substratum with numerous rhizoids. Perithecia clothed in gray hairs which obscure them at maturity. Terminal hairs flexed below, becoming spirally coiled above with three to several coils, infrequently branched, 3–4μ wide, dark-colored, septate, smooth or finely roughened with rounded tip. Lateral hairs slender, straight or flexed, septate, light colored, finely roughened, at base bulbous. Asci cylindrical-linear, 8-spored, 65 x 7μ, pars sporif. 38–42μ. Ascospores dilute olive-brown, broadly ovate, subapiculate at one end, rounded at the other end, 6–7.5 x 4–6μ, monostichous in the cylindrical asci.

Type locality: Recife, Brazil.

Habitat: On dung of *Cavia cobaya;* on cotton lint; on cotton tent. Distribution: Brazil; Japan.

*Chaetomium brasiliense* Batista & Pontual, 1948, was described by the writer as *C. velutinum* in 1949 from a pure culture isolated by Dr. G. W. Martin, No. J–359, from a Japanese tent. Specimens of my culture, which are considered identical with *C. brasiliense* by Skolko & Groves and myself, are deposited in the U.S. National Herbarium, Washington, D.C.

*C. brasiliense* may be identified by the narrow, coiled, terminal hairs, the broadly ovate ascospores, apiculate at one end and rounded at the other, their slight attachment to the substratum, and their silver-gray appearance when young. The monostichous arrangement of the ascospores in the cylindrical linear asci is an aid in identification.

**12. CHAETOMIUM BREVIPILIUM** sp. nov.

Plate 21, Figs. 1–7.

Peritheciis ostiolatis, ochraceis vel pallide fulvis, immaturitate splendidis, cum aetate perbrunneis, ovatis vel elongate ovatis, 350–410 x 230–265μ, ad substratum cum rhizoideis ochraceis affixis. Pilis terminalibus, crinem densum in ostiole gerentibus et al circa 270μ extendentibus, distincte septatis, spiculatis, circa 5 μ diametro basi, apice gradatim attenuatis, pallide ochraceis vel pallide fulvis basi, celeriter medio pallidioribus, prope sine colore terminalibus. Pilis lateralibus et terminalibus similaribus sed brevioribus et temere in peritheciis distributos. Asci octosporis, clavatis, pro maturitate dissolutis. Ascosporis brunneis cum parietibus crassis, limoniiformibus vel globosis, utrimque leniter apiculatis, 7–8.1 x 6.5–7.7μ. In media agar-agar cum liquore tuberis, *Solani tuberosi*, aleuriosporae in numeris moderatis producentur, 5–10μ in diameter.

Perithecia ostiolate, ochraceous to light yellow-brown, bright when young, browning with age, oval to elongate-oval, 350–410 x 230–265μ in diameter, snugly attached to the substratum with strong, ochraceous rhizoids. Terminal hairs forming a dense tuft about the ostiole, extending to about 270μ in length, distinctly septate, spine-like, about 5μ in diameter at base, narrowing to a sharp point, pale ochraceous or light yellow-brown at base, quickly fading to the midsection, one-third of the end becoming practically colorless. Lateral hairs are of the same type as the terminal ones except somewhat shorter and randomly distributed over the perithecium. Asci 8-spored, club-shaped, usu-

ally deliquesing before the ascospores are mature. Ascospores brown, thick-walled, lemon-shaped or broadly globose, apiculate at both ends, 7–8.1 x 6.5–7$\mu$. In agar medium aleuriospores 5–10$\mu$ in diameter are formed in moderate numbers.

Type locality: Honduras.

Habitat: Isolated from dead wood.

Distribution: Honduras; Greenland.

Type specimens (Honduras isolate) are deposited in the U.S. National Herbarium, Washington, D.C.

*Chaetomium brevipilium* was received from Dr. G. W. Martin. (T–58) 9007, who isolated it from dead wood collected in Honduras by Dr. C. J. Alexopolis, Aug. 1958. The writer also isolated this species from bird dung sent to him from Greenland, collected by Dr. Bruce Lee.

**13. CHAETOMIUM BRITANNICUM** sp. nov.
Plate 5, Figs. 10–14

Peritheciis ostiolatis, ovatis vel longis vasiformibus, 360–420 x 230–260$\mu$, basi rotundibus, apice aliquantum contractis, ad substratum cum rhizoideis firmiter affixis. Pilis terminalibus et lateralibus septatis, fuscis, longis rectis vel undulatis, diametro 1.2–1.4$\mu$ basi, apice gradatim attenuatis. Ascis clavatis, octosporis, 70 x 25$\mu$, pars sporif. 35$\mu$. Ascosporis pallide brunneis, 19–24 x 11–14$\mu$, ovatis vel globoso-ovatis.

Perithecia ostiolate, ovoid to elongated vase-shaped, 350–420 x 230–260$\mu$, rounded at the base, broad at the neck or narrow-oval at the ostiole, quite firmly attached to the substratum with undifferentiated rhizoids. Terminal and lateral hairs covering the perithecium are very slender, gray, septate, straight or somewhat wavy, at base 1.2–1.4$\mu$ in diameter, gradually narrowing to a long, thin, thread-like tip. Asci club-shaped, 8-spored, 70 x 25$\mu$, pars sporif. 35$\mu$. Ascospores brown, 19–24 x 11–14$\mu$, irregularly oval, rounded on the ends. Perithecia develop when incubated at approximately 47°C. A thermophile.

Type locality: Southern part of England.

Habitat: Mushroom compost.

Distribution: Known only from type locality.

Type specimens deposited in the U.S. National Herbarium, Washington, D.C.

**14. CHAETOMIUM CANCROIDEUM** Tschudy, Am. Jour. Botany 24: 478, 1937
Plate 3, Figs. 1–4

Perithecia ostiolate, subglobose, 105–200 x 100–175$\mu$, attached firmly to the substratum by dark rhizoids. Terminal hairs forming a very dense compact head, many branches, the upper portions branched dichotomously with the angles between branch narrow, acute, concave on the inner side and thus producing the characteristic overlapping or "crab-claw" effect; occasionally inflated and constricted, the whole length is covered with spines and irregular projections; terminal perithecial spines medium in length, brown to black in color, and usually inconspicuous and hidden by the profuse dichotomous hairs. Lateral hairs not prominent, mostly smooth, stiff, dark brown at base, becoming lighter brown to hyaline at tip, rarely and obscurely septate. Ascospores when young greenish blue, with one to several refractive globules; when mature dark brown, lemon-shaped, ends more often rounded than apiculate or umbonate, 4.4–5.8 x 3.2–4.5$\mu$.

Type species deposited in the mycological herbarium, University of Washington. (Tschudy.)

Illustrations, Tschudy (119).

A pure culture of *C. cancroideum* was received from Skolko & Groves and has been maintained in my living cultures for several years. Specimens, from subcultures, are deposited in the U.S. National Herbarium, Washington, D.C.

**15. CHAETOMIUM CAPRINUM** Bainier, Bull. Soc. Myc. France 25: 223, 1909
Plate 17, Figs. 4–6

Steel gray. Perithecia ostiolate large, tall, the greatest width just above the base, then narrowing with the cylindrical upper portion to the ostiolar collar, 400–620 x 200–240$\mu$, seated on a subiculum of dark olive-brown to black rhizoids, with perithecium wall composed, from center upward, of cells greatly elongated in a plane parallel to the long axis of the perithecium, in whorls, resembling palisades. Terminal hairs almost entirely obscured at maturity by the mass of spores, smooth or minutely roughened with spines, irregularly and remotely septate, at base straight or flexed, dark olive-brown, about 7.5$\mu$, in diameter, fading toward tip, coiling above irregularly or in the form of a spiral, producing here and there along their convolutions short branches which in turn are septate, tapering and irregularly coiled. Asci club-shaped 8-spored, 50 x 10$\mu$, pars sporif. 24$\mu$. Ascospores when young greenish filled with granular contents when mature.

Type locality: France, probably in the vicinity of Paris.

Habitat: On goat and sheep dung; on dog, mouse, rat, and various other types of dung.

Distribution: France, Wales, Belgian Congo, New England, Virginia, Tennessee.

Specimens are deposited in the U.S. National Herbarium, Washington, D.C.

*Chaetomium caprinum* has been isolated from dog and rat dung frequently. In addition to my frequent isolations of the species I have received pure cultures from Dr. G. W. Martin, and have isolated it from rat dung received from Dr. J. Meyer, who collected it in the Belgian Congo, 1958.

*C. caprinum* may be confused with *C. pachypodioides* from which it differs mainly in two characters. The perithecium of *C. pachypodioides* is uniformly composed of non-linear cells; the upper perithecium of *C. caprinum* is composed of several tiers of linear cells, palisade-like in formation. In *C. pachypodioides* the terminal hairs are more regularly coiled, with longer coils which extend far beyond the spore mass at maturity. When mature the terminal hairs of *C. caprinum* are almost submerged by the spore mass.

**16. CHAETOMIUM CAUSIAEFORMIS** Ames, Mycologia 41: 644, 1949

Plate 9, Figs. 7–11

Perithecia small, delicate, translucent when young brown with age, ostiolate, globose to subglobose, 80–100 x 80–90$\mu$, or sometimes somewhat larger, without cirrhi, rhizoids numerous, provided with a distinct ostiolar collar, lightly attached to the substratum. Terminal hairs are of two types (a) ostiolar hairs short, septate, irregularly branched and looped or gnarled, smooth, obscurely septate, at base 4.25–5.0$\mu$ in diameter, untapered at ends; (b) long, undulating, widespreading, and branched only rarely at right angles, septate, smooth, 3–4$\mu$ in diameter. Lateral hairs are few in number, slender, smooth distinctly septate, tapering to a rounded tip, light colored, at base 1.25–2.0$\mu$ in diameter. Asci clavate, 8-spored, 23 x 9$\mu$, pars sporif. 18$\mu$. Ascospores ovoid or subglobose, rounded on ends, 4.75–6 x 3.5–5.5$\mu$.

Type locality: Guadalcanal.

Habitat: Sweatband of a helmet liner.

Distribution: Known only from the type locality.

Type deposited in the U.S. National Herbarium, Washington, D.C.

The pale to translucent perithecium with a dark ostiolar collar, surrounded by gnarled, branched hairs forming a compact head from which radiate long, undulating, widely spreading hairs distinguish *C. causiaeformis* from all other species. This fungus was sent as a pure culture to the writer by Dr. G. W. Martin under the label J–1334, isolated from the sweatband of a helmet liner.

**17. CHAETOMIUM CIRCINATUM** Chivers, Memoirs of the Torrey Bot. Club 14: 168, 1915

Plate 6, Figs. 8–12

Perithecium ostiolate, ovate or globose, 325 x 312$\mu$ (270–344 x 255–340$\mu$), base bluntly pointed. Terminal hairs dark, nearly opaque, olive-brown or brownish-black, sinuous, 7$\mu$ in diameter, at base irregularly encrusted, at the apex smooth or only slightly encrusted, circinate, two or three times re-curved. Lateral hairs long, flexed, graceful, sparsely and irregularly septate, at base olive-brown, roughened 5.6$\mu$ in diameter, at the apex smooth, pale olive, slender. Asci irregularly club-shaped, 8-spored, 70 x 25$\mu$ pars sporif. 50$\mu$. Ascospores ovate or lemon-shaped, apiculate or umbonate, light brown, 14.0 x 8.9$\mu$ (12.9–15.3 x 8.1–9.7).

Type locality: Worcester, Mass. (Chivers No. 12).

Habitat: On old burlap.

Distribution: Known only from Chiver's specimen which was seen at the Farlow Herbarium, Cambridge, Mass.

This species may be distinguished from *C. murorum* by its characteristic terminal hairs which are stout and sinuous instead of flexed, roughened by crystals of calcium oxalate which are irregularly clustered along their entire length, circinately recurved at the tips, the last coil of which often springs out to one side or the other from the plane of coiling.

**18. CHAETOMIUM COCHLIODES** Palliser N. A. Flora 3: 61, 1910

*Chaetomium flexuosum* Palliser, N. A. Flora 3: 16, 1910.

Plates 14, Figs. 6–11

Grayish-green to brilliant green, often losing color and becoming dark brown in dry herbarium material. Perithecia ostiolate, globose or subglobose with bluntly pointed base, 340 x 295$\mu$ (318–360 x 273–310), forming black cirrhi in comparatively few cases only, producing a heavy mass of stout, dark olive-brown to black rhizoids which anchor the plants firmly to the substratum. Terminal hairs very numerous and finally interwoven forming a thick, massive, shaggy head, always of two types; (a) thick, stout, projecting beyond the dense portion of the head, then becoming spirally coiled with about three or four convolutions, dark olive-brown, almost black below, fading above to light yellow or becoming colorless, evenly roughened throughout and without visible septa, at base about 7.5$\mu$ in diameter; (b) slender, sometimes coiling in spirals, at other times irregularly twisted or undulate, medium olive to light yellow, lighter than those of type a, about 2.5$\mu$ in diameter at base. Lateral hairs numerous, irregularly and sparsely septate, evenly roughened with extremely fine projections, some hairs rather stout,

tapering, straight or evenly bent, at base about 5.3$\mu$ in diameter and dark olive-brown to black, above faded yellow, at tips frequently hyaline, other hairs loosely and irregularly twisted through their entire length, still others straight for a long distance then spirally twisted. Asci irregularly club-shaped, 8-spored, 88 x 11$\mu$, pars sporif. 32$\mu$. Ascospores when young colorless, filled with refractive globules, when mature dark, rich olive-brown, lemon-shaped, apiculate at both ends, 9.5 x 7.2$\mu$ (8.9–9.7 x 6.4–8.4), when seen edgewise, compressed, 6.4$\mu$ broad.

Type locality: Newfield, N.J.

Habitat: On paper (Ellis & Everhart); on paper, straw, dung, and leaves (Chivers); on various seeds (Skolko & Groves).

Distribution: Many localities in New England, also from middle Western and Southern United States, Canada, Java, Ceylon and Japan.

Exsiccati—Sub. *C. chartarum* Ehrb. N.A.F. 1541 (in part).

*Chaetomium cochliodes* has been isolated from various kinds of animal dung, by the writer, from Virginia and Tennessee.

Specimens are deposited in the U.S. National Herbarium, Washington, D.C.

*C. cochliodes* may be distinguished from *C. angustum*, with which it might be confused, by hair types and perithecial size; the former has two types of terminal hairs, the latter has three types, in addition *C. angustum* is larger and has coarser hairs.

**19. CHAETOMIUM CONGOENSIS** sp. nov.
Plate 10, Figs. 1–8

Peritheciis ostiolatis vel subglobosis cinereis, sed interdum aberrantibus cum capitibus duobus 200–300 x 200–250$\mu$, pallide fuscis, ad substratum cum rhizoideis tenellis affixis. Pilis terminalibus fuscis, maturitate pallide brunneis, perobscure septatis, ramosis vel frequenter 1–3 ramosis, terminalibus crispis vel crispis distortibus, basi 4–5.5$\mu$ diametro, apice angustis. Pilis lateralibus septatis, rectis, spiculiformibus. Ascis longis, cylindricis, octosporis, 75 x 6.3$\mu$, pars sporif. 40$\mu$. Ascosporis ovalis vel lemoniiformibus, pallide brunneis, 7.4–7.75 x 4.75–6.7$\mu$.

Perithecia globose to subglobose, occasionally aberrant with two heads or other shapes, ostiolate, 200–300 x 200–250$\mu$, light gray, lightly attached to the substratum with undifferentiated rhizoids. Terminal hairs gray, darkening with age to a light brown color, remotely and indistinctly septate, some unbranched, others are one to three times branched with beautifully coiled ends, some quite regular, others contorted, at base 4–5.5$\mu$ in diameter, tips narrow. Lateral hairs spine-like or flexed, distinctly septate. Asci linear, cylindrical, 75 x 6.3$\mu$, pars sporif. 40$\mu$. Ascospores oval to lemon-shaped, pale brown, 7.4–8.75 x 4.75–6.7$\mu$.

Type locality: Belgian Congo.

Habitat: On rat dung.

Distribution: Known only from the type locality.

Type specimens deposited in the U.S. National Herbarium, Washington, D.C.

The writer isolated this species from rat dung which was sent to him by Dr. J. Meyer, (Institute Carnoy, Louvain, Belgium) who collected it in the Belgian Congo, 1958.

**20. CHAETOMIUM CONTORTUM** Peck, Rep. New York State Mus., Nat. Hist. 49: 24, 1896
Plate 7, Figs. 1–4

Perithecia ostiolate, globose or subglobose, 220–400 x 200–340$\mu$, size influenced by substrate. Terminal hairs dense olive-brown to black, without visible cross walls when mature, roughened throughout with blunt, flat topped projections, nearly straight below, contorted above into loops which are separated by short, abrupt arches, terminating in an arch with circinate, recurved tips, 15$\mu$ in thickness at the crown of the terminal arch. Lateral hairs numerous, straight or flexed, clearly septate, smooth, some with equal diameter and olive-yellow throughout, others thicker to 5.5$\mu$ and dark olive-brown at base, gradually tapering and fading toward tip. Asci cylindrical, 80–100 x 8–10$\mu$, pars sporif. 65–80$\mu$. Ascospores when young hyaline, refractive, filled with refractive globules, when mature dark rich olive-brown, irregularly lemon-shaped, sometimes apiculate at both ends, 11.5 x 9.4$\mu$ (10.5–12.5 x 7.4–10.5).

Type locality: Woodside, N.Y.

Habitat: On lily bulbs, *Lilium longiforum*. (F.C. Stewart); on dog dung. (Ames)

Distribution: New England, Tennessee, Virginia.

Specimens are deposited in the U.S. National Herbarium, Washington, D.C.

The perithecium is described as 875 x 1050$\mu$ in size by Chivers; the specimens isolated and cultivated by the writer agree with Chivers' description in all respects except in perithecial dimensions. It is probable that Chivers' measurement represents the distance from the base of the perithecium to the extremities of the terminal hairs.

*Chaetomium contortum* is easily distinguished from other species of the group with cylindrical-linear asci by the narrow neck of each contorted loop of the terminal hairs followed by thickening before the next loop is formed.

**21. CHAETOMIUM CONVOLUTUM** Chivers, Proc. Am. Acad. Arts & Sciences 48: 85, 1912

Plate 17 Figs. 7–9

Perithecia ostiolate, globose or subglobose, sometimes narrowed below, 235–300 x 240–275$\mu$, light brown and clothed with a relatively few, loose, widespreading hairs. Terminal hairs forming a broadly spreading head, dark olive to black, regularly and thickly covered with minute spines and globular projections, irregularly and obscurely septate, straight below, spirally coiled above, the convolutions open and of large diameter below, 8–10 in number, but toward the tip are constantly and evenly decreased in diameter and become more and more closely appressed. Lateral hairs comparatively few in number septate, graceful, tapering, straight, at base yellow, minutely roughened, about 3.5–5.5$\mu$ in diameter, tapering and fading to a long, hyaline, frequently collapsed tip, Asci club-shaped, 8-spored, 55 x 10$\mu$ pars sporif. 27$\mu$. Ascospores when young colorless with granular contents, when mature, pale dull-olive ovate or lemon-shaped, bluntly pointed at either end, slightly apiculate, 8–85 x 6.0–6.5$\mu$ when viewed edgewise 4.5–5.6$\mu$ thick.

Type locality: Germany.

Habitat: On mouse dung (Chivers); on rat dung.

Distribution: Germany; Virginia, Tennessee.

Specimens are deposited in the U.S. National Herbarium, Washington, D.C.

This species may be recognized by the long spreading, drooping, loosely coiled, sparse hairs which, to the naked eye or hand lens appears bluish in color.

**22. CHAETOMIUM CRISPATOIDEUM** Sergejeva, Botanicheskiye Materialy, Publication of the Academy of Sciences USSR, V. L. Komarov Botanical Institute, Moscow-Leningrad, 11: 104, 1956

Plate 12, Figs. 18–23

Brown to dark brown. Perithecia ostiolate, are broadly ellipsoidal, almost globose in form, 190–240$\mu$ in length and 160–240$\mu$ in width, with a rounded stoma about 10$\mu$ in diameter, dark-brown, anchored with rhizoids at the base, covered on top and sides with ornamental hairs. Terminal hairs dense, dark-brown, straight in the lower part, 6.0–7.5$\mu$ in diameter at the base, unbranched, indistinctly septate, coiled in the middle into an irregular, somewhat extended spiral forming in the upper part one or two loops coiled in different directions and terminating in a more or less curved hook, covered with somewhat crude, blunt, minute prickles. Intermingled among the contorted terminal hairs are found a relatively few straight or nearly straight hairs resembling the lateral ones but of greater length. Lateral hairs are straight or nearly so, shorter on the lower part of the perithecium than on the upper part, 4$\mu$ in diameter at the base, covered by thin, sharp, minute prickles, brown in color, tapering toward the apex, less coarse and lighter-colored to colorless. Asci cylindrical, 60–66 x 6$\mu$ in size, 8-spored, monostichous, pars sporif. 41–48$\mu$. Ascospores are flattened, convex on one side and concave on the other, when viewed from the broad surface they are broadly ellipsoid or almost round, apiculated at one end, 9–10 x 7.5–8.5$\mu$, olive-brown in color; the broad surface appears finely granulated, which gives an impression of wartiness.

Type locality: Kazan Forest farm, USSR.

Habitat: On prematurely shed linden fruits. (Collected by V. V. Guiliayer.)

Distribution: Known only from type locality.

Subcultures made from the pure culture received from Sergejeva are deposited in the U.S. National Herbarium, Washington, D.C.

*Chaetomium crispatoideum* is close to *C. simile* Massee & Salmon, and to *C. crispatum* Fuckel. Compared with the first of these *C. crispatoideum* is almost identical in the form and size of spores and asci but differs from it by the top and side hairs. The terminal hairs of *C. simile* are smooth, while those of *C. crispatoideum* are covered over the whole surface by dense, blunt prickles. The terminal bend of the terminal hairs of *C. crispatoideum* is less extended and more curved than that of *C. simile*.

**23. CHAETOMIUM CRISPATUM** Fuckel, Symb. Myc. 90, 1870. *Chaetomium streptothrix* Quélet, Mem. Soc. d'Emul. Montbeliard 1875: 103 pl. 4, f. 40, 1876

Plate 7, Figs. 19–22

Perithecia ostiolate, globose or subglobose with a bluntly pointed base, 195–320 x 180–350$\mu$, covered with a loose mass of light to dark olive-brown, twisted or coiled hairs. Terminal hairs dense olive-brown to black, with few, obscure septations, and covered rather evenly with minute spines throughout, at base about 4$\mu$ in diameter, straight or slightly curved, twisting or coiling above into an irregular spiral, near the tip forming alternate loops and arched, ending in an arch with circinate tip, irregularly and obscurely septate above, enlarging to 7.5$\mu$ in diameter at the crown of the terminal arch. Lateral hairs numerous, straight or slightly flexed, long, slender, gradually tapering to a point, smooth or very finely roughened, about 4$\mu$ in diameter and dark olive-brown at base, fading to a light yellow or brown, to a colorless collapsed tip.

Asci 8-spored, long, narrow, cylindrical, 80–100 x 8–10$\mu$, pars sporif. 65–80$\mu$ ascospores monostichous, hyaline and filled with greenish refractive globules, when young, when mature, dark rich olive-brown,

lemon-shaped, apiculate at both ends or broad and apiculate at one end and slightly more pointed and less conspicuously apiculate at the other, 11–12.3 x 8.0–10$\mu$, when viewed edgewise, compressed, lenticular, 6–6.5$\mu$ thick.

*C. crispatum* could be confused with *C. simile*, which has a much longer, more graceful terminal loop and arch to the terminal hairs.

Type locality: In the cellar of L. Fuckel, Germany.

Habitat: On rotting potatoes; on various kinds of animal dung.

Distribution: In different localities in New England (Chivers No. 9). Reported from England, Germany, and various other localities in Europe and from Virginia and Tennessee.

Exsiccati: Fung. Sax. XXIV, 1167. Sub *Sphaeria crispata* Fuckel: Fung. Rhen. 2022.

Specimens are deposited in the U.S. National Herbarium, Washington, D.C.

*Chaetomium crispatum* may be confused with *C. simile* which has a much longer more graceful terminal loop and arch to the terminal hairs and a smaller perithecium, or with *C. contortum* which has larger perithecia and wider, more coarsely roughened terminal hairs.

**24. CHAETOMIUM CRUENTUM** sp. nov.

Plate 16, Figs. 18–23

Peritheciis perpallidis lactis, perlucidis, ostiolatis, fragilibus, cum maturitate ascosporis russis vel rufis, sanguinis aspectum producentibus. Peritheciis ostiolatis, globosis vel sub-globosis, acuminatis ad collum distinctum apicibus, 310–450 x 240–270$\mu$, cum cirrhis frequenter provisis, cum rhizoideis tenellis ad substratum affixis. Pilis terminalibus paucis, perpallide lactis, delicatis, diametro 2$\mu$ basi, obscuri septatis, apice gradatim attenuatis. Pilis lateralibus et terminalibus uniformibus. Asci clavatis, octosporis, 45 x 15$\mu$, parte sporif. 25$\mu$. Ascosporis maturis russis vel rufis, ovatis vel limoniiformibus, utrinque leniter apiculatis, 7.0–10.2 x 6.5–7.5$\mu$.

Very pale cream-colored, translucent, fragile, when mature the pink to red ascospores give the fungus the appearance of being covered with blood. Perithecia ostiolate, globose to subglobose, narrowed at the top to a distinct neck, 310–450 x 240–270$\mu$, frequently forming cirrhi, more often forming a mass of ascospores of variable shapes in the terminal hairs. Terminal hairs sparse in number, delicate, indistinctly septate, pale cream colored, 2$\mu$ in diameter at base, tapering, unbranched, somewhat wavy. Lateral hairs of the same type but shorter. Asci club-shaped, 8-spored, 45 x 15$\mu$, pars sporif. 25$\mu$. Ascospores lemon-shaped or broadly ovate, with ends slightly apiculate to rounded, pink to red in mass, 7–10.2 x 6.7–7.5$\mu$ in size.

Type locality: Fort Belvoir, Va.

Habitat: On paper.

Distribution: Known only from type locality.

Type deposited in the U.S. National Herbarium, Washington, D.C.

The very pale color of the perithecum and ornamental hairs together with the pink to red (in mass) ascospores are distinguishing characters of *C. cruentum*.

**25. CHAETOMIUM CUNICULORUM** Fuckel, Symb. Myc. 89, 1869. *Chaetomium cristatum* Ames, Mycologia 41: 639, 1949

Plates 23, Figs. 7–11

Perithecia brown to dark brown, ostiolate, globose to subglobose, ostiolate, 240–300 x 175–300$\mu$, attached to the substrate with light brown rhizoids. At first the perithecium is covered with very light-colored finely branched hairs having the appearance of a fuzzy ball. Shortly one notices, at the apex, a small point of dark color produced by the emergence of thick, black hairs which soon grow far beyond the mass of delicate hairs. Thus the terminal hairs are of two types: (a) the finely branched, septate hairs, at base about 2.5–4$\mu$ in diameter and decreasing to thin often collapsing tips; (b) the long, black, septate hairs, few in number, originating about the ostiole, at base 6.8$\mu$ in diameter, extending far beyond the first type, some branched near their tips, frequently anastomoing, irregularly dichotomously branched, closely held together for the most part, seldom spreading in a rosette. Lateral hairs numerous, slender, septate, branched, gradually tapering, merging imperceptibly into the delicate terminal hairs. Asci clavate, 8-spored 45 x 12$\mu$, pars sporif. 28$\mu$. Ascospores, when mature dark olive-brown, broadly ellipsoid in front view, slightly apiculated at both ends, 8–12 x 4.5–6$\mu$.

Type locality: Freinweinheim, Germany.

Habitat: On rabbit dung.

Distribution: Germany, New England, Virginia, Tennessee, New Mexico, California.

Exsiccati. Fung. Rhen. 1961, in Herbarium E. Boudier, Paris. Fragments of specimens on rabbit pellets.

Specimens are deposited in the U.S. National Herbarium, Washington, D.C.

*Chaetomium cuniculorum* is reported by Bainier as occurring very commonly on dung of rabbit, his illustrations (Plate XXV) leave no doubt in my mind but that the species as illustrated in the present monograph is similar to the fungus described by Fuckel. This

species has repeatedly occurred in my cultures, primarily on rabbit dung, collected from New England, Virginia, Tennessee, New Mexico, and California. On natural substrates the specimens are smaller than the size they attain on the artificial media used in this study. *C. cuniculorum* Fuckel is closely related to *C. teratoideum* Ames, but is much smaller and has fewer terminal hairs which usually are closely clumped, and branched at their tips.

**26. CHAETOMIUM CUPREUM** Ames, Mycologia 41: 642, 1949

Plate 16, Figs. 11–17

Perithecia small, ostiolate, globose to ovate, 120–130 x 110–120$\mu$, with conspicuous cirrhi, attached to the substratum with undifferentiated rhizoids. Perithecia covered with bright copper-colored hairs. Terminal hairs rigid, distinctly septate, 4.5–6$\mu$ in diameter at the base and with 1–3 convolutions at the apex, covered with copper-colored granules. Lateral hairs numerous, slender, distinctly septate, 3–3.5$\mu$ in diameter at the base and with 1–2 convolutions at apex. Terminal and lateral hairs are encrusted with copper-colored granules which are insoluble in water. Asci clavate, 8-spored, 38 x 13$\mu$, pars sporif. 27$\mu$. Ascospores when mature olive-brown, irregularly ovate, subapiculate, 8.5–12.5 x 5.0–6.0$\mu$.

A somewhat similar specimen, originating on apple wood, from Iowa City, Iowa, G. W. Martin No. 6408, has been discussed by Skolko & Groves (105). They pointed out its similarities, in respect to the one-to-three-coiled tips of the terminal hairs, and its difference in ascospore shape and size, to *C. trilaterale*. The differences in such characters as spore size and shape may warrant separating Martin's specimen from *C. trilaterale*; its disposition apparently awaits a comparative study of integrating forms.

Type locality: Canal Zone, Panama.

Habitat: Vegetable detritus.

Distribution: Panama (Paul Marsh); Guadalcanal (G. W. Martin).

Specimens are deposited in the U.S. National Herbarium, Washington, D.C.

This bright-colored species was first sent to the writer by Dr. Paul Marsh, U.S. Department of Agriculture, Beltsville, Md., who obtained it from material collected in Panama Canal Zone. A second collection was sent to the writer by Dr. G. W. Martin who isolated it from material shipped from Guadalcanal. This species is somewhat intermediate, in certain characteristics, between *C. trilaterale* Chivers and *C. aureum* Chivers. *C. aureum* and *C. cupreum* both produce conspicuous cirrhi, *C. trilaterale* does not produce cirrhi. The ascospores of *C. cupreum* are similar in shape, although somewhat larger, than those of *C. aureum*. The pigment produced by *C. trilaterale*, in agar cultures, is soluble in water while the pigment granules produced by *C. cupreum* are insoluble in water.

**27. CHAETOMIUM DISTORTUM** sp. nov.

Plate 21, Figs. 21–30

Peritheciis fuscis, parvis, ostiolatis, subglobosis vel ovatis, 100–160 x 70–120$\mu$, ad substratum cum rhizoideis tenellis affixis, cirrhis frequenter provisis. Pilis terminalibus pallide olivaceis, distincte septatis, robustis, 160$\mu$ longitudine, diametro 4.5–5$\mu$ basi, interdum irregulater ramosis, interdum similibus gallicalcaribus, in apicibus frequenter recurvatis cum 1–2 convolutionibus non constantibus. Pilis lateralibus rigidis, distincte septatis, pallide fulvis, 80$\mu$ longitudine, diametro 3.5–4$\mu$ basi, apicibus sursum curvatis. Ascis clavatis, octosporis, 30 x 10$\mu$, pars sporif. 18$\mu$. Ascosporis maturis pallide nigris, limoniiformibus, utrimque leniter apiculatis 6–7.7 x 4–5.6$\mu$. In medio agar-agar cum liquore tuberis, *Solani tuberosi*, aleuriosporae copiose producentur, diametro 4.5–6$\mu$.

Dark brown. Perithecia ovate with a bluntly pointed base 100–160 x 70–120$\mu$, ostiolate, lightly attached to the substratum with undifferentiated rhizoids, often producing cirrhi. Terminal hairs light to pale yellow, distinctly septate, stout to about 160$\mu$ long, at base 4.5–5$\mu$ in diameter, occasionally irregularly branched often resembling spurs, strongly curved at tips 1–2 irregular convolutions. Lateral hairs stiff, distinctly septate, pale yellow to about 80$\mu$ in length, at base 3.5–4$\mu$ in diameter, curved upward at the tips. Asci club-shaped, 8-spored, about 30 x 10$\mu$, pars sporif. 18$\mu$, ascospores apiculate at both ends, when mature dilute black in color 6–7.7 x 4–5.6$\mu$. Numerous chlamydospores 4.5–6$\mu$ in diameter are produced in the nutrient agar substratum.

Type locality: Iowa City, Iowa.

Habitat: On dead aspen leaf.

Distribution: Known only from type locality.

Type deposited in the U.S. National Herbarium, Washington, D.C.

*Chaetomium distortum* was received as a pure culture from Dr. G. W. Martin, (T–32) 9003, Iowa City, Iowa. This species has certain characteristics of *C. aureum* and *C. trilaterale*. From the former it differs in the 1–2 irregular convolutions of the terminal hairs and the smaller ascospores; from the latter species it differs in the stiffness of the terminal hairs which occasionally produce short, stubby branches.

**28. CHAETOMIUM DOLICHOTRICHUM** Ames, Mycologia. 37: 145, 1945.

Plate 1, Figs. 10–13

White to gray becoming smoky olive. Perithecia ostiolate, olive to dark smoky gray in color, globose to subglobose, 100–150$\mu$ in diameter, attached to the substrate with dark rhizoids. Terminal hairs are of two types: (a) those forming a compact head dichotomously branched, light brown in color, septate, minutely roughened, or irregular width, varying from 2.5–3$\mu$ wide; (b) those forming extremely long, unbranched to once dichotomously branched to several times regularly dichotomously branched, smooth or only slightly roughened or with a few prominent blunt projections, dark brown, regularly septate, 5.5$\mu$ in diameter at base; branches widely divergent, often at right angles to the axis, occasionally somewhat reflexed. Lateral hairs few in number, relatively short, brown becoming lighter colored toward the apex, 3–4$\mu$ in diameter at base, smooth or slightly roughened, regularly septate, tapering abruptly to a blunt rounded point or occasionally to long collapsed tips. Asci club-shaped, fugaceous. Ascospores light brown in color, oval to ovoid in shape, 5.7–6.1 x 4.0–5.5$\mu$.

Type locality: Cades Cove, Great Smoky Mountains, Tenn.

Habitat: On plant detritus and animal excrement; on Brazil nut (Thaxter); isolated from various seeds (Skolko & Groves).

Distribution: Tennessee, Virginia, Quebec, Ontario, Saskatchewan, Connecticut.

This species can be recognized by its distinctive primary hairs; it appears to be intermediate between *C. indicum* and *C. funicolum*.

Specimens are deposited in the U.S. National Herbarium, Washington, D.C.

**29. CHAETOMIUM ELATUM** Kunze ex Fries, Systema Mycologicum 3: 254, 1829.

*Sphaeria comata* Tode, Fung. Mecklenb, 2: 15, 1791.

*Conoplea atra* Persoon, Syn. Fung. 1: 235, 1801.

*Chaetomium atrum* Link, Linnaeus, Spec. Plant. Ed. 5, 1: 40, 1824.

*Chaetomium pannosum* Wallroth, Flora Crpt. German. 2: 267, 1833.

*Chaetomium lageniforme* Corda, Icones 1: 24, 1837.

*Chaetomium graminis* Rabenhorst, Bot. Zeit. 34: 569, 1851.

*Chaetomium graminicolum* Fuckel, Fung. Rhen. VII, 647, 1863.

*Chaetomium fieberi* Fuckel, Symb. Myc. 90, 1869.

*Chaetomium libertii* Roumequère & Patouillard, Rev. Myc. 5: 15, 1883.

*Chaetomium atrum* var. *therryana* Roumeguère & Patouillard, Rev. Myc. 5: 29, 1883.

*Chaetomium velutinum* Ellis & Everhart, Jour. Myc. 1: 90, 1885.

*Chaetomium atrum*, var. *distinctum* Roumeguère, Rev. Myc. 8: 198, 1886.

*Chaetomium fieberi, F. chartarum* Roumeguère, Fung. Gall. LIX 59: 5827, 1891.

*Chaetomium glabrescens* Ellis & Everhart, Proc. Acad. Nat. Sci. Phil. 1893: 130, 1893.

*Chaetomium comatum*, var. *ligni* Roumeguère, Fung. Gall. LXIV, 6309.

*Conoplea atra* Sprengel, Syst. 4: 554.

Plate 1, Figs. 1–5

Black. Perithecia ostiolate, large, subglobose or ovate, up to 500$\mu$ tall and 450$\mu$ wide. (400–500 x 335–450), firmly seated on and attached to the substratum by dark olive-brown to black rhizoids. Terminal hairs extremely coarse, conspicuously roughened throughout with irregular pyramidal projections and blunt spines, stout, 5–8$\mu$ in diameter, several times dichotomously branched, usually one branch arising slightly below the other formed by the main branch, thus the branching is not strictly dichotomous, branches widely spreading and often reflexed, at base black and about 9.5$\mu$ in thickness, tapering and fading to slender, hyaline tips. Some terminal, secondary hairs are unbranched, others are similar to the primary hairs except much narrower and not as dark and producing irregular branching. Lateral hairs numerous, unbranched, straight or slightly flexed, long, slender, near the base dark olive-brown to black, roughened by irregular projections, about 4$\mu$ in diameter at base, gradually tapering and fading to slender, pale to hyaline smooth tips which are obscurely septate. Asci broadly and irregularly club-shaped, 8-spored, 60–75 x 17$\mu$, pars sporif. 34$\mu$. Ascospores hyaline to light olive when young, at maturity dark, rich, olive-brown, lemon-shaped, apiculate at both ends, 11–13 x 8.5–9.5$\mu$, when viewed edgewise, compressed, 7.4$\mu$ broad.

Type locality: Halle, Germany.

Habitat: On dead leaves of *Typha* and *Sparganium*; on a wide variety of substrata such as straw, rope, burlap, wood and animal excrement and seeds.

Specimens are deposited in the U.S. National Herbarium, Washington, D.C.

Exsiccati—In Persoon's Herbarium, 910, 263–428 as *C. atra*, Pers., = *C. elatum* Kunze in his own handwriting; #910, 263–435 *C. atra* Pers.=*C. elatum* Kunze; #910, 203–426 as *Conoplea cylindrica* Pers.

identified as *C. elatum* Kunze in his own handwriting; #910, 263–433 as *Conoplea atra* Pers., determined as *C. elatum* Kunze, in his own handwriting. Additional listings of exsiccati are found in Chivers monograph and in Skolko and Groves (104). *Chaetomium elatum* is a frequently found and widely distributed species on various substrates such as wood, straw, rope, paper, various cellulose products and dung of different animals. This species has been reported from many areas in the United States and Canada, from England, France, Germany, Russia, and many other places. No other species of *Chaetomium* has received more attention than *C. elatum* nor has been re-described under more different names with the exception of *C. globosum* Kze. The large lemon-shaped, apiculate ascospores should greatly aid in distinguishing this species from *C. indicum*, *C. junicolum*, and *C. virgecephalum* with which it might be confused.

**30. CHAETOMIUM ERECTUM** Skolko & Groves, Canadian Jour of Res. C. 26: 277, June 1948.

Plate 3, Figs. 15–19

Perithecia ostiolate, dark green, ovoid, 130–140$\mu$ wide, firmly attached to the substratum with numerous dark rhizoids. Cultures closely grouped, dark green in color, with a narrow white to yellowish margin. Terminal hairs, several times branched dichotomously, stout, to 6.5$\mu$ in diameter, rigid, dark, smooth below, becoming hyaline and somewhat roughened above toward the short tip, internodes short, the hairs forming an erect, relatively short, stout cluster at the apex of the perithecium. Ascospores dark, unequally oval to elliptical, acute at both ends, 6.5–7.5 x 4.5–5.0$\mu$.

Type locality: Milford, Conn.

Habitat: On seed of parsley (*Petroselinum hortense* Hoffm.).

Distribution: Known only from type locality.

Type in the herbarium at Ottawa as number DAOM 14205.

Illustrations (Skolko & Groves) (104).

A pure culture was received from Skolko & Groves and has been maintained in my living cultures for several years. Specimens from my stock are deposited in the U.S. National Herbarium, Washington, D.C.

*Chaetomium erectum* resembles *C. reflexum*, which likewise has short, stout, branched terminal hairs but in *C. reflexum* the hairs are arcuate and the branches strongly reflexed or curved.

**31. CHAETOMIUM ERRATICUM** sp. nov.

Plate 15, Figs. 7–15.

Peritheciis fulvus vel pallide fulvis, ostiolatis, ovatis vel globosis, 110–145 x 105–144$\mu$, ad substratum cum rhizoideis tenellis affixis, vel saepenumero in hypha aeria fructum ferentibus. Pilis terminalibus non ramosis, distincte septatis, pallide fulvis, curvatis vel undulatis vel inflectoribus, pannosis aspectu, apicibus rotundis extretusis, ad 170$\mu$ longitudine, diametro 4$\mu$ apice, bulbosis basi. Pilis lateralibus et terminalibus uniformibus sed brevioribus et in numero paucioribus. Ascis clavatis, 35 x 11$\mu$, pars sporif. 23$\mu$. Ascosporis maturis ovatis vel ellipticis angustis, utrimque lenibus, apiculatis utrimque, vel uno apice rotundatis et alio apiculatis, pallide fulvis, 9.5–12.5 x 4.3–5.1$\mu$.

Perithecia ovoid or globose, ostiolate, 110–145 x 105–144$\mu$, brown, lightly attached to the substratum with undifferentiated rhizoids, often fruiting in the aerial mycelia. Terminal hairs unbranched, distinctly septate, light brown in color, rounded at the ends, many distinctly recurved throughout their length, others somewhat waved, not uniformly arranged but having a ragged appearance, in length to 170$\mu$, averaging approximately 130$\mu$, and 4$\mu$ in diameter in the central area, enlarged at the base to 7.2$\mu$ in diameter. Lateral hairs similar to the terminal hairs but shorter and only slightly recurved or straight, and fewer in number. Asci club-shaped, 35 x 11$\mu$, pars sporif. 23$\mu$. Ascospores ovate or narrow elliptical, slightly apiculate at both ends or apiculate at one end and rounded at the other, light brown in color, 9.5–12.5 x 4.3–5.1$\mu$.

Type locality: White Sands, N. Mex.

Habitat: Vegetable detritus.

Distribution: New Mexico and Greenland.

Type deposited in the U.S. National Herbarium, Washington, D.C.

The writer isolated this species from vegetable detritus collected in the desert area at White Sands, N. Mex., 1958. A second isolate was obtained from vegetable detritus collected in Greenland by Dr. Bruce Lee.

**32. CHAETOMIUM FIBRIPILIUM** Ames, Mycologia 42: No. 5, 642, 1950

Plate 19, Figs. 1–4

Greenish yellow to yellowish brown. Perithecia ostiolate, medium to moderately large in size, subglobose or ovate with bluntly pointed bases 260 x 230$\mu$ (200–330 x 185–285), supported by delicate rhizoids, occasionally producing cirrhi. Terminal hairs numerous, interwoven, greenish yellow when young, browning with age, unbranched or branched, some compositely branched, distinctly septate, forming large bushy heads,

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at base 2.35–3.5$\mu$ in diameter gradually tapering to the apex. Lateral hairs numerous, greenish yellow, browning with age, straight near base, irregularly wavy toward the apex, distinctly septate, at base 2.25–3.25 $\mu$ in diameter gradually tapering to the apex. Asci club-shaped, 8-spored, fugacious. Ascospores dilute green when young, when mature dilute brown, ovate, slightly apiculate at one end, round at the other, 10 x 8$\mu$ (9.5–11.25 x 7–8.5).

Type locality: Hawaiian Islands.

Habitat: On sugar cane.

Distribution: Known only from type locality.

Specimens are deposited in the U.S. National Herbarium, Washington, D.C.

*Chaetomium fibripilium* was isolated by Dr. E A Bessey from sugar cane collected in the Hawaiian Islands. The species is distinguished, when young, by its neutral green ascospores which become pale brown with age, and its compact head of hairs, many of which are compositely branched. The branched terminal hairs are quite similar in structure to those of *C. sphaerale* Chivers, but differ in color, those of *C. sphaerale* being grayish yellow to olive yellow. The two species differ in the ostiole region, *C. sphaerale* having a distinct neck which is lacking in *C. fibripilium*.

**33. CHAETOMIUM FLAVUM** Omvik, Mycologia, Vol. 47: 751, 1955

Perithecia dark brown, globose to subglobose, ostiolate, 275–345 x 230–315$\mu$, loosely attached to the substratum. Terminal hairs septate, violet-brown to yellow-brown, of three types, (a) spirally coiled, dark, somewhat roughened, with blunt tip, at base about 2.9$\mu$ in diameter, (b) spirally coiled below, dark at base, roughened, yellow-brown above tapering to a long, thin hyaline tip, at base about 7$\mu$ in diameter, (c) straight, dark at base, roughened, yellow-brown above, tapering to a long-thin, hyaline tip, at base about 4$\mu$ in diameter. Lateral hairs much fewer than the terminal hairs, much shorter but of the same general characteristics. Asci club-shaped, 8-spored. Ascospores dark grey-violet, irregularly lemon-shaped, strongly umbonate at both ends, 11.9–15.4 x 7.7–8.8$\mu$, some spores attaining to 17.6 x 11$\mu$ in size.

Type locality: Western Norway.

Habitat: On filter paper from soil.

Distribution: Known only from type locality.

Type in the Centraalbureau voor Schimmelculture, Baarn, Netherlands.

Illustrated by Omirk (74).

The large strongly, umbonate ascospores are distinctive of this species, specimens of which were received from Miss Omvik.

**34. CHAETOMIUM FUNICOLUM** Cooke, Grevillea 1: 176, 1873.

*Chaetomella Cavallii* Mattirolo: Savoia, II Ruwenzori 1: (3) pl. 3, f. 1–3, 1909

*Chaetomium Bartholomaei* Saccardo and Sydow; Saccardo, Syll, Fung 14: 490, 1899.

*Chaetomium setosum* Ellis & Everhart, Am. Nat. 31: 340, 1897.

Plate 3, Figs. 5–9

Black. Perithecia ostiolate, ovate to globose, 130–160 x 130–160$\mu$, firmly attached to the substratum by dark olive to black rhizoids, frequently producing long straight or curved cirrhi. Terminal hairs forming an especially dense, compact head, dichotomously branched with narrow, acute angles, frequently alternately constricted and inflated throughout, near base dark olive-brown to black and about 6$\mu$ in diameter, fading to light brown, pale olive, or colorless tips, at maturity bearing on the branches clusters of refractive needles. Lateral hairs comparatively numerous, smooth or irregularly roughened by short, blunt projections, stiff, spine-like, dark olive-brown to black almost to the tip, hyaline and crumpled at tip, rarely and obscurely septate, about 4$\mu$ in diameter at base. Asci club-shaped, 8-spored 34 x 8$\mu$, pars sporif., 16$\mu$. Ascospores when young greenish hyaline, refractive, filled with globules, when mature dark, rich, olive-brown, egg-shaped to lemon-shaped, slightly more pointed at one end, apiculate at both ends, 5.5–6.5 x 3.75–5$\mu$.

Type locality: British Museum.

Habitat: On twine (W. Carruthers); on various seeds (Skolko & Groves); on burlap, wood, paper, and vegetable detritus.

Distribution: Reported from New England, Southern States, and Michigan in the United States; from Canada, Denmark, Germany, England, Nairobe, Congo, and Japan.

Type in Royal Botanical Gardens, Kew.

Exsiccati: Sub *C. setosum* Ell. & Ev.: Fungi Columb. XII 1126; N.A.F. 2d Ser. XXXV, 3423.

*Chaetomium funicolum* is frequently isolated from dung of various animals and plant detritus. Pure cultures have been received, in a variety of collections, from Dr. G. W. Martin. The species has also been isolated from rat and mouse dung received from Dr. J. Meyer who collected it in the Belgian Congo, 1958.

**35. CHAETOMIUM FUSIFORME** Chivers, Proc. Am. Acad. Arts & Sci. 48: 87, 1912.

Plate 25, Figs. 19–23

Perithecia small, subglobose to ovate, with a bluntly pointed base, 130–170 x 120–150$\mu$, without cirrhi, pro-

ducing at base a few yellowish rhizoids, at the apex a simple, wide ostiole. Terminal hairs dark brown, smooth, septate, minutely roughened, nearly straight for a distance from base, about 3.5–4$\mu$ in diameter, at apex arcuate with once to twice-recurved tips, 2.5–3$\mu$ in diameter. Lateral hairs light brown, or olive-yellow, smooth, septate, straight or curved at apex, 2.5–3.5$\mu$ in diameter. Asci club shaped, 8-spored, 48 x 11$\mu$, pars sporif. 32$\mu$. Ascospores when young filled with refractive globules, when mature olive-yellow or olive-brown, long, narrow, fusiform flattened on one side, 12–17 x 5–6$\mu$.

Type locality: Alabama, Herb. R. Thaxter (Chivers No. 3).

Habitat: On paper, dung and vegetable detritus.

Distribution: Alabama, Tennessee, Virginia, French Congo, Japan.

Type, it is believed, was deposited in the Farlow Herbarium; a specimen in the Chivers Herbarium at Cornell (Ithaca, N.Y.) No. 3, is probably from the type isolation.

Specimens are deposited in the U.S. National Herbarium, Washington, D.C.

The long, narrow, fusiform ascospores and arcuate terminal hairs distinguish *C. fusiforme* from other species having very small perithecia.

**36. CHAETOMIUM FUSUM** sp. nov.

Plate 2, Figs. 1–7

Peritheciis ostiolatis, flavo-viridibus, parvis, diametro 120–175$\mu$, ad substratum cum rhizoideis firmiter affixis. Pilis terminalibus generium duorum: (a) rigidis, septatis, in diametro usque ad 10$\mu$ basi, dichotomoramosis, apicibus, interdum circinantibus, magna lutea vel flavo-viridia crystalla in magno numero ferentibus; (b) reticulatis cum minoribus pilis, septatis, basi diametro 5$\mu$, frequenter ramosis, frequenter anastomosis, nunc angustatis nunc inflatis, perobscure septatis, crassis et retusis cum crystallis luteis vel flavo-viridibus incrustatis, apice perpallidis. Pilis lateralibus generium duorum: (a) paucis, brevibus, spiculi formibus, (b) brevibus, frequenter ramosis. Ascis clavatis, octosporis, 30 x 7.5$\mu$, pars sporif. 18$\mu$. Ascosporis maturis perpallide flavo-viridibus, gracilibus, furiformibus, utrinque acutis, 7.5–10 x 2–3$\mu$.

The fruiting body has the general appearance of being yellow-green in color due to pigments within the hairs and to large quantities of yellowish orange or yellow-green crystals ornamenting the terminal and lateral hairs. Perithecia ostiolate, globose, small, 120–175$\mu$ in diameter, firmly attached to the substratum with yellowish-orange rhizoids. Terminal hairs of two types: (a) stout, septate, straight below to about 10$\mu$ in diameter at base, rigid, the end portions dichotomously branched with a strong tendency for the ends to recurve, supporting large yellow-orange or yellow-green colored crystals in large quantities; (b) lacy network of smaller hairs, 5$\mu$ in diameter at base, branching and frequently anastomosing, sparsely and indistinctly septate, frequently alternately constricted and inflated throughout, heavily incrusted with yellow-orange or yellow-green colored crystals, fading in color at the tips. Lateral hairs of two types: (a) a few as relatively short unbranched spines and, (b) similar to type (b) of the terminal hairs, but much shorter and few in number. Asci club-shaped, 8-spored, 30 x 7.5$\mu$, pars sporif. 18$\mu$. Ascospores very pale yellowish-green in color, narrow fusiform in shape, pointed at both ends, 7.5–10 x 2–3$\mu$.

Type locality: Bataan, Costa Rica.

Habitat: Leaf mould and vegetable detritus.

Distribution: Known only from type locality.

Type deposited in the U.S. National Herbarium, Washington, D.C.

This species is easily distinguished from other dichotomously branched *Chaetomia* by its small fusiform ascospores and the large crystals which ornament the hairs.

This species was isolated from leaf mould given to me by Dr. Ralph Emerson who collected the material at Bataan, Costa Rica, March 13, 1957.

**37. CHAETOMIUM GANGLIGERUM** Ames, Mycologia *41:* 640, 1949

Plate 6, Figs. 1–7

Perithecia light brown, ostiolate, ovate to sub-globose, 230–260 x 190–210$\mu$, without cirrhi, attached to the substratum with numerous brown rhizoids. Terminal hairs numerous, distinctly or obscurely septate, covered with many little barbules, straight or curved from the base, tawny yellow to light brown in color, 3.5–4.25$\mu$ in diameter, spirally recurved at the apex. Lateral hairs are numerous, slender, septate and gradually decreasing in diameter to the apex. Asci clavate, 8-spored, 50 x 18$\mu$, pars sporif. 36$\mu$. Ascospores when mature, rich olive-brown, ovate to globose-ovate, umbonate to sub-apiculate, 12–18 x 7–11$\mu$. In agar-agar media enriched with potato and maize meal broth numerous dark-colored bulbils are formed in a variety of shapes.

Type locality: Fairfax County, Va.

Habitat: Wood and vegetable detritus.

Distribution: Known only from type locality.

Specimens are deposited in the U.S. National Herbarium, Washington, D.C.

This species was isolated from wood samples which were under test conditions in the Tropical Testing Chamber, Fort Belvoir, Va.

**38. CHAETOMIUM GLOBOSUM** Kunze, ex Fries, Syst. Myc. *3:* 225. 1829.

*Chaetomium chartarum* Ehrenberg, Sylv. Myc. Berol. 15, 27, 1818.

*Chaetomium fieberi* Corda, Icones 1: 24, pl. 7, f. 293c, 1837.

*Chaetomium offine* Corda, Icones 4: 37, pl. 8, 101, 1840.

*Chaetomium amphitrichum* Corda, Icones 4: 37, pl. 8, f. 103, 1840.

*Chaetomium araliae* Corda, Icones 4: 37, pl. 8, f. 102, 1840.

*Chaetomium lanosum* Peck, Rep. New York State Mus. Natural History 28: 64, 1876.

*Chaetomium fieberi* var. *chlorina* Saccardo, Myc. Venet X, 1876.

*Chaetomium orientale* Cooke, Grevillea 5: 103, 1877.

*Chaetomium kunzeanum* Zopf, Nova Acta Acad Leop-Carol 42: 278, 1881.

*Chaetomium macrosporum* Saccardo & Penzig, Michelia 2: 591, 1882.

*Chaetomium cymatotrichum* Cooke, Grevillea 12: 21, 1883.

*Chaetomium kunzeanum* var. *fimicolum* Bommer & Rousseau, Bull. Soc. Roy. Bot Belgique 23: 207, 1884.

*Chaetomium oospora* Beauverie, Ann. Univ. Lyon. Nouv. Ser. 1 3: 201, 1900.

*Chaetomium elasticae* Koorders, Verhand. d. K. Akad. v. Wternschappen te Amsterdam 134: 185, 1907.

*Chaetomium kunzeanum* var. *chlorina* Mich., Bull. Soc. Myc. France 25: 202, 1910.

*Chaetomium setosum* Bainier, Bull. Soc. Myc. France 25: 209, 1910.

*Chaetomium spirilliferum* Bainier, Bull. Soc. Myc. France 25: 207, 1910.

*Chaetomium undulatum* Bainier, Bull. Soc. Myc. France 25: 208, 1910.

*Chaetomium subterraneum* Swift & Povah, Mycologia 21: 210, 1929.

*Chaetomium deustum* Batista & Pontual, Bol. Sec. Agri-Inc. & Com. Pernambuco 15: 72, 1948.

Plate 20, Figs. 4–6

Perithecia ostiolate, variable in shape, subglobose, somewhat elongated with a bluntly pointed base, when young yellow, translucent, allowing the cellular structure of the wall to be seen. When mature opaque, black 200–320 x 200–280$\mu$. Often producing short, black cirrhi, attached to the substrate with a thick mass of dark olive to black rhizoids, color ranging from gray, green, light brown to olive-brown. Terminal hairs numerous, interwoven, forming a bushy or ompact head, in age spreading and drooping, the hairs slender, graceful, undulating, seldom septate, minutely roughened with spines throughout, at base about 3.5$\mu$ in diameter and dark olive-brown, lighter brown through the greater part of length, tapering and paler to hyaline at tip, wavy, undulate or kinked. Lateral hairs numerous, slender, plainly or obscurely and remotely septate, finely roughened with spines. Quite dark at base, olive-brown, about 3.5$\mu$ in diameter, light olive or yellow to hyaline at tip, straight or only slightly flexed, or more slender and undulate or even kinked. Asci irregularly club-shaped, 8-spored, 64 x 13$\mu$, pars sporif. 37$\mu$. Ascospores filled with several large, refractive globules, when mature dark, rich, olive-brown, varying in shape from broadly ovate or subglobose to lemon-shaped, with the ends apiculate or sub-umbonate or nearly rounded, varying in size, 9–13 x 6–9.5$\mu$, when viewed edgewise frequently compressed, 7$\mu$ broad.

Type locality: Leipzig.

Habitat: On a wide variety of vegetable materials, including various types of seeds.

Distribution: Cosmopolitan (See Skolko & Groves (105) for an extensive review).

Specimens are deposited in the U.S. National Herbarium, Washington, D.C.

Exsiccati—Fung. Gall, XLV, 4438; Klotzsch Herb. Viv. Myc. X,959. Sub *C. chartarum* Ehrb.: Fung. Austro-Americani, 193; Fung. Brit. IV, 328; Micro-Fung. Brit. 475; Fung. Gall. XI, 1090; N.A.F. 2nd Series, 1541. Sub *C. Fieberi* Cda.: Fungi Gall. LXV, 6409; Herb. Myc., Edit. Nova, II, 165; Myc. Ital. XIII, 1288. Sub *C. fieberi* Cda., var. *chartarum* Roum.: Fung. Gall. LIX, 5827. Sub *C. fieberi* Cda., f. *lignicola chlorina* Sace: Myc. Venet. X, 906. Sub *C.* Kunzeanum Zopf; Fung. Gall. XLV, 4436; Fung. Longob. I, 31; Myc. March 3246. Sub *C. lanosum* Peck: Fung. Gall. XLV, 4437.

No other species of *Chaetomium* has received more taxonomic attention, nor in recent years has figured so prominently as a cellulosic test organism in government and private laboratories. It holds the distinction of being described and illustrated by Kunze as the type of his new genus, having first appeared on dead leaves and stalks of various plants in the vicinity of Leipzig. It was described by Kunze as a globular fungus, a fourth of a line in size, black when in a fresh condition

and entirely covered with hairs. His simple figures illustrate a comparatively young parithecium; a more developed state showing a punctiform opening at the crown; a group of somewhat spherical transparent spores mixed with a gelatinous mass and a cross-section through the body of the closed fungus. This description is quite indefinite in nature and even with his illustrations quite insufficient for positive identification. With the quite inadequate description and the variability of the organism, it is not surprising that it has been re-described so many times.

**39. CHAETOMIUM GRACILE** Udagawa, Jour. Gen. Appl. Microbiology, 6: 235, 1960

Perithecia dark brown to black, superficial, subglobose to ovate, 180–240 x 160–220$\mu$, with wide ostiole, firmly attached to the substratum by dark olive-brown rhizoids, rapidly maturing in 2–3 weeks. Terminal hairs dark olive-brown to black, arcuate from the base and incurved in the early stages, then gradually becoming long, straight or slightly sinuate at maturity, unbranched or sometimes once divergently branched near the tip, delicately roughened, septate, 4–5.5$\mu$ wide at the base, untapered, with blunt tips. Lateral hairs light brown, short, straight or somewhat incurved, smooth, septate, 3–4$\mu$ wide at the base. Asci club-shaped, 8-spored, 46–48 x 10–12$\mu$. Ascospores olive-brown, extruded in long cirrhi, up to 1–2 mm. in length, ellipsoid, 10.5–12 x 5.5–6$\mu$, faintly apiculate at the ends.

Type locality: Japan.

Habitat: On soil, Tsu, Mie Pref., Nov. 1958. (NHL) 2251 Type. 2252.

Illustrated by Udagawa (121).

Type specimen as reported by Udagawa, deposited in the Mycological Collections of the Institute of Applied Microbiology, University of Tokyo, The Nagao Institute, Tokyo, and the Institute for Fermentation, Osaka.

The terminal hairs of this species closely resemble those of *C. aureum* until almost at maturity, especially on common vegetative media. However, it may be easily distinguished from the latter by means of the ascospore shape. On the other hand, the ascospore size of this species falls within the range described for *C. cristatum*. Considering only the ascospore, therefore, *C. gracile* is near *C. cristatum;* in terminal hair characteristics the two species are unlike.

**40. CHAETOMIUM HOMOPILATUM** Omvik, Mycologia *47:* 749, 1955.

Plate 26, Figs. 8–12

Perithecia dark brown, oval, 242–345 x 127–196$\mu$, with numerous brown rhizoids. Terminal and lateral hairs of the same character, straight to somewhat undulate, septate, at the base about 4$\mu$ in diameter, yellow-brown to dark at base with a reddish tint, tip hyaline, smooth to somewhat roughened, some hairs, especially at some distance from the base. Asci blunt club-shaped, 8-spored. Ascospores smoke-colored with violet tint, broadly oval, apiculate at both ends, 5.9–6.8 x 4.8–6.2$\mu$. Some giant ascospores form among the others, about 11 x 6.6$\mu$ in size. Aleuriospores grow in the agar substrate, yellow-brown, globose, 6.3–8.4$\mu$ in diameter; oval 8.4–6.3$\mu$; intercalary chlamydospores 10.5–15.8 x 4.6–8.4$\mu$.

Type locality: Western Norway.

Habitat: On paper from soil.

Distribution: Known only from type locality.

Type in the Centraalbureau voor Schimmelculture, Baarn, Netherlands.

Illustrated by Omvik (74).

Isolated on filter paper from soil, Western Norway. A pure culture was received from Miss. Omvik.

*Chaetomium homopilatum* resembles *C. seminudum* Ames in having uniform lateral and terminal hairs, and in producing chlamydospores. In the form of the perithecia the two species have some resemblance to each other. *C. homopilatum* differs from *C. seminudum* in having far larger perithecia, more and dark-colored, partly roughened hairs, brown rhizoids and smaller ascospores.

**41. CHAETOMIUM INCOMPTUM** sp. nov.

Plate 8, Figs. 6–12

Peritheciis ostiolatis, globosis, diametro 120–145$\mu$, ad substratum cum rhizoideis perbrunneis affixis. Pilis terminalibus crispis vel undulatis, ad angustum apicem gradatim attenuatis, septatis, basis bulbosis, interdum ramosis vel interdum anastomosis. Pilis lateralibus spiculiformibus cum basibus bulbosis, circa 1.5–2$\mu$ diametro, septatis, apice gradatim attenuatis. Ascis longis, cylindricis, octosporis, 50 x 8$\mu$, pars sporif. 35$\mu$. Ascosporis amygdalformibus, 6.8–8.3$\mu$.

Perithecia ostiolate, globose, 120–145$\mu$ in diameter, attached to the substratum with dark rhizoids. Terminal hairs loosely spirally coiled, large at first, diminishing in diameter to the narrow tip, septate, with a bulbous base; other terminal hairs may be irregularly wavy or terminating in a loose circinate tip, occasionally branched, or occasionally anastomosing. Lateral hairs awl-shaped with bulbous bases, about 1.5–2$\mu$ in diameter near the base, septate, gradually decreasing in diameter to a sharp point. Asci linear, cylindrical 50 x 8$\mu$, pars sporif. 25$\mu$, 8-spored. Ascospores almond-shaped, 6.8–8.3$\mu$.

Type locality: Aptos, Calif.

Habitat: On vegetable detritus.

Distribution: Known only from type locality.

Type deposited in the U.S. National Herbarium, Washington, D.C.

*Chaetomium incomptum* was isolated from mouldy leaves collected near Aptos, Calif., 1958. The perithecium is small, the bases of the terminal and lateral hairs are enlarged, the general appearance can best be described as disheveled.

**42. CHAETOMIUM INDICUM** Corda, Icones *4:* 38, 1840.

*Chaetomium melioloides* Cooke & Peck, Rep. New York State Mus. Nat. Hist. 27: 106, 1875.

*Chaetomium setosum* Winter, Hedwigia *26:* 16, 1887.

Plate 1, Figs. 6–9

Perithecia ostiolate, small, olive-green or yellowish when young, variable in color, darkening with age, subglobose to globose, 100–200 x 100–190$\mu$, firmly attached to the substratum by dark olive-brown to black rhizoids. Terminal hairs of two types which can be distinguished by studying the perithecia at different stages of development: (a) occasionally a few quite short straight hairs which, if present, are obscured by the conspicuous terminal hairs and the mass of extruded ascospores, (b) conspicuous hairs several times regularly dichotomously branched at almost right angles to the axis at the first branch, the following branches may be slightly reflexed or sometimes incurved, the whole forming a regular network, the tips are slender but blunt, at base 5–6$\mu$ wide occasionally to 7.5$\mu$ in diameter. Lateral hairs are few in number or lacking, when present are mostly unbranched or dichotomously branched, straight or curved upward or sometimes reflexed and roughened by spine-like projections, at base dark olive-brown to black and about 1.5$\mu$ in diameter, fading only slightly or becoming hyaline at their tips. Asci club-shaped, 8-spored, 30 x 9.5$\mu$ pars sporif. 16.5$\mu$. Ascospores hyaline when young and filled with refractive greenish globules, when mature dark, rich olive-brown, ovate to lemon-shaped, slightly apiculate at one or both ends, 5–7 x 4.5–5.5$\mu$, when seen edgewise compressed, 4$\mu$ broad.

Type locality: India, Tenasserim, Maulmain.

Habitat: On rotten paper, vegetable detritus, and various animal excrement.

Distribution: Massachusetts (Chivers); Parque de la Plata, Argentine (Spegazzini); India, Tenasserim, Maulmain (Dr. Helfer); Canada (Skolko & Groves); Tennessee and Virginia (Ames); Japan (Udagawa).

Specimens are deposited in the U.S. National Herbarium, Washington, D.C.

*Chaetomium indicum* is related, more or less, to a group represented by *C. funicolum* Cooke, *C. erectum* Skolko & Groves, *C. cancroideum* Tschudy and *C. dolichotrichum* Ames. In *C. funicolum* the unbranched lateral and terminal hairs are numerous and conspicuous, many extending far beyond the spore mass. The terminal dichotomously branched hairs are less regularly branched, and with acute angles. The regularly, wide-spreading dichotomously hairs of *C. indicum* distinguishes it from the other related species.

**43. CHAETOMIUM IRICOLOR** sp. nov.

Plate 22, Figs. 1–5

Versicolor. Peritheciis longis, vasiformibus, ostiolatis, 530–540 x 240–260$\mu$, basi latis apice aliquantum contractis, cum pilis reticulatis terminatis. Pilis terminalibus septatis, basi erectis, diametro 3.5–4.7$\mu$, ramosis super et apice gradatim attenuatis, gracilibus, reticulatis. Pilis lateralibus septatis, spineis, diametro 3–4.1$\mu$ basi, apice gradatim attenuatis. Asci claviformibus, evanescentibus. Ascosporis limoniiformibus, apiculatis, 6.2–9 x 4–6.6$\mu$.

Varicolored. Perithecia tall, vase-like, ostiolate, 530–540 x 240–260$\mu$, broad at the base, narrowing to the apex which is covered with lacy many-branched hairs. Terminal hairs septate, straight at the base 3.5–4.7$\mu$ in diameter, above branching and re-branching and gradually decreasing in diameter to thin whip-like tips. When growing in Petri plate displaying hairs variously colored, ranging from pale yellow to yellow, to mixtures containing reddish hues; colored liquid droplets are also formed. Lateral hairs spiny, septate, 3–4.1$\mu$ in diameter near the base gradually tapering to a sharp tip; base of lateral hairs swollen. Asci club-shaped, evanescent. Ascospores lemon-shaped, apiculated at both ends, 6.2–9 x 4–6.6$\mu$.

Type locality: Mexico.

Habitat: Vegetable detritus.

Distribution: Known only from Mexico.

Type deposited in the U.S. National Herbarium, Washington, D.C.

A pure culture of this species was given to me in 1958 by Mme. Jacqueline Nicot who obtained it from Mexico. A second culture was sent to me in 1959 by Dr. G. W. Martin who likewise obtained it from Mexico.

**44. CHAETOMIUM LEUCOPHORA** sp. nov.

Plate 15, Figs. 16–23

Peritheciis subglobosis, ostiolatis, 120–140 x 110–120$\mu$ basi rotundis ad substratum cum rhizoideis tenellis affixis, sine cirrhis, cum capitibus compactis. Pilis terminalibus gracilibus basi, diametro 2–2.5$\mu$, septatis,

perpallide fuscis vel sine colore; partibus terminalibus diametro 3.6μ, pallide fuscis cum 1–3 ramis diffundis secundis et in apicibus 1–2 convolutis non constantibus. Pilis lateralibus, septatis, angustis, longis, diametro 2–2.3μ basi, apice gradatim attenuatis, pallide fuscis. Ascis longis, cylindricis, octosporis, 44 x 7μ pars sporif. 28–35μ. Ascosporis maturis pallide fuscis, ovatis vel ellipticis, 5.6–7.8 x 3.75–5.5μ.

Perithecia subglobose, ostiolate, 120–140 x 110–120μ rounded at base, lightly attached to the substratum with undifferentiated rhizoids, the compact head is formed by the terminal hairs which are slender at base 2–2.5μ in diameter, septate and pale brown in color or practically colorless, the terminal area bearing one to three on more large coiled tips which are much darker in color and to 3.6μ in diameter; secondary coiled tips often branching from primary coiled tips. Lateral hairs septate, slender, long, at base 2–2.3μ in diameter, gradually tapering to a narrow tip, dilute brown in color. Asci long, cylindrical 8-spored, 44 x 7μ, pars sporif. 28–35μ. Ascospores monostichous, hyaline when young, when mature pale brown, ovoid or broadly elliptical rounded on the ends, 5.6–7.8 x 3.75–5.5μ.

Type locality: White Sands, N. Mex.

Habitat: On vegetable detritus.

Distribution: Known only from type locality.

Type deposited in the U.S. National Herbarium, Washington, D.C.

**45. CHAETOMIUM LONGICOLLEUM** Krzemieniewska & Badura, Acta Societatis Botanicorum, Poloniae, *23:* 748. 1954.

Plate 24, Figs. 8–12

Perithecium ostiolate, vase shaped, long-necked, base at widest part 95.0–120μ in diameter, gradually narrowing to the ostiole, hairs surrounding the ostiole form an exit tube for the ascospores, total length 500–800μ, surface of the perithecium bearing scattered bristle-like hairs. Terminal hairs long and bristle-like, septate, separating at the tip, forming a channel through which a multiple column of ascospores emerge from the perithecium. Lateral hairs sparsely scattered, bristle-like, much shorter than the terminal hairs. Asci club-shaped, 40 x 9.6–12.7μ with a long stalk, eight spored. Ascospores 10.5–12.0 x 9.5–10.5μ, the young ones rhomboidal, the mature ones lemon-shaped. Illustration prepared from a slide of the species received from Dr. Badura, which is deposited in the U.S. National Herbarium, Washington, D.C.

**46. CHAETOMIUM LONGIROSTRE** (Farrow) comb. nov. *Chaetoceratostoma longirostre* Farrow, Mycologia *47:* 418. 1955

Plate 24, Figs. 1–7

Perithecia, ostiolate, dark brown, membranous, ovoid, 150–210 x 70–120μ. Attached to substratum with dark colored, well-developed rhizoids. Terminal hairs long, septate, originating around the ostiole and forming a tall, beak-like structure, 1,000 to 2,100μ long, through which the ascospores are expelled in a single column, the beak-like hairs frequently separating at tip and occasionally to the base at the ostiole, displaying their nature as individual ornamental hairs. Lateral hairs brown rigid, septate, 200–630μ long, 3.5–5.0μ in diameter at base, tapering to a rounded tip, straight or slightly incurved. Asci 8-spored, club-shaped, evanscent, 24–43 x 12–19μ, pars sporif. approximately 23μ. Ascospores hyaline when young, at maturity dark brown, subglobose, apiculate, 8.8–12.0 x 8.5–10.2μ. In agar copious aleuriospores and chlamydospores are produced, 8–14μ in diameter.

Type locality: Barro Colorado Island, Canal Zone.

Habitat: From soil.

Distribution: Known only from type locality.

Type culture preserved in the U.S. National Herbarium, Washington, D.C.

This species is closely related to *Chaetomium longicolleum* Krzem & Badura, but has a much longer beak-like structure, and a narrower spore exit channel. The production of chlamydospores in the agar-agar substrate is similar to those found in several other species of *Chaetomium*. Originally described from specimen collected by Dr. G. W. Martin, No. 8875, from soil on Barro Colorado Island in 1952.

A pure culture of this species was obtained at Baarn, and is maintained in my living cultures. Specimens from my collection are deposited in the U.S. National Herbarium, Washington, D.C.

**47. CHAETOMIUM MEGALOCARPUM** Bainier, Bull. Soc. France *25:* 202, 1910. *Chaetomium atrosporum* Skolko and Groves, Can. J. of Botany, *31:* 784, Nov. 1953

Plate 4, Figs. 1–5

Perithecia subglobose to ovoid, base obtuse, ostiole more or less lipped 280–411 x 225–245μ. Terminal hairs long, sinuous, 2.5–3.5μ wide throughout most of their length, slightly tapering to blunt tips, light colored, minutely roughened with scattered larger projections, nonseptate, occasionally branched at wide

angles, bifurcate toward the middle sometimes with three branches. Lateral hairs similar to the terminal hairs. From several collections variations of hair color will range from grayish-black to yellow or greenish-yellow. In quantity the hairs vary from few to quite abundant.

Asci eight-spored, clavate to pyriform, 45–60 x 23$\mu$, pars sporif. 35$\mu$. Ascospores globose to subglobose to ovoid, often depressed on one side, very dark brown, variable in size and shape, 13–16.5 x 12–14$\mu$.

A pure culture, #541, was received from Dr. Paul R. Harding, Jr., in 1956, isolated from the perianth of a shriveled date, *Phoenix dactylifera* was found similar to *C. atrosporum* Skolko and Groves, in most respects except color; culture #541 had yellow-green terminal hairs.

Illustrations by Skolko & Groves (105). Bainier (6). The variable color characteristics and the similar ascospore and branching characteristics of the terminal hairs correspond with the description and illustrations of *C. megalocarpum* Bainier, which is considered a valid species. Cultures of both color types are deposited in the U.S. National Herbarium, Washington, D.C.

**48. CHAETOMIUM MICROCEPHALUM** Ames, Mycologia 37: 145, 1945

Plate 25, Figs. 29–33

Perithecia ostiolate, ellipsoid when young, becoming oblong-cylindrical at maturity, 450–575–(675) x 150–200$\mu$. Perithecia appearing white to light gray in color. Terminal hairs light-colored, septate, short, stout, to 5$\mu$ in diameter at base, straight below, spirally coiled above with a few to seven or eight coils, occasionally with coiled branches whose basal cells are rounded at point of attachment, terminal hairs partially obscured at maturity by a small compact mass of spores forming a small head. Lateral hairs light-colored, septate, straight with a long tapering point, to 4.0–5.5$\mu$ in diameter at base; both terminal and lateral hairs are very finely roughened. Asci club-shaped, 8-spored. Ascospores light-brown, broadly ovoid, apiculate at both ends, 6–7 x 5–5.5$\mu$.

Type locality: Cades Cove, The Great Smoky Mountains, Tenn.

Habitat: On vegetable detretus.

Distribution: Known only from type locality.

Type deposited in the U.S. National Herbarium, Washington, D.C.

*C. microcephalum* is distinguished by its cylindrical perithecium whose apex is ornamented with short coiled hairs which are partially obscured by a small, round mass of ascospores.

**49. CHAETOMIUM MINUTUM** Krzemieniewska & Badura, Acta Societatis Botanicorum Poloniae, 23: 747, 1954

Plate 24, Figs. 20–23

Perithecia vase-shaped, 80–125 x 40–60$\mu$, light brown in color, translucent, uniformly covered with gray bristle-like hairs, 30–50$\mu$ in length and 1.7–2.3$\mu$ in diameter, and terminated at the apex by a small ostiole. Asci club-shaped, almost globose, greenish-brown 9.6–11.0 x 7.0–9.0$\mu$. Specimens were received from Dr. Badura; a slide prepared from his specimens is deposited in the U.S. National Herbarium, Washington, D.C.

**50. CHAETOMIUM MOLLICELLUM** sp. nov.

Plate 10, Figs. 9–15

Pallidum. Peritheciis ostiolatis, subglobosis vel ovatis, 120–135 x 110–125$\mu$, frequenter cirrhis carentibus, ad substratum cum rhizoideis tenellis affixis et cum pilis tennibus decorantibus. Pilis terminalibus generium duorum: (a) erectis, diametro 5$\mu$ basi, subter spiraliformibus, obscure septatis, cum minutis granuloso-spinis incrustatis; (b) longis, rectis vel undulatis, diametro 3–4.1$\mu$ basi, apice gradatim attenuatis, et cum minutis granuloso-spinis incrustatis. Pilis lateralibus paucioribus in numero, longis, rectis vel undulatis vel interdum circinantibus, diametro 3–3.8$\mu$ basi, apice gradation attenuatis, septatis et cum minutis granuloso-spinis incrustatis. Ascis longis, cylindricis, octosporis, 73 x 7.7$\mu$. Ascosporis maturis brunneis, globoso-ovatis, subapiculatis, 8–10 x 5–7$\mu$.

Gray. Perithecia are of medium size, ostiolate, subglobose to ovate, 210–135 x 110–125$\mu$, mostly without cirrhi, attached lightly to the substratum with undifferentiated rhizoids and covered with delicate terminal and lateral hairs which are very easily crushed. Terminal hairs are of two types: (a) straight below, about 5$\mu$ in diameter at the base, coiled loosely above with broad convolutions which diminish in size to the apex, indistinctly septate and covered with small crystal-like spines or projections; (b) long straight or wavy hairs which extend far beyond type (a), at base about 3–4.1$\mu$ in diameter diminishing to a narrow tip, covered with crystal-like projections. Asci long, cylindrical, 73 x 7.7$\mu$, 8-spored. Ascospores when mature are brown, globose-ovate, sub-apiculate, monostichously arranged in the ascus, 8–10 x 5–7$\mu$.

Type locality: Washington, D.C.

Habitat: On excrement of spotted skunk. (National Zoological Park)

Distribution: Known only from type locality.

Type deposited in the U.S. National Herbarium, Washington, D.C.

**51. CHAETOMIUM MOLLIPILIUM** Ames, Mycologia 42: 644 1950.

Plate 19, Figs. 5–8

Light brown to cream-colored. Perithecia ostiolate, of medium size, globose to subglobose 175 x 130$\mu$ (165–240 x 130–190), supported by light brown rhizoids, producing cirrhi. Terminal hairs sparse, forming a relatively open head, septate, often branched with wide angles, at base 3.25–4.25$\mu$ in diameter, gradually tapering to a narrow tip. Lateral hairs moderate in number, wavy, seldom branched, septate, graceful, at base 3–3.75$\mu$ in diameter, gradually tapering to the apex. Asci clavate, 8-spored, 38 x 12.5$\mu$, pars sporif. 28–30$\mu$. Ascospores lemon-shaped, apiculate at both ends, 12 x 10$\mu$ (10–12.25 x 8.5–10).

Type locality: New Guinea or Guadalcanal.

Habitat: On a Japanese raincoat.

Distribution: In type locality and in Virginia (from human infection).

Type deposited in the U.S. National Herbarium, Washington, D.C.

Culture was made from a Japanese raincoat by Dr. G. W. Martin while he was at the Jeffersonville Quartermaster Depot, Jeffersonville, Indiana, and designated as J–587, APO, 565. A similar isolate was designated J–805.

This species is distinguished by its soft, easily mashed hairs, many of which are branched at wide angles. Looking directly down on comparatively fresh cultures the outline of each perithecium is clearly visible due to the paucity of terminal hairs. I have isolated this species four times from diseased fingernails. Nail specimens from four sources were washed in 95% alcohol, rinsed in sterile distilled water and then placed on sterile mineral agar. The perithecia which developed were found growing on the nail specimen. This species has also been isolated from hairs plucked from a boy's head, which was extensively infected. Twenty insolations were made from hairs plucked at random and incubated on sterile nutrient media.

**52. CHAETOMIUM MURORUM** Corda, Icones *1*: 24, 1837

*Chaetomium comatum* var. *helicotrichum* Saccardo, Michel: 1, 222. 1878

*Chaetomium griseum* Cooke, Grevillea 1: 175, 1873

Plate 6, Figs. 13–16

Perithecia ostiolate globose or ovate with a bluntly pointed base 240–340 x 200–345$\mu$, blue-black, loosely attached to substratum. Terminal hairs variable with age, when young stout, about 5.5$\mu$ in diameter at the middle of their length, not circinately curved at tips, but broadly arched throughout their length; at maturity slender, about 4$\mu$ in diameter, gracefully flexed or nearly straight, ending in a graceful arch with circinate tip, dark rich olive-brown, sparsely and irregularly septate, smooth or roughened by irregular projections, in old age becoming still darker, frequently losing their circinate tips and tending to become wavy throughout. Lateral hairs long, graceful, flexed, insensibly tapering to a point, delicate when young, when mature about 7.5$\mu$ in diameter, dark olive brown near base, gradually fading at tip, conspicuously granular-roughened, or nearly smooth, clearly or obscurely septate. Asci broadly and irregularly club-shaped, 8-spored, 54 x 20$\mu$, pars sporif. 34$\mu$. Ascospores filled with greenish refractive globules when young, when mature dark olive-brown, globose-ovate to narrow elliptical, apiculate at both ends or apiculate at one end and umbonate at the other, frequently collapsing by a longitudinal furrow, 11.0–13 x 7.8–8.3$\mu$, when seen edgewise, compressed, 6.4$\mu$ broad.

Type locality: Prague, Czechoslovakia.

Habitat: On a damp wall (Corda); on various types of animal excrement, especially dog dung; on seeds (Skolko & Groves).

Distribution: Bohemia (Corda), New England (Chivers), Montana (Ellis & Everhart), Germany (Zopf), Canada (Skolko & Groves), Virginia, Tennessee and California (Ames), Japan (Udagawa).

The long undulating hairs with incurved tips and the ellipsoid spores which usually show a longitudinal furrow, distinguish *C. murorum* from all other species except *C. circinatum* which, however, has stouter hairs with recurved circinate tips and larger ascospores.

**53. CHAETOMIUM NIGRICOLOR** Ames, Mycologia 42: 654, 1950

Plate 19, Figs. 9-13

Black. Perithecia ostiolate, of moderate size, globose to subglobose, 250 x 230$\mu$ (200–285 x 190–260), attached to the substratum with brown rhizoids, seldom producing cirrhi, the bushy-haired heads with a ragged appearance. Terminal hairs numerous, black, regularly and thickly covered with little black projections, with large crystals and projections appearing at random, undulating or with occasional spiral coils, frequently branching, at base 3–4$\mu$ in diameter, tapering to faded tips. Lateral hairs moderately numerous, straight or undulating, obscurely septate, 3.5–4.5$\mu$ in diameter, roughened, black in color and tapering to faded tips. Asci fugaceous, club-shaped, 8-spored, 25 x 9$\mu$, pars sporif. 14$\mu$. Ascospores when mature

brown, almond-shaped, slightly apiculate at one end, 5–6 x 4–5μ.

Type locality: India

Habitat: Vegetable detritus.

Distribution: Known only from type locality.

Type deposited in the U.S. National Herbarium, Washington, D.C.

This species was received from Dr. J. C. Gilman, who received the specimen from India under the binomial *Chaetomium convolutum* Chivers. They are similar only in color. *C. nigricolor* is distinguished by the black, intermingling branched, and simple undulating hairs, and the small brown almond-shaped ascospores.

**54. CHAETOMIUM OCHRACEUM** Tschudy, Am. Jour. Botany 24: 475, 1937

Plate 20, Figs. 1–3

Perithecia ostiolate, globose, about 325–400μ in diameter, overall color green to yellow-green when young, graying with age, lightly attached to the substratum. Terminal hairs narrow throughout their length, light colored, yellow-green with variations when young, smooth, nonseptate, irregularly sinuous, kinky or loosely coiled, 1.5–2.0μ in diameter, interwoven into a large, dense, compact head. Lateral hairs similar but shorter, less sinuous, irregular and appressed. Asci clavate, 8-spored. Ascospores dark olive-brown, ovoid, subumbonate or faintly apiculate at both ends, 7–8.5 x 5.5–6.5μ.

Type locality: State of Washington.

Habitat: On plant detritus; on animal dung.

Distribution: In Washington, Virginia, and Tennessee.

Specimens from my collection are deposited in the U.S. National Herbarium, Washington, D.C.

*C. ochraceum* is recognized by the ochraceous mycelium by its extremely fine, sinuous terminal hairs which intertwine to form a dense compact head and its small ascospores.

*C. ochraecum* has been isolated from vegetable debris and animal excrement from Virginia and Tennessee. These isolations were identical with the culture first received from Tschudy's collection. An additional isolate was obtained from the Centraalbureau voor Schimmelculture, Baarn, Netherlands.

**55. CHAETOMIUM OLIVACEUM** Cooke & Ellis, Grevillea, 6: 96: 1878

Plate 20, Figs. 15–17

Perithecia ostiolate, globose, in size about 300–400μ in diameter, clothed with a loose mass of gray to brown hairs. Terminal hairs dark colored, distinctly roughened, septate, 3–5μ in diameter, long, undulate, loosely interwoven. Lateral hairs are similar but only slightly flexed, ending in a hyaline, blunt tip. Asci irregularly club-shaped. Ascospores dark olive-brown, broadly ovoid unbonate at both ends, 9.0–12.5 x 7.5–9.0μ.

Type locality: Newfield, N.J.

Habitat: On rotting stems of *Erigeron;* on various dead plants, moist wood, rye-straw, and pasteboard.

Distribution: New England, and New Jersey.

Exsiccati: Ellis, N. Amer. Fungi.

**56. CHAETOMIUM PACHYPODIODES** Ames, Mycologia 37: 145, 1945

Plate 17, Figs. 1–3

Perithecia ostiolate, ovoid-elongate, broad below, narrowing above, 350–460 x 150–260μ, firmly attached to the substratum with dark colored rhizoids. Terminal hairs dark colored, septate, smooth to finely roughened, below to 5μ in diameter and straight, above spirally coiled, with few to 10–12 coils, gradually diminishing in diameter and extending beyond the mass of spores at maturity, producing a few coiled lateral branches, rounded at their point of attachment. Lateral hairs straight, dark-colored below, fading above, tapering gradually to a pale sharp tip, septate, finely roughened, at base 3.5–4μ in diameter. Asci club-shaped. Ascospores globose to subglobose, slightly apiculate at both ends, 5.5–7.0 x 4.0–5.5μ, extruded in an irregular mass.

Type locality: Cades Cove, The Great Smoky Mountains, Tenn.

Habitat: On vegetable detritus.

Distributions: Known only from the type locality.

Specimens are deposited in the Cryptogamic Herbarium, Harvard, and in the U.S. National Herbarium, Washington, D C.

*C. pachypodiodes* resembles *C. caprinum* but differs in having long, regularly coiled terminal hairs, with few branches, which extend beyond the spore mass at maturity. *C. pachypodiodes* has a much elongated perithecium not found in *C. bostrychodes* with which it might be confused.

**57. CHAETOMIUM PERLUCIDUM** Sergejeva, Botanicheskie Materialy, Botanical Institute, Moscow-Leningrad, 11: 108, 1956

Plate 12, Figs. 12–17

Perithecia in mass appear olive-yellow to light brown in color to the naked eye, are globose, very small, 105–135μ in height by 100–130μ in width, with a round stoma 24–27μ in diameter, light brown in color, with rhizoids at the base, covered on top and sides with ornamental hairs. The perithecial walls are friable and are composed of readily discernible individual

cells. Terminal hairs forming a comparatively large spreading head, are unbranched, septate, the lower third is straight, coiled above into a very elongated, somewhat conical spiral 30–45$\mu$ in diameter at the base, with 5–7 convolutions, sometimes with a very extended straight tip. These appendages are very tender, flexible, with sparse septations, having a diameter of 2.5–3.0$\mu$ at the base, and are covered with almost imperceptible, minute prickles of a yellow-olive color, with tapering tips, smooth or nearly smooth, light-colored to almost colorless. Sometimes among the top convoluted hairs are found nearly straight ones, resembling the lateral hairs but longer than these. Lateral hairs of the perithecium are straight or nearly so, long with closer septations than the terminal ones, 2.0–2.5$\mu$ in diameter at the base, yellow-olive in color, covered with scarcely perceptical minute prickles, with tips tapering out into threads that are lighter in color to nearly colorless. Asci short, clavate, 39–45 x 12$\mu$, 8-spored, pars sporif. 30–33$\mu$. Ascospores are flattened, with one side concave and the other convex, when viewed from the broad surface spindle-shaped, with blunt, round ends, 12–13.5 x 5.6–6$\mu$, of a muddy brownish-yellow color.

Occurring on stalks of a grassy plant collected by Z. G. Lavitskaya.

*Chaetomium perlucidum* is reported close to *C. undulatum* Bainier, but is distinguished by a dissimilar form of spores (a very important characteristic with *Chaetomium*) and also by smaller perithecia and thinner terminal hairs, coiled in a different form of spiral. The terminal hairs of *C. undulatum* are coiled into an irregular spiral, with convolutions which suddenly diminish in diameter in the upper part and lie close to one another, which is not observed in *C. perlucidum*.

Specimens, cultured from a pure culture sent to me by Sergejeva, are deposited in the U.S. National Herbarium, Washington, D.C.

### 58. CHAETOMIUM PERPULCHRUM sp. nov.

Plate 8, Figs. 1–5

Peritheciis globosis, ad 260$\mu$ diametro; ostiolo cum orbe nigro circumvento, ad substratum cum rhizoideis tenellis affixo. Pilis terminalibus simplicibus, fuscis, vel pallide-brunneis, undulatis vel late undulatis, cum crassis granulis vestitis, basi 5–6$\mu$ diametro, apice retusis, 3–4$\mu$ diametro, obscure et raro septatis. Pilis lateralibus ad 700$\mu$ longis, gracilibus bulbosis basi, 2$\mu$ diametro, apice gradation attenuatis, distincte septatis. Ascis longis, cylindricis, octosporis, 58 x 5$\mu$, pars sporif. 38$\mu$. Ascosporis maturis pallide fuscis, ovalis non constanter, 7.5–9.4$\mu$.

Perithecia globose, to 260$\mu$ in diameter, ostiole surrounded by a dark ring, lightly attached to the substratum with undifferentiated rhizoids. Terminal hairs unbranched, gray to light brown, undulate or loosely coiled or both, conspicuously and evenly covered with projections, at base 5–6$\mu$ in diameter, at blunt tip 3–4$\mu$ in diameter, inconspicuously and rarely septate. Lateral hairs to 700$\mu$ long, thin, bulbous at base, 2$\mu$ in diameter near base, gradually tapering to a thin sharp point, conspicuously septate. Asci cylindrical 58 x 5$\mu$, pars sporif. 38$\mu$. Ascospores uniseriate in ascus, irregularly ovoid 7.5–9.4$\mu$.

Type locality: Aptos, Calif. (1959).

Habitat: Vegetable detritus.

Distribution: Known only from type locality.

Type deposited in the U.S. National Herbarium, Washington, D.C.

### 59. CHAETOMIUM PINNATUM sp. nov.

Plate 21, Figs. 15–20

Peritheciis globosis vel subglobosis, angustis super ad collum, breve et latum, 200–240 x 150–165$\mu$ (collum 30–50$\mu$ longum, 20–40$\mu$ latum), cum rhizoideis tenellis ad substratum affixis; maturitate pilis terminalibus plerumque ad ascosporis et saepe a brevibus et latis cirrhis obscuris. Pilis terminalibus ipsis numerosis, simpliciter vel compositer ramosis, distincte septatis, basi flavis vel gilvis, 3.3–4.1$\mu$ diametro, apicibus grandatim palescentibus ramosis et acutis, cum peritheciis lacteis. Pilis lateralibus distincte septatis, apice gradatim attenuatis, basi 3–4.1$\mu$ diametro, gilvis. Ascis clavatis, octosporis. Ascosporis maturis perbrunneis limoniiformibus, subumbonatis vel utrinque apiculatis, 6.0–6.8 x 4.8–6.2$\mu$. In medio agar-agar cum liquore tuberis, *Solani tuberosi*, aleuriosporae copiose producentur, 7.0–8.1$\mu$ diametro.

Perithecia globose to subglobose, narrowed above to a short, wide neck, 200–240 x 150–165$\mu$ including the neck, neck 30–50$\mu$ long, 20–40$\mu$ wide, base rounded, firmly attached to the substratum with pale mycelial-like rhizoids, terminal hairs at maturity mostly obscured by the mass of ascospores and, in many cases, by short, wide cirrhi. Terminal hairs numerous, branched and rebranched, distinctly septate except the very long, narrow tips, at base yellow to pale yellow, 3.3–4.1$\mu$ in diameter, gradually fading, branching, gradually tapering for a long distance, terminating in long colorless threads, giving a feathery, cream-colored appearance to the mature head. Lateral hairs distinctly septate, pale yellow, at base 3.0–4.1$\mu$ in diameter, gradually tapering to the tip. Asci club-shaped, 8-spored, 30 x 10$\mu$, pars sporif. 20$\mu$. Ascospores lemon-shaped, brown, apiculate to sub-umbonate at both ends, 6.0–6.8 x 4.8–6.2$\mu$. Numerous aleuriospores, 7.0–

8.2μ in diameter are produced in the nutrient agar-agar media.

Type locality: Coronado National Forest, Ariz.

Habitat: On dead wood.

Distribution: Known only from type locality.

Type deposited in the U.S. National Herbarium, Washington, D.C.

This species was received from Dr. G. W. Martin, (T–54) 9006, who isolated it from dead wood collected by J. L. Lowe in the Coronado National Forest, Ariz., August–September 1958.

**60. CHAETOMIUM PULCHELLUM** sp. nov.

Plate 21, Figs. 8–14

Peritheciis ostiolatis, subglobosis vel doliformibus, 300–360 x 210–290μ, basi rotundis vel leviter acutis, ad substratum cum rhizoideis affixis. Pilis terminalibus rigidis distincte septatis, simplicibus, coloram sucini referentibus, subter erectis, diametro 4.2μ basi, super cum 2–6μ latis undulationibus, interdum reflexis. Pilis lateralibus gracilibus sed ad pilos terminalea similibus, diametro 2–2.75μ basi. Asci clavatis, octosporis. Ascosporis lemoniiformibus, apiculatis, 4.6–6.1 x 3.7–5μ, pallide brunneis vel brenneis. Aleuriosporae in medio agar-agar cum liquore tuberis, *Solani tuberosi*, producentur, diametro 8–12μ.

Perithecia subglobose or barrel-shaped, ostiolate, 300–360 x 210–290μ, brown, rounded at base or slightly pointed, attached to the substratum with differentiated rhizoids. Terminal hairs stiff, distinctly septate, unbranched, amber-colored, the lower portion straight, to 4.2μ in diameter, the upper portion terminated in 2–6 convolutions with large diameter below decreasing to a sharp tip, some coiled hairs are reflexed so that their tips point toward the base of the hairs, frequently the tips intertwine. Lateral hairs somewhat similar to the terminal hairs but shorter and more delicate, 2–2.75μ in diameter at base. Asci club-shaped, 8-spored, ascospores lemon-shaped, apiculated at both ends, 4.6–6.1 x 3.75–5μ, brown in color. In agar-agar culture media many chlamydospores are produced 8–12μ in diameter, or occasionally club-shaped.

Type location: New Haven Gap, Portland Parishes, Jamaica.

Habitat: Vegetable litter.

Distribution: Known only from type locality.

Type deposited in the U.S. National Herbarium, Washington, D.C.

This species was sent to me as a pure culture by Dr. G. W. Martin under the number (T–41) 9004. Jamaica, B.W.I. Isolated from litter collected by A. L. Welden at New Haven Gap on border of St. Andrews and Portland Parishes, 1 Sept. 1957.

**61. CHAETOMIUM QUADRANGULATUM** Chivers, Proc. Am. Acad. 48: 85, 1912

Plate 18, Figs. 1–9

Perithecia ostiolate, large and elongated, barrel-shaped, 330–460 x 240–350μ, frequently producing one or more very long cirrhi, producing a mass of dark olive-colored rhizoids at base. Terminal hairs of two types; (a) unbranched, minutely roughened, below dark olive-brown to black, straight, septate, above coiling in the form of a spiral with 2–6 convolutions, near tips light olive-yellow, or colorless, sparsely septate; (b) showing tendency to twist in spiral fashion near the middle of their length, or curved or sometimes nearly straight throughout, many with a single coil near the middle finely roughened throughout, below dark olive-brown to black, and about 7.5μ in the thickness, clearly septate to near tips which are hyaline—along the hairs of this type several branches may be produced; the branches having the nature of the hairs.

Lateral hairs numerous, slender, straight, regularly and distinctly septate, at base dark olive to black, minutely roughened and about 7.5μ in thickness, in upper part pale, yellow or hyaline, smooth. Asci club-shaped, 8-spored, 39 x 9.7μ pars sporif. 21μ. Ascospores when young greenish, hyaline with small refractive globules, when mature pale olive, when seen in face view four-sided and four-angled, either nearly square with equally rounded corners or with depressions in the four sides, in which latter case there are generally two acute angles at opposite ends which mark the length of the spore, while the angles at the sides are broad and obtuse 16.4–8 x 5.5–6.5μ, when viewed edgewise ovate 3–4μ broad.

Type locality: Cambridge Mass. (Chivers No. 29).

Habitat: On dung.

Distribution: Massachusetts, Chile and Little Swan Island, Gulf of Mexico.

This species was obtained from the Centraalbureau Voor Schimmelculture, Baarn, Netherlands. Specimens are deposited in the U.S. National Herbarium, Washington, D.C.

**62. CHAETOMIUM REFLEXUM** Skolko & Groves, Canadain Jour. Res. C. 26: 279, 1948

Plate 3, Figs. 10–14

Perithecia ostiolate, black, ovoid to subglobose, small, 100–125μ wide, densely massed forming an almost continuous layer, obscured by the dense mass of dark rhizoids and terminal hairs. Terminal hairs short, stout, 5μ wide, arcuate from the base, short, stout, strongly recurved, dichotomously branched, tips blunt, dark brown, only slightly roughened above, obscurely septate, forming a dense, flat-topped mass above

the perithecium. Lateral hairs few, unbranched, very short, narrow, 2.5$\mu$ in diameter at base, uneven, only slightly colored, with rounded tip, appearing as modified, short rhizoids. Ascospores light olive-brown, oval, slightly flattened on one side, rounded, to slightly acute on the ends, 5.0–6.5 x 4.0–4.5$\mu$.

Type locality: Manitoba.

Habitat: On seeds, *Lycopersicon*, *Pisum*, *Hibiscus*, *Capsicum*. Type specimen from *Capsicum annum* L.

Distribution: Manitoba, New Jersey, Ohio.

Type in the herbarium at Ottawa under the number DAOM14201.

*C. reflexum* may be distinguished by the small densely massed perithecia, and the flat-topped mass of short, stout, curved terminal hairs with reflexed, short, blunt branches. A pure culture of this species was received from Skolko & Groves. Specimens from subcultures are deposited in the U.S. National Herbarium, Washington, D.C.

### 63. CHAETOMIUM RETICULOPILIUM sp. nov.

Plate 26, Figs. 1–7

Aurata-luteis. Peritheciis ostiolatis, vasiformibus, 190–240 x 120–135$\mu$, cum collo lato, diametro 5–9$\mu$, ad substratum firmiter cum rhizoideis tenellis affixis. Pilis terminalibus generium duorum: (a) longis, angustis, septatis, subcurvatis interdum ramosis, 2–3.5$\mu$ diametro basi subluteis, apice perpallidies; (b) gracilibus, mollibus, basi luteis, diametro 1.5–2.5$\mu$, languidioribus basi, apice sine colorem, cum pilis linoribus, dichotomoramosis, frequenter textorium reticulum formantibus. Pilis lateralibus gracilibus, mollibus, septatis, subluteis basi, diametro 1.5–2.5$\mu$. Ascis clavatis, octosporis, 33 x 10$\mu$, pars sporif. 22$\mu$. Ascosporis brunneis, 6–8 x 4–7$\mu$, limoniiformibus apiculatis. Aleuriosporae in medio agar-agar cum liquore tuberis, *Solani tuberosi*, producentur, diametro 6–8$\mu$. Orange-yellow. Perithecia vase-shaped with a wide neck at the ostiole, 190–240 x 120–135$\mu$, width of neck 5–9$\mu$, firmly attached to the substratum with undifferentiated rhizoids. Terminal hairs of two types: (a) long, thin, septate, arcuate, occasionally branched, thin at the tips, at base 2–3.5$\mu$ in diameter, pale orange-yellow at the base, fading somewhat to the tips; (b) delicate hairs originating around the mouth of the ostiole, best seen when the perithecium is crushed, at the base yellowish, quickly fading to colorless as they branch many times, frequently anastomosing, forming a reticulum of fine threads, the ends of which intermingle with those of type (a), together they produce a soft texture, at the base 1.5–2.5$\mu$ in diameter, narrowing to very delicate threads. Lateral hairs slender, delicate, septate, pale orange-yellow, 1.5–2.5$\mu$ in diameter at base. Asci club-shaped, 8-spored, 33 x 10$\mu$, pars sporif. 22$\mu$. Ascospores brown, 6–8 x 4–7$\mu$, apiculate, occasionally large ascospores are formed, to 10 x 8$\mu$, Aleuriospores produced in nutrient agar media, 6–8$\mu$ in diameter.

Type locality: Bataan, Costa Rica.

Habitat: On vegetable debris.

Distribution: Known only from type locality.

Type deposited in the U.S. National Herbarium, Washington, D.C.

### 64. CHAETOMIUM ROBUSTUM sp. nov.

Plate 12, Figs. 1–6

Nigrum. Peritheciis ostiolatis, nigris vel perbrunneis, grandibus, elongatis magnopere, diameter grandissimis basi, tum apice angustatis, 575–650 x 250–265$\mu$, ad substratum cum rhizoideis numerosis perbrunneis affixis; apice cum pilis nigris crispis decorantibus. Pilis terminalibus crassis aequaliliter brevibus, septatis, terminalibus crispis, 7–9.5$\mu$ diametro basi, apice gradatim attenuatis. Pilis lateralibus septatis, distinctis, spiculatis, circa 3.8–5$\mu$ diametro basi, apice gradatim attenuatis, nigris vel pallide nigris. Asci clavatis, octosporis, 33 x 10$\mu$ pars sporif. 20$\mu$. Ascosporis perbrunneis, utrinque leniter apiculatis, 6–8 x 4.5–6.3$\mu$.

Black. Perithecia ostiolate, large, greatly elongated with the greatest width just above the base, then narrowing above, vase-shaped, parenchymatous in structure, 575–650 x 250–265$\mu$, affixed to the substratum with numerous strong, dark rhizoids, ornamented at the apex with stout coiled terminal septate hairs. The terminal hairs are distinct when young, with age the hairs are obscured by masses of extruded ascospores. Terminal hairs stout, septate about 7–9.5$\mu$ in diameter at the base, relatively short, the ends terminating in close, handsome coils, first part of coil large, then each successive coil quickly decreasing in diameter to a sharp apex, corkscrew-like in shape. Lateral hairs relatively short, stiff, spine-like, more or less evenly distributed over the perithecium, septate, at base 3.8–5$\mu$ in diameter, gradually diminishing to a sharp point. Asci club-shaped, 8-spored, 33 x 10$\mu$, pars sporif. 20$\mu$, dark brown in color, 6–8 x 4.5–6.3$\mu$, apiculated at both ends.

Type locality: Portland Parish, Jamaica.

Habitat: Vegetable and soil litter.

Distribution: Known only from type locality.

Type deposited in the U.S. National Herbarium, Washington, D.C.

Specimen was received from Dr. G. W. Martin (T–44) 9005, who isolated it from litter collected by A. L. Welden in Portland Parish, Jamaica, B.W.I., 1 September 1957.

**65. CHAETOMIUM SEMEN–CITRULLI** Sergejeva, Botanicheskiye Materialy, Publication of the Academy of Science USSR, V. L. Komarov Botanical Institute, Moscow-Leningrad, II; 113, 1956.

Plate 13, Figs. 1–8

Perithecia off-white when young, becoming greenish-brown with age, subglobose or almost globose, small, 176–272$\mu$ in diameter, with a rounded stoma 12–15$\mu$ in diameter, yellow to brownish-yellow, with a dark brown rim around the stoma, usually without rhizoids, covered by ornamental hairs, comparatively sparse on the sides and exceptionally dense on the top, strongly interlaced and forming a tuft resembling in its form the head of a young white mushroom. The terminal appendages are unbranched for a short distance; in their lower part straight, coiling above into a more or less regular, somewhat extended spiral, of 8–10 convolutions of 24–31$\mu$ in diameter, nearly cylindrical throughout most of its length but tapering toward the ends, where the spirals are often curved in larger spirals. These hairs are flexible, with sparse but distinct partitions, smooth or covered with nearly indistinguishable prickles, olive-brown in color, 2.5–3.5$\mu$ in diameter at the base, slightly tapering toward the tip. Lateral hairs short, almost straight in the lower part of the perithecium, those near or at the upper part are often slightly curved in a spiral, with distinct septations, smooth or covered with scarcely noticeable prickles, of light olive-brown color, 3–3.5$\mu$ in diameter, tapering slightly toward the ends. Additional lateral hairs are soft in texture, straight and sharply tapering toward the tips, 3–4$\mu$ in diameter at the base, semi-transparent, yellowish, smooth, septate, others colorless and without septations at the tips. Asci short clavate, 63–66 x 16–18$\mu$, 8-spored; pars sporif. 49–51$\mu$. Ascospores flattened, concave on one side and convex on the other, when viewed from the broad surface broadly elliptical, bluntly pointed at one end, apiculate at the other, 13–15 x 10.5–12.0$\mu$, dark rich brown in color.

Type locality: Turkoman, USSR

Habitat: On fox dung (Collected by E. N. Koshkelova).

Distribution: Known only from type location.

*Chaetomium semen-citrulli* stands out from all known species of *Chaetomium* by its helically curved, terminal ornamental hairs, and large, very dark ascospores which are pointed at one end, rounded at the other. The light coloring and translucency of the perithecia with the dark, strongly pronounced rim around the stoma are also very characteristic of the species.

A pure culture of this species was sent to me by Sergejeva, subcultures of which are deposited in the U.S. National Herbarium, Washington, D.C.

**66. CHAETOMIUM SEMINUDUM** Ames, Mycologia 41: 41, 1949

Plate 24, Figs. 13–19

Perithecia small and black, vase-shaped 100–165 x 60–85$\mu$, ostiolate, with long cirrhi, attached to the substatum with translucent mycelium like rhizoids. Terminal hairs and lateral hairs are similar, few in number, septate, at the base 3.5–4$\mu$ in diameter, narrowing to a sharp tip. Asci clavate, 8-spored, liquefying before the ascospores mature. Ascospores when mature light olive-brown, globose-ovate, to broadly ovoid, dark brown in color, sub-apiculate at one or both ends. 8–9.8 x 7–8.5$\mu$.

Type locality: Ames, Iowa.

Habitat: On vegetable detritus; on tomato seed (*Lycopersicon esculentum* Mill.) from Skolko & Groves.

Distribution: Iowa, Pennsylvania.

Specimens are deposited in the U.S. National Herbarium, Washington, D.C.

In agar-agar media enriched with potato extract, myriads of chlomydospores and aleuriospores, 9–15$\mu$ in diameter are produced. Growing on the agar surface of culture media, hair-like structures appear which strongly resemble the ornamental hairs on the perithecia.

This interesting species was sent as a pure culture to the writer by Dr. J. C. Gilman, Iowa State University, Ames, Iowa. The species is easily distinguished by the small size and shape, the vase-shaped perithecium with a short, conic ostiole, and the sparse, erect, unbranched terminal and lateral hairs.

**67. CHAETOMIUM SENEGALENSIS** sp. nov.

Plate 26, Figs. 13–17

Peritheciis ostiolatis, globosis, pallide brunneis, diametro 150–185$\mu$. Pilis terminalibus et lateralibus gracilibus, undulatis vel tortuosis, ramosis, basi bulbosis, apice angustis. Ascis longis, cylindricis, octosporis, 63 x 7.5$\mu$, pars sporif. 48$\mu$. Ascosporis amygdaliformibus vel aliquantum ovatis, 6.5–12.5 x 4–7$\mu$.

Perithecia ostiolate, globose, pale brown, 150–185$\mu$ in diameter. Terminal hairs and lateral hairs narrow, kinky, undulate, ribbon-like, branched, bulbous at the base, forming an intricately hairy head, 1.3–1.8$\mu$ in width, narrower at the tips. Ascilong, cylindrical 63 x 7.5$\mu$, pars sporif. 48$\mu$. Ascospores almond-shaped, or somewhat oval, 6.5–12.5 x 4–7$\mu$.

Type location: Dakar, Senegal.

Habitat: On plant remains.

Distribution: Known only from type location.

Type deposited in the U.S. National Herbarium, Washington, D.C.

This species was received as a pure culture from Mme. Jacqueline Nicot in 1960; the specimen was collected in Senegal and designated as "Dakar 39b."

**68. CHAETOMIUM SIMILE** Massee & Salmon, Ann. Bot. 16: 71, 1902

*Chaetomium glabrum* Bainier, Bull, Soc, Myc. France 25: 214, 1910

Plate 7, Figs. 10–14

Perithecia ostiolate, subglobose to ovoid in shape, often broader than tall, 190–275 x 200–340$\mu$, covered with loose, steel-gray hairs which become dark gray to black with age. Terminal hairs dense, dark olive-brown to black, under low power appearing smooth, under high power irregularly thickened with minute spines, irregularly and sparsely septate, 7–8$\mu$ in diameter, nearly straight below, contorted above consisting of successively reversed loops with long graceful arches, terminating in an arch with circinate tip, 5.5–7$\mu$ in thickness at the crown of the terminal arch. Lateral hairs extremely fine, undifferentiated, forming a tomentum of pale yellow to transparent mycelia threads. Asci cylindrical, about 80 x 9–10$\mu$. Ascospores monostichous, when young hyaline, filled with refractive greenish globules, when mature, dark rich olive-brown, subglobose or very broadly elliptical, some clearly apiculate at one end and rounded at the other. 10 x 8$\mu$ (9.5–10.5 x 7.5–8.9) when seen edgewise, compressed, 6.4$\mu$ broad.

Type location: Kew, England

Habitat: On dog dung; on vegetable detritus.

Distribution: England, New England, Tennessee, Virginia.

Specimens are deposited in the U.S. National Herbarium, Washington, D.C.

**69. CHAETOMIUM SPHAERALE** Chivers, Proc. Am. Acad. Arts & Sci. 48: 84, 1912

Plate 16, Figs. 6–10

Perithecium ostiolate, globose or subglobose, evenly rounded at base, distinctly narrowed above, 300–330 x 240–260$\mu$, frequently producing short black cirrhi, without rhizoids, clothed with hairs which become olive yellow to golden yellow with age. Terminal hairs long, slender, graceful, olive colored at base, fading toward the tip to golden yellow then pale yellow, terminating in a colorless, easily collapsible tip, at base smooth, closely septate, tending to break at the septa, straight below, about 4$\mu$ in diameter, becoming much branched above with long, narrow, septate, irregularly sinuous, often collapsed branches, somewhat constricted at the septa, interwoven and extending beyond the spore mass. Lateral hairs numerous, graceful, slender, smooth, septate, olive at base, fading toward the tip to golden yellow, pale yellows, terminating in a colorless, easily collapsible tip, some rather straight and long, 1–2 branched, at base about 3.7$\mu$ in diameter, others wavy, rather short, unbranched, at base about 2.8$\mu$ in diameter, Asci club-shaped, 8-spored, 48 x 13$\mu$, pars sporif. 26$\mu$. Ascospores when young filled with refractive greenish hyaline globules, when mature dark olive-brown, lemon-shaped to globose, apiculate or umbonate at both ends, 6.0–7.5 x 5–6$\mu$.

Type locality: Reading, Mass.

Habitat: In a culture of caterpillars.

Distribution: Reading and Amesbury, Mass.

Type of *C. sphaerale* is in the Farlow Herbarium, Cambridge, Mass.

Specimens are also in the Chivers Herbarium, Cornell University, Ithaca, N.Y.

The ovoid, rounded base of the perithecium and the narrowed ostiolar region together with the severally branched, delicate terminal hairs, and the absence of differentiated rhizoids are significant characters in recognizing this species. Drawings of this species were made from Chiver's material.

**70. CHAETOMIUM SPICULIPILIUM** sp. nov.

Plate 15, Figs. 1–6

Peritheciis ostiolatis, nigris, permagnis, longis vel subglobosis, diametro 420–520 x 290–335$\mu$, ad substratum cum rhizoideis robustis fuscis firmiter affixis. Pilis terminalibuslongis, crassis, nigris, late undulatis, raro flexuosis vel semel bifuricis, in cuspide longis terminatis, manifeste cum granulis tuberibus et cum obtusis spinculis retusis, diametro.7.5$\mu$ basi. Pilis lateralibus longis, crassis, cum rigidis spinis, obscure septatis, apice gradatim attenuatis. Asci clavatis, 50 x 14$\mu$, pars sporif. 32$\mu$. Ascosporis fuscis, ovatis, utrimque leniter subapiculatis, 8.5–11.3 x 5.2–7.5$\mu$.

Perithecia black, large elongated or barrel-shaped, 420–520 x 290–335$\mu$, attached firmly to the substratum with strong dark rhizoids. Terminal hairs long, coarse, black, widely undulate, occasionally loosely coiled or once forked, terminating in a long spear-like tip, conspicuously roughened throughout with irregular projections and blunt spines 7.5$\mu$ in diameter at base. Lateral hairs long, coarse, stiff spine-like, inconspicuously septate, conspicuously roughened with irregular projections and blunt spines, 7.5$\mu$ in diameter at base, decreasing to a sharply pointed apex. Asci club-shaped, 50 x 14$\mu$, pars sporif. 32$\mu$. Ascospores

brown, ovoid, subspiculate at both ends, 8.5–11.3 x 5.2–7.5μ.

Type locality: Aptos, Calif.

Habitat: On decaying vegetable debris.

Distribution: Known only from type location.

Type deposited in the U.S. National Herbarium, Washington, D.C.

**71. CHAETOMIUM SPINOSUM** Chivers, Proc. Am. Acad. 48: 86, 1912

Plate 18, Figs. 10–16

Perithecia ostiolate, ovate, obovate or subglobose, 270–320 x 205–265μ, at maturity producing a copious mass of spores extruded in a single cirrhus, and affixed to the substrate by rhizoids. Terminal hairs of two kinds, (a) primary hairs dark olive-brown, coarsely roughened below, fading and smooth above, unbranched, rigid and spine-like, at base 7.5μ in diameter, tapering to a short, collapsed tip, (b) secondary hairs, pale olive-brown, septate, finely roughened, constricted at the septa, straight untapered, repeatedly branched at right angles, and rebranched forming an elaborate system of branches which at first consists of club-shaped out-growths from the main shaft directed either at right angles to it, or backward from it. Lateral hairs numerous, straight, rigid, spine-like, roughened by minute spines or projections which are irregular in shape, at base black or nearly so and about 7.5μ in diameter, fading to dark olive-brown, terminating in a yellow or colorless, collapsed, hypha-like tip, obscurely septate in the terminal part. Asci narrowly club-shaped 40 x 7.5μ pars sporif. 22μ, Ascospores when young filled with granules and globules, greenish, refractive, when mature, pale olive, egg-shaped, 5.5–6.5 x 3.2–4μ.

Type location: Buenos Ayres (R. Thaxter).

Habitat: Growing on rat dung.

Distribution: Buenos Ayres (Chivers No. 7); a second collection, probably from the type, in the Chivers Herbarium, No. 7–1, from rat dung, Buenos Ayres, 1907, is a mixed collection, containing specimens of *C. cochliodes*.

Culture reported by Skolko & Groves as received from oat seed, County Down, Northern Ireland.

*C. spinosum* can be recognized by the egg shaped spores and the spine-like primary terminal hairs, from which arise slender, delicate, irregularly swollen and constricted out-growths, from which secondary branches arise which elongate and precede the cirrhus of spores as it forms, in this way giving support to the spore mass. A pure culture was obtained from the Centraalbureau voor Schimmelculture, Baarn, Netherlands. Specimens grown from this source are deposited in the U.S. National Herbarium, Washington, D.C.

**72. CHAETOMIUM SPIRALE** Zopf, Nova Acta Leop. Carol. Akad. *42*: 275, 1881.

*Chaetomium spirochaete* Palliser, N. A. Flora *3:* 61 1910.

Plate 11, Figs. 9–11

Dark brown to black. Perithecia of medium size, 150–300μ, ostiolate, globose or ovate with a bluntly pointed base, attached to substrate by dark olive-yellow to brown rhizoids. Terminal hairs sparsely septate, dark, rich olive-brown, roughened by minute spines and warts, slightly paler and somewhat less roughened near the tips, straight or only slightly bent below for 300–370μ of their length, 4–6μ in diameter at base, spirally coiled above with 6–14 turns. Lateral hairs long, graceful, nearly straight or slightly flexed, very gradually tapering toward the tip, septate throughout, at base 3–5.5μ in diameter, dark olive-brown, sometimes smooth but more frequently roughened by irregular hyaline bodies of varying size and shape, becoming smooth above and fading to a colorless or pale yellow tip. Asci club-shaped, with a short stalk, pars sporif. 34–43μ long. Ascospores lemon-shaped, slightly apiculate at either end or irregularly oval or spherical, dark rich olive-yellow to olive-brown, 9 x 7μ (6–12 x 5.6–9), when seen edgewise, 5.5–7μ broad.

Type locality: Berlin.

Habitat: On horse dung; on dog and rat dung.

Distribution: New England, Iowa, Tennessee, Virginia, Japan.

Specimens of *C. spirale* are deposited in the U.S. National Herbarium, Washington, D.C.

The large size and dark color of the ascospores are characteristics which easily separate this species from *C. bostrychodes* Zopf with which it has some superficial likeness, it differs from *C. aterrimum* in having larger ascospores and narrower terminal hairs.

**73. CHAETOMIUM SUBSPIRALE** Chivers, Proc. Am. Acad. 48: 84, 1912

Plate 12, Figs. 7–11

Perithecia ostiolate, large, elongated, somewhat barrel-shaped to ellipsoid, 300–400 x 220–290μ, erect, covered with hairs some of which are gray white, brown or tinged with pink, producing at maturity an irregular blue-black spore mass which almost entirely conceals the terminal hairs, producing at or near the base a dense mass of olive-brown to black rhizoids. Terminal hairs graceful slender, closely and distinctly septate, about 4μ in diameter at base, smooth, straight and dark olive below, fading to a light olive-yellow or becoming color-

less, and spirally coiled at first tightly, finally becoming extended and drawn out into a twisted thread. Lateral hairs numerous, only very slightly tapering, slender, graceful, comparatively short, regularly and distinctly septate, smooth, near base dark-olive and about 3.6$\mu$ in diameter, straight, above fading and becoming extremely refractive, twisting near the tips into a very small and tightly coiled spiral. Asci club-shaped, 8-spored, 45–9.7$\mu$ pars sporif. 24$\mu$. Ascospores pale olive, lemon-shaped apiculate at both ends, 6.2 x 5–5.6$\mu$.

Type locality: New England.

Habitat: On cow dung, and a variety of other animal dungs.

Distribution: New England, Michigan, Tennessee, Virginia, Belgian Congo.

Type deposited in the Farlow Herbarium, Cambridge, Mass., specimens in poor condition. A number of specimens of *C. subspirale* are in the Chivers Herbarium, Cornell University; these specimens were isolated from a variety of animal dungs.

Specimens are deposited in the U.S. National Herbarium, Washington, D.C.

This species can be easily recognized by its characteristic hairs; the lateral ones being short, straight and dark below, toward the extremity coiled into a spiral of small diameter, hyaline and refractive at the tips, the terminal hairs slender, at first tightly coiled into a fine delicate spiral, later elongated, becoming twisted and appearing wooly, often with a pink tint.

I have isolated this species on several occasions from material collected in New England, Virginia, and Tennessee, also from animal excrement sent to me by Dr. J. Meyer who collected it in the Belgian Congo, 1958.

**74. CHAETOMIUM SUCCINEUM** Ames, Mycologia 41: 645, 1949

Plate 20, Figs. 11–14

Perithecia globose to ovate, 22–340 x 200–230$\mu$, somewhat larger on some media, ostiolate, frequently producing cirrhi, attached to the substratum with delicate rhizoids. Terminal hairs numerous, often, on some media, a beautiful amber color, darkening with age, 2–3.75$\mu$ in diameter, smooth or minutely roughened, septate, untapered, straight or flexed below, terminating in two or three graceful large looping coils or several sinuous, distinct coils. Lateral hairs numerous, slender, septate, similar to the terminal hairs but not coiled, and terminating in a hyaline, short tip. Asci clavate, 8-spored, 35 x 15$\mu$, pars sporif. 27$\mu$. Ascospores pale olive-brown ellipsoid, rounded at both ends. 12–15$\mu$ (18) x 7–8.5 (10.0).

Type locality: Mount Shasta, Calif.

Habitat: Shasta fir (G. W. Martin); various seeds (Skolko & Groves); wood and vegetable litter (W. Bridge Cooke).

Distribution: Washington, California, Canada, Cambridge, Massachusetts. Specimens are deposited in the U.S. National Herbarium, Washington, D.C.

*C. succineum* is characterized by the loose cluster of slender amber-colored, coiled terminal hairs and large ellipsoid ascospores. Cultures of this fungus were sent to the writer by Dr. G. W. Martin, J–6259 and J–6260 (Type), and from Dr. W. Bridge Cooke.

**75. CHAETOMIUM TERATOIDEUM** sp. nov.

Plate 23, Figs. 1–6

Peritheciis immaturis reticulatis, globosis; maturis, pilos longos, nigros, producentibus, 20 vel 30 numerosis. Peritheciis maturis plerumque globosis, sed interdum basi apiculatis, 300–650 x 300–550$\mu$, ad substratum cum rhizoideis stabilibus affixis. Pilis terminalibus longis, nigris, septatis, plerumque erectis, simplicibus, interdum bifurcastis, infrequenter terminalibus anastomosis, diametro 8–10$\mu$ basi gradatim attenuatis. Pilis lateralibus numerosis, reticulatis. Asci clavatis, octosporis, 45 x 10$\mu$, pars sporif. 25$\mu$. Ascosporis ellipsoidibus, subapiculatis, 8–10 x 4–5.2$\mu$.

Perithecia in early stage of development appear as fuzzy, off-white to cream-colored balls due to the finely multibranched primary hairs. As the perithecia enlarge tips of black terminal hairs push through the fuzzy primary hairs, approximately 20 to 30 in number and reaching to a millimeter in length. Perithecia at maturity are usually globose in shape, but occasionally with a somewhat pointed base. 300–600 x 300–550$\mu$, firmly attached to the substratum with strong dark rhizoids. Terminal hairs long, black, septate, usually straight, spreading, occasionally branched, seldom anastomosing at the tips, at base 8–10$\mu$ in diameter, gradually decreasing to a relatively blunt tip. Lateral hairs covering the perithecium to the extent of forming part of the terminal hairs. They are multibranched, septate, terminating in thread-like tips, in color at maturity the perithecia appear cream-colored to light brown except for the black tuft of terminal hairs. Asci club-shaped, 8-spored 45 x 10$\mu$ pars sporif. 25$\mu$. Ascospores ellipsoidal subapiculate, 8–10.5 x 4–5.2$\mu$.

Type locality: Aptos, Calif.

Habitat: On vegetable detritus.

Distribution: Known only from type locality.

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Type deposited in the U.S. National Herbarium, Washington, D.C.

This large species was isolated from vegetable debris which I collected in the vicinity of Aptos, California, 1958.

**76. CHAETOMIUM TETRASPORUM** Hughes, Trans. Brit. Mycol. Soc. 29: 70–1946

Plate 16, Figs. 1–5

Perithecia gray, ostiolate, subglobose, 300–450$\mu$ in diameter, supported on a poorly differentiated tufts of rhizoids. Terminal hairs septate, loosely coiled, dark olive-brown and roughened but paler and smoother towards the rounded apex, about 5$\mu$ wide, bearing conspicuously branched, loosely coiled lateral branches, whose ultimate branches are narrower, closely and evenly coiled with up to eight convolutions, each coil pale olive-brown or hyaline and almost smooth, with a rounded apex. Lateral hairs numerous, of two sorts: (a) straight, unbranched, finely roughened, septate, 3.5$\mu$ in diameter, pale olive-yellow to brown at base, tapering to hyaline apex; (b) loosely coiled, olive-brown at base, slightly paler at apex, usually unbranched but sometimes with a short coiled lateral at the base, heavily roughened with minute warts, septate, up to 5$\mu$ in diameter. Asci more or less cylindrical, stalked, 65–83 x 7.5–10.5$\mu$, pars sporif. 45–52$\mu$ long, four-spored. Ascospores obliquely uniseriate, at first hyaline, later dark olive, lemon-shaped and strongly apiculate, often angular, elliptical and compressed when viewed edgewise, 10.5–14 x 6.9$\mu$, mostly 12 x 7$\mu$, Paraphyses absent.

Type locality: England.

Habitat: Appeared as a contaminant of an agar plate, presumably from vegetable specimens.

Distribution: Known only from type locality.

Type deposited in the herbaria of the Imperial Mycological Institute, Royal Botanical Gardens at Kew.

A pure culture, which I failed to maintain in a living condition, was sent to me by Dr. Hughes. A slide prepared from his material is deposited in the U.S. National Herbarium, Washington, D.C.

**77. CHAETOMIUM THERMOPHILE** La Touche, Trans Brit. Mycol. Soc. 33: 94, 1950

Plate 5, Figs. 1–4

Perithecia superficial more or less gregarious, globose or subglobose, 75–172$\mu$ in diameter, at first lightly colored, with age becoming dark olivaceous or brownish olive, parenchymatous in texture, made up of polygonal cells; ostiole terminal, surrounded by thin-walled hyaline cells; basal hypae olivaceous or brownish olive, branched or unbranched, sometimes forming a thick strand. Terminal hairs branched dichotomously and densely entangled when mature, unequally thickened and constricted along their length, tortuous, ampulliform or subampulliform at the base, covered with minute granules, olivaceous or brownish olive in color, septate, 2–4$\mu$ in width, branches and branchlets often reflexed with anastomosing, terminal branchlets diverging at an obtuse angle and having hyaline tips. Lateral hairs septate or continuous, branched or unbranched at the tips, hyaline or slightly colored; minute granules are distributed over the surface. Asci linear-cylindrical or rarely club-shaped, short stalked, hyaline, 50–57 x 7–8$\mu$, pars sporif. 44–54$\mu$ evanescent, eight-spored. Ascospores monostichous or rarely irregularly distributed, dark olivaceous or brownish olive when mature, globose or irregularly subglobose, with a single apiculus; 7–8$\mu$ in diameter or occasionally 9 x 7$\mu$, when viewed edgewise 5–6$\mu$ wide.

*Chaetomium thermophile* was isolated by La Touche from fermenting straw incubated at about 45°C. It may be distinguished by its uneven, dichotomously branched hairs and its large, subglobose spores which are prominently umbonate on only one end.

Type locality: England.

Habitat: Fermenting straw; vegetable detritus.

Type specimen of MRA, 112 is deposited in the Herbarium of the Commonwealth Mycological Institute, England.

Specimens of my isolation are deposited in the U.S. National Herbarium, Washington, D.C.

**78. CHAETOMIUM TORTILE** Bainier, Bull. Soc. Myc. France, 25: 214, 1909

Plate 7, Figs. 5–9

Perithecia ostiolate, globose or subglobose with a bluntly pointed base, sometimes wider than tall, 225–320 x 225–360$\mu$, covered by profuse, twisted mass of dark hairs. Terminal hairs dark olive-brown to black with age, roughened with minute spines, irregularly and sparsely septate, about 5.6$\mu$ in diameter at the middle of their length, nearly straight or flexed below, intricately contorted above, at times coiling into a regular spiral, then twisting in the opposite direction forming a series of congested coils, terminating in irregular or regular spirals which are often out of line with the axis of the hair and giving a tortuous appearance, terminating in an irregular or regular spiral, or in a loop followed by an arch with blunt circinate tips. Lateral hairs numerous, 3.8$\mu$ in diameter, dark olive-brown at base, fading to hyaline at the tips, septate, smooth throughout or very finely roughened, undulate, ending in a long collapsed tip, often breaking near their bases with age, giving the perithecial wall a coarse

rough appearance. Asci long, cylindrical, 8-spored, 100 x 8–10$\mu$, pars sporif. 50–60$\mu$. Ascospores monostichous, hyaline when young when mature dark rich olive-brown, subglobose or very broadly elliptical, varying from clearly apiculate to obscurely angular, 7.2–9 x 5.5–7$\mu$.

Specimens are deposited in the U.S. National Herbarium, Washington, D.C.

**79. CHAETOMIUM TORULOSUM** Bainier, Bull. Soc. Myc. France 25: 224, 1910

Plate 22, Figs. 6–10a

Perithecia ostiolate, vase-shaped, rather tall and elongated, 140–320 x 110–185$\mu$, frequently producing short, stout, blue-black cirrhi, covered with hairs which give it a golden yellow appearance. Terminal hairs almost entirely concealed at maturity by the spore mass, long, slender, graceful, irregularly flexed, clearly and reguarly septate to near the tips, conspicuously constricted at, and inflated between the septa, dark olive-brown at base, about 3.8$\mu$ in diameter, very gradually fading and tapering for a long distance, terminating in a long colorless refractive thread in mass having a golden-yellow color. Lateral hairs numerous, varying in length, delicate, smooth, generally slightly curved or bent, clearly and regularly septate, near base dark olive, about 3.7$\mu$ in diameter, gradually fading above to yellow and ending in extremely slender, colorless, crumpled tips. Asci irregularly club-shaped, 8-spored, 40 x 10$\mu$, pars sporif. 18$\mu$. Ascospores when young hyaline filled with refractive globules, when mature very dark olive-brown, lemon-shaped, apiculate, extremely variable in size, 7–13.5 x 6–9$\mu$, when seen edgewise, compressed 4.5$\mu$ broad.

Type locality: France (Probably Paris).

Habitat: On paper, vegetable detritus and various animal dung.

Distribution: New England, Western and Southern United States, Belgian Congo, Japan.

Specimens are deposited in the U.S. National Herbarium, Washington, D.C.

This species frequently appears on various dung specimens and vegetable debris from collections made in New England, Virginia, Tennessee, New Mexico and California.

**80. CHAETOMIUM TRIGONOSPORUM** (Marchal) Chivers, Mem. Torrey Botan. Club 14: 166, 1915

*Bommerella trigonospora* Marchal, Bull. Soc. Roy. Bot. Belgique 24: 1. 1885

Plate 11, Figs. 6–8

Perithecia ostiolate, globose to subglobose to somewhat elongated, 240–350 x 155–270$\mu$, black, seated on mats of hyphae which are olive-yellow to olive brown, at maturity producing long, slender, straight or curved, black spore columns. Terminal hairs straight, unbranched, dark rich olive, regularly septate except near the tips, smooth or only slightly and obscurely roughened, at base about 4.6$\mu$ in diameter at tip pale yellow or colorless, without septa. Lateral hairs rather numerous, comparatively short, spine-like, tapering, below dark olive-brown, minutely roughened, conspicuously and evenly septate, smooth, colorless near tip. Asci narrowly and irregularly club-shaped, 8-spored, 50 x 8$\mu$ pars sporif. 32$\mu$. Ascospores greenish when young and filled with highly refractive globules, when mature rich olive-yellow to dark olive-brown, in face view irregularly triangular, 8–9.9 x 4.5–6.5$\mu$, when seen edgewise nearly oval. 3–6$\mu$ broad.

Type locality: In heath near Aerschot, Belgium.

Habitat: On dung of hare; on rabbit dung.

Distribution: Belgium, North Carolina.

Specimens are deposited in the Farlow Herbarium (Chivers). Specimens are deposited in the U.S. National Herbarium, Washington, D.C.

From rabbit dung, North Carolina. Herb R. Thaxter (Chivers No. 6).

Specimens were obtained from the Centraalbureau Voor Schimmelculture, Baarn, Netherlands, from which drawings were prepared.

**81. CHAETOMIUM TRILATERALE** Chivers, Proc. Am. Acad. 48: 87, 1912

Plate 25, Figs. 13–18

Perithecia globose or ovate with a bluntly pointed base, 95–110 x 90–100$\mu$, translucent when young becoming opaque with age, without cirrhi or differentiated rhizoids, and having a simple, wide ostiole. Terminal hairs stouter and more darkly colored than the lateral ones, dark olive-yellow fading above, minutely roughened, lower portion about 4$\mu$ in diameter, plainly septate, strongly curved, at tips 1–3 spirally convolute, coils of diminishing diameter. Lateral hairs numerous, graceful, rather long, regularly and distinctly septate, golden yellow at base, minutely roughened and about 2.5–3.3$\mu$ in diameter, near the tips, smooth and 1–3 spirally convolute. Asci club-shaped, 8-spored, 50 x 9.5$\mu$, pars sporif. 25$\mu$. Ascospores when young hyaline with obscure globules, when mature rich olive-yellow to olive-brown, having the shape of a section of an orange, slightly apiculate at both ends, 8.5–9.5 x 5.6$\mu$.

Type locality: New England (Chivers No. 2).

Habitat: On paper, and from various animal dung.

Distribution: New England, Virginia, Tennessee, Belgian Congo, Japan.

Type in the Farlow Herbarium, Cambridge, Mass. Specimens of Chivers collection at Herbarium, Cornell.

Specimens are deposited in the U.S. National Herbarium, Washington, D.C.

I have isolated this species from various kind of animal dung and plant debris from New England, Virginia and Tennessee.

**82. CHAETOMIUM TURGIDOPILOSUM** Ames, Mycologia 41: 639, 1949

Plate 25, Figs. 24–28

Perithecia ostiolate, ovoid, to globose, 120–140 x 105–135$\mu$, provided with conspicuous cirrhi, attached to the substratum with delicate rhizoids. Terminal hairs dark colored, fading with age to a light gray-brown color, rigid, distinctly septate, smooth, 7–7.5$\mu$ at inflated middle portion, narrower at base, arcuate with incurved or once-curved, blunt tips. Lateral hairs distinctly septate, smooth, light-colored, narrow, about 3$\mu$ in diameter at base, straight below irregularly flexed above with long, pointed, hyaline tips. Asci clavate, 8-spored, 20–22 x 9.5–11.5$\mu$, pars sporif. 15$\mu$. Ascospores when mature are dark olive-brown, ovoid, lemon-shaped, slightly umbonate or somewhat apiculate at both ends, 7.5–10.5 x 5–6.5$\mu$.

Type locality: Pacific area—exact area not known.

Habitat: Isolated from a storage tent (G. W. Martin).

Distribution: Known only from the type material.

Type deposited at the Farlow Herbarium, Cambridge, Mass.

Specimens also deposited in the U.S. National Herbarium, Washington, D.C.

This species is easily recognized by the distinctively inflated terminal hairs which are reflexed at their tips. *C. turgidopilosum* was isolated from the top of a storage tent by Dr. G. W. Martin and sent to the writer under the designation J–730 APO 929 (A–1ff).

**83. CHAETOMIUM VENEZUELENSE** sp. nov.

Plate 25, Figs. 1–7

Peritheciis ostiolatis, subglobosis, 150–200 x 120–165$\mu$, ad substratum cum rhizoideis tenellis affixis; in agar-agar medio pigmentium perpurpureum producentibus; maturis et siccis pillis terminalibus explicantibus ad rosam similibus. Pilis terminalibus immaturis simplicibus, septatis, arcuatis, apicibus retusis, 120–135$\mu$ longo, 3.5–4$\mu$ latis, basi bulbosis, cum crystallis colaratis affixis; maturis pilis terminalibus ramosis, nodolos septatos ramos producentibus qui facile comminuent. Pilos lateralibus septatis, rectis, simplicibus, spiculiformibus, diametro 2–3$\mu$ basi, apici gradatim attenuatis. Ascis clavatis, octosporis. Ascosporis ovatis vel lemoniiformibus, subapiculatis, pallide brunneis, 7.5–9 x 3.75–4.8$\mu$.

Perithecia subglobose, ostiolate, 150–200 x 120–165$\mu$, lightly attached to the substratum with delicate rhizoids. The mycelium secretes pigment causing a dark-purplish tinge to the agar-agar substratum. To the naked eye the entire organism appears tangerine in color; often pinkish liquid drops are formed when grown in pure culture. When mature and drying the terminal hairs often spread out from the center like the opening of a rose blossom, the center is darkened with a mass of ascospores. Terminal hairs when young are unbranched, septate, arcuate, blunt at the tips, about 120–135$\mu$ long, 3.5–4$\mu$ wide near the base, swollen at the base, slightly roughened, encrusted with colored crystals; the ends of the hairs in age becoming branched with gnarled irregular, septate branches which become numerous, interlace and fragment very easily. Lateral hairs straight, septate, finely roughened arising at an acute angle, tapering from the base to a narrow apex, typically unbranched, 2–3$\mu$ wide at base. Asci club-shaped, 8-spored, usually deliquescing before the ascospores mature. Ascospores ovate or lemon-shaped, sub-apiculate at both ends, light brown in color 7.5–9 x 3.75–4.8$\mu$.

Type locality: Venezuela.

Habitat: On soil and vegetable detritus.

Distribution: Known only from type locality. Type deposited in the U.S. National Herbarium, Washington, D.C.

This species was isolated from a mixture of soil and vegetable detritus which was sent to me by Dr. Julian H. Miller, 1958.

**84. CHAETOMIUM VIRGECEPHALUM** sp. nov.

Plate 2, Figs. 8–12

Peritheciis ostiolatis, nigris, subglobosis vel doliformibus, 375–500 x 300–380$\mu$, ad substratum cum rhizoideis nigris affixis. Pilis terminalibus generium duorum: (a) longis, rigidis, dichotomoramosis, diametro 7.5–10$\mu$ basi, apice retusis; (b) gracilioribus sed rigidis, nigris, irregulater ramosis, dichotomoramosis vel aspectum virgularum habentibus. Pilis lateralibus nigris, gracilibus, spiculiformibus, diametro 2–3.5$\mu$ basi, apice gradatim attenuatis. Asci calvatis, octosporis, 60 x 15$\mu$, pars sporif. 28$\mu$. Ascosporis maturis ovatis vel limoniiformibus, non apiculatis, 8–11 x 5–7.6$\mu$.

Perithecia black, large, subglobose to barrel-shaped, 375–500 x 300–380$\mu$, attached to the substratum with strong, black rhizoids. Terminal hairs of two types: (a) stiff, black dichotomously branched, at base 7.5–10$\mu$ in diameter, tips of terminal branches narrow-blunt; (b) more slender but stiff, black, irregularly branched, a mixture of dichotomous and irregular

branches giving the head a twiggy, brambly appearance. Lateral hairs black, slender, spine-like, unbranched except a few near the ostiole, at base 2–3$\mu$ in diameter, narrowing to sharp tips. Asci club-shaped, 8-spored 60 x 15$\mu$, pars sporif. 28$\mu$, ascospores oval to lemon-shaped, not apiculated, 8–11 x 5–7.6$\mu$.

Type locality: Aptos, Calif.

Habitat: On decomposing leaves.

Distribution: Known only from type locality.

Type deposited in the U.S. National Herbarium, Washington, D.C.

**85. CHAETOMIUM VIRGINICUM** sp. nov.

Plate 5, Figs. 5–9

Peritheciis ostiolatis, maturis brunneis, globosis, diametro ad 240$\mu$, ad substratum cum rhizoideis tenellis affixis. Pilis terminalibus et lateralibus similibus; pilis maturis perbrunneis, copiosis, densis, intricatis, irregulariter vel dichotomo ramosis, non constanter, nunc angustatis nunc inflatis, basi sub-ampulliformibus, tortuosis, minute gransuloso-incrustatis, 2–4$\mu$ latis, ramis saepe anastomosantibus, apicibus hyaline. Asci longis, cylindricis, octosporis, 70 x 10$\mu$, pars sporif. 45$\mu$. Ascosporis maturis unistichis dispositis, fusco-olivaceis vel pallidebrunneis, amygdaliformibus, 8–11.3$\mu$ raro ad 28 x 10$\mu$.

Perithecia when mature a rich brown color, globose, to 240$\mu$ in diameter, attached to the substratum with undifferentiated rhizoids. The terminal hairs cover the entire perithecium giving it the appearance of a tumbleweed in miniature. Terminal and lateral hairs are similar and indistinguishable, dense, intricate, irregularly branched or suggestive of dichotomous branching, at base sub-bulbous, through their length are intermittently constricted and inflated, some places round, other places flattened, minutely granular, 2–4$\mu$ wide, often anastomosing to form a loose network. Asci long, cylindrical, 8-spored, 70 x 10$\mu$, pars sporif. 45$\mu$. Ascospores unistichous, light yellow-brown to pale brown, almond-shaped, 8–11.3$\mu$, rarely forms giant spores to 28 x 10$\mu$. A thermophile.

Type locality. White Marsh, Va.

Habitat: On decomposing leaves.

Distribution: Known only from type locality.

Type deposited in the U.S. National Herbarium, Washington, D.C.

This species was isolated from litter collected under very old trees at White Marsh, an old plantation about twenty miles north of Old Point Comfort, Va., 1960.

## ADDENDA

*Chaetomium fusisporum* Smith

Smith, G. Transactions British Mycological Society, *44:* 46, pt. 4f. 7–10, 1961.

*Chaetomium hyderabadense* Salam & Musrath

Salam and Musrath, Indian Bot. Soc. *38:* (4) 543, fig. 1. 1959.

*Chaetomium kurssanovianum* Beliakova

Beliakova, Muskov. Obsch. Isp. Priorody B. Oted. Biol. *59:* 85, fig. 1. 1954.

*Chaetomium lusitanicum* Gomes

Gomes, M. Estud. and Inform. Dir. Ger. Serv. Florest & Aquicol. Portugal No. *18:* p. 3, 19 fig. 1953.

*Chaetomium pampanini* Ciferri

Ciferri, Bull. Soc. Bot. Italy *1923:* 98, 1923.

*Chaetomium piluliferum* Daniels

Daniels, J. transactions British Mycological Society *44:* 84, 1961.

*Chaetomium prasinum* (Berk. & Curt.) Hughes

Hughes, S. J. Canad. Jour. Bot. *36:* (6) : 746, 1958.

*Chaetomium rufum* Ramakrishnan

Ramarkrishnan R., Proc. Indian Acad. Sci. B. *38:* 118, fig. 1. A–E, 1953.

*Chaetomium sub-globosum* Sergejeva

Sergejeva, K. S. Bot. Mater. Inst. Bot. Acad. Urss, *13:* 172, 1960.

*Chaetomium sub-spirilliferum* Sergejeva

Sergejeva, K. S. Bot. Mater. Inst. Bot. Acad. Sci. URSS, *13:* p. 174, 1960.

*Chaetomium tenuissimum* Sergejeva

Sergejeva, K. S. Bot. Mater. Inst. Bot. Acad. Sci. URSS, *13:* 169, 1960.

The above species were either overlooked or for some other reason not obtained in time to be included in the text.

## SPECIES EXCLUDENDA

A number of names exist for species of *Chaetomium* in publications and in notes with exsiccati, the use of which should be discontinued. In some cases the description of certain species clearly indicates that they are not chaetomiums. In other cases the names used were unaccompanied by a description or by one so brief and incomplete that a conclusion regarding the identity may not be reached with certainty. However it is quite conceivable that specimens may come to hand, the taxonomic characteristics of which may complement and make clear previously incomplete descriptions; with this possibility some species now excluded may be recognized.

Recognition of a specimen, at least in part, may be illustrated with one described by Massee & Salmon in 1902 under the name *Chaetomium arachnioides*. The spore type and general characteristics strongly suggest it to be one of the organisms now included in the *Chaetomiaceae* in the genus *Lophotrichus* Benj. the ascopores of which are honey-yellow as described. The following names of organisms are considered, as far as possible, in historical sequence.

Ehrenberg (33 p. 15) 1818, described as new *C. gelatinosum* which was thought, by Zopf (132 p. 204), to be an undeveloped condition of either some other *Chaetomium* or a *Myxotrichum*; Saccardo (90) places it among his doubtful species. The original description, unaccompanied with illustrations, contains only a few general statements which are inadequate for identification.

In 1829 Fries (43) described *C. pusillum* as new; this organism was non-ostiolate and therefore does not belong in the genus *Chaetomium*. The minute, spherical cleistothecium was opaque, covered with very short, stiff, bristle-like hairs, and produced spores which are at least one-septate. Other names for the same organism are the following:

*Acanthostigma Chaetomium* Auersw. in Synopsis Pyrenomycetum europearum: Gonnerman & Rabenhorst, Mycologia Europaea 5–6, 1869; *Caelosphaeria exilis* (Alb. & Schw.) Sacc. (90); *Niesslia Chaetomium* (Cda.) Auersw. (5); *Niesslia exilis* (Alb. & Schw.) Winter (128); *Niesslia pusilla* (Fries) Schroeter (101); *Nitschkia exilis* (Alb. & Schw.) Fuckl. (47 p. 165); *Peziza aterima* Lasch; *Sphaeria Chaetomium* Cda. (26); *Sphaeria exilis* Alb. & Schw. (1 p. 44); *Sphaeria exosporioides* Desm. (31 No. 126); *Venturia chaetomium* (Cda.) Ces. & De Not. (17). Authentic specimens of *C. pusillum*—distributed by Fries in the Schleromyceti Sueciae XXVIII No. 272—consist of small, black, naked pustules, not in the least resembling *chaetomia*, scattered over the surface of pine needles. Specimens under the same name and with similar characteristics have been distributed by Rehm in Ascomyceten No. 1762.

Eight species published by Wallroth, 1833, in the Flora Cryptogamia (130) are here excluded because of incomplete descriptions, or because species other

than *chaetomia* are indicated. Wallroth's species are the following: *Chaetomium alchemillae; C. circinans; C. coccodes; C. depressum; C. epiphyllum; C. oxysporium; C. potentillae; and C. strigosum.*

The description of *C. alchemillae* Wallr. (130 p. 873) is brief and incomplete, leaving one in doubt of its identity but suggesting that it might be a *Venturia* which was so recorded by Saccardo (90, 91) as *Venturia Alchemillae* (Grev.) B. & Br.; other authors have listed it under the following names: *Asteroma Alchemillae* Grev. (42, 50a); *Coleroa Alchemillae* (Grev.) Wint. (128 p. 199); *Dothidea Alchemillae* Rabh.; *Dothidia ceramioides* Duby (32); *Stigmatea Alchemillae* Fr. (44 p. 423).

*Chaetomium circinans* Wallr. (130 p. 266) is not a *Chaetomium;* this form was given the name *Venturia Kunzei* by Saccardo (86, 90) and by other authors the following names: *Coleroa Chaetomium* Rabh. (82, No. 1456); *Dothidia Chaetomium* Kze. (59); *Stigmatea Chaetomium* (Kze.) Fr. (44 p. 422).

From the description of *C. coccodes* by Wallroth (130 p. 265) it is not possible to arrive at an understanding of the species. Zopf (132 p. 205) stated that it probably represents a *Chaetomium*, and suggests that it might be a slightly developed stage of *C. crispatum* Fuckel.

The original description of *C. depressum* Wallr. (130 p. 266) is hardly that of a *Chaetomium*, but that of an *Excipula*, since the perithecia are described as depressed-globose, sometimes oval, rough at the base, from which arise short, rigid, black hairs, exposing at the apex a disc of sporophores.

The name *C. epiphyllum* Kze. appeared among the species of Wallroth (130 p. 265) with a note rather than a description. The name was referred by Kunze to specimens which he sent in a letter to Wallroth; specimens of which were distributed in Klotzsch, Herb. Myc. No. 1347 consisting of very small, black, smooth pustules.

*C. oxysporium* Wallr. (130 p. 242) is mentioned by Wallroth for an organism which he had previously called *Fusarium Chaetomium*, but did not publish.

In the description of *C. potentillae* Wallr. (130 p. 266), the perithecia are described as minute, black, with short rigid hairs; this is not complete enough to indicate a true *Chaetomium*. Saccardo (90 p. 594) has listed this under the name *Venturia potentillae* (Fr.) Cke. (23). Other authors have placed it under the following names: *Coleroa potentillae* (Fr.) Wint. (128 p. 199); *Dothidea potentillae* Fr. (44 p. 563); *Stigmatea potentillae* Fr. (42 p. 422).

The vague, incomplete description of *C. strigosum* Wallr. (130 p. 265) is insufficient for identification. This has been called *Ceuthospora phaeocomes* by Rabenhorst (No. 1309).

In 1834 the name *C. Typhae* was added by Schweinitz (102 p. 265) accompanied by a short note. No specimens of the type could be found on stalks of *Typha* at the Curtis herbarium deposited at the Farlow herbarium, Harvard University. The imcomplete description and the lack of type specimens is the basis for discontinuing the use of this name or that of *C. typhianum*, which was later used by Schweinitz (102 p. 310).

Two supposedly new species of *Chaetomium* were published by Léveillé (61) in 1845, under the names *C. cumingii*, found by him on decaying leaves near Manila, and *C. viride*, on fallen grass in Paraguay. The descriptions are so meager and incomplete that their true characteristics cannot be understood.

A four-spored species, *C. hispidum* Fries (44 p. 405) 1849, is so briefly and generally described that its identity cannot be determined. It was described as having a hemispherical perithecium, but no measurements of structures are given. The fact that its asci contained four ascospores is not a character that would exclude it from the genus as presently understood, the name is excluded because the species as described cannot be determined.

The species which Bonorden (13) in 1851 described as a *Chaetomium*, under the name *C. ciliatum*, obviously belonged to some other genus, since the ascospores are cylindrical, and their ends are provided with delicate cilia, characters not associated with *Chaetomium*.

A study of *C. Braunii* Rabh. in Klotzsch Herb., Myc No. 1554, shows that the fruiting bodies originate below and push through the host epidermis; the fruiting bodies are black and coriaceous, covered with short, black, spine-like hairs, the general characteristics are foreign to *Chaetomium*.

Three species, *C. concinnatum*, *C. tomentosum* and *C. signatum* were described only in very general terms by Preuss (80), these species were without measurements or illustrations. The apparent similarity of *C. tomentosum* Preuss, with *C. pannosum* Wallr. was suggested by Rabenhorst, in Linnaea (24 p. 144), who stated that in his specimens the hairs are soft, not rigid; Rabenhorst's species of *C. tomentosum* in Klotzsch Herb. Myc No. 1856, is *C. murorum* Cda. No reference has been made by other authors concerning the reappearance of these forms and until they can be verified the use of these names should be discontinued.

A new species of *Chaetomium* was published under the name *C. nivale* by Strauss (113), in 1853, and in

1856 Montagne (70) added the name *C. raripilum*. The description and figures which Strauss published gave evidence that the fungus he described was not a *Chaetomium* but belonged in a different genus. The same species was placed by Saccardo (91, p 855) under the name *Acanthostigma nivale* (Str.). It is also evident that the fungus described by Montagne belonged in a genus other than *Chaetomium;* it was placed by Saccardo Vol. III, (p 322), under the name *Chaetomella raripila* (Mont).

*Chaetomium fimeti,* described and published by Fuckel (45 p. 491) was later described and figured by Zopf (132 p. 280) 1881, under the name *Chaetomidium fimeti,* and in 1910 this non-ostiolate fungus was again redescribed and figured by Bainier (6) under the same name.

In 1866 *C. paucisetum* was described by Fuckel (46) as globose, non-ostiolate, black, firmly adnate to the surface of the substratum, naked or bearing only a few short, slender, scattered spine-like hairs. The description indicates that it belongs to a genus other than *Chaetomium.* Type specimens are to be found in Fung. Rhenani No. 1572. In Die Pilze Deutschlands (128 p. 65) this form is given the name *Chaetomella atra* (Fuckel).

In 1873 Berkeley & Broome (11) described as new *Chaetomium globosum* and *C. rufulum.* The descriptions and figures convince one that neither species belongs to the genus *Chaetomium.* The former has been described as *Orbicula perichaenoides* by Cooke (24) and by Saccardo as *Anixia perichaenoides* (90 p. 35).

In 1878 Saccardo (87) described the species *C. calvescens,* but later, in 1882, it was listed by him (90 p. 227) under "Species Desciscentes." Chivers prepared slides from type specimens, which he received from Dr. Saccardo, on the basis of which he was unable to identfy the specimens with any degree of accuracy. Chivers excluded it from *Chaetomium* on the basis of the honey-yellow wascospores. The asospore color now suggests its affinity to the genus *Lophotrichus* Benj.

Karsten (54) in 1881 contributed the name *C. fimisedum,* a species which produced many spores in the ascus; on the basis of multi-spored asci the species is excluded from *Chaetomium* which does not exceed eight spores per ascus.

The name *C. Polypori* Rehm (8) 1882, is excluded, as the description does not indicate a *Chaetomium.*

Roumeguère and Patouillard, in Rev. Myc. (5: 29), gave the name *Therryana* to a variety of *C. atrum* Link. The descriptions and illustrations show that it has no resemblance to *C. atrum,* but is identical to *Chaetomidium fimeti* (Fuckel) Zopf.

To a fungus in Fung. Gall. No. 4438 Roumerguère in 1888 gave the name *C. globosum* Kze., *f. chartarum.* Specimens examined shows it to be identical with *Chaetomidium fimeti* (Fuckel) Zopf.

Under the name *C. Montemartinii* Cavara (16) described a fungus the perithecium of which was globose with a long ostiolate neck. The honey-yellow ascospores and general characteristics now suggest its affinity to the genus *Lophotrichus* Benj.

In 1894 Ellis and Everhart (39) described *C. pallidum* and Lindau described *C. marchicum,* the characteristics of both species suggest a *Melanospora. C. marchicum* was given the name *Sphaeroderma marchicum* by Saccardo (94 p. 627). Again the general characteristics of these species suggest affinity to *Lophotrichus* Benj.

*Chaetomium abietinum* was described as new by Ellis and Everhart (41) in 1898, and Hennings (52 pp. 153, 154) described two species as new, using the names *C. importatum* and *C. laeliicola.*

In *C. abietinum* the perithecia are black, opaque, somewhat coriaceous, firmly fixed to the substratum and lacking an ostiole, densely covered overall with short, stout, spine-like hairs which are not characters of *Chaetomium.*

In Hennings' species *C. importatum* appears as dark brown or black, irregular pustule with an occasional stiff bristle near the margin of the pustule. There is little if any resemblance of this species to a *Chaetomium. C. laeliicola,* referred to by Saccardo (96 p. 429) as *C. laeliicolum,* consists of irregular pustules which originate below and push through the host's epidermis.

In 1900 Cocconi (20) gave the name *C. papillosum* to a fungus which he described and figured as having a small globose perithecium, perforated at the apex with an ostiole, and with hairs extending in all directions. The asci were cylindrical, the ascospores arranged in a single row. Experiments reported by Cocconi were to the effect that a pycnidial stage developed which produced two-celled spores, and formed branched conidiophores, bearing spores in a clump at the tips of the branches.

*C. subnudum* B. & C., found in the Curtis herbarium under No. 5978, consists of fruiting bodies which are pustular and sunken in the host tissue, are black and round or elongated. The spores are dark and one-septate, a character not that of a *Chaetomium.*

Slides prepared from type material of *C. fiscicolum* Petrak, No. 1101 in the Mycological herbarium, Agri-

culture Research Center, Beltsville, Md., shows ascospores with fragments of a gelatinous coating and perithecia characteristic of a species of *Sordaria* and not that of a *Chaetomium*.

### *UNCERTAIN SPECIES*

*Chaetomium discolor* Starback (111)
*Chaetomium Douglassii* Schweinitz (102)
*Chaetomium Fieberi* var *macropoda* Spegazzini (110)
*Chaetomium humanum* Karsten (55)
*Chaetomium lanatum* Quélet (81)
*Chaetomium microsporum* Spegazzini (109)
*Chaetomium rostratum* Spegazzini (110)
*Chaetomium stercoreum* Spegazzini (108)
*Chaetomium varium* Delacroix (30)

## REFERENCES TO ILLUSTRATIONS OF THE *CHAETOMIACEAE*.

Reference is made to representative drawings and photographs of the species of *Chaetomium*, *Ascotricha* and *Lophotrichus* by authors other than the writer.

Bainier, M. G. (6) Plates X–XXVI
Batista, A. C. et Pontual, D. (7) Fig. 1–21
Benjamin, R. K. (8a) Fig. 1–33
Chivers, A. H. (19) Plates 6–17
Corda (26) I: Pl. 7. f. 293, B pl. 13, f. 103
Hughes, S. J. (53) Fig. 1, A–F
Krzem. et Badura (57) Plate III, fig. 1–3
Omvik, A. (74) Fig. 1–5
Sergejeva, K. S. (103) Vol 10; fig. 1–2; vol II, fig. 1–4
Skolko, A. J. et Groves, J. W. (104) Plates I–VII
Skolko, A. J. et Groves, J. W. (105) Plates I–VIII
Saccardo, Sylloge Fungorum, Index Iconium Fungorum, XIX, pp. 262–265
Tschudy, R. H. (119) Fig. 1–15; Photographs 1–18
Udagawa, S. (121) Fig. 1–24; Plates III and IV

## LOCATION OF CLASSICAL FUNGUS COLLECTIONS IN EUROPEAN HERBARIA.

Collections of:

| | |
|---|---|
| Corda | : in Prague; Kew. |
| Ehrenberg | : in Berlin; Leyden; Strasbourg, Upsala. |
| Fries | : in Upsala; Berlin. |
| Fuckel | : in Geneva. |
| Karsten | : in Helsinki. |
| Kunze & Schmidt | : in Berlin; Leyden; Strausbourg; Upsala. |
| Nees, C. G. | : in Strasbourg; Leyden; Upsala. |

Collections of—Continued

| | |
|---|---|
| Persoon | : in Leyden; Strasbourg; Berlin. |
| Saccardo | : in Padova. |
| Wallroth | : in Strasbourg; Berlin; Prague. |

## THE GENUS ASCOTRICHA

The genus *Ascotricha* was first described by J. M. Berkeley in the Annuals of Natural History (5. p. 257). The characteristics were described as follows: "Peridium thin, at length bursting, clothed with dark, subpellucid, even, obscurely jointed hairs. Sporidia simple, contained in linear asci. Superficial, at length free or only supported by the investing thallus; black." The description of the genus was accompanied by a detailed description of a single species, *A. chartarum* with illustrations. A second species was described by Ellis in 1890, in the Proceedings of the Academy of Natural Sciences of Philadelphia, page 220, under the name *Chaetomium pusillum*.

In the Handbook of British Fungi, (2: 653) 1871, Cooke defined the organism as follows: "perithecium thin, free, mouthless, seated on loose, branched, conidiophorous threads; sporangia linear, containing dark elliptical sporidia." The spherical or flask-shaped perithecia, almost naked below and constricted at the top into a neck from which the terminal hairs arise around the ostiole, with stiff jointed, ampullate hairs, and the mycelium bearing numerous conidia, afford a sufficient basis for separating these forms from the genus *Chaetomium*.

*Ascotricha* Berk., Ann. Nat. Hist. 1: 257, 1838

Perithecia superficial, subglobose or spherical below or nearly so, constricted above into a narrow and distinct neck perforated by a central channel terminating in an ostiole, when young dark green and translucent, membranaceous, darkening and becoming brittle with age. Perithecia ornamented with hairs which are distinguised by the presence of ampullae, hairs usually dark-colored and branched sympodially, varying in number, sometimes numerous, but at times almost wanting. Mycelium consisting of sparsely or densely branching fungus threads radiating in a network from the point of origin. The fungus hyphae are predominately colored, usually greenish, frequently producing dark branches which are ampullate and bearing copious quantities of conidia. Asci linear, cylindrical, 8-spored. Ascospores arranged in a single row in the ascus, simple, single-celled, dark colored, discharged from the ostiole in a cylindrical cirrhus. Type species, *Asotricha chartarum* Berkeley.

## KEY TO THE SPECIES OF ASCOTRICHA

| | |
|---|---|
| Perithecial hairs slender | |
| Ascospores 5.5 x 4μ | *A. pusilla* |
| Ascospores 10.5 x 6.5μ | *A. xylina* |
| Perithecial hairs stout | |
| Ascospores disc-shaped | |
| Conidia roughened, warty | *A. chartarum* |
| Conidia smooth | *A. Congoensis* |
| Ascopores egg-shaped, compressed | |
| Terminal hairs arborescent | *A. guamensis* |
| Terminal hairs arcuate | *A. arcuata* |

**1. ASCOTRICHA ARCUATA** sp. nov.

Plate 29, Figs. 1–9

Peritheciis ostiolatis nigris, in magnitudine mediis, globosis vel subglobosis basi, 95–135 x 100–125μ, cum collo conspicuo circa 25–33μ alto et 30–42μ lato, frequenter cirrhis provisis, crasso papilliformi. Pilis terminalibus nigris e collo ortis, basi circa 6.5μ diametro, robustis, atris, non-septatis vel perobscure septatis, perarcuatis, in apice angusto terminatis. Pilis lateralibus atris, 1–4 geniculatis, ampullatis, in numero paucis, circa 4–5μ diametro basi, saepe, in apice angusto terminatis vel in ampulla. Ascis longis, cylindricis, octosporis, circa 72 x 7.5μ. Ascosporis maturis perbrunneis vel nigris, 13–16.3 x 7.3–12.8μ, ovatis vel subovatis, concavis a latere visis, antustes, 5.5–7.5μ. Conidiis lenibus, in forma pirum 8.5–10.1 x 6.5–7μ.

Perithecia ostiolate, black, medium in size, globose or subglobose at the base, 95–135 x 100–125μ, with a distinct neck at the apex, 25–33μ tall, and 30–42μ wide, extruding spores into the coarse, arcuate, branched terminal hairs as a black mass, loosely affixed to the substratum among conidiophores bearing abundant quantities of conidia. Terminal hairs black, 1–3 branched and arcuate, stiff, arising from the region of the neck, ampullate, non-septate or rarely and obscurely so, about 6.5μ in diameter at the base, terminating in a medium narrow, rounded tip. Lateral hairs black, 1–4 jointed, ampullate, generally curving downward, few in number, about 4–5μ in diameter at the base, often terminating in a medium narrow, rounded tip or an ampullae. Asci delicate, linear, cylindrical, 8-spored, about 72μ long by 7.5μ in width. Ascospores monostichous, when mature very dark olive-brown, or appearing black, 13–16.3 x 7.3–12.8μ, ovate or roughly egg-shaped, rounded at the ends, when seen edgewise, compressed, 5.5–7.5μ. Conidia smooth, general outline pear-shaped, 8.5–10.1 x 6.5–7μ.

Type location: Fort Belvoir, Va.

Habitat: From tap water; on decaying vegetation.

Distribution: Known only from type locality.

Type deposited in the U.S. National Herbarium, Washington, D.C.

**2. ASCOTRICHA CHARTARUM** Berkeley, Ann. Nat. Hist. 1: 257, 1838.

*Ascotricha Zopfii* (Boul.) Peyronel, Ann. Myc. *12:* 459–470, f. 1–3, 1914.

*Chaetomium Berkeleyi* Schroeter; Cohn, Krypt.-Fl. Schleisien: *3:* 284, 1894.

*Chaetomium chartarum* Winter, Rabenhorst's Kryptogamen—Flora I. *2:* 157, f. 4–7, 1885. Not *Chaetomium chartarum* Ehrenberg, Sylv. Berol 27, 1818.

*Chaetomium delicatulum* Roumeguère, Rev. Myc. *7:* 22, 1885.

*Chaetomium sphaerospermum* Cooke & Ellis, Grevillea *8:* 16, 1879.

*Chaetomium Zopfii* Boulanger, Rev. Gén. Bot. *9:* 25, pl. 1–3, 1897.

*Dicyma ampullifera* Boulanger, Rev. Gén. *9:* 17, pl. 1–3, 1897.

*Sporotrichum* sp. Boulanger, Rev. Gén. *9:* 17, pl. 2, 1897.

Plate 27, Figs. 1–6

Black. Perithecia ostiolate, small, globose or subglobose, constricted into a neck at the upper extremity, frequently flattened at the base, 192μ tall x 198μ broad (126–232 x 135–236), discharging black spore cirrhi many times longer than the perithecium, rhizoids not differentiated, but seated among and upon the mat of hyphae and branches of the abundant conidiophores. Terminal hairs extremely variable in length, straight, stiff, dark olive-brown to black except at the ampullae and extreme tips, remotely septate, frequently with an angular swelling at the septum, profusely and sympodially branched, each individual axis producing one or two lateral branches beyond the point of origin of which the axis terminates in a somewhat swollen, club-shaped colorless ampulla. Lateral hairs rather numerous, very variable in length but nearly always short, tapering near the tips only, branched and ampullate as are the terminal hairs, very dark olive-brown to black below, about 3.2μ in diameter near the base, colorless and frequently septate near their tips. Asci linear, cylindrical, 8-spored, 65 x 11μ, pars sporif. 45μ. Ascospores monostichous, when young pale olive with a greenish tinge, when mature dark olive-brown to black, regularly or irregularly circular in face view, lenticular, with girdle apparent when seen edgewise, 8.1 x 7.7μ (7.2–9 x 7.2–8.1) when seen edgewise 4.5–5.4μ broad.

Type locality: King's Cliffe, England.

Habitat: On a candle box; on paper, wood, and cardboard.

Distribution: Cambridge, Mass. (Herb. R. Thaxter); on barrel bottoms in New England (Chivers No. 40); reported also from Germany and South America.

Exsiccati—Fung. Europ. Edit. nova, Series II, XXV, 2472; Micro-Fung. Brit. IV, 343, 355 and V, 474; Myc. Ital. I, 63; Myc. March. 69, *Sub. C. delicatulum* Roum.; Fung. Gall. XXXII, 3143.

Observed on cardboard, Cambridge, Massachusetts, Herbarium R. Thaxter, and Chivers No. 40. The writer has maintained this species in pure culture for more than two years.

Type locality: King's Cliffe, England; on a candle box.

This species was first observed in America by Ellis, and described as *C. sphaerospermum* by Cooke. It has repeatedly been redescribed under a variety of names, as indicated in the above synonomy, in spite of having been clearly characterized previously.

Conidial growth develops extensively preceeding perithecial development. The conidiophores appear greenish-gray when young becoming black at maturity, as observed by the unaided eye. Under magnification they are dark olive-brown to black near the base, about 5$\mu$ in diameter, clearly but irregularly septate, sympodially branched, each axis producing a single branch, or forking and producing two symmetrical branches, in the axis is formed a colorless, clavate ampulla. On the peripheral branches may arise an irregular whorl, from which arise clusters of conidia which are roughly spherical, ovate or egg-shaped, roughened by minute warts, hyaline when young and light olive-brown or olive-yellow when mature, 6.1–5.0$\mu$ (5.4–7.2 x 3.6–5.9).

Of the four species thus far described and having stout perithecial hairs *A. chartarum* can be easily distinguished from *A. congoense* because of the former's roughened conidia as compared with the smooth conidia of the latter; from *A. guamensis* and *A. arcuata* by their compressed ascospores as compared with the lenticular ascospores of *A. chartarum*. Specimen deposited in the U.S. National Herbarium, Washington, D.C.

**3. ASCOTRICHA CONGOENSIS** sp. nov.

Plate 29, Figs. 20–27

Peritheciis ostiolatis, magnitudine mediis vel parvis globosis vel subglobosis basi, 95–115 x 85–115$\mu$, cum collo distincto, circa 40–50 x 55–65 $\mu$. Pilis terminalibus robustis, nigris, e collo ortis, basi circa 6–7.5$\mu$ diametro, atris, non-septatis vel perobscure septatis, interdum ramosis, apicibus retusis. Pilis lateralibus in numero paucis, robustis, nigris, non-septatis vel perobscure septatis, circa 3.7–4.7$\mu$ diametro basi, apicibus retusis. Ascis longis, cylindricis, octosporis, circa 65 x 7.5$\mu$. Ascosporis, monostichis, maturis brunneis visis a fronte irregulariter ovatis, a latere lenticularibus cum cinctura, octosporis, 11.0–12.6 x 7–7.5$\mu$.

Perithecia ostiolate, black, medium to small, globose to subglobose, base 95–115 x 80–115$\mu$, with a distinct neck about 40–50 x 55–65$\mu$. Terminal hairs stout, black, arising from the region of the neck, long, simply or compositely branches, ampullate, non-septate or very obscurely septate, about 6–7.5$\mu$ in diameter at the base, gradually tapering to a blunt tip. Lateral hairs sparsely scattered over the rounded part of the perithecium, stout, black, non-septate or very obscurely septate, about 3.7–4.7$\mu$ in diameter at the base, gradually tapering to a blunt tip. Asci delicate, linear, cylindrical, 8-spored, about 65 x 7.5$\mu$. Ascospores monostichous, when mature, very dark brown to black, irregularly egg-shaped in face view, lenticular, with a girdle apparent when seen in profile, 11.0–12.6 x 7–7.5$\mu$. Conidia smooth, general outline pear-shaped, 7.5–8 x 5.4–5.7$\mu$.

Type locality: Belgian Congo.

Habitat: Animal dung and vegetable litter.

Distribution: Known only from type locality.

Type deposited in the U.S. National Herbarium, Washington, D.C. This species was isolated from samples of animal dung and litter received from Dr. J. Meyer, (Inst. Carnoy, Louvain, Belgium) which was collected in the Belgian Congo, 1958.

**4. ASCOTRICHA GUAMENSIS** Ames, Mycologia 43: 30, 1951

Plate 28, Figs. 8–15

Black. Perithecia ostiolate, globose to subglobose, constricted to a short, thick neck at the upper extremity, rounded at the base, 80 x 65$\mu$ (75–110 x 60–90), extruding spores into the stiff branched terminal hairs as a black mass or frequently forming cirrhi, loosely affixed to the substratum among conidiophores bearing abundant quantities of conidia. Terminal hairs arising from the region of the neck around the ostiole, averaging about 250–300$\mu$ in length, dark olive-brown to black, stiff, simple or compositely branched, ampullate, obscurely septate, 4.5–6.5$\mu$ in diameter, gradually tapering to a blunt point. Lateral hairs sparsely scattered over the upper rounded portion of the perithecium, stout, obscurely septate, dark olive-brown to black, generally curving inward, about 4–5$\mu$ in diameter, gradually tapering, becoming pale olive at the blunt tips, jointed, ampullate, occasionally branched. Asci delicate, linear, cylindrical, 8-spored, 68 x 8$\mu$. Ascospores monostichous, when mature dark

olive-brown, 8.5–7.5μ (8–10 x 7–9) ovate or roughly egg-shaped, rounded at the ends, when seen edgewise compressed, 4–5μ. Conidia smooth, general outline pear-shaped, 6 x 3–4μ. Portions of the conidiophores greenish when young becoming dark with maturity, some terminal parts hyaline.

Type locality: Guam.

Habitat: Cardboard.

Distribution: Known only from type locality.

Specimens deposited in the U.S. National Herbarium, Washington, D.C.

Isolated from cardboard boxes of photographic film which was stored in an Army warehouse, Guam, Guam No. 3 of White and Yeager.

The species of *Ascotricha* are easily distinguished from those of *Chaetomium* by the ampullate, jointed perithecial hairs and the presence of abundant, conspicuous conidia. Conidial growth precedes the development of the perithecia; the conidia may be round and smooth or roughened, fusiform or pear shaped and borne on simple, sympodially or dichotomously branched conidiophores. The conidiophores, when young, are grayish-green in color or become black at maturity with the exception of many terminal spore-bearing branches which may be light-colored. The perithecia are loosely attached to the substratum or superficially on the vegetative growth. The species of *Ascotricha* are important cellulose destroying fungi.

**5. ASCOTRICHA PUSILLA** (Ellis & Everhart) Chivers, Mem. Torrey Botan. Club, *14:* 220–221, 1915.

*Chaetomium pusillum* Ellis & Everhart, Proc. Acad. Nat. Sci. Phil. *1890:* 220, 1890.

*Chaetomium Ellisianum* Saccardo & Sydow, Syll. Fung. *14.* 491, 1899.

Plate 27, Figs. 7–11

Black. Perithecia ostiolate, small, globose, the body somewhat broader than long, constricted above to form a distinct neck, 151 x 166μ (135–190 x 139–202), extruding long, black cirrhi, rather firmly adnate to the substratum and associated with numerous conidiophores. Terminal hairs arising in the region of the neck, extremely long, slender, whip-like, graceful, smooth and even, with the exception of slight angular swelling and ampulla formation at the septa, flexed and often recurved forming a loop, septate but so dark that the septations are nearly obscured, very dark olive to black, about 5–6μ in diameter at base, almost imperceptically tapering and fading toward the pale olive tip, unbranched except in rare cases. Lateral hairs when present sparsely scattered over the upper portion of the perithecium wall, slender, whip-like, more or less flexed or gracefully recurved to form a loop, tapering almost imperceptibly, evenly remotely but obscurely septate, slightly swollen at the septa, near the base dark olive-brown to black and about 5–6μ in diameter, becoming pale olive at the tips, unbranched except very rarely when the short main axis produces an extremely long, whip-like outgrowth just above the origin of which the axial portion terminates in a club-shaped, hyaline ampulla. Asci extremely delicate, linear, cylindrical, 8-spored, 60 x 6μ pars sporif. 43μ. Ascospores monostichous, hyaline when young, when mature dark olive-brown, ovate, roughly egg-shaped, rounded at both ends, 5.6 x 4.2μ (5.4–6 x 3.5–4.5), when seen edgewise, compressed, 3.2μ broad.

Type locality: As *C. pusillum* E. & E., Newfield, N.J.

Habitat: On Basswood barrel bottom in cellar. Also Manhattan, Kans. on an old churn (Kellerman 1437).

Distribution: New Jersey, Massachusetts, New Hampshire, Maine, Kansas. Original material collected by Ellis at Newfield, New Jersey.

Specimens, Chivers No. 41—Farlow Herb.

Reported on barrels in cellar, Cambridge, Massachusetts, and Kittery Point, Maine (R. Thaxter); on barrel hoops and packing boxes in cellar in Hanover, N. Hamp., and Amesbury, Mass. (Chivers No. 41). Also reported on an old churn in cellar, Manhattan, Kans. (Kellerman 1437).

This species, originally collected by Ellis at Newfield, New Jersey, was described by him as *Chaetomium pusillum*, apparently not realizing that the combination had been used by Fries (43) for a different species at an earlier date. To correct this a new name *C. Ellisianum* was proposed by Saccardo and Sydow. Chivers, in recognizing Berkeley's original name *Ascotricha*, changed the name *C. pusillum* E. & E. to *Ascotricha pusilla* (Ellis & Everhart) Chivers.

One of the outstanding characteristics of the genus *Ascotricha* is the copious production of conidia which precedes the formation of the perithecia. The lower part of the conidiophores when young is grayish-green in color, at maturity black; the upper portion bearing the conidia is much lighter pigmented, branched, and bears large clusters of ovate to globose conidia which are hyaline when young, light olive-brown at maturity, measuring 5.4 x 3.6μ, appearing smooth under moderate magnification but under oil immersion lens the wall surface appearing slightly irregular.

The whip-like terminal hairs distinguish this species from *A. xylina* Ames; all other described species have stout terminal hairs. Drawings were made from Chiver's material at the Farlow Herbarium, Cambridge, Massachusetts.

**6. ASCOTRICHA XYLINA** Ames, Mycologia, 43: 30, 1951

Plate 28, Figs. 1–7

Black. Perithecia ostiolate, globose to subglobose, constricted above to form a short distinct neck, rounded at the base, 110 x 90$\mu$ (80 x 75–100), extruding spores into the slender branched terminal hairs as a black mass or frequently in the form of cirrhi, loosely affixed to the substratum amidst numerous conidiophores bearing copious quantities of conidia. Terminal hairs arising from the region of the neck, adjacent to the ostiole and attaining a length of 650$\mu$ or more, slender, 1.75–2.25$\mu$ in diameter, septate, in mass black, becoming glossy with age, separately dilute black, ampullate, simple or compoundly branched. Lateral hairs sparsely scattered over the perithecium, slender, septate, ampullate, of variable length to 450$\mu$. Asci delicate, linear, cylindrical 8-spored, 17 x 3.5$\mu$. Ascospores monostichous, when mature dark olive-brown 10 x 7.5$\mu$ (8–10.5 x 6.5–8), ovate, roughly egg-shaped, rounded at the ends, when seen edgewise, compressed 4.5–5.25$\mu$. Conidia smooth, general outline pear-shaped, 3.5–4 x 5$\mu$.

Type locality: Manila.

Habitat: On cotton duck.

Distribution: Known only from type locality.

Specimen deposited in the U.S. National Herbarium, Washington, D.C.

Conidiophores partly greenish when young becoming dark with maturity, some terminal parts hyaline. Isolated from cotton duck obtained at Manila, Manila No. 5 of Lawrence White and Charles Yeager.

## CHARACTERS OF THE GENUS LOPHOTRICHUS

Perithecia, when grown in culture media, partly or entirely submerged or sometimes practically superficial, spherical and translucent when young, when mature, globose, with a long or sometimes relatively short neck, dark and opaque, ostiolate. Perithecial wall membranaceous, cellular, delicate, brittle with age, provided with appendages in the form of variously modified hairs. Terminal hairs thick-walled or relatively so, or may be thin and originating from the ostiolar region. Mycelium mostly submerged, rarely superficial. Asci thin-walled, delicate, evanescent, subglobose to broadly clavate and short stalked, 8-spored. Ascospores single-celled, light-colored, lemon-shaped or nearly so, expelled from the ostiole in a mass or long, thin cirrhus.

**LOPHOTRICHUS** Benjamin, Mycologia *41*: 347, 1949

Perithecia submerged or partially superficial, spherical and translucent when young, when mature globose with a long, narrow neck, occasionally with short necks, dark and opaque, tip of neck pierced by an ostiole. Perithecial wall membranaceous, brittle, provided with appendages in the form of variously modified hairs. Mycelium mostly submerged, rarely superficial. Asci thin walled, delicate, subglobose to broadly clavate and short stalked, evanescent, 8-spored. Paraphyses lacking. Ascospores single-celled, light-colored, lemon-shaped, or oval. Type species, *Lophotrichus ampullus* Benjamin.

## KEY TO THE SPECIES OF LOPHOTRICHUS

| | |
|---|---|
| Perithecia with long necks | |
| Terminal hairs of one sort. | *L. ampullus* |
| Terminal hairs of two sorts. | *L. martinii* |
| Perithecia with short necks; terminal hairs unbranched. | *L. brevirostratus* |

**1. LOPHOTRICHUS AMPULLUS** Benjamin, Mycologia. 41: 347, 1949

Plate 30, Figs. 1–6a

Perithecia black, globose, 150–260$\mu$ in diameter, immersed or partially superficial, with dark rhizoid-like mycelia or submerged parts, walls thin, membranaceous, necks usually one, occasionally two and sometimes three on a perithecium, black, 130 to 760$\mu$ long or sometimes longer, more or less uniform in diameter, 40–60$\mu$. Terminal hairs surrounding the ostiole are numerous, long, septate, thick-walled, straight or irregularly contorted, up to 1.6 mm. long, 3.8–5.3$\mu$ in diameter, walls 0.57–1.52$\mu$ thick, dark, smoky in color, more or less densely encrusted, tips curved to circinate. Lateral hairs colorless, septate, accuminate, up to 150$\mu$ long, 2–3$\mu$ in diameter at base. Asci sub-globose to broadly clavate and short stalked, colorless, 10–20 x 20–34$\mu$, evanescent, 8-spored, paraphyses lacking. Ascospores extruded in a mass or as cirrhi, frequently up to 1.5 mm. in length, bright copper-colored in mass, singly faintly colored or hyaline, lemon-shaped, apiculate, thin-walled, 6.5–10.6 x 5.3–7.6$\mu$, germinating at both ends.

Type locality: Urbana, Ill.

Habitat: On goat dung and various other types of animal excrement.

Distribution: Illinois, Kansas, Virginia, Michigan.

Type in the Mycological Collections, University of Illinois Herbarium (Mycological Collections No. 1763); specimens in the Mycological Collections of the Agriculture Research Center, Beltsville, Md.; Farlow Herbarium, Harvard University, and the Herbarium of the State University of Iowa, Iowa City.

Specimens from the writer's collection are deposited in the U.S. National Herbarium, Washington, D.C.

This species in many respects is similar to *L. martinii* but the differences are quite obvious when the two are closely compared. *Lophotrichus martinii*, in culture, appears darker, the terminal hairs are thicker and less graceful, most about the ostiole are relatively short, with a tendency to branch, a few are much longer. The terminal hairs of *L. ampullus* are more more slender, much longer, of one type, and have no or slight tendency, if any, to branch; the hairs in general are more numerous and bushy than *L. martinii*.

The relative abundance of perithecia developing more than one neck is characteristic of both species, but differs in degree. Perithecia of *L. ampullus* may develop two necks in a small percentage of ascocarps, seldom more, in contrast *L. martinii* may develop two to four necks in as many as 25 percent of the ascocarps. Most of the necks reach the surface of agar cultures and bear normal hairs from the ostiolar region, those necks which fail to reach the agar surface fail to develop hairs or only sparse modified ones. Many species of *Chaetomium* develop perithecia submerged in agar plate cultures and likewise fail, under those circumstances, to develop normal ornamental hairs.

**2. LOPHOTRICHUS BREVIROSTRATUS** sp. nov.
Plate 30, Figs. 7–10

Peritheciis ostiolatis, globosis, nigris, diametro 270–310$\mu$, immersis vel semiimmersis vel exteris, ad substratum cum rhizoideis tenellis affixis, partibus supernis pilis lateralibus in forma hyphae, sine colore, septatis tenellis, cum parientibus tenuibus membranaceis; color plerumque singule, nigro, 30–50$\mu$ longitudine, diametro 30–40$\mu$. Pilis terminalibus nigris, septatis, acuminatis ad 1.4 mm. longitudine vel longioribus, diametro 3.8–4.75$\mu$ basi, apice gradatim attenuatis. Pilis lateralibus septatis, sine colore, acuminatis ad 150$\mu$ longitudine, diametro 2–3$\mu$ basi. Ascis subglobosis vel late clavatis, cum stirpe breve, sine colore 20–30 x 10–18$\mu$ evanescentibus, octosporis, sine paraphasibus. Ascosporis maturis in cirrhis extrusis, colore cupris plerumque, separatim pallidis, sublimoniiformbus, utrimque tenuibus parietibus, 6.0–7.5 x 4.5–5.5$\mu$.

Perithecia black, ostiolate, globose, 270–310$\mu$ in diameter, immersed or semi-immersed or superficial, affixed to the substratum with delicate mycelial-like rhizoids, membranaceous, with a short neck at the apex. The neck measuring 30–50$\mu$ in length and 30–40$\mu$ in diameter. Terminal hairs black, septate, acuminate to 1.4 mm. in length or longer, 3.8–4.75$\mu$ in diameter, gradually tapering to a narrow tip. Lateral hairs are septate, colorless or nearly so, to 150$\mu$ in length, at base 2–3$\mu$ in diameter and gradually tapering to a very narrow tip. Asci subglobose to wide clavate, with a short stipe, 8-spored, evanescent, 20–30 x 10–18$\mu$. Ascospores extruded in a cirrhus at maturity, copper color in mass, pale when seen singly, sub-lemon-shaped, a clear spot at each end but not apiculate, 6.0–7.5 x 5–5.5$\mu$.

Type locality: Edwards County, Kans.

Habitat: On rat dung (Collection 1501 of Dr. T. E. Brooks).

Distribution: Known only from the type locality.

Type deposited in the U.S. National Herbarium, Washington, D.C.

*L. brevirostratus* was received as a pure culture from Dr. Brooks in June 1950.

**3. LOPHOTRICHUS MARTINII** Benjamin, Mycologia *41:* 351, 1949
Plate 30, Figs. 11–17

Perithecia black, globose, 220–330$\mu$ in diameter, immersed or partially superficial, with dark, rhizoid-like mycelia on the submerged parts, walls thin, membranaceous, necks usually one, commonly two to four on a perithecium, 200–1000$\mu$ long or longer, more or less uniform in diameter, 40–65$\mu$. Terminal hairs surrounding the ostiole are of two types (a) shorter hairs grouped around the ostiole forming a loose head 130–450$\mu$ long. (b) a few long hairs extending in length 1000$\mu$ or longer, all are septate, thick-walled, straight or curved, dark smoky in color. 3.8–6$\mu$ in diameter, walls 1.15–2.28$\mu$ thick, more or less densely encrusted, tips straight or curved. Lateral hairs septate, colorless, acuminate, up to 150$\mu$ long, 2–3$\mu$ in diameter at base. Asci subglobose to broadly clavate and short stalked, colorless, 20–36 x 11–17$\mu$, evanescent, 8-spored, lacking paraphyses. Ascospores extruded as cirrhi, or contained as a mass by the hairs, bright copper colored in mass, singly faintly colored or hyaline, lemon-shaped, apiculate, ends thin-walled, 7–10 x 5.3–6.8$\mu$, germinating at both ends.

Type locality: Talara, Peru, Sept. 1945, G.W.M. No. 6290.

Habitat: On dung.

Distribution: Known only from type locality.

Material representing type deposited in the mycological collections, University of Illinois Herbarium (Mycological Collections No. 1762); the Mycological Collections of the Bureau of Plant Industry, Beltsville, Md.; Farlow Herbarium, Harvard University; and the Herbarium of the State University of Iowa, Iowa City.

Specimens from the writer's subcultures are deposited in the U.S. National Herbarium, Washington, D.C.

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## FUNGI EXSICCATI

The taxonomy of the species of the Chaetomiaceae has been based in part on the exsiccati specimens in the Cryptogamic Herbarium at Harvard University, and on collections in various herbaria in Europe.

Berkeley, M. J. British Fungi
Cavara, F. Fungi Longobardiae
Cooke, M. C. Fungi Britannici
Curtis, M. A. Collection (not an exsiccati).
Desmazieres, J. B. H. J. Plantes Cryptogames de France
Ellis, J. B. & Everhart, B. M. North American Fungi. Fungi Columbiani
Fries, E. Scleromyceti Sueciae
Fuckel, L. Fungi Rhenani
Jaap, O. Fungi Selecti Exsiccati
de Jaczewski, A. Fungi Rossiae Exsiccati
Karsten, P. A. Fungi Fenniae Exsiccati
Krieger, K. W. Fungi Saxonici
Kunze, G., & Schmidt, J. K. Deutschlands Schwämme
Mougeot, J. B. & J. A., & Nestler, C. Stripes Cryptogamae Vogeso-Rhenanae
Rabenhorst, L. Fungi Europaei
Rabenhorst, L. Fungi Europaei. Klotzschii Herbarium vivum Mycologicum
Rehm, H. Ascomyceten
Rick, J. Fungi Austro-Americani
Roumerguère, C. Selecti Gallici Exsiccati
Saccardo, D. Mycotheca Italica
Saccardo, P. A. Mycotheca Veneta
de Thumen, F. Fungi Austriaci Exsiccati. Mycotheca Universalis
Vestergren, T. Micromycetes Rariores Selecti
Vill, A. Fungi Bavarici Exsiccati
Vize, J. E. Micro-Fungi Britannici
Wartmann, B., & Schenk, B. Schweizerische Kryptogamen
Westendorp, G. D., & Wallays, A.C.F. Herbier Cryptogamique Belge
Zahlbruckner, A. Kryptogamiae Exsiccatae, editae a Museo Palatino Vindobonensi (Fungi by Keissler, C.T.)
Zopf, W., & Sydow, P. Mycotheca Marchica

## EXPLANATION OF PLATES

Plate 1

*Chaetomium elatum* Kunze

Fig. 1 Mature perithecium. Fig. 2 End portion of terminal hair. Fig. 3 Terminal hair. Fig. 4 Young and mature Asci. Fig. 5 Ascospores.

*Chaetomium indicum* Corda

Fig. 6 Mature perithecium. Fig. 7 Terminal hair. Fig. 8 Ascus. Fig. 9 Ascospores.

*Chaetomium dolichotrichum* Ames

Fig. 10 Mature perithecium. Fig. 11 Ascus. Fig. 12 Ascospores. Fig. 13 Portion of terminal hair.

Plate 2

*Chaetomium fusum* Ames

Figs. 1 and 2 Mature perithecia. Fig. 3 Ascus. Fig. 4 Ascospores. Fig. 5 Terminal hair from which the crystals have been dissolved. Fig. 6 Terminal hair encrusted with crystals. Fig. 7 Short, slender terminal hairs.

*Chaetomium virgecephalum* Ames

Fig. 8 Mature perithecium. Fig. 9 Ascus. Fig. 10 Ascospores. Fig. 11 Terminal hair. Fig. 12 End of slender type terminal hair.

Plate 3

*Chaetomium cancroideum* Tschudy

Fig. 1 Mature perithecium. Fig. 2 Asci. Fig. 3 Ascospores. Fig. 4 Terminal hair.

*Chaetomium funicolum* Cooke

Fig. 5 Mature perithecium. Fig. 6 Ascus. Fig. 7 Ascospores. Fig. 8 Terminal hair. Fig. 9 Distal portion of terminal hair showing constriction and inflation characteristics often found in the species.

*Chaetomium reflexum* Skolko & Groves

Fig. 10 Mature perithecium. Fig. 11 Ascus. Fig. 12 Ascospores. Fig 13 End portion of terminal hair. Fig. 14. Distal portion of terminal hair showing recurved characteristics.

*Chaetomium erectum* Skolko & Groves

Fig. 15 Mature perithecium. Fig. 16 Ascus. Fig. 17 Ascospores. Fig. 18 Terminal hair moderately encrusted. Fig. 19 Terminal hair with inflated crystals or projections.

Plate 4

*Chaetomium megalocarpum* Bainier

Fig. 1 Mature perithecium. Fig. 2 Ascus. Fig. 3 Ascospores. Fig. 4 Terminal hair. Fig. 5 High magnification of cells about the ostiole. The specimen from which this drawing was made was unusually prominent in this respect.

*Chaetomium africanum* Ames

Fig. 6 Mature perithecium. Fig. 7 Ascospores. Figs. 8–10 Three types of terminal hairs.

Plate 5

*Chaetomium thermophile* LaTouche

Fig. 1 Mature perithecium. Fig. 2 Two asci. Fig. 3 Ascospores. Fig. 4 Terminal hairs.

*Chaetomium virginicum* Ames

Fig. 5 Mature perithecium. Fig. 6 Outline of perithecium after the hairs were removed. Fig. 7 Ascus. Fig. 8 Normal and giant ascospores. Fig. 9 Distal portions of terminal hairs.

*Chaetomium britannicum* Ames

Fig. 10 Mature perithecium. Fig. 11 Outline of perithecium. Fig. 12 Asci. Fig. 13 Ascospores.

Plate 6

*Chaetomium gangligerum* Ames

Figs. 1 and 5 Mature perithecia. No. 5 with most of the hairs removed to show ostiole. Fig. 2 Ascus. Fig. 3 Ascospores. Figs. 4 and 6 Terminal hairs. Fig. 7 Bulbil.

*Chaetomium circinatum* Chivers

Fig. 8 Mature perithecium. Fig. 9 Ascus. Fig. 10 Ascopores. Figs. 11 and 12 Terminal hairs.

*Chaetomium murorum* Corda

Fig. 13 Mature perithecium. Fig. 14 Ascus. Fig. 15 Ascospores. Fig. 16 Terminal hair.

Plate 7

*Chaetomium contortum* Peck

Fig. 1 Mature perithecium. Fig. 2 Ascus. Fig. 3 Ascospores. Fig. 4 Terminal hair.

*Chaetomium tortile* Bainier

Fig. 5 Mature perithecium. Fig. 6 Ascus. Fig. 7 Ascospores. Figs. 8 and 9 Terminal hairs.

*Chaetomium simile* Massee & Salmon

Fig. 10 Mature perithecium. Fig. 11 Ascus. Fig. 12 Ascospores. Figs. 13 and 14 Terminal hairs.

*Chaetomium brasiliense* Batista & Pontual

Fig. 15 Mature perithecium. Fig. 16 Ascus. Fig. 17 Ascospores. Fig. 18 Terminal hair.

*Chaetomium crispatum* Fuckel

Fig. 19 Mature perithecium. Fig. 20 Ascus. Fig. 21 Ascospores. Fig. 22 Terminal hair.

Plate 8

*Chaetomium perpulchrum* Ames

Fig. 1 Mature perithecium. Fig. 2 Ascus. Fig. 3 Ascospores. Fig. 4 Terminal hairs. Fig. 5 Lateral hair.

*Chaetomium incomptum* Ames

Fig. 6 Mature perithecium. Fig. 7 Ascus. Fig. 8 Ascospores. Fig. 9 Portion of terminal hairs anastomosing. Fig. 10 Lateral hairs. Figs. 11 and 12 Terminal hairs.

*Chaetomium alba-arenulum* Ames

Fig. 13 Mature perithecium. Fig. 14 Ascus. Fig. 15 Ascospores. Figs. 16 and 17 Terminal hairs. Fig. 18 Lateral hair.

Plate 9

*Chaetomium anguipilium* Ames

Fig. 1 Mature perithecium. Fig. 2 Ascus. Fig. 3 Ascospores. Fig. 4 Distal portion of terminal hair. Figs. 5 and 6 Lateral hairs.

*Chaetomium causiaeformis* Ames

Fig. 7 Mature perithecium. Fig. 8 Mature perithecium viewed from above. Fig. 9 Ascus. Fig. 10 Ascospores. Fig. 11 Portion of terminal surrounding the ostiole.

Plate 10

*Chaetomium congoensis* Ames

Figs. 1 and 2 Mature perithecium. Fig. 3 Ascus. Fig. 4 Ascospores. Figs. 5, 6, 7 and 8 Terminal hairs.

*Chaetomium mollicellum* Ames

Fig. 9 Mature perithecium. Fig. 10 Ascus. Fig. 11 Ascospores. Figs. 12 and 13 Terminal hairs. Fig. 14 Lateral hairs. Fig. 15 Distal portion of two terminal hairs anastomosing.

Plate 11

*Chaetomium angustum* Chivers

Fig. 1 Mature perithecium. Fig. 2 Ascus. Fig. 3 Ascospores. Fig. 4 Terminal hair. Fig. 5 Enlargement of section of terminal hair fig. 4.

*Chaetomium trigonosporum* (Marchal) Chivers

Fig. 6 Mature perithecium. Fig. 7 Ascus. Fig. 8 Ascospores.

*Chaetomium spirale* Zopf

Fig. 9 Mature perithecium. Fig. 10 Terminal hair. Fig. 11 Ascospores.

*Chaetomium aterrimum* Ellis & Everhart

Fig. 12 Mature perithecium. Fig. 13 Ascospores. Fig. 14 Terminal hair.

Plate 12

*Chaetomium robustum* Ames

Fig. 1 Mature perithecium. Fig. 2 Ascus. Fig. 3 Ascospores. Figs. 4 and 5 Terminal hairs. Fig. 6 Lateral hair.

*Chaetomium subspirale* Chivers

Fig. 7 Mature perithecium. Fig. 8 Ascus. Fig. 9 Ascospores. Figs. 10 and 11 Terminal hairs.

*Chaetomium perlucidum* Serg.

Fig. 12 Mature perithecium. Fig. 13 Ascus. Fig. 14 Ascospores. Figs. 15 and 16 Terminal hairs. Fig. 17 Lateral hair.

*Chaetomium crispatoideum* Serg.

Fig. 18 Mature perithecium. Fig. 19 Ascus. Fig. 20 Ascospores. Fig. 21 Terminal hair. Fig. 22 Tip of terminal hair. Fig. 23 Lateral hair.

Plate 13

*Chaetomium semen-citrulli* Serg.

Fig. 1 Mature perithecium. Fig. 2 Perithecium stripped of hairs. Fig. 3 Ascus. Fig. 4 Ascospores. Figs. 5, 6, and 7 Terminal hairs. Fig. 8 Lateral hair.

*Chaetomium angustispirale* Serg.

Figs. 9 and 10 Mature perithecia. Fig. 11 Ascus. Fig. 12 Ascospores. Figs. 13, 14, and 15 Terminal hairs.

Plate 14

*Chaetomium bostrychodes* Zopf

Fig. 1 Mature perithecium. Fig. 2 Showing how the hairs often separate from the perithecium. Fig. 3 Ascus. Fig. 4 Ascospores. Fig. 5 Terminal hair.

*Chaetomium cochliodes* Palliser

Fig. 6 Mature perithecium. Fig. 7 Ascus. Fig. 8 Ascospores. Figs. 9 and 10 Terminal hairs. Fig. 11 Lateral hair.

Plate 15

*Chaetomium spiculipilium* Ames

Fig. 1 Mature perithecium. Fig. 2 Outline of perithecium. Fig. 3 Ascus. Fig. 4 Ascospores. Fig. 5 Terminal hair. Fig. 6 Lateral hair.

*Chaetomium erraticum* Ames

Figs. 7 and 8 Mature perithecia. Fig. 9 Ascus. Fig. 10 Ascospores. Figs. 11 and 12 Terminal hairs. Figs. 13, 14 and 15 Lateral hairs.

*Chaetomium leucophora* Ames

Fig. 16 Mature perithecium. Fig. 17 Ascus. Fig. 18 Ascospores. Figs. 19, 20, 21 and 22 Terminal hairs. Fig. 23 Lateral hair.

Plate 16

*Chaetomium tetrasporum* Hughes

Fig. 1 Mature perithecium. Figs. 2 and 3 Asci. Fig. 4 Ascospores. Fig. 5 Terminal hair.

*Chaetomium sphaerale* Chivers

Fig. 6 Mature perithecium. Fig. 7 Ascus. Fig. 8 Ascospores. Fig. 9 Terminal hair. Fig. 10 Lateral hair.

*Chaetomium cupreum* Ames

Fig. 11 Mature perithecium. Fig. 12 Ascus. Fig. 13 Ascospores. Figs. 14 and 15 Terminal hairs. Figs. 16 and 17 Lateral hairs.

*Chaetomium cruentum* Ames

Fig. 18 Mature perithecium. Fig. 19 Ascus. Fig. 20 Ascospores. Figs. 22 and 23 Lateral hairs.

Plate 17

*Chaetomium pachypodioides* Ames

Fig. 1 Mature perithecium. Fig. 2 Ascospores. Fig. 3 Terminal hair.

*Chaetomium caprinum* Bainier

Fig. 4 Mature perithecium. Fig. 5 Ascospores. Fig. 6 Terminal hair.

*Chaetomium convolutum* Chivers

Fig. 7 Mature perithecium. Fig. 8 Ascospores. Fig. 9 Terminal hair.

Plate 18

*Chaetomium quadrangulatum* Chivers

Figs. 1 and 2 Mature perithecia. Fig. 3 Ascus. Fig. 4 Ascospores. Figs. 5, 6, 8 and 9 Terminal hairs. Fig. 7 Lateral hair.

*Chaetomium spinosum* Chivers

Figs. 10 and 11 Mature perithecia. Fig. 12 Ascus. Fig. 13 Ascospores. Figs. 14, 15 and 16 Terminal hairs.

Plate 19

*Chaetomium fibripilium* Ames

Fig. 1 Mature perithecium. Fig. 2 Ascus. Fig. 3 Ascospores. Fig. 4 Terminal hair.

*Chaetomium mollipilium* Ames

Fig. 5 Mature perithecium. Fig. 6 Ascus. Fig. 7 Ascospores. Fig. 8 Section of a terminal hair.

*Chaetomium nigricolor* Ames

Fig. 9 Mature perithecium. Fig. 10 Terminal hairs. Fig. 12 Ascospores. Fig. 13 Cluster of immature asci.

Plate 20

*Chaetomium ochraceum* Tschudy

Fig. 1 Mature perithecium. Fig. 2 Ascospores. Fig. 3 Terminal hair.

*Chaetomium globosum* Kunze

Fig. 4 Mature perithecium. Fig. 5 Ascus. Fig. 6 Ascospores.

*Chaetomium atrobrunneum* Ames

Fig. 7 Mature perithecium. Fig. 8 Ascus. Fig. 9 Ascospores. Fig. 10 Portion of a terminal hair.

*Chaetomium succineum* Ames

Fig. 11 Mature perithecium. Fig. 12 Ascus. Fig. 13 Ascospores. Fig. 14 Terminal hair.

*Chaetomium olivaceum* Cooke & Ellis

Fig. 15 Mature perithecium. Fig. 16 Ascus. Fig. 17 Ascospores.

Plate 21

*Chaetomium brevipilium* Ames

Figs. 1 and 2 Mature perithecia. Fig. 3 Ascus. Fig. 4 Ascospores. Fig. 5 Terminal hair. Fig. 6 Lateral Hair. Fig. 7 Aleuriospores.

*Chaetomium pulchellum* Ames

Fig. 8 Mature perithecium. Fig. 9 Ascus. Fig. 10 Ascospores. Figs. 11 and 12 Terminal hairs. Fig. 13 Lateral hair. Fig. 14 Aleuriospores.

*Chaetomium pinnatum* Ames

Figs. 15 and 16 Mature perithecia. Fig. 17 Ascus. Fig. 18 Ascospores. Fig. 19 Terminal hairs. Fig. 20 Aleuriospores.

*Chaetomium distortum* Ames

Figs. 21 and 22 Mature perithecia. Fig. 23 Ascus. Fig. 24 Ascospores. Figs. 25, 26, 27, and 28 Terminal hairs. Fig. 29 Lateral hair. Fig. 30 Aleuriospores.

Plate 22

*Chaetomium iricolor* Ames

Figs. 1 and 2 Mature perithecia. Fig. 3 Ascospores. Fig. 4 Terminal hair. Fig. 5 Lateral hair.

*Chaetomium torulosum* Bainier

Figs. 6 and 7 Mature perithecia. Fig. 8 Ascus. Fig. 9 Ascospores. Fig. 10 Terminal hair. Fig 10a Lateral hair.

*Chaetomium ampullare* Chivers

Fig. 11 Mature perithecium. Fig. 12 Ascus. Fig. 13 Ascospores. Fig. 14 Terminal hair.

Plate 23

*Chaetomium teratoideum* Ames

Fig. 1 Mature perithecium. Fig. 2 Ascus. Fig. 3 Ascospores. Figs. 4, 5 and 6. Terminal hairs.

*Chaetomium cuniculorum* Fuckel

Fig. 7 Mature perithecium. Fig. 8 Ascus. Fig. 9 Ascospores. Fig. 10(a) Type terminal hair. Fig. 11(b) Type terminal hair.

Plate 24

*Chaetomium longirostre* (Farrow) Ames

Figs. 1 and 2 Mature perithecia. Fig. 3 Ascus. Fig. 4 Ascospores. Fig. 5 Terminal section of terminal hairs which form a channel through which ascospores are forced. Fig. 6 Tip of a terminal hair. Fig. 7 Aleuriospores.

*Chaetomium longicolleum* Krzem & Badura

Figs. 8 and 9 Mature perithecia. Fig. 10 Ascospore. Fig. 11 Section thru terminal hairs showing ascospore exit channel. Fig. 12 Terminal hair.

*Chaetomium seminudum* Ames

Fig. 13 Mature perithecium. Fig. 14 Ascus. Fig. 15 Ascospores. Fig. 16 Ascospores, from oil immersion magnification. Fig. 17 Terminal hair. Fig. 18 Aleuriospores. Fig. 19 Aleuriospore and its attachment from oil immersion magnification.

*Chaetomium minutum* Krzem & Badura

Figs. 21 and 22 Mature perithecia. Fig. 22 Ascospores. Fig. 23 Terminal hair.

*Chaetomium* sp.

Fig. 24 Mature perithecium. Fig. 25 Ascus. Fig. 26 Ascospores. Fig. 27 Terminal hair. Fig. 28 Aleuriospore on attachment.

Plate 25

*Chaetomium venezuelense* Ames

Figs. 1 and 2 Mature perithecia. Fig. 3 Asci. Fig. 4 Ascospores. Fig. 5 Terminal hair. Figs. 6 and 7 Proliferating tips on terminal hairs.

*Chaetomium aureum* Chivers

Fig. 8 Mature perithecium. Fig. 9 Ascus. Fig. 10 Ascospores. Fig. 11 and 12 Ornamental hairs.

*Chaetomium trilaterale* Chivers

Fig. 13 Mature perithecium. Fig. 14 Ascus. Fig. 15 Ascospores. Figs. 16, 17 and 18 Terminal hairs.

*Chaetomium fusiforme* Chivers

Figs. 19 and 20 Mature perithecia. Fig. 21 Ascus. Fig. 22 Ascospores. Fig. 23 Terminal hairs.

*Chaetomium turgidopilosum* Ames

Figs. 24 and 25 Mature perithecia. Fig. 26 Ascus. Fig. 27 Ascospores. Fig. 28 Terminal hairs.

*Chaetomium microcephalum* Ames

Figs. 29 and 30 Mature perithecia. Fig. 31 Ascus. Fig. 32 Ascospores. Fig. 33 Terminal hair.

Plate 26

*Chaetomium reticulopilium* Ames

Fig. 1 Mature perithecium. Fig. 2 Ascus. Fig. 3 Normal ascospores. Fig. 4 Abnormally large ascospores. Figs. 5 and 6 Conspicuous terminal hairs. Fig. 7 Inconspicuous terminal hairs.

*Chaetomium homopilatum* Omvik

Fig. 8 Mature perithecium. Fig. 9 Ascus. Fig. 10 Ascospores. Fig. 11 Terminal hair. Fig. 12 Aleuriospores.

*Chaetomium senegalensis* Ames

Fig. 13 Mature perithecium. Fig. 14 Outline of perithecium after the hairs were removed. Fig. 15 Ascus. Fig. 16 Ascospores. Fig. 17 Terminal hairs.

Plate 27

*Ascotricha chartarum* Berkeley

Fig. 1 Mature perithecium. Fig. 2 Ascus. Fig. 3 Ascospores. Fig. 4 Terminal hair. Figs. 5 and 6 Branches bearing spiny corridia.

*Ascotricha pusilla* (Ellis & Everhart) Chivers

Fig. 7 Mature perithecium. Fig. 8 Ascus. Fig. 9 Ascospores. Fig. 10 Conidiophore bearing conidia. Fig. 10 Terminal hairs.

Plate 28

*Ascotricha xylina* Ames

Fig. 1 Mature perithecium. Fig. 2 Ascus. Fig. 3 Ascospores. Fig. 4 Terminal hair. Fig. 5 Conidiophore arising from slender vegetative mycelium. Fig. 6 Tip of conidiophore bearing conidia.

*Ascotricha guamensis* Ames

Fig. 8 Mature perithecium. Fig. 9 Ascus. Fig. 10 Ascospores. Figs. 11 and 12 Terminal hairs. Fig. 13 Hair similar to terminal perithecial hairs but arising from vegetative hypha. Figs. 14 and 15 Conidiophores arising from slender vegetative hyphae.

Plate 29

*Ascotricha arcuatum* Ames

Fig. 1 Mature perithecium. Fig. 2 Perithecium after hairs were removed. Fig. 3 Ascus. Fig. 4 Ascospores. Figs. 5 and 6 Terminal hairs. Figs. 6, 7 and 8 Lateral hairs. Fig. 9 Tip of conidiophore bearing conidia.

*Ascotricha congoensis* Ames

Fig. 21 Mature perithecium. Fig. 21 Perithecium after hairs were removed. Fig. 22 Ascus. Fig. 23 Ascus enlarged). Fig. 24 Ascospores. Figs. 25 and 26 Terminal hairs. Fig. 27 Conidiophore bearing conidia. Fig. 28 Tip of conidiophore bearing conidia.

Plate 30

*Lophotrichus ampullus* Benj.

Figs. 1, 2 and 2 Mature perithecia. Fig. 4 Ascus. Fig. 5 Ascospores. Fig. 6 Terminal hair. Fig. 6a Lateral hair.

*Lophotrichus brevirostratus* Ames

Fig. 7 Mature perithecium. Fig. 8 Ascus. Fig. 9 Ascospores. Fig. 10 Terminal hair.

*Lophotrichus martini* Benj.

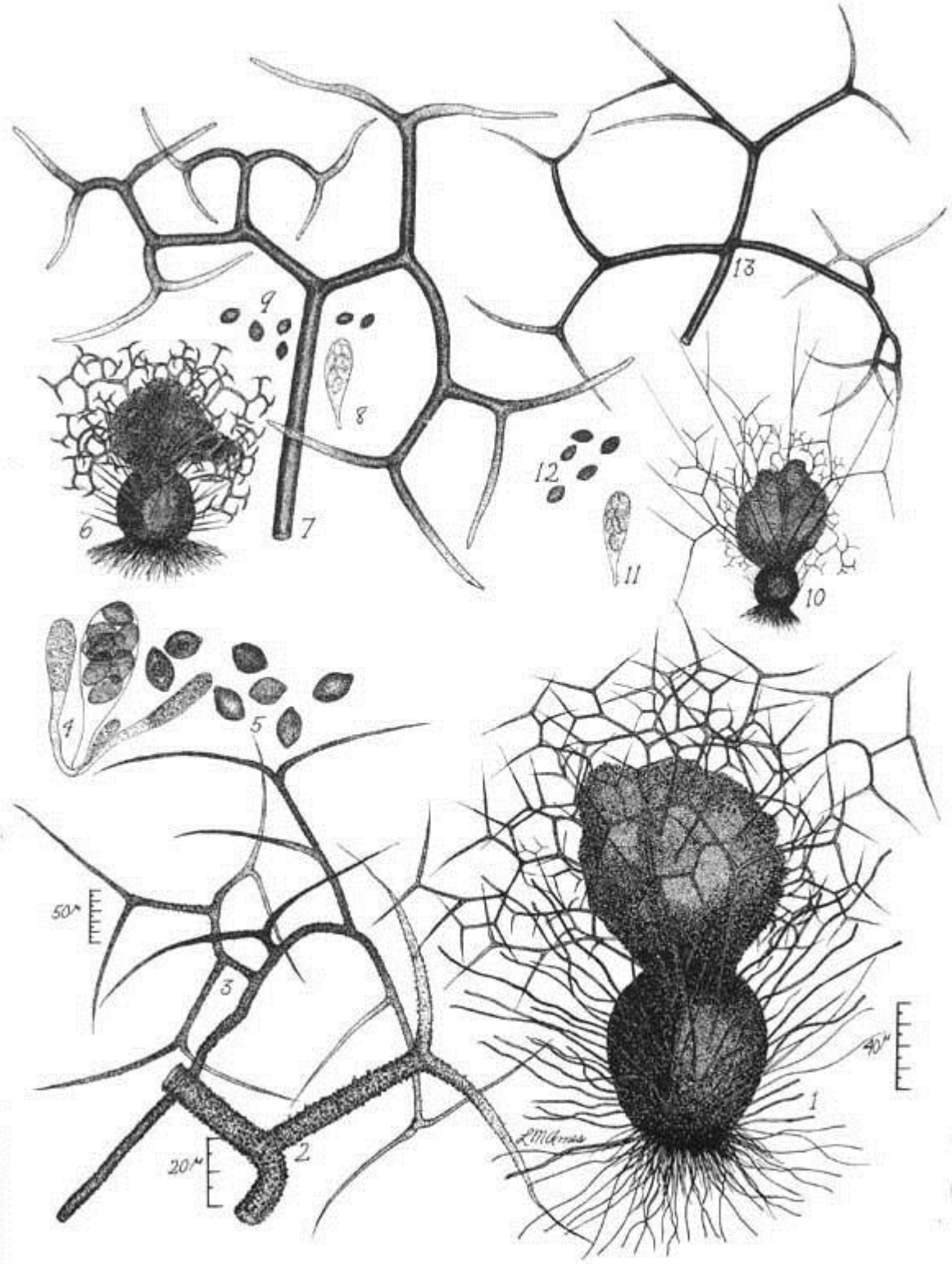
Fig. 11 Mature perithecium. Fig. 12 Mature perithecium (reduced in magnification). Fig. 13 Ascus. Fig. 14 Ascospores. Figs. 15, 16 and 17 Terminal hairs. Fig. 18 Lateral neck hair.

# INDEX

New names, the final members of new combinations, and the numbers of the pages on which the descriptions are to be found are in bold face type.

## PLATE NO. 1

1–6. *Chaetomium elatum* Kunze
7–9. *Chaetomium indicum* Corda
10–13. *Chaetomium dolichotrichum* Ames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11
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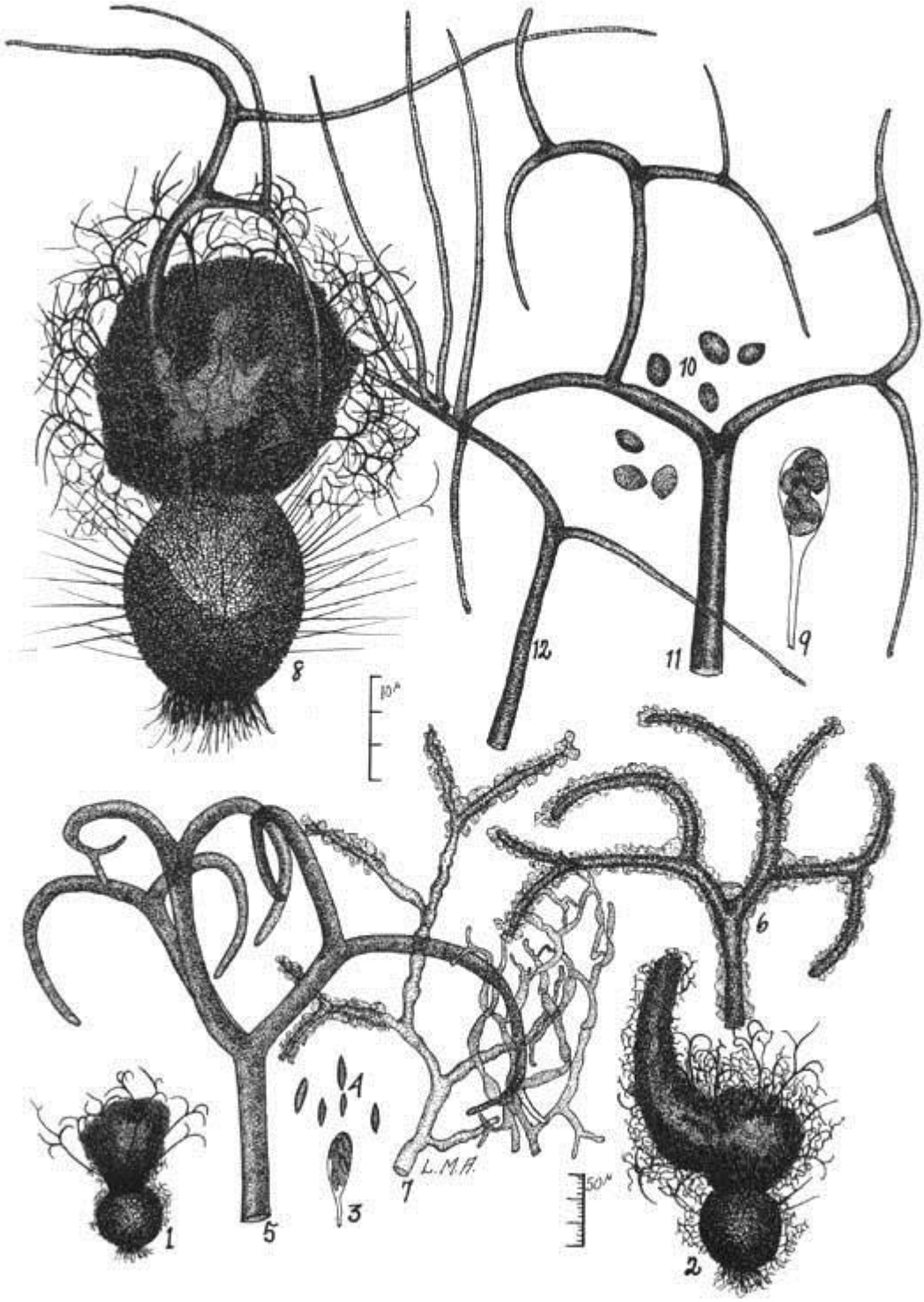
40μ
20μ
50μ

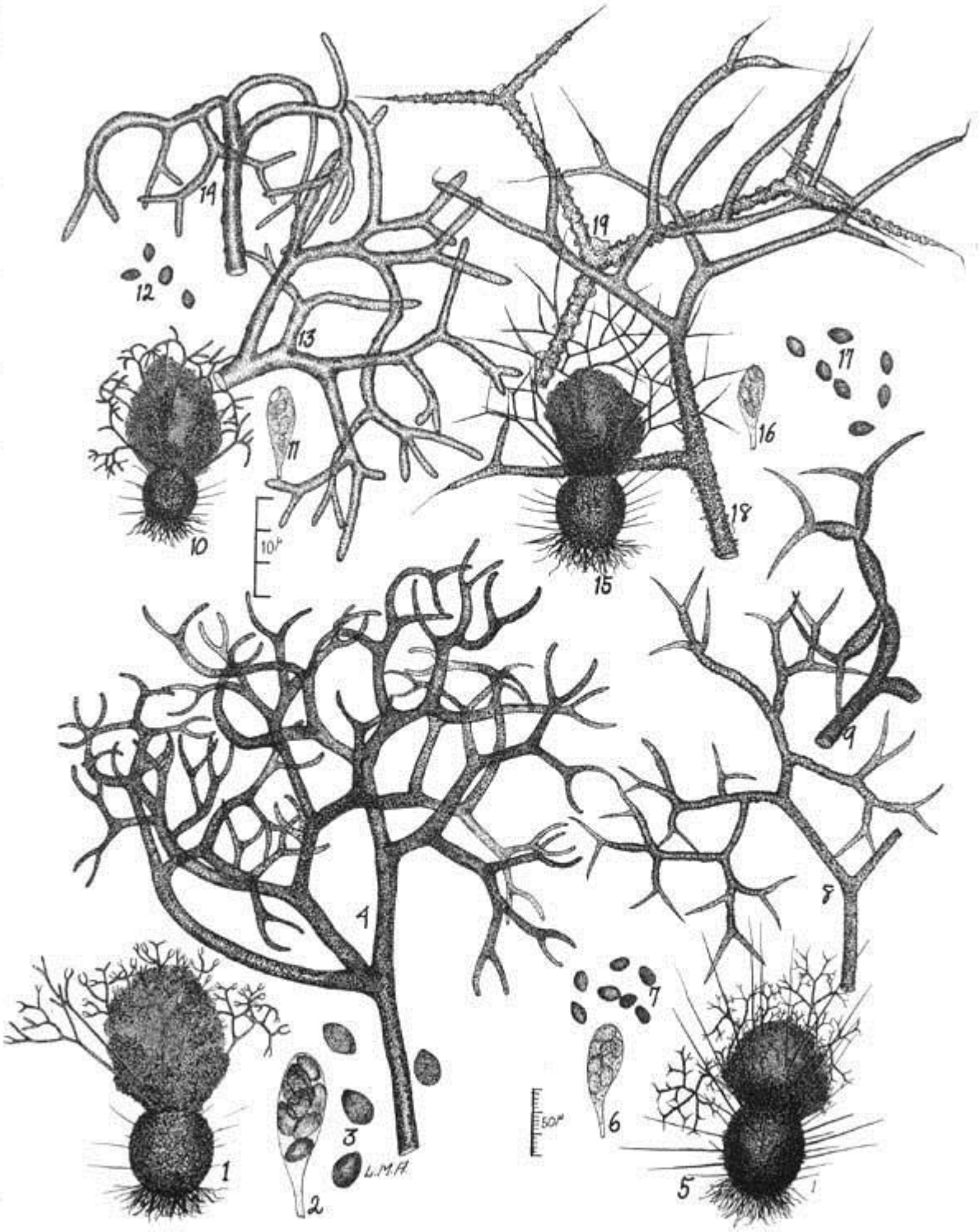
## PLATE NO. 2

1–7. *Chaetomium fusum* Ames
8–12. *Chaetomium virgecephalum* Ames


10
12
11
9
8
10 μ
6
4
3
7
L.M.A.
50 μ
1
5
2

## PLATE NO. 3

1–4. *Chaetomium cancroideum* Tschudy
5–9. *Chaetomium funicolum* Cooke
10–14. *Chaetomium reflexum* Skolko & Groves
15–19. *Chaetomium erectum* Skolko & Groves

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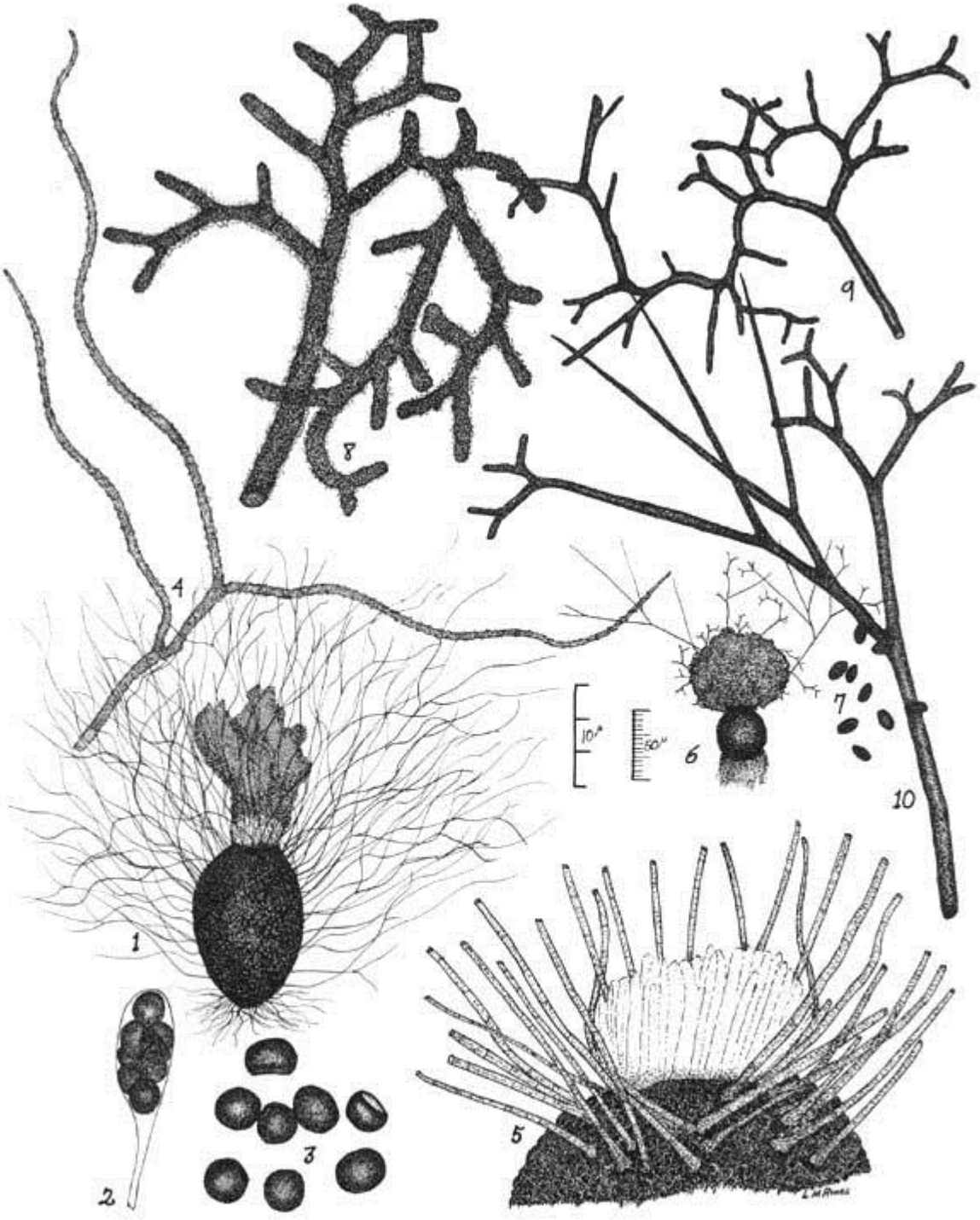
## PLATE NO. 4

1–5. *Chaetomium megalocarpum* Bainier
6–10. *Chaetomium africanum* Ames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10μ
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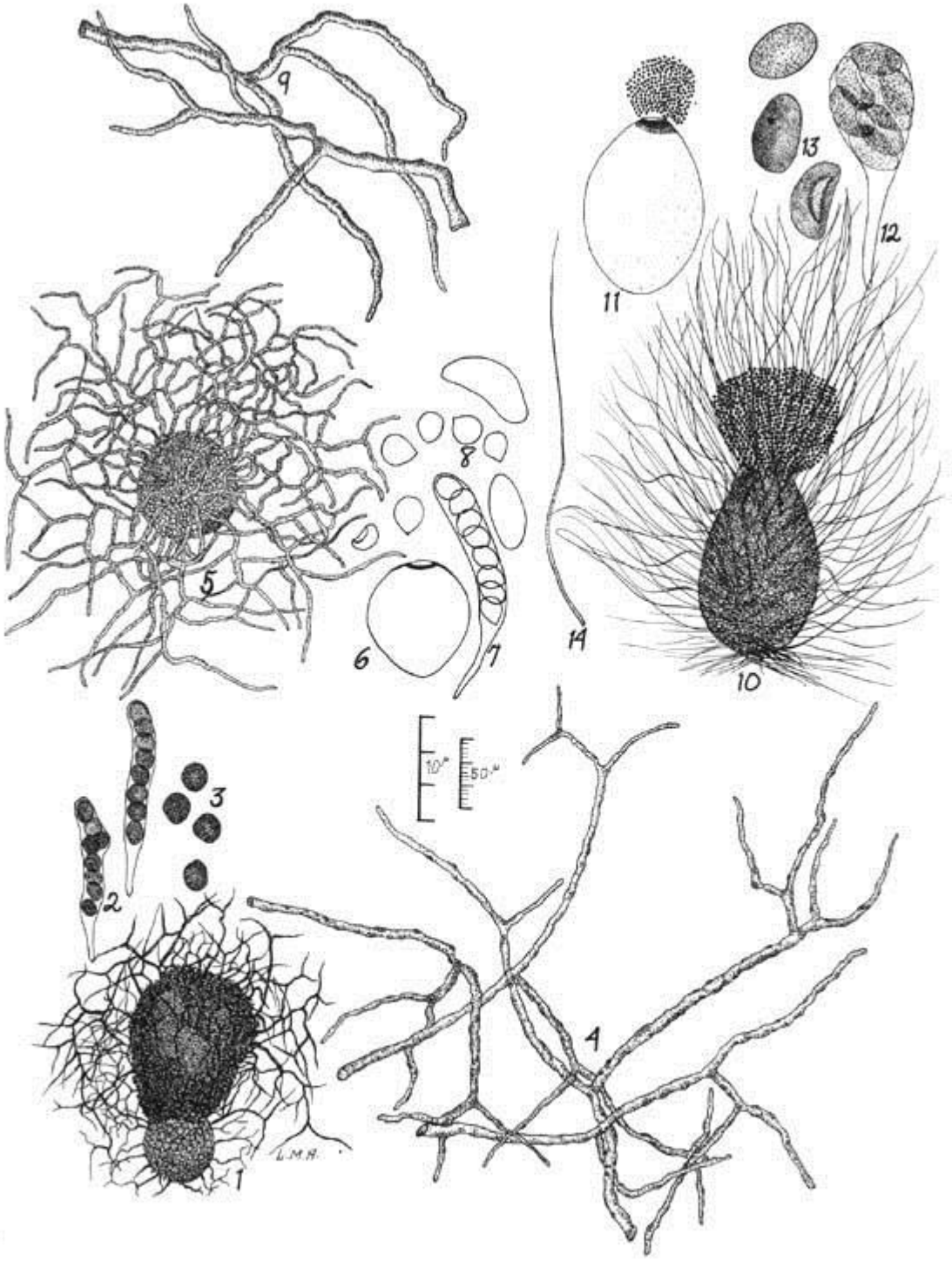
## PLATE NO. 5

1–4. *Chaetomium thermophile* La Touche
5–9. *Chaetomium virginicum* Ames
10–13. *Chaetomium britannicum* Ames


9
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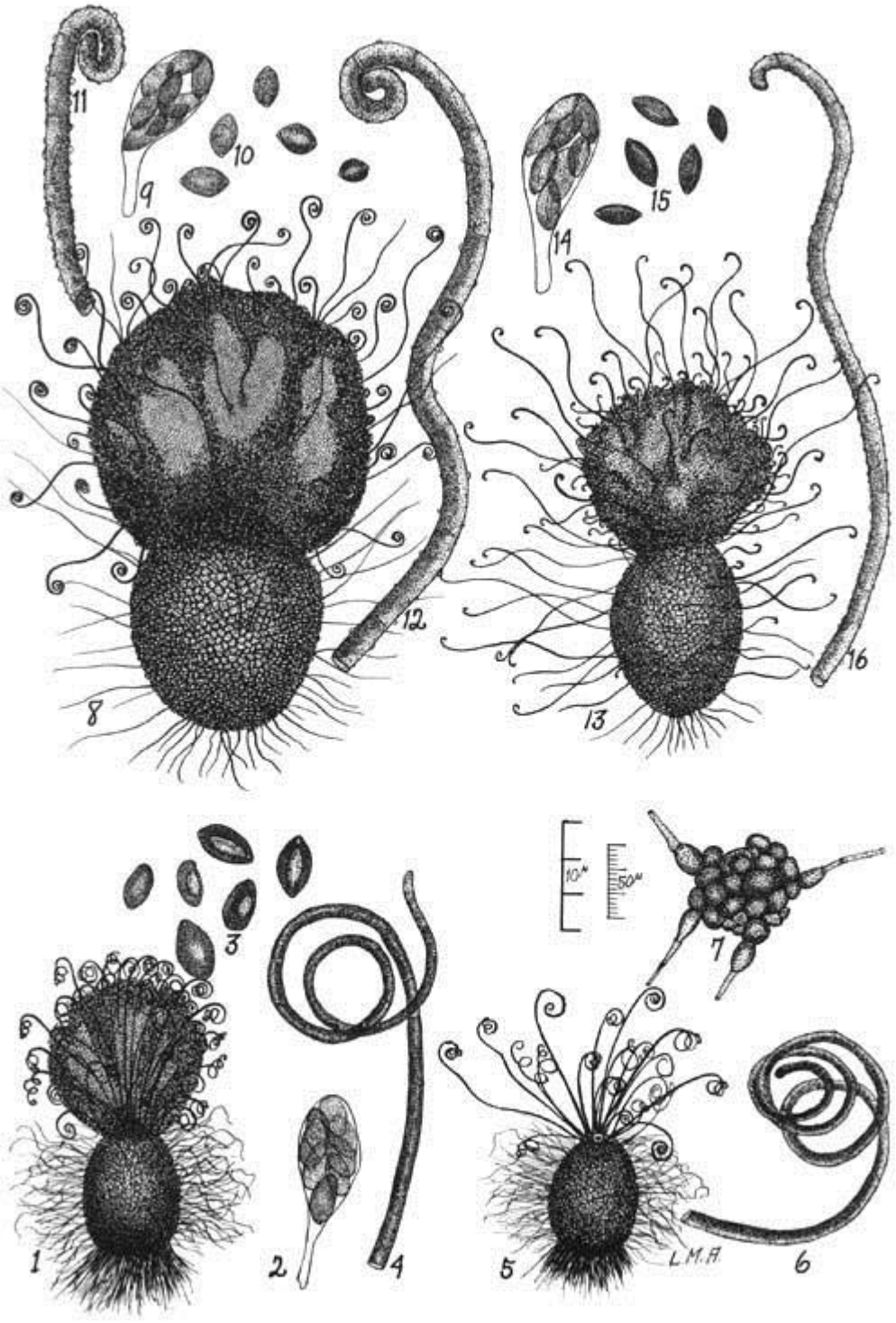
6
7
14
10
10*
50 μ
3
2
4
1
L.M.H.

## PLATE NO. 6

1–7. *Chaetomium gangligerum* Ames
8–12. *Chaetomium circinatum* Chivers
13–16. *Chaetomium murorum* Corda


11
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15
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16
13
3
1
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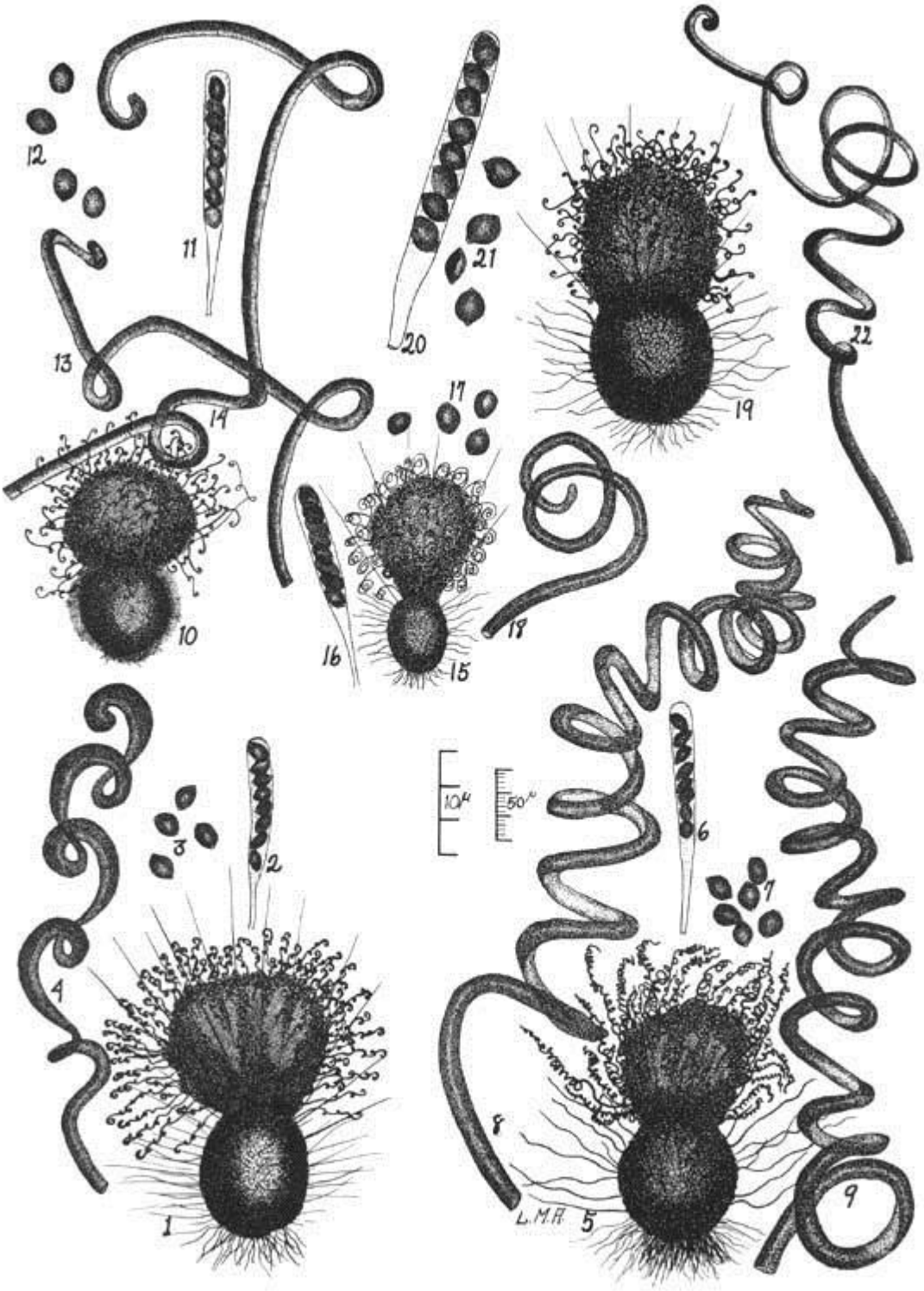
10μ
50μ
7
5
L.M.A
6

## PLATE NO. 7

1–4. *Chaetomium contortum* Peck
5–9. *Chaetomium tortile* Bainier
10–14. *Chaetomium simile* Massee & Salmon
15–18. *Chaetomium brasiliense* Batista & Pontual
19–22. *Chaetomium crispatum* Fuckel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22
18
10μ
50μ
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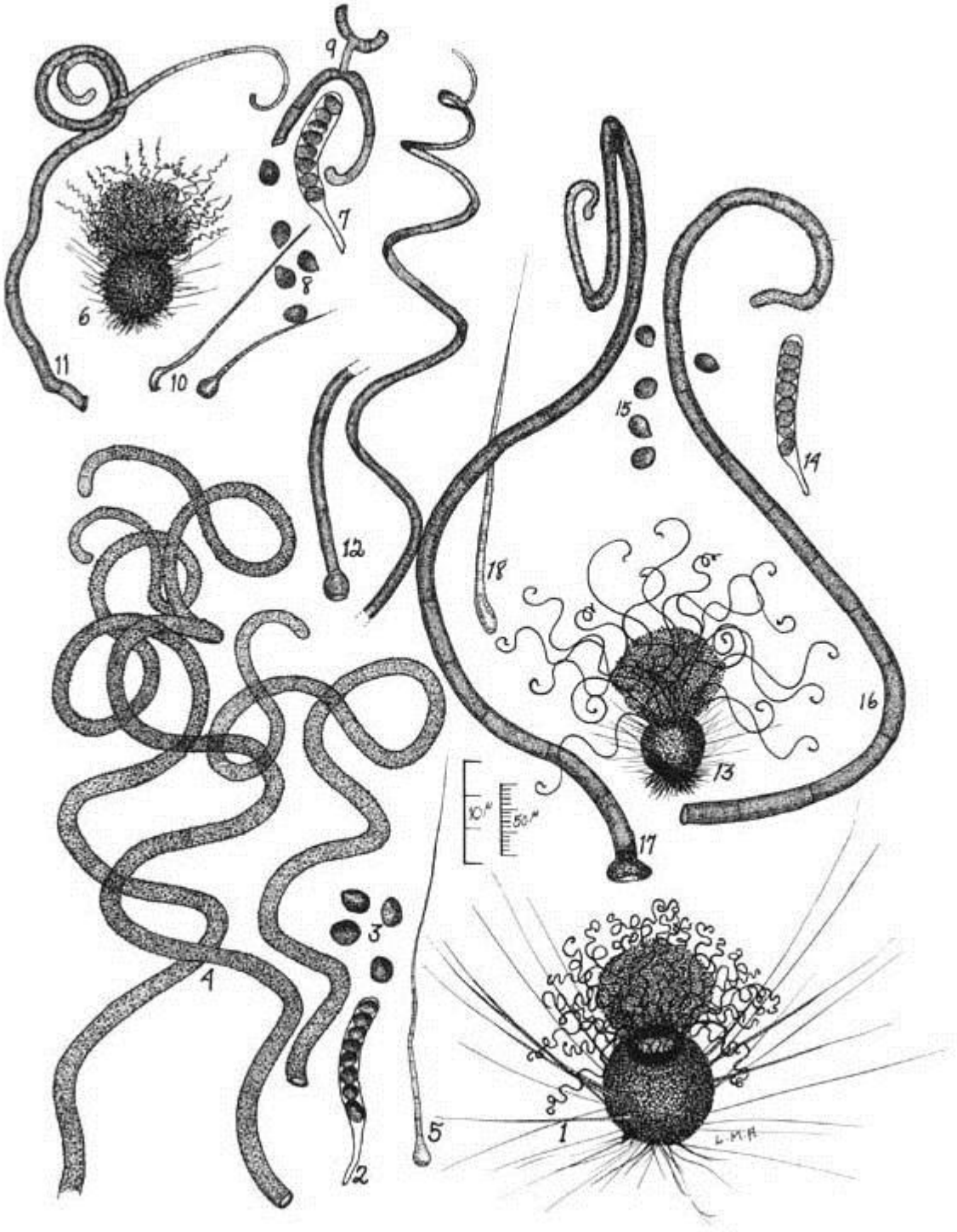
1
8
L.M.R. 5
9

## PLATE NO. 8

1–5. *Chaetomium perpulchrum* Ames
6–12. *Chaetomium incomptum* Ames
13–18. *Chaetomium alba-arenulum* Ames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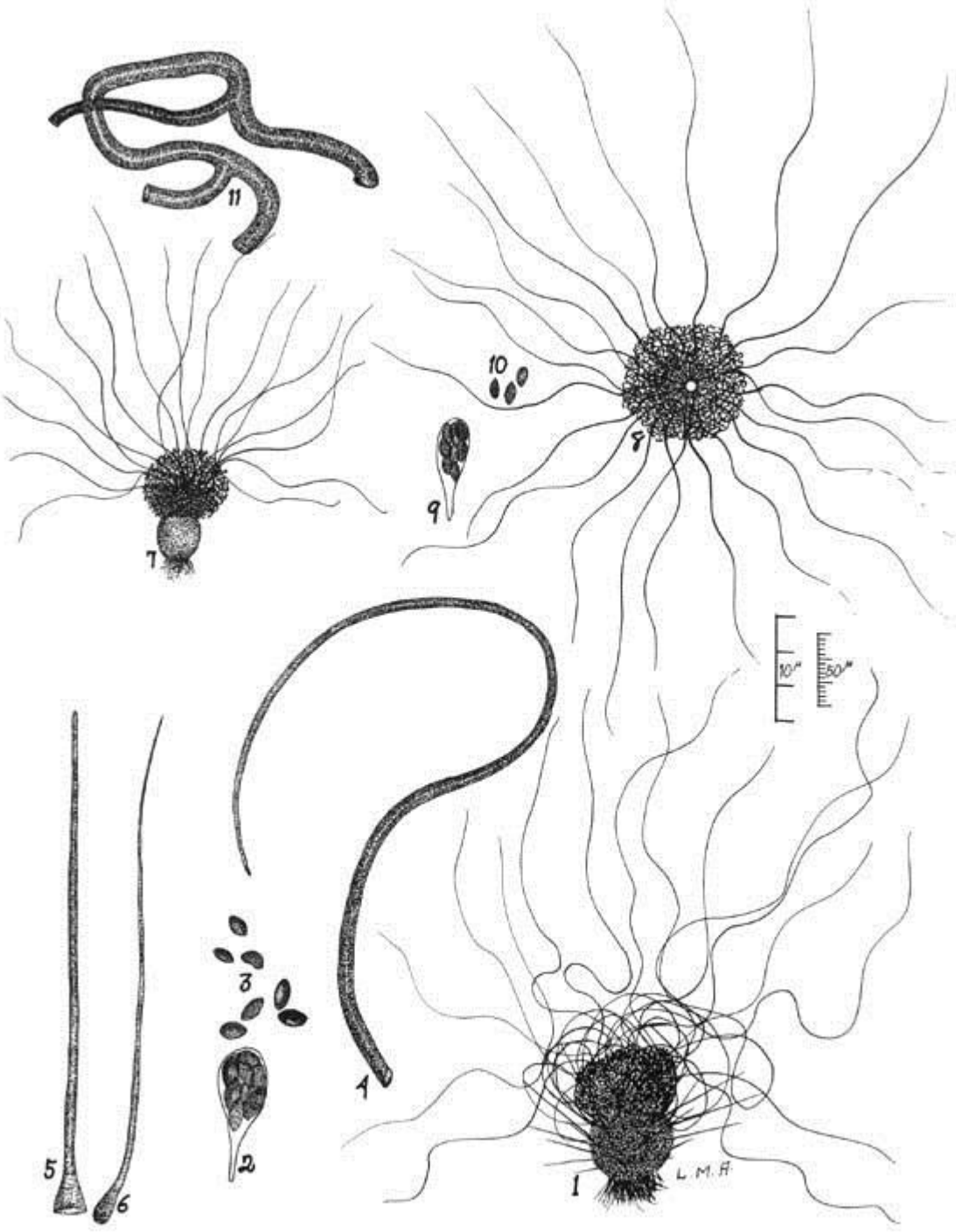
17
18
10 μ
50 μ
L.M.A.

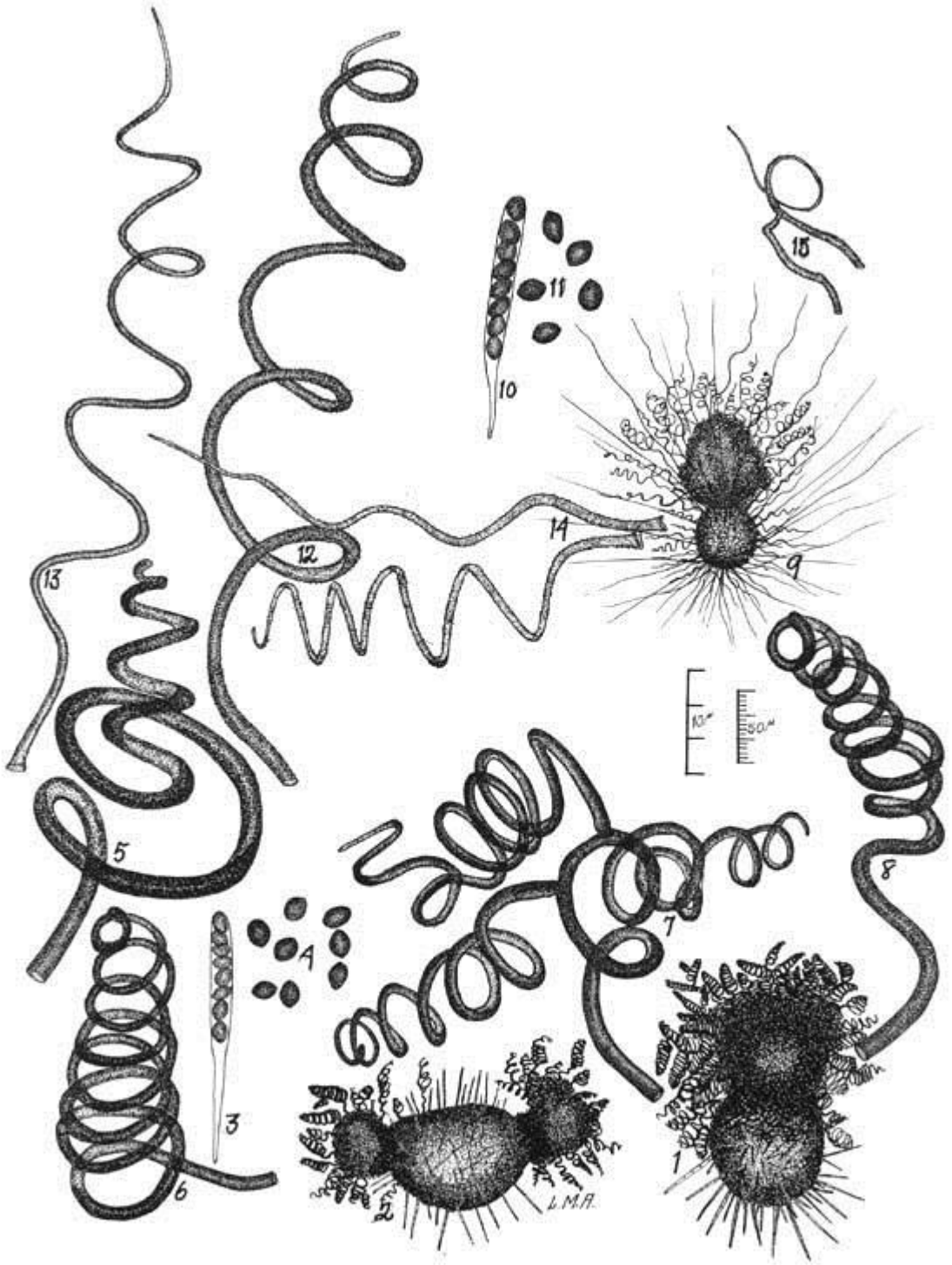
## PLATE NO. 9

1–6. *Chaetomium anguipilium* Ames
7–11. *Chaetomium causiaeformis* Ames


11
10
8
9
7
10 µ
50 µ
4
3
2
5
6
1
L. M. A.

## PLATE NO. 10

1–8. *Chaetomium congoensis* Ames
9–15. *Chaetomium mollicellum* Ames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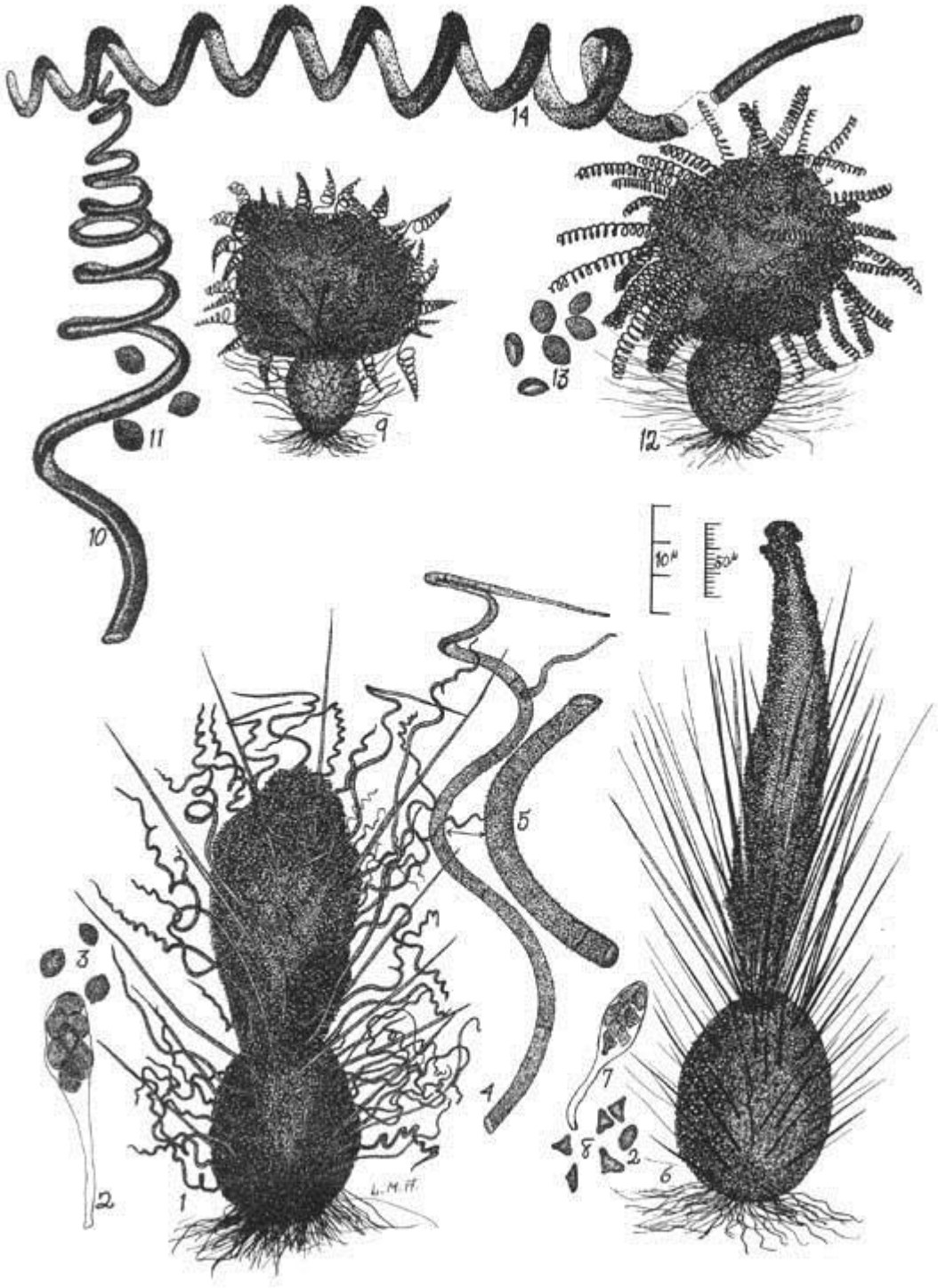
L.M.A.

## PLATE NO. 11

1–5. *Chaetomium angustum* Chivers
6–8. *Chaetomium trigonosporum* Chivers
9–11. *Chaetomium spirale* Zopf
12–14. *Chaetomium aterrimum* Ellis & Everhart

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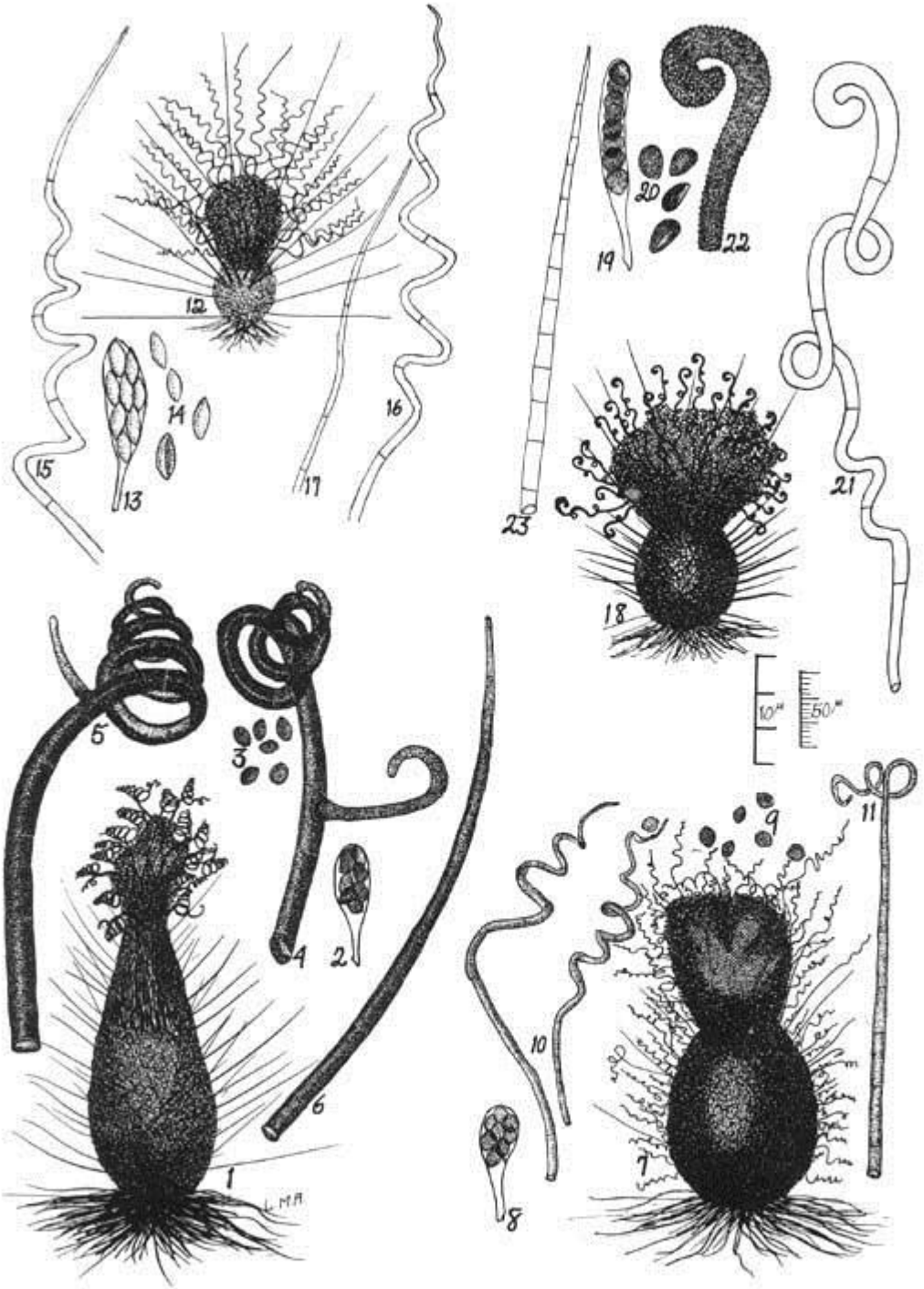
## PLATE NO. 12

1–6. *Chaetomium robustum* Ames
7–11. *Chaetomium subspirale* Chivers
12–17. *Chaetomium perlucidum* Sergejeva
18–23. *Chaetomium crispatoideum* Sergejeva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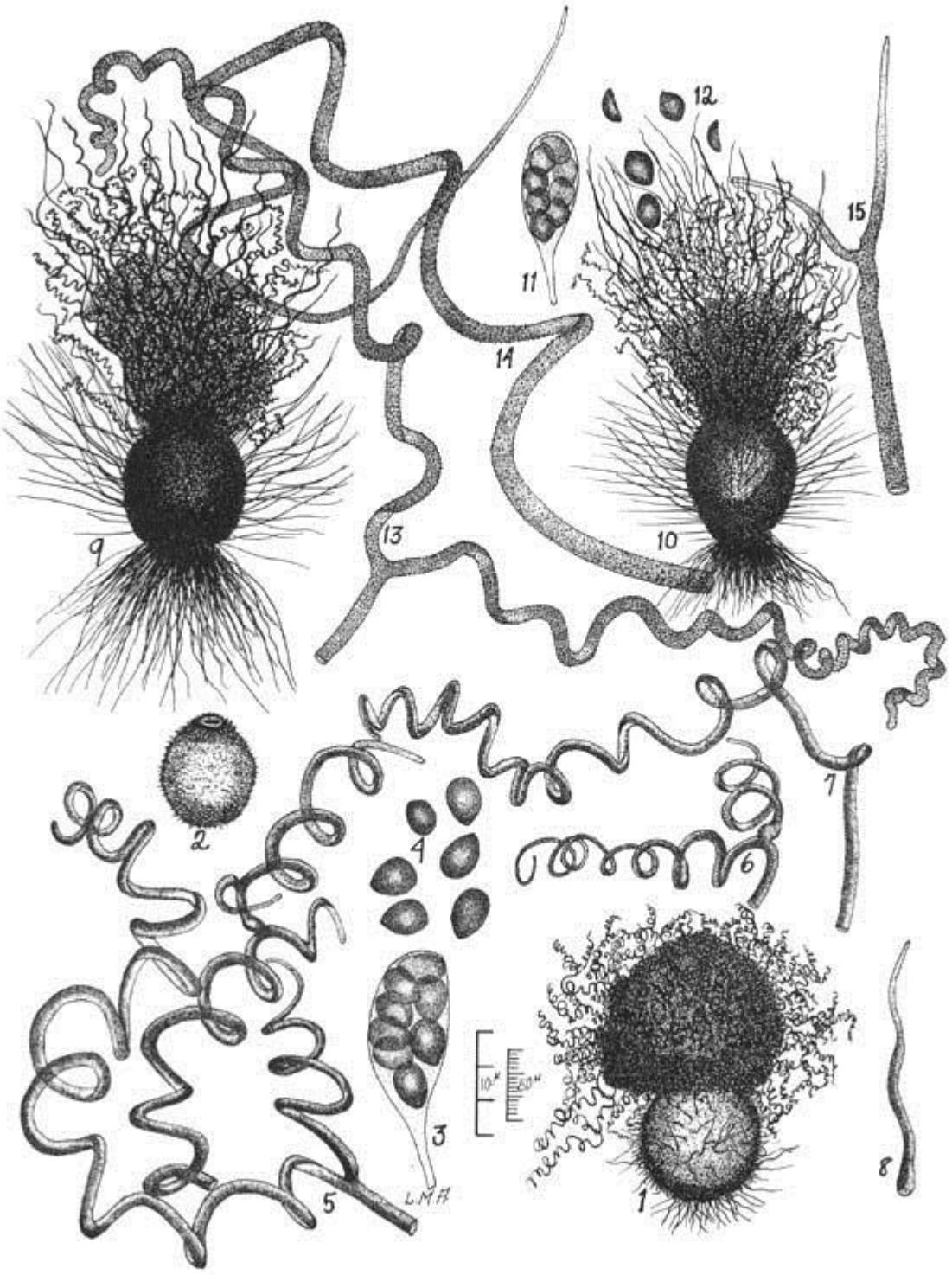
## PLATE NO. 13

1–8. *Chaetomium semen-citrulli* Sergejeva
9–15. *Chaetomium angustispirale* Sergejeva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10μ
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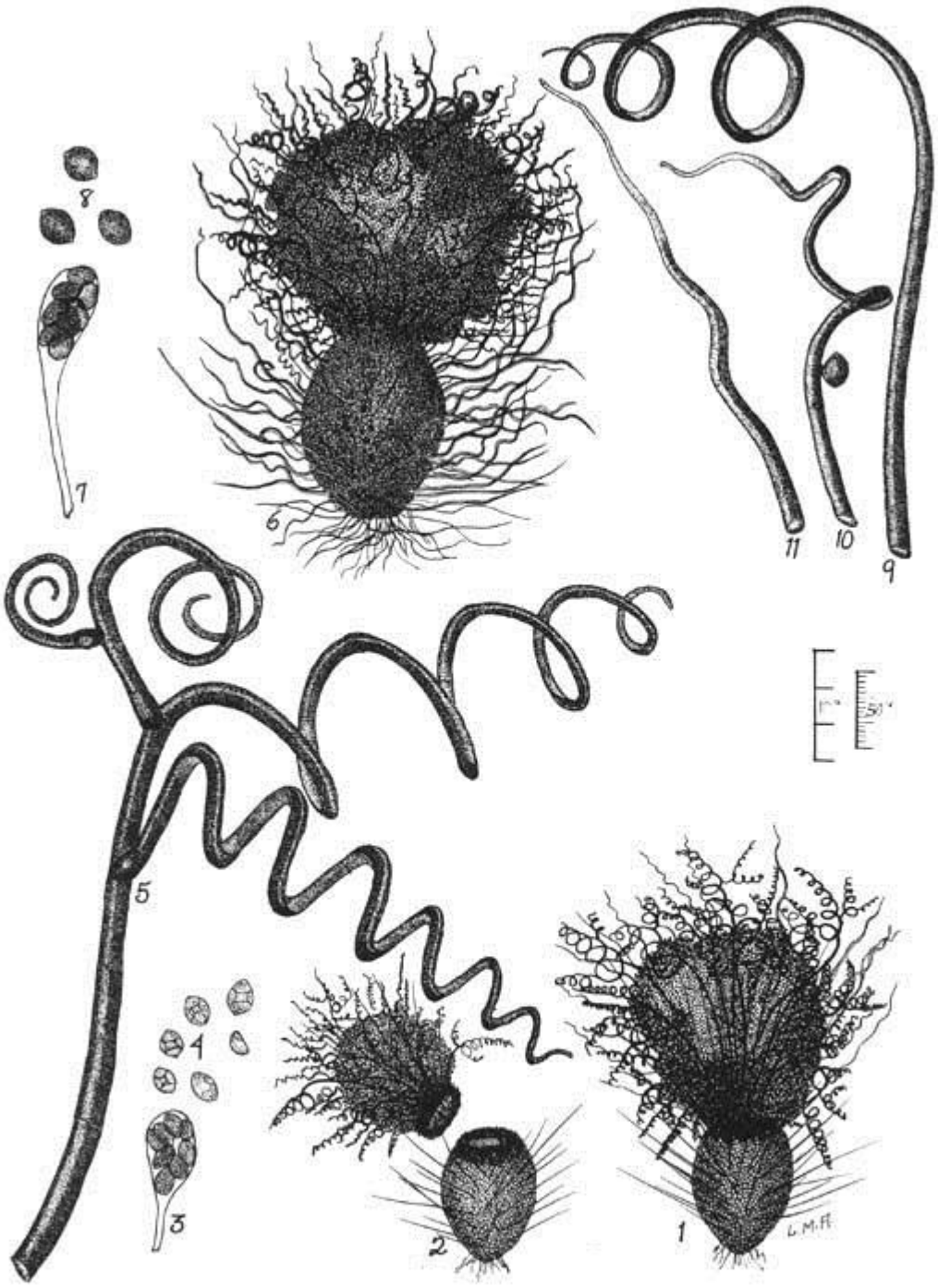
**PLATE NO. 14**

1–5. ***Chaetomium bostrychodes* Zopf**
6–11. ***Chaetomium cochliodes* Palliser**


8
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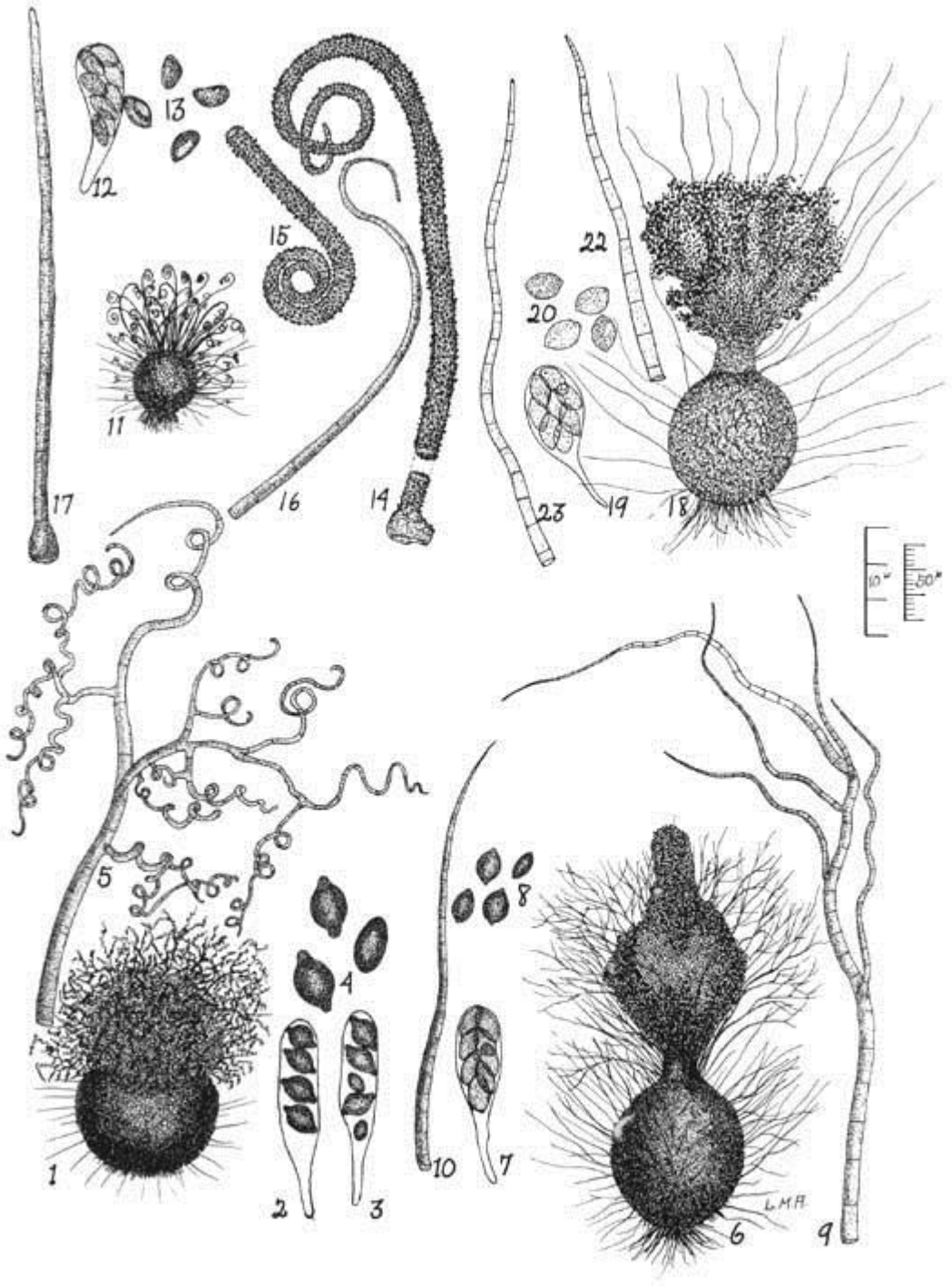
L.M.R.

## PLATE NO. 16

1–5. *Chaetomium tetrasporum* Hughes
6–10. *Chaetomium sphaerale* Chivers
11–17. *Chaetomium cupreum* Ames
18–23. *Chaetomium curentum* Ames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LMA
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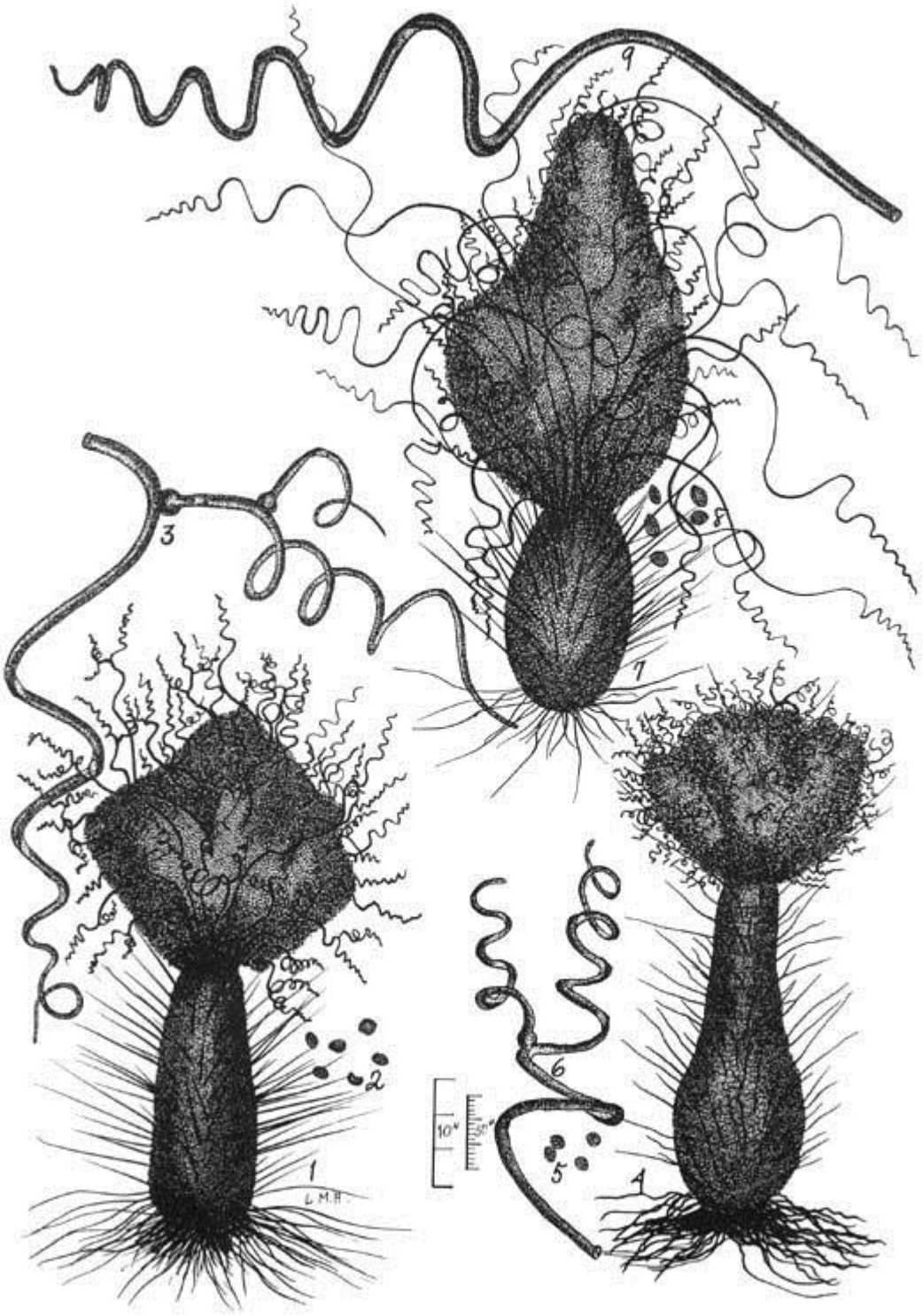
## PLATE NO. 17

1–3. *Chaetomium pachypodiodes* Ames
4–6. *Chaetomium caprinum* Bainier
7–9. *Chaetomium convolutum* Chivers


9
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7
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L.M.H.
6
10 μ
5
4

## PLATE NO. 18

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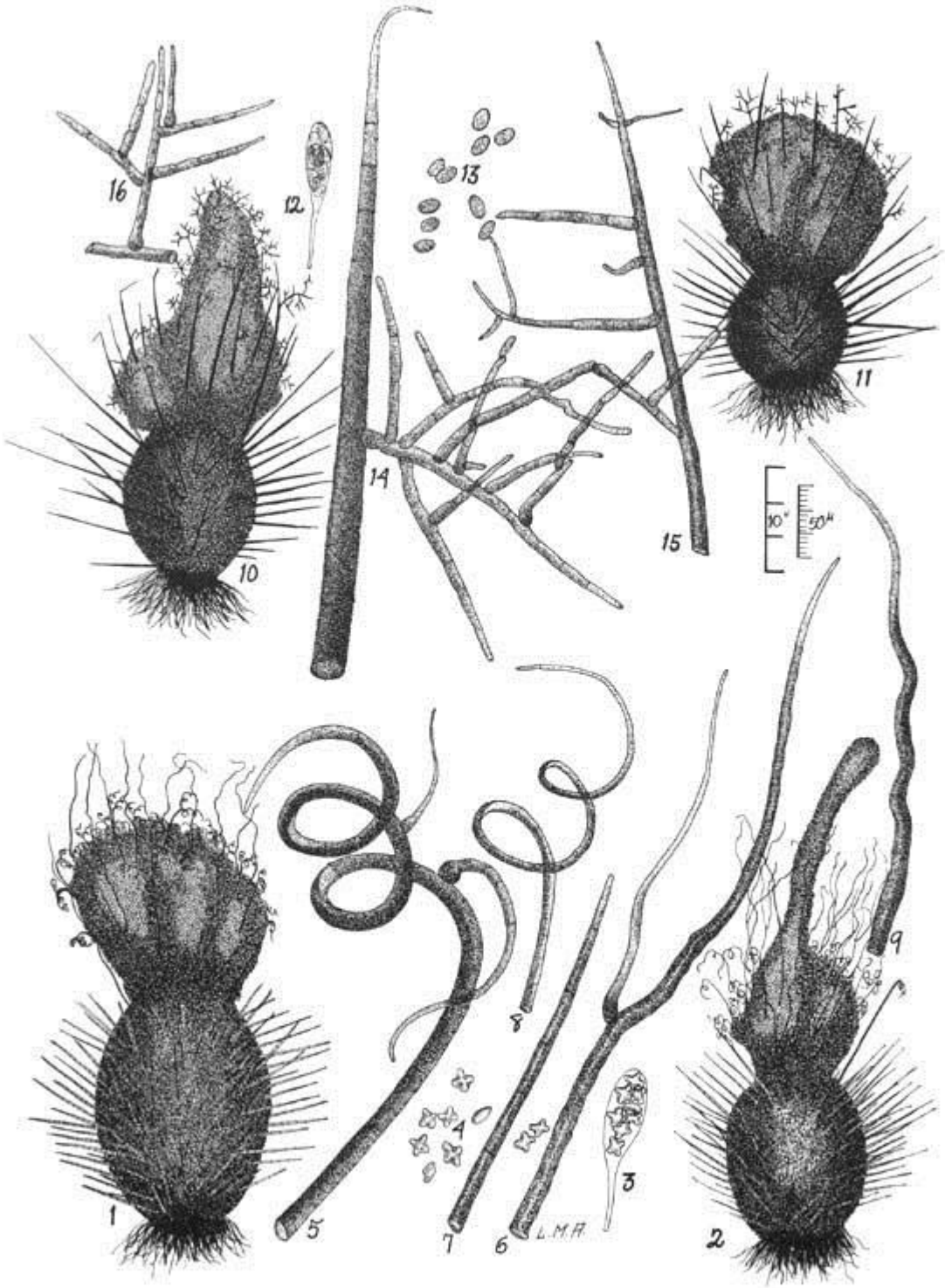
10–16. *Chaetomium spinosum* Chivers


16
12
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10 μ
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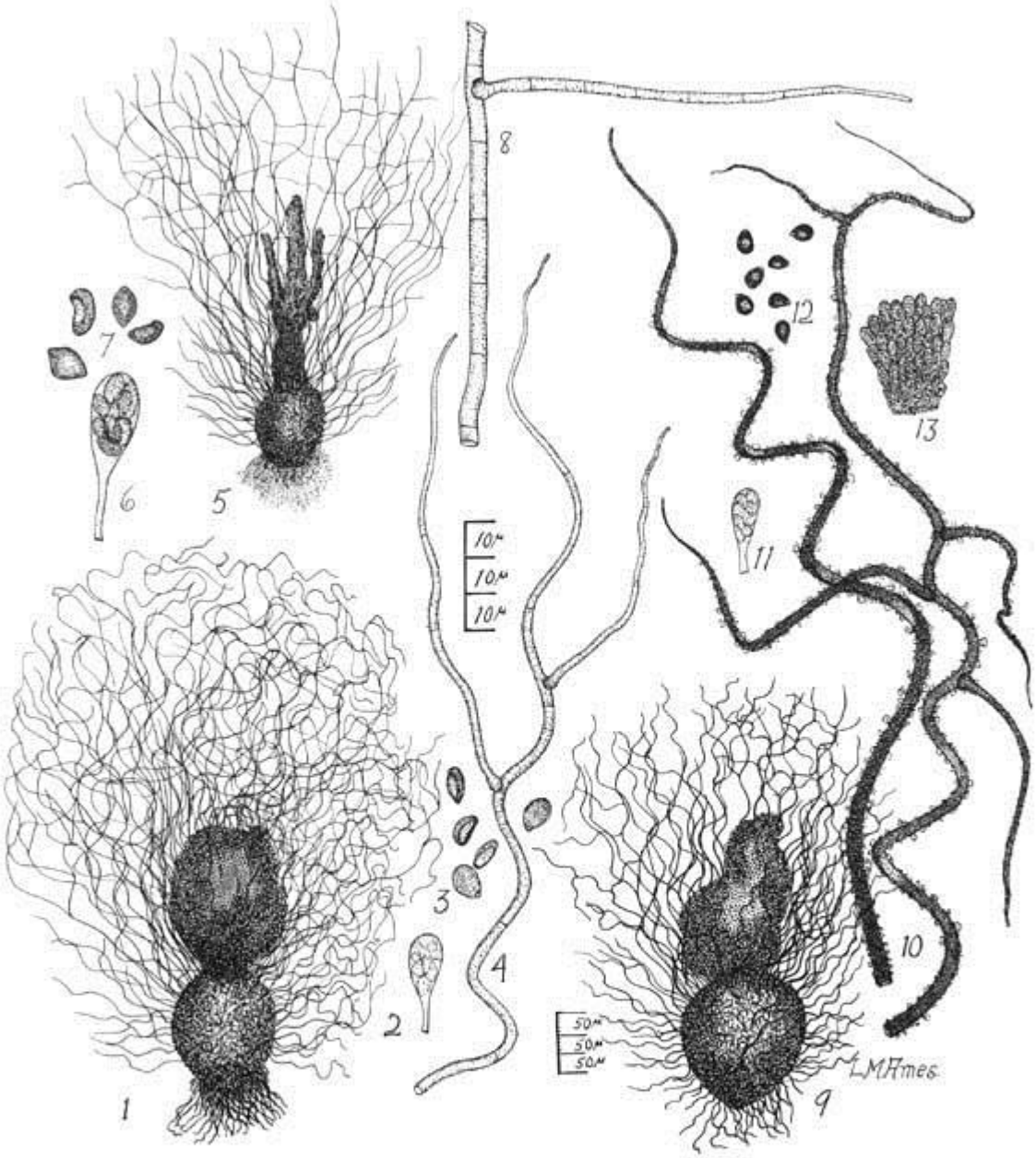
6
L.M.A.
3
2
9

## PLATE NO. 19

1–4. *Chaetomium fibripilium* Ames
5–8. *Chaetomium mollipilium* Ames
9–13. *Chaetomium nigricolor* Ames

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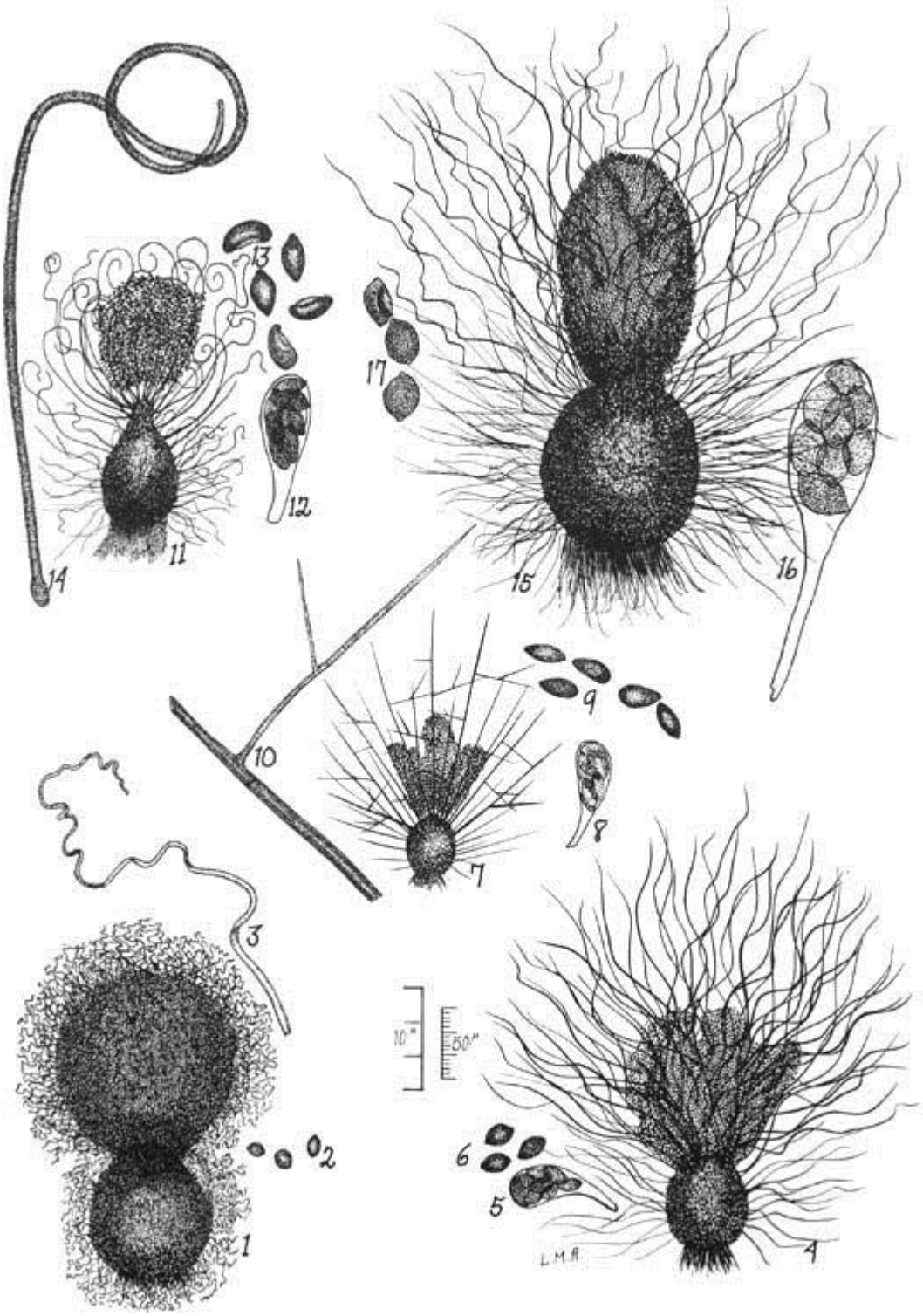
## PLATE NO. 20

1–3. *Chaetomium ochraceum* Tschudy
4–6. *Chaetomium globosum* Kunze
7–10. *Chaetomium atrobrunneum* Ames
11–14. *Chaetomium succineum* Ames
15–17. *Chaetomium olicaceum* Cooke & Ellis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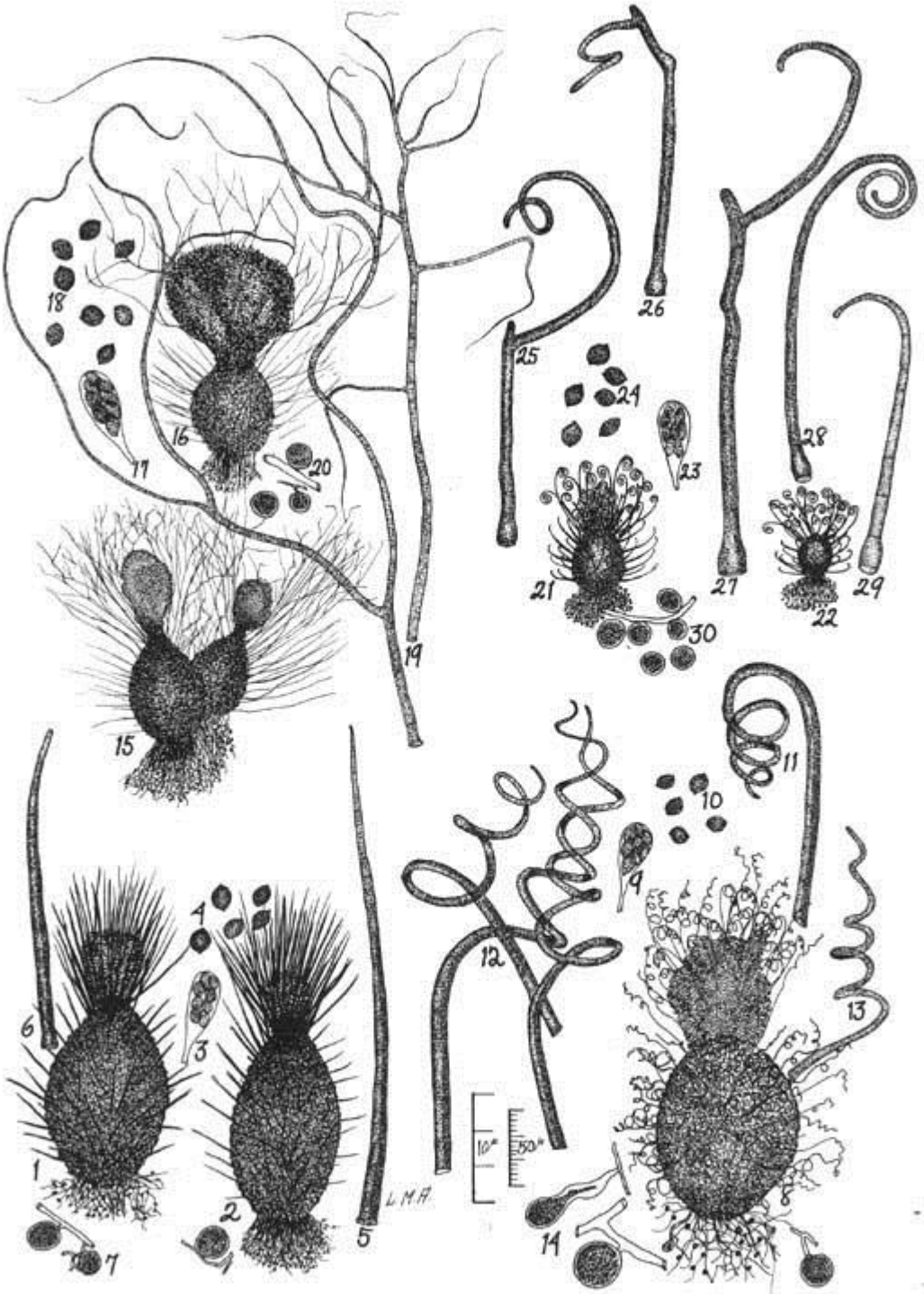
11
12
13
14
15
16
17
10 μ
50 μ
L.M.R.

## PLATE NO. 21

1–7. *Chaetomium brevipilium* Ames
8–14. *Chaetomium pulchellum* Ames
15–20. *Chaetomium pinnatum* Ames
21–30. *Chaetomium distortum* Ames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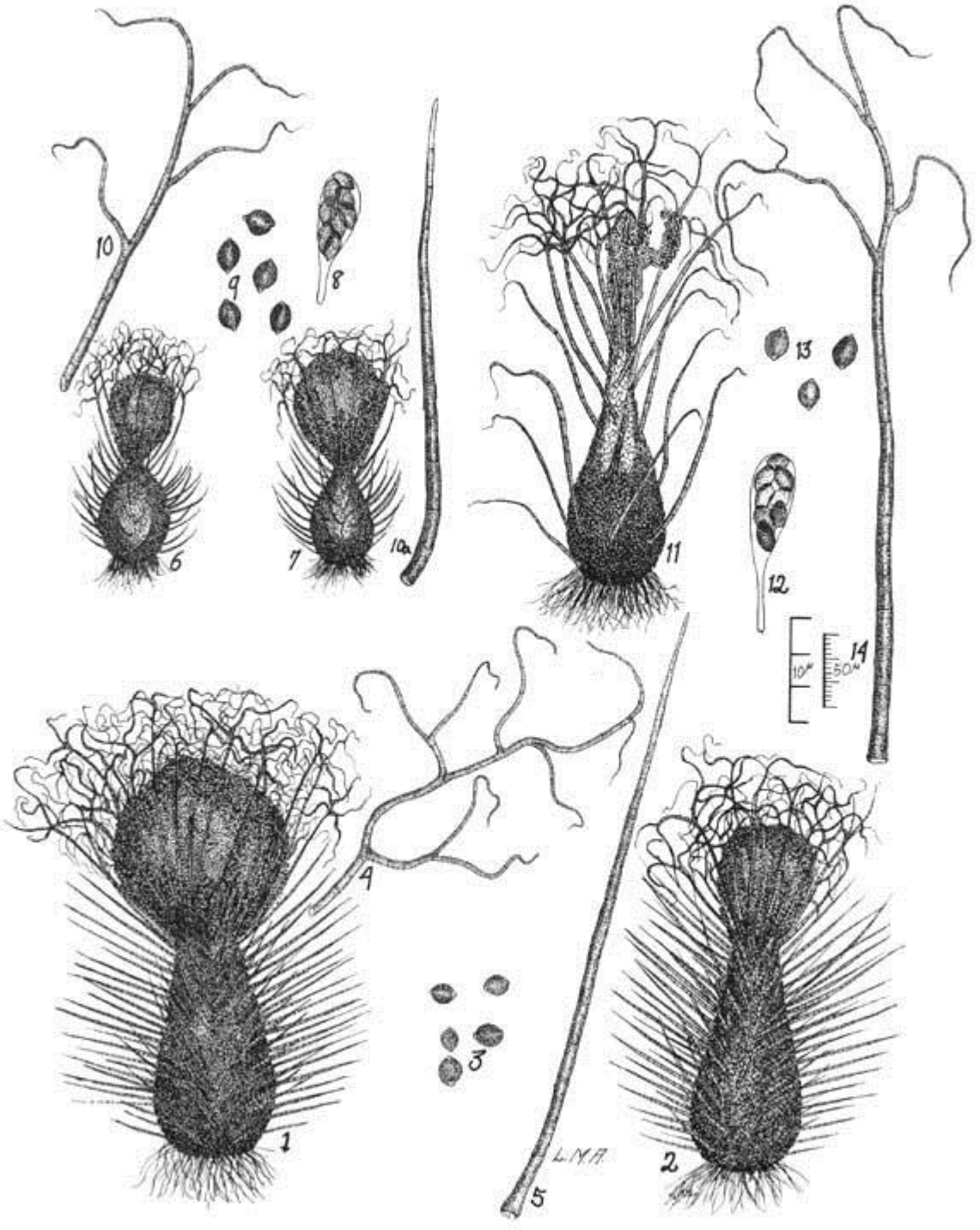
21
22
23
24
25
26
27
28
29
30
L.M.H.

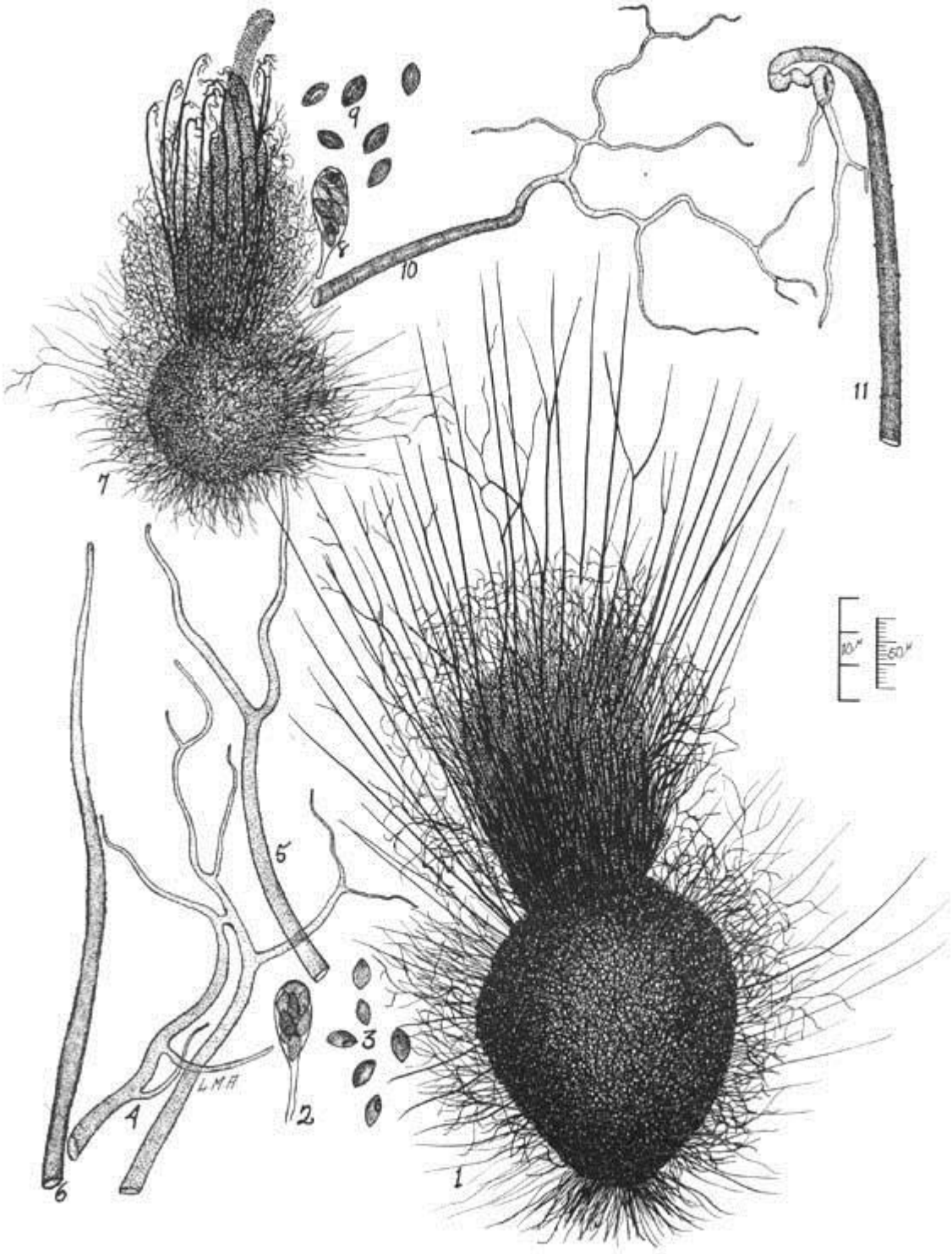
## PLATE NO. 22

1–5. *Chaetomium iricolor* Ames
6–10a. *Chaetomium torulosum* Bainier
11–14. *Chaetomium ampullare* Chivers


10
9
8
6
7
10a
11
13
12
14
10μ
50μ
4
3
1
5
2

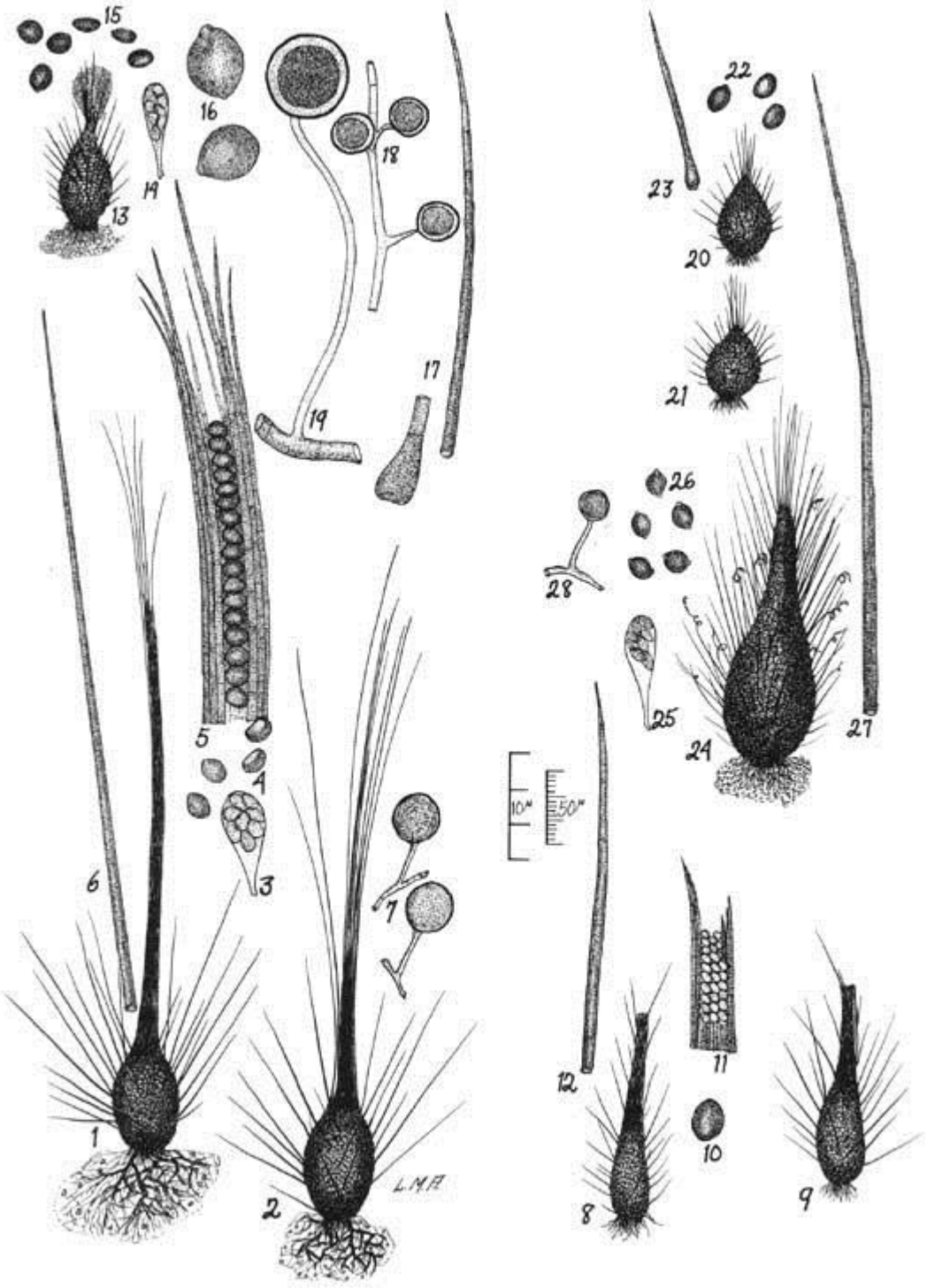
## PLATE NO. 23

1–6. *Chaetomium teratoideum* Ames
7–11. *Chaetomium cuniculorum* Fuckel


9
10
11
7
5
3
2
4
LMA
6
1
50 µ
50 µ

## PLATE NO. 24

1–7. *Chaetomium longirostre* (Farrow) Ames
8–12. *Chaetomium longicolleum* Krzem. & Badura
13–19. *Chaetomium seminudum* Ames
20–23. *Chaetomium minutum* Krzem. & Badura
24–28. *Chaetomium sp.*


15
16
18
14
13
19
17
5
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6
7
1
2
LMA
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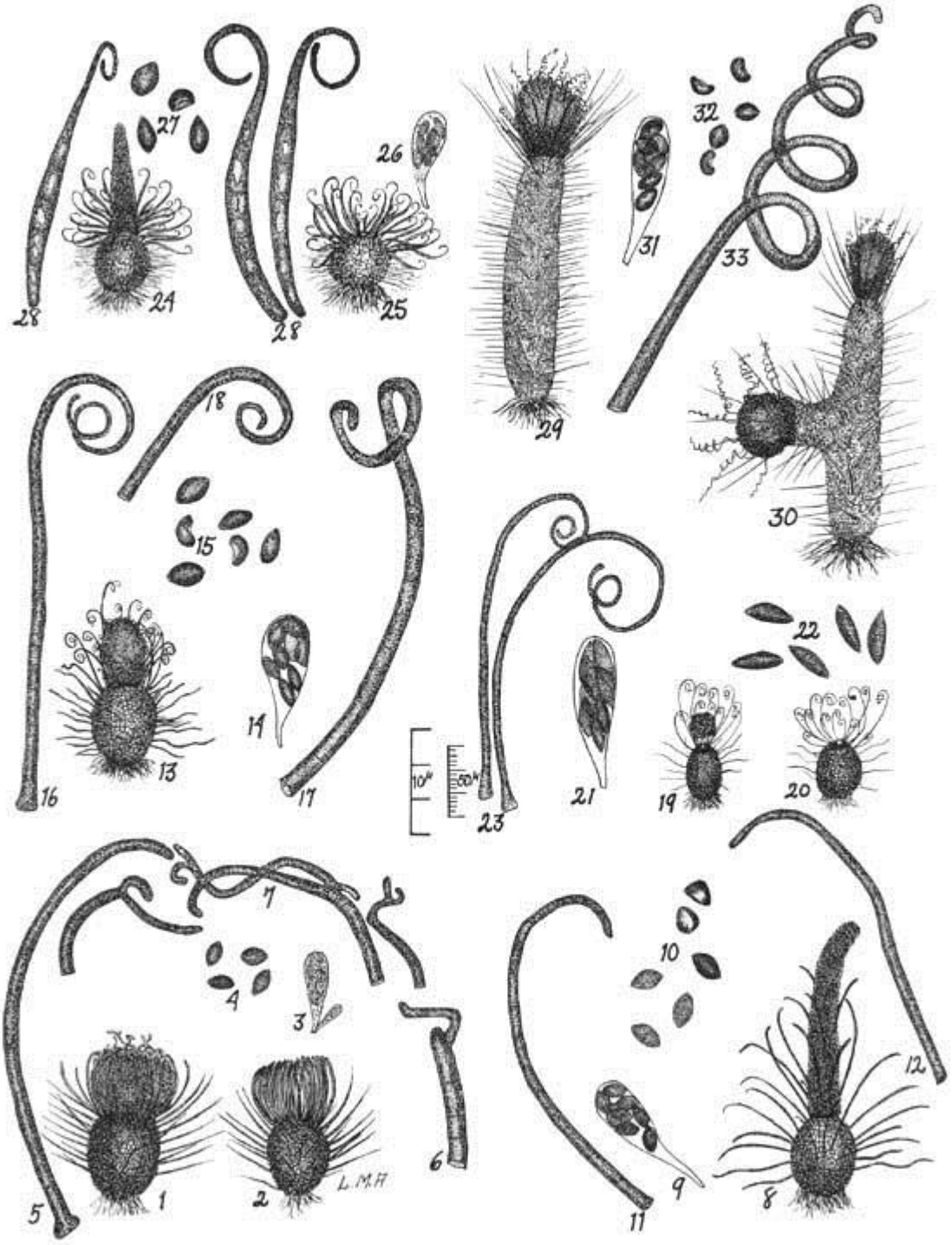
23
20
21
26
28
25
24
27
10"
50"
12
11
10
8
9

## PLATE NO. 25

1–7. *Chaetomium venezuelense* Ames
8–12. *Chaetomium aureum* Chivers
13–18. *Chaetomium trilaterale* Chivers
19–23. *Chaetomium fusiforme* Chivers
24–28. *Chaetomium turgidopilosum* Ames
29–33. *Chaetomium microcephalum* Ames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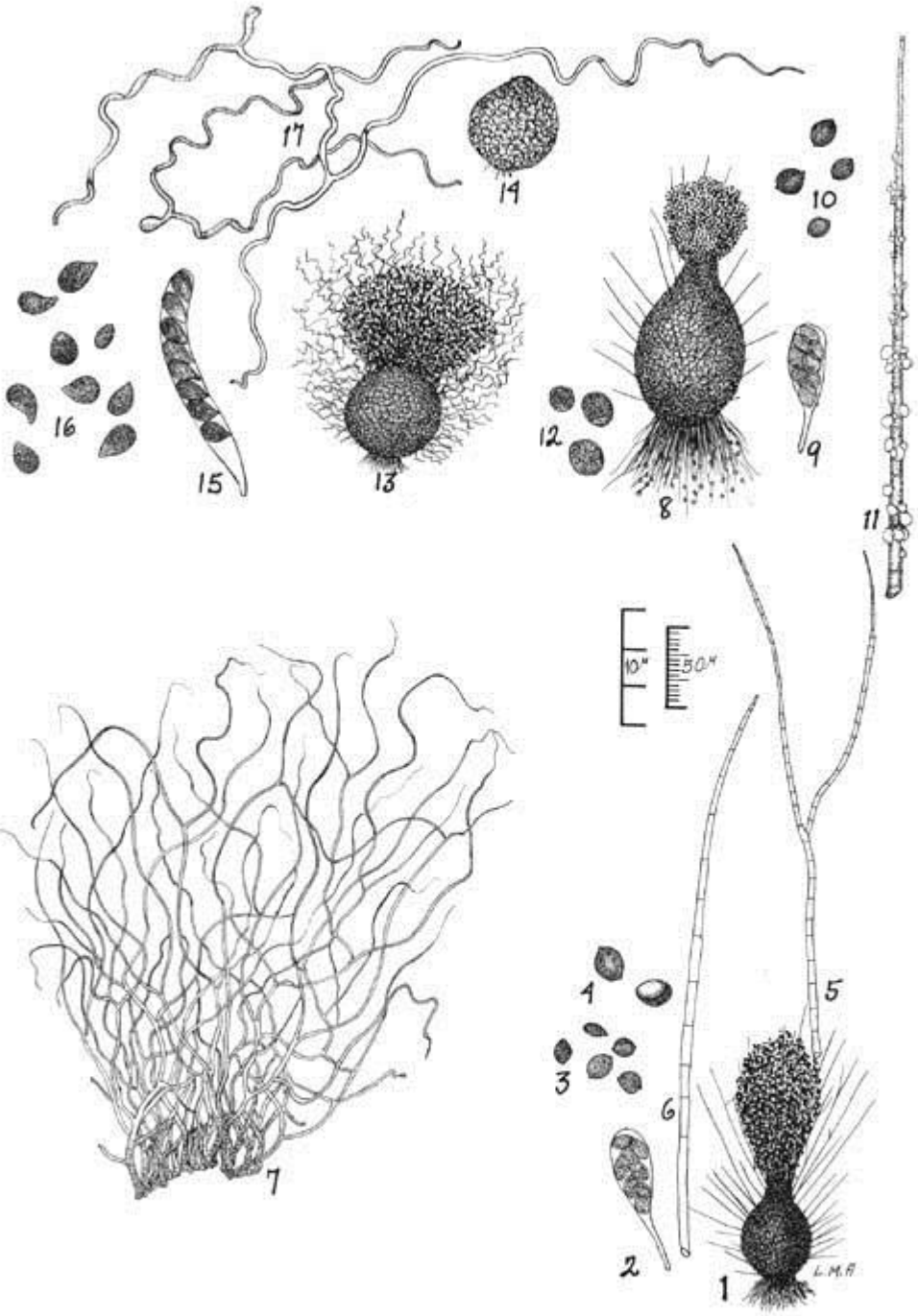
32
33
L.M.H

## PLATE NO. 26

1–7. *Chaetomium reticulopilium* Ames
8–12. *Chaetomium homopilatum* Omvik
13–17. *Chaetomium senegalensis* Ames


17
19
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16
15
13
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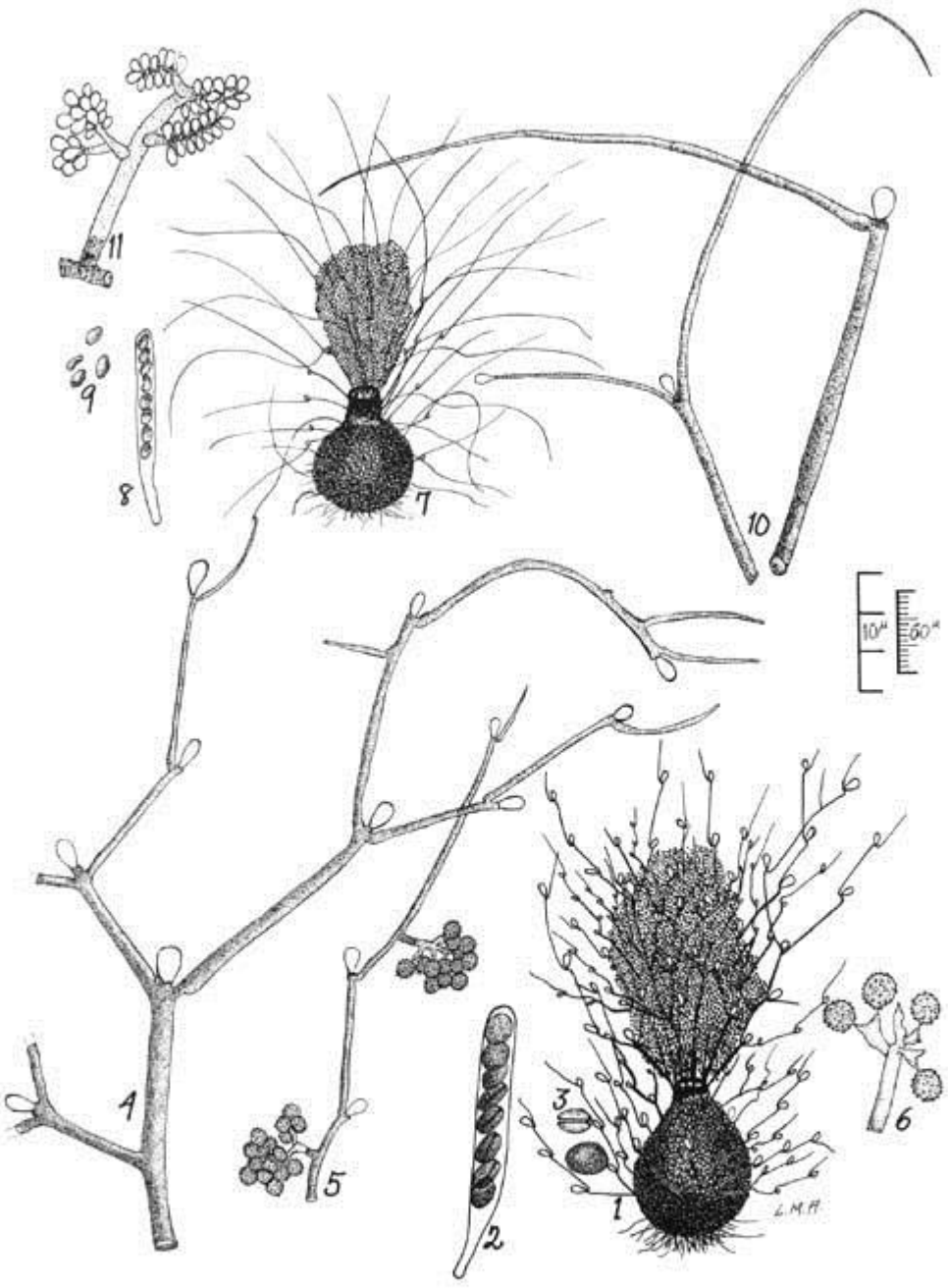
8
9
11
10"
50μ
7
1
5
3
6
2
1
L.M.A

## PLATE NO. 27

1–6. *Ascotricha chartarum* Berkeley
7–10. *Ascotricha pusila* (Ellis & Everhart) Chivers

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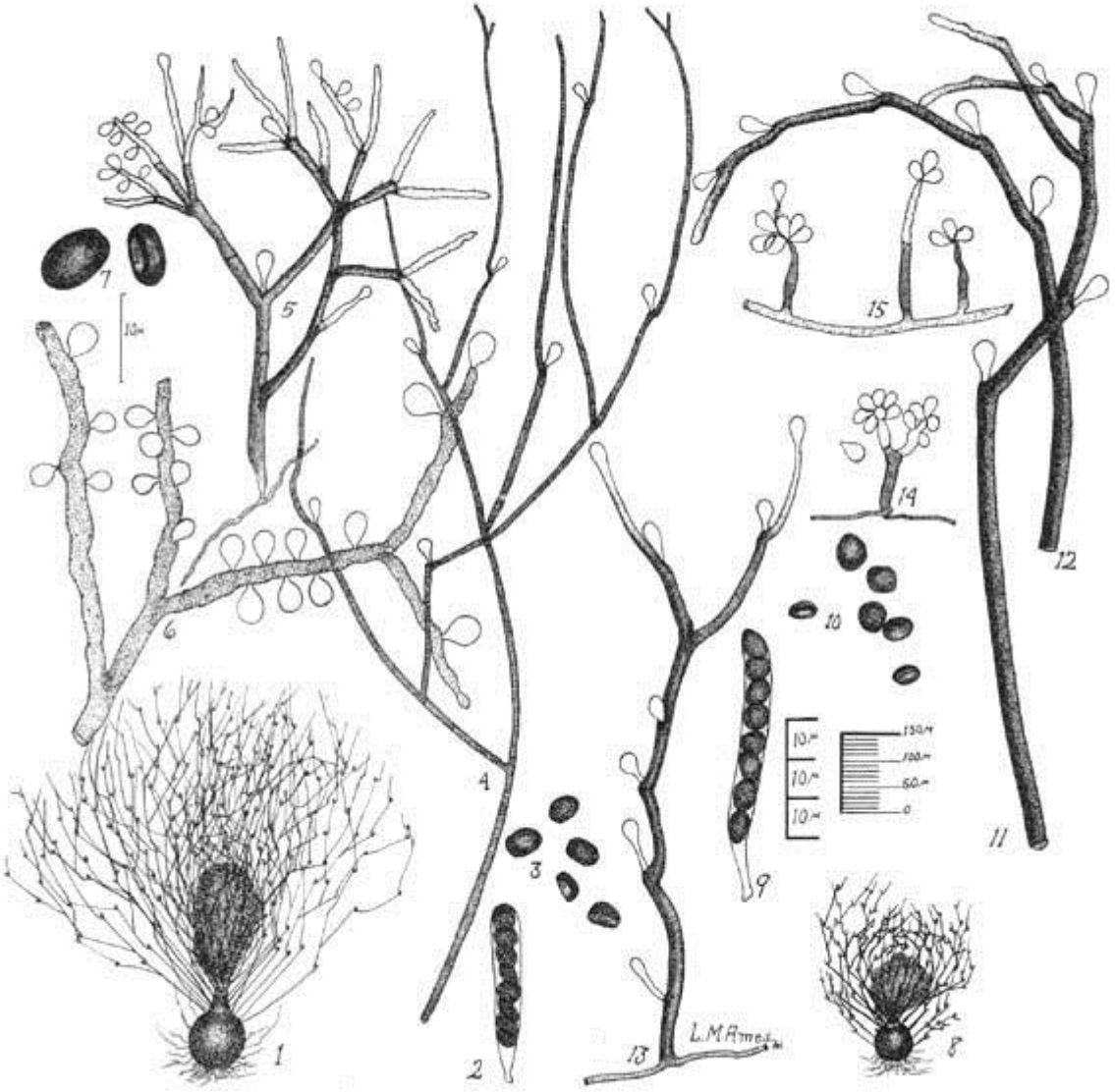
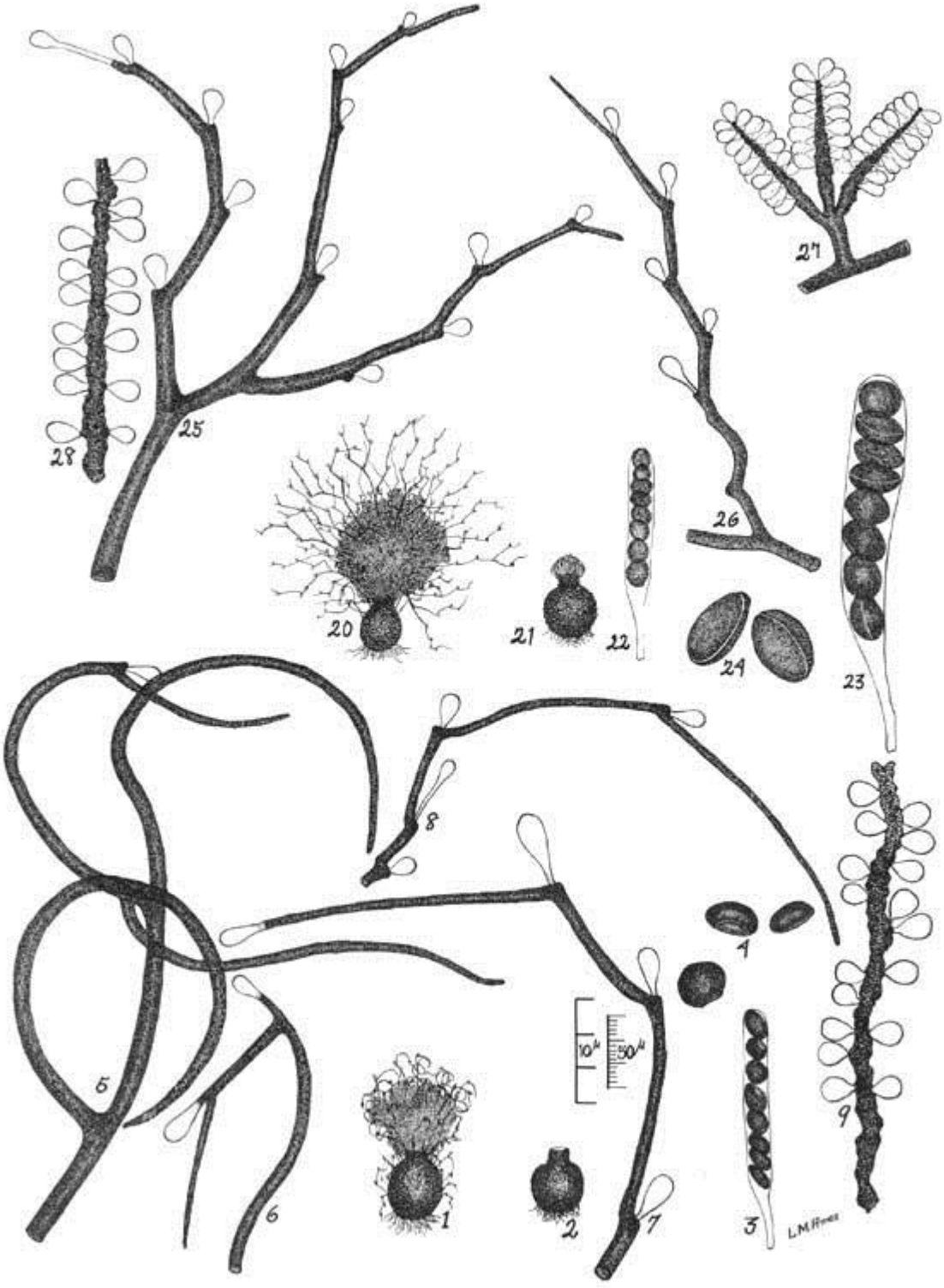
## PLATE NO. 28

1–7. *Ascotricha xylina* Ames
8–15. *Ascotricha guamensis* Ames


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
L.M.Ames

## PLATE NO. 29

1–9. *Ascotricha arcuatum* Ames
21–28. *Ascotricha congoensis* Ames


28
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10μ
50μ
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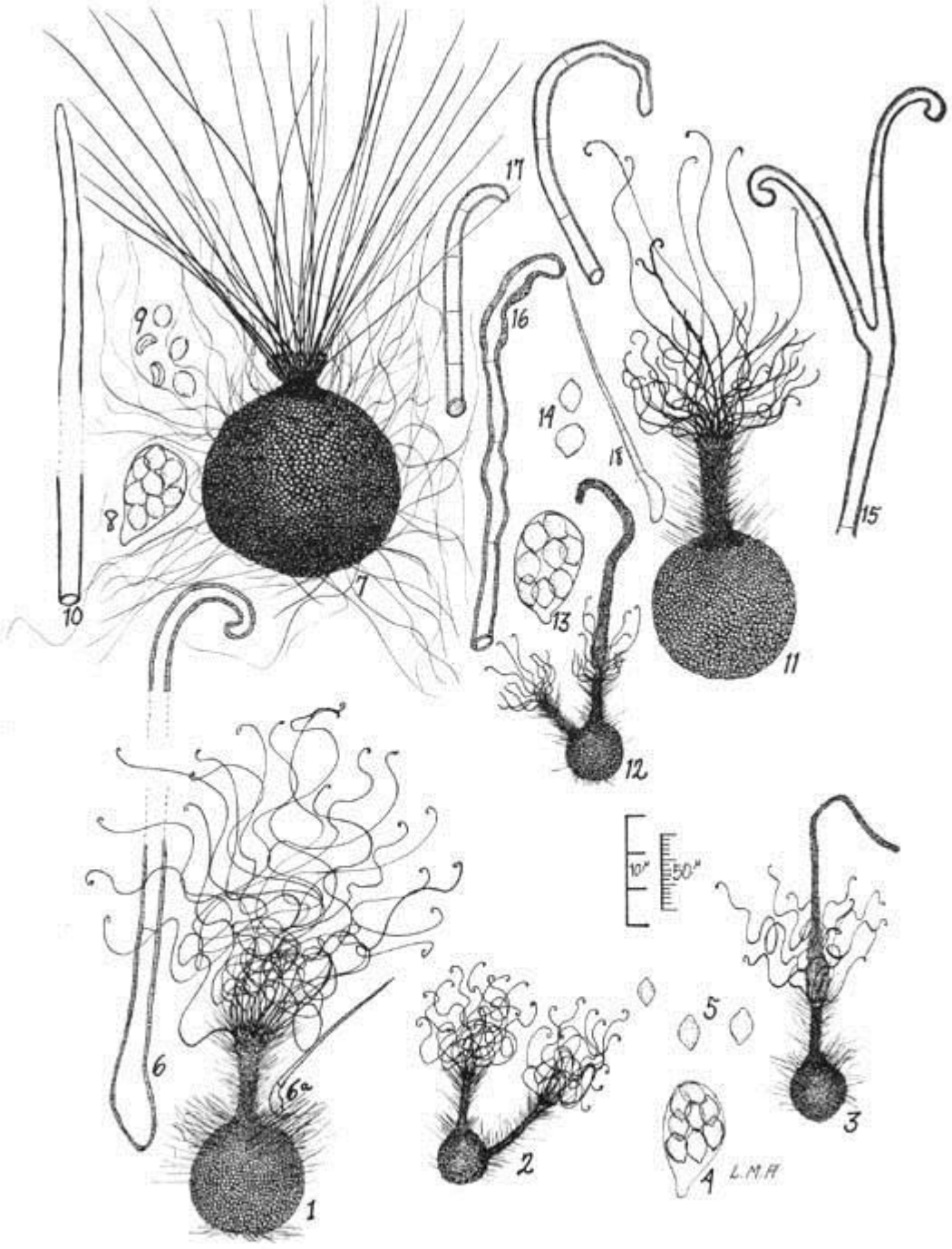
9
6
1
2
7
3
L.M.Rivas

## PLATE NO. 30

1–6a. *Lophotrichus ampullus* Benjamin
7–10. *Lophotrichus brevirostratus* Ames
11–18. *Lophotrichus martini* Benjamin

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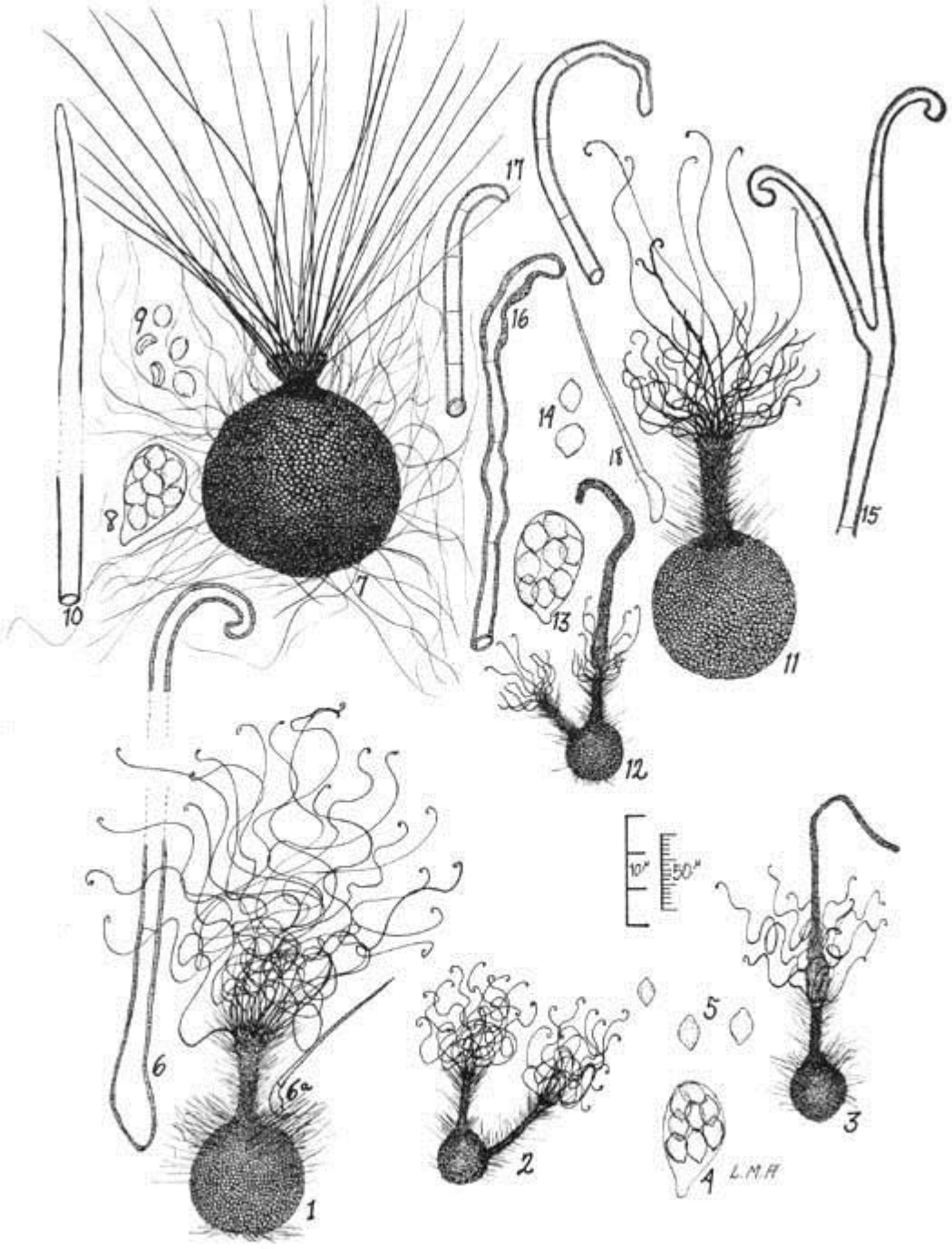
## PLATE NO. 30

1–6a. *Lophotrichus ampullus* Benjamin
7–10. *Lophotrichus brevirostratus* Ames
11–18. *Lophotrichus martini* Benjamin

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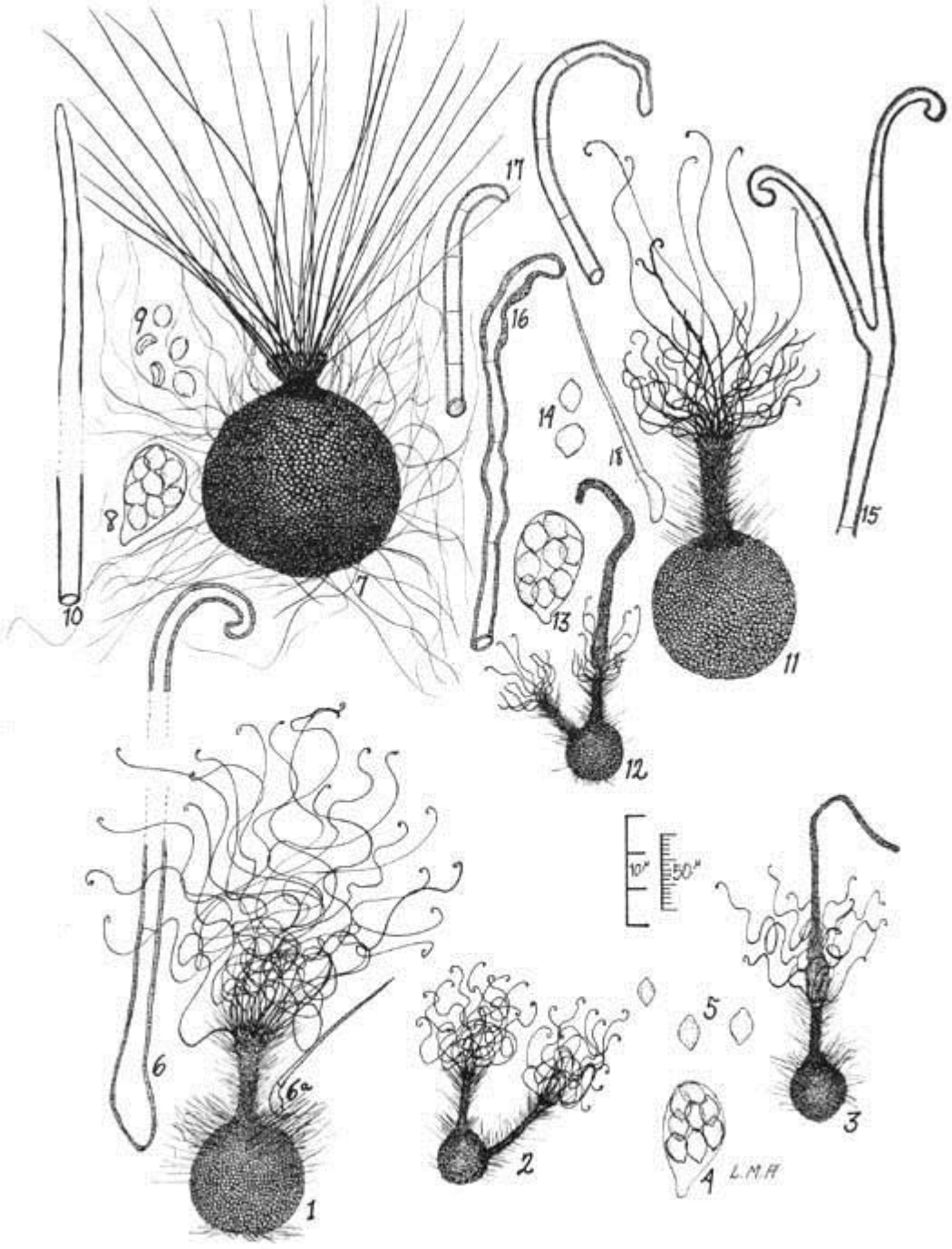
## PLATE NO. 30

1–6a. *Lophotrichus ampullus* Benjamin
7–10. *Lophotrichus brevirostratus* Ames
11–18. *Lophotrichus martini* Benjamin

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