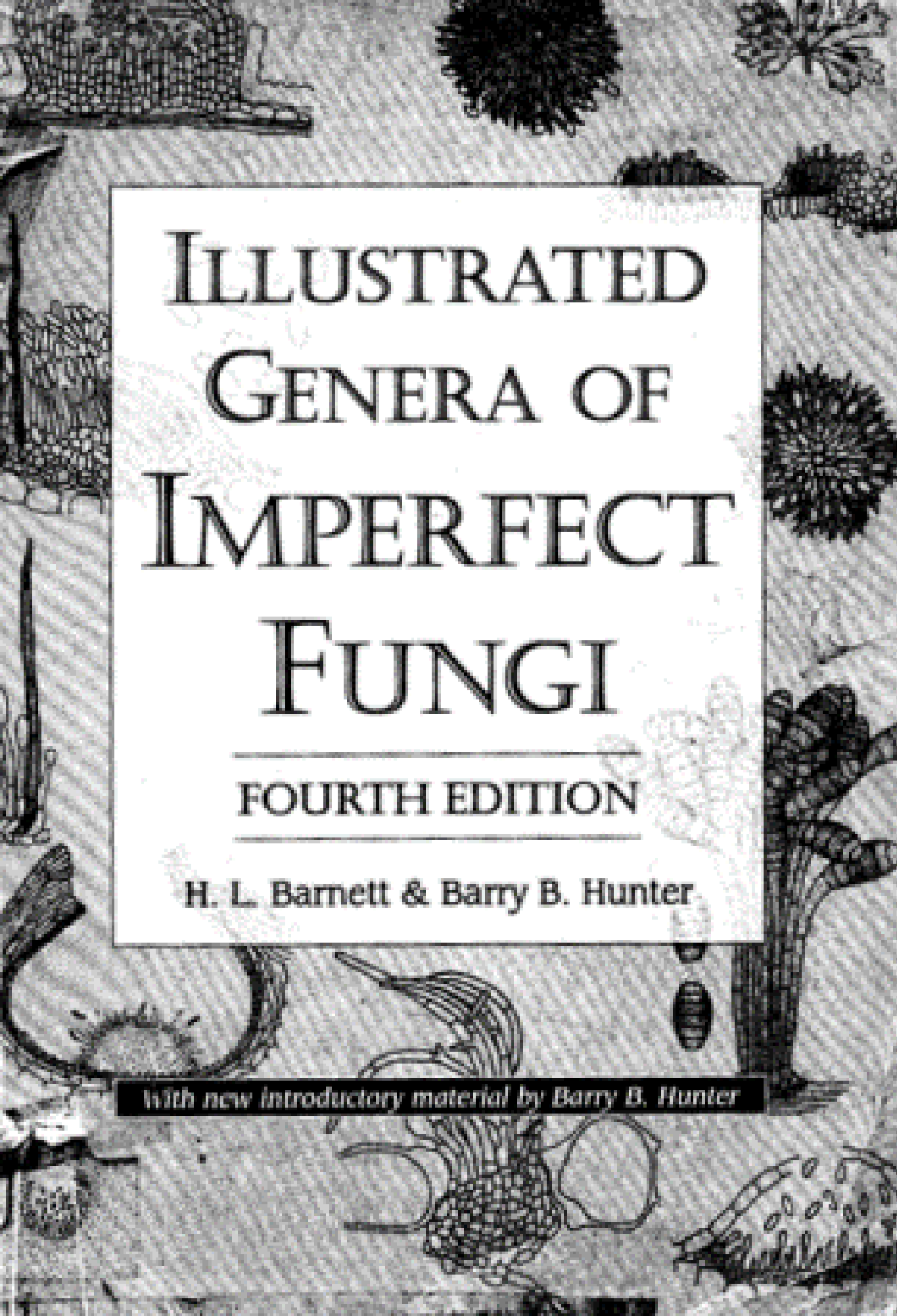

Illustrated Genera of Imperfect Fungi

FOURTH EDITION

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With new introductory material by Barry B. Hunter

CONTENTS

INTRODUCTION

The *Deuteromycetes* or *Fungi lmperfecti* (former taxonomic designations) are an anomalous, heterogeneous assemblage of asexual ascomycetes and basidiomycetes which no longer have formal taxonomic status. These fungi were traditionally considered as lesser fungi because they lacked the perfect stage—sexual reproduction. The absence of asci (ascomycetes) and basidia (basidiomycetes) prevented their assignment to a natural taxon and necessitated .artificial non-sexual characteristics to describe and classify them. This genetic inability of many imperfects to reproduce sexually is considered a primitive condition and in contemporary mycology presents a taxonomic quandary. Alexopoulus *et al,* 1996, provide excellent scientific rationale for excluding imperfect fungi from contemporary fungal systematics, and discuss considerations needed to develop logical and valid taxonomic approaches to determine their phylogeny (1). Consequently, the taxons which previously were recognized as taxonomically valid for the deuteromycetes (imperfect fungi), are used in this book only to facilitate their identification.

The imperfects are important eucaryotic microorganisms (possessing nuclei and organelles) which affect humans and most other life forms in a myriad of ways. The need to determine their identities is paramount in research, industry, medicine, plant pathology and in many other disciplines. Imperfect fungi are identified according to their conidial or non-sexual states. Nevertheless, many imperfects possess sexual structures of known ascomycetes or basidiomycetes, whereas others produce no conidia and/or sexual structures. Roper, 1966, described a parasexual cycle in which genetic recombination can occur in hyphae (16). This observation suggests that some fungi may never have possessed sexual structures or required sexual reproduction for genetic exchange. However, while there is little data which substantiates that pansexuality occurs under natural conditions today, it could have occurred during the origin and evolution of these fungi.

When sexual structures are associated with the conidial state, a valid taxonomic status can be ascribed. However, this often does not occur, and for practical purposes is not important. Although the scientific name of the sexual state constitutes a valid taxonomic designation, the imperfect name is retained for practicality and for conventional use. Therefore, to identify the imperfect fungi, it is necessary to know their conidial morphologies regardless of whether the sexual state is also present in culture or in nature.

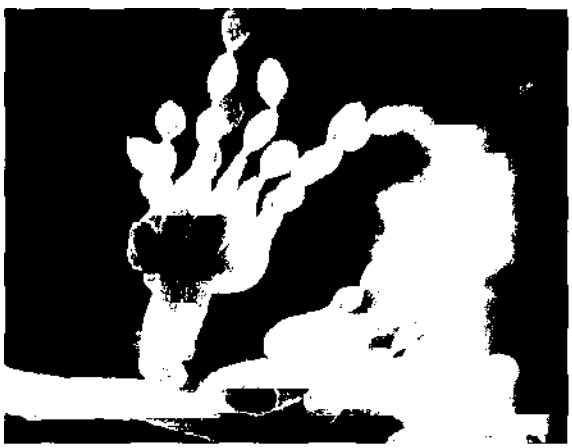
The deuteromycetes constitute an important group of fungi which require continued study despite their obscure and confounding systematic relationships both to themselves and to other fungi. Barron, 1968 (2), Hunter and Barnett, 1973 (10), Hunter « tf *al.,* 1978 (11), and Alexopoulus *et al.* (1) provide additional information on many aspects of the morphology, sporulation, growth, ecology and economic importance of imperfect fungi.

Scanning electron and light photomicrographs are provided on several of the following pages. They show conidia, conidiophores, and hyphal structures found on many different kinds of imperfect fungi. Compare them with like illustrations in the book to better understand how these structures are important in identifying imperfect fungi.

MAJOR GROUPINGS OF IMPERFECT FUNGI AND THEIR IMPORTANCE IN THE BIOSPHERE

The imperfect fungi or deuteromycetes have been classified according to principles established by Saccardo in *Sylloge fungorum* (17). While this taxonomic system is no longer valid, it is still the best way to learn the mycology that is necessary for identifying the imperfect fungi. It is also the primary means used in this book to identify imperfect fungi. The scientific names of imperfect fungi are still used, albeit, only in a non-taxonomic sense, and as a necessity to know their practical importance in the biosphere. The Hughes-Tubaki-Barron System (conidial ontogeny) has also been used as a way of classifying and identifying these fungi (2, 9, 18). Details pertaining to this system are provided on pages 40-44 and related identification keys are found on pages 44-57. The use of conidial and conidiophore ontogeny for identifying deuteromycetes should be used by individuals who are well versed in mycology. The shape, pigmentation, and septation of conidia are important characteristics in the Saccardo System but reduced to secondary importance in the Hughes-Tubaki-Barron System.

To better understand the Saccardo System, common and economically-important imperfect fungi of the four form orders will be presented. Following the Saccardoan System, the species of the form orders can be separated into four distinct groups of fungi. This provides a basis from which to begin a search (appropriate key) for the identity of an unknown fungus. The form orders are as follows: (**I**) **Moniliales** - Conidiophores and conidia occurring free and distributed over the mycelium. Conidiophores may be separate, in clusters, or in tightly-packed groups. Illustrative examples and accompanying descriptions of many of the diverse genera in this group are provided from pages 68 through 161; (2) Sphaeropsidales - Conidiophores and conidia contained within asexual fruiting bodies called pycnidia. See pages 162 through 187 for descriptions and illustrations of pycnidia-producing fungi. (3) **Melanconiales** - Conidia typically produced under natural conditions in an acervulus, an open saucer-shaped fruiting body. In culture, conidiophores may be single or in compact groups similar to sporodochia of the Mormiales. These fungi can be found on pages 188 through 194; (4) **Mycelia Sterilia** - Species in this form order are genetically incapable of producing conidia or any kind of reproductive cells. Sclerotia or other survival structures occur in the mycelium. Descriptions and illustrations of the three species depicted in this book are provided on pages 196 and 197.



Conidiophores ot *Paecilomyces* sp. with typical flask-shaped phialides and catenulate conidia.

Conidia of *Trichoderma* sp. emerging from apices ot the conidiophores.

Two of the spomlating form orders, Moniliales and Sphaeropsidales can be separated into several form families. Characteristics are predicated upon such artificial features as color, shape, and consistency of the pycnidium in the Sphaeropsidales, or color of the conidia and presence of synnemata or sporodochia in the Moniliales. The form family taxon is not used in Mycelia Sterilia and only one form family exists in the Melanconiales.

There are at least 1,400 form genera of imperfect fungi and several thousand species. The most common in nature and the most economically important are found in the form order Moniliales. Some are pathogens of plants, animals and humans, some produce toxins, while others are important in the production of antibiotics and other chemicals. In the Saccardo System, it is the color and morphology of the conidia which are used to separate form genera into sections. For example, one-celled hyaline (devoid of any color) conidia are called hyalospores; colored, one-celled conidia are phaeospores; didymospores are two-celled; and transversely septate conidia with three or more cells are phragmospores. Add hyalo to phragmospore (hyalophragmospore) and it is a hyaline, transversely septate conidium; cylindrically-spiraled, one to several cell formations are helicospores, regardless of the presence or absence of color. Problems encountered when using the Saccardo system are variations in type of fruiting body (acervulus, sporodochium, and pycnidium), conidium color and conidium morphology. These structures can vary on different media and in their response to varying environmental conditions. Consequently, what is described in the keys may differ slightly to significantly when the fungus in question is grown on different media or when it is incubated at different temperatures. Nevertheless, time and experience will negate these factors. Therefore, because of its simplicity and practicality, the Saccardo System is still the best way for students and others to study and identify imperfect fungi.

SACCARDOAN FORM ORDERS

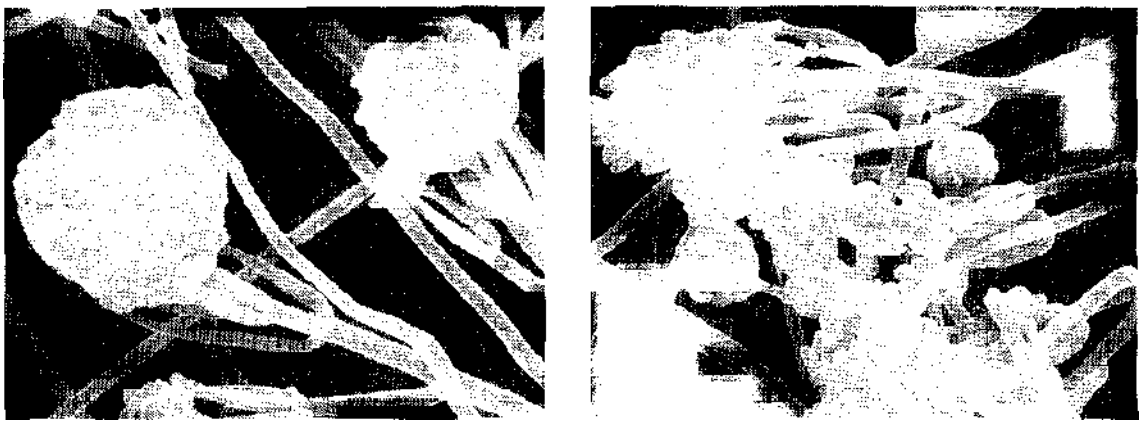
FORM ORDER MONILIALES

Most species of deuteromycetes reside in this form order and are grouped into four form families (see page 7). This is the only form order in which form families are described in this book. Form families Moniliaceae and Dematiaceae have species which are delimited by one or more of the following

Conidia In basipetal chains radiating from the apex of an *Aspergillus* sp. conidiophore.

characteristics: conidial septation; conidiophore appearance and branching; conidial morphology; true and pseudomycelium (some imperfects are yeasts without true hyphae); the manner in which the conidia are produced; presence of chlamydospores and morphology; conidia produced in chains or in a head; presence or absence of mucilage; conidial number and arrangement at apex of the conidiophore; conidia produced on conidiophore or mycelium; and exogenous or endogenous production of conidia. Refer to page 68 through page 145 for numerous examples of the Moniliaceae and the Dematiaceae. Note that imperfects in this form order with hyaline conidia are members of the Moniliaceae; those with pigmented conidia and/or conidiophores reside in form family Dematiaceae. The reason that the fungi of these two form families are discussed together is because the only difference between the species is the color of their conidia and conidiophores. This seemingly obvious color difference is at times difficult to determine in culture and under the microscope. However, careful use of the microscope, diligence and experience in identifying these and other fungi, will in time allow orje to make accurate determinations of pigmentation, along with many other pertinent fungal characteristics.

Many of the more common fungi are found in the form families Moniliaceae and Dematiaceae. Species of *Aspergillus* (page 95), *Penicillium* (page 95), *Alternaria* (page 132) and *Stemphylium* (page 132) are routinely isolated from the air and numerous other substrates. These genera and several other species of the Moniliaceae are discussed here. *Aspergillus fumigatus* is an opportunistic pathogen of humans and other animals and is responsible for the human disease aspergillosis, a pulmonary disorder. *Penicillium chrysogenum* and closely related species are the sources of penicillin, an important antibacterial antibiotic, which has saved countless humans from death and serious illness for many decades. Other species of *Penicillium* are responsible for the contamination of food and clothing. *Gl'tocladium* spp. (page 93) are similar to the penicillia, but differ at maturity by having the spore mass encompassed by mucilage. One species, *G. roseum* is a good example where identification is confusing because it produces two different conidial types, one being the *Gliocladium* type and the other that of *Veriicillium albo-atrum* (page 92). Fortunately, this is unusual, but warns one to not always consider fungal cultures contaminated when two distinct conidial types occur in the same culture. *Verticillium albo-atrum* is a destructive plant pathogen that causes a wilt of some economically-important plants. *Monilia* (page 73) *cinerea* var. *americana,* the pathogen of brown rot of peach and other fruits, is often found as a contaminant of microbial cultures. *Geotrichum candidum* (page 68) is the causative agent of geotrichosis, a human disease which can occur orally, in the intestine and as a pulmonary disease. Species of the genus *Candida* (page 71) are common in the Moniliaceae. Note that this fungus is not always filamentous, but can possess yeast-like cells. An important species *C. albicans,* is an opportunistic human pathogen causing oral and vaginal diseases and may become systemic. This filamentous yeast can be differentiated from other *Candida* spp. by the production of S to 12 pm spherical chlamydospores on corn meal agar.

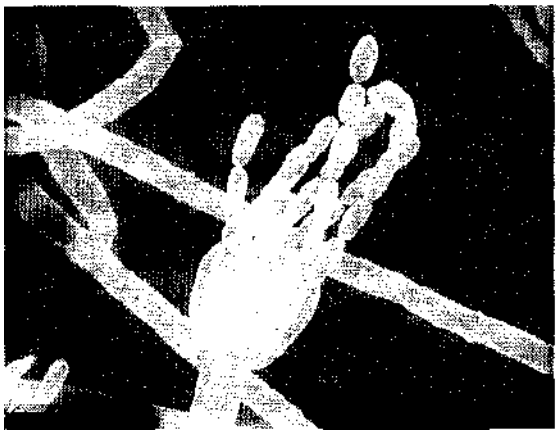


One-celled *Gliocladium* sp. conidia in mucilaginous masses on penicillate branches of conidiophores.

Many species having pigmented conidia and/or conidiophores, reside in the form family Dematiaceae. Many of these species are also common and/or economically-important fungi. *Stachybotrys* (page 89), a soilborne saprotroph, has pigmented single-celled conidia and conidiophores that slime down to form glistening beads. *Cladosporium* (page 107) is prevalent in the air, and some species are plant or human pathogens. This fungus has a highly branched conidiophore and one-or two-celled conidia that occur in chains. Since all conidia of one species are not always of the same cell number or size, purity of a culture cannot be determined by this means. *Aureobasidium* (page 71) is a filamentous yeast, hyaline when young, becoming dark with age. *Aureobasidium* is often confused with species of *Candida,* but pigmentation appears in its hyphae which is not found in Candida. One species, *A. pullalans* is saprotrophic, but can become an opportunistic pathogen of plants. This same fungus is also known to be a major agent in the deterioration of painted surfaces. Many species of *Helminthosporium* (page 125) are well known to plant pathologists as pathogens of grasses. These fungi produce dark cylindrical conidia, which are multiseptate and usually have rounded ends. The conidia of *Bipolaris* (page 127) and *Dreschlera* (page 123) are nearly identical to those of *Helminthosporium* but differ in the mode of conidial formation. The ends of the conidia vary only slightly making the differentiation of species between *Bipolaris, Dreschlera* and *Helminthosporium* difficult. Illustrations along with the keys are most helpful in correctly identifying species of these three genera. The most commonly encountered fungus in the Dematiaceae is *Alternar'ta* (page 133), which produces large muriform conidia, often borne acropetally in chains. Isolates of this fungus are readily recovered from air, soil, decaying vegetation and from diseased potatoes and tomatoes.

Imperfect species which have conidiophores united in columns or clusters reside in the form family Stilbaceae (pages 152 - 161). These multiple fused conidiophores are called synnemata or coremia and tend to be more plentiful in aging cultures. The conidia are produced on the upper portions of the synnemata. Some isolates of the Stilbaceae do not form synnemata on all media making identification most difficult. *Isaria* spp. (page 157) are frequently isolated from soil and grow profusely on most mycological agar media. One species, *Pesotum ulmi,* is well known to plant pathologists because it is the imperfect form of the fungal pathogen that causes Dutch elm disease. The synnemata of *P. ulmi* are tall and have a rounded mass of light-colored conidia embedded in mucilage.

The presence of sporodochia in the mycelium distinguishes form family Tubercula riaceae from the other three form families of form order Moniliales. Refer to pages 146 - 151 and observe the many different types of sporodochial fungi. A sporodochium is a cushioned-shaped structure made up of closely grouped conidiophores. Definitive identification of sporodochial-producing fungi is often difficult because the structures often vary with cultural conditions. Some, but not all species of *Fusarium* (page 131), produce sporodochia. Species of *Fusarium.* are pathogens of humans, insects, plants and are



Catenulate conidia of *Penicillium* sp. on phialides of a conidiophore.

Arthrospores of *Geotrlchum* sp.

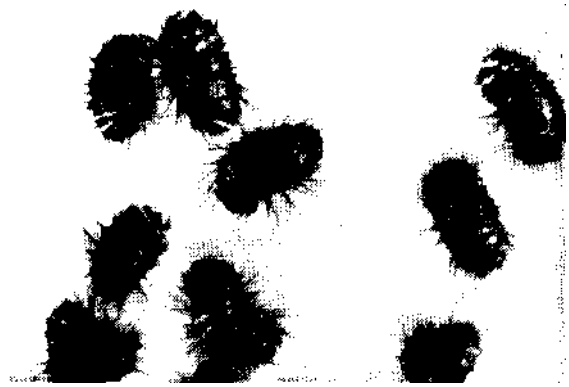
abundant in the air and soil. It is easy to identify isolates to genus because of their characteristic banana-shaped conidia. However the tremendous variability in conidial size, microconidia and macroconidia, make them difficult to speciate. Species in the genus *Epicoccum* (page 151) are frequently isolated from soil and decaying wood. This fungus has dark sporodochia, from which compact or loose conidiophorcs give rise to dark, globose dictyospores (conidium has both oblique and transverse septa).

FORM ORDER SPHAEROPSIDALES

There are four form families in this form order and all of the species have well defined asexual fruiting bodies i.e. pycnidia (page 162 through 187), Pycnidia are easily seen at low magnifications with a compound or stereo-microscope. They have conidia which are either endogenously produced (inside the pycnidium), or that differ from most other imperfect fungi and are exogenously produced. According to Saccardo, the form families are differentiated as follows. Sphaeropsidaceae - dark pycnidia, leathery to carbonaceous, which may or may not be produced on a stroma, usually having a circular opening; Zythiaceae - physical characteristics as in form order Sphaeropsidaceae, but the pycnidia are bright-colored and waxy; Leptostromataceae - upper half of pycnidium fully developed, rather than in the basal portion; Excipulaceae - Pycnidia are cupped or saucer-shaped. In this book, we do not separate pycnidia - producing fungi using the four form families, although we may use a particular characteristic from a given form family as part of the key composition.

Many members of the form order Sphaeropsidales are saprotrophic, although some are plant pathogens and others infect insects and other fungi. Among the more common form genera are *Phoma,* (page 163), *Phyllosticta* (page 163), *Sphaeropsis* (page 177), *Coniothyrium* (page 177) and *Septoria* (page 183). Many of the species of these five genera are pathogens of plant stems and leaves. Problems in identifying these fungi are obvious when comparing *Phoma* and *Phyllosticta.* Their pycnidia and conidia are so similar that distinctions are at best arbitrary. Both have dark, erumpent pycnidia enclosing short conidiophores that produce hyaline, non-septate conidia. *Sphaeropsis* is another form genus which is similar to *Phoma. Septoria* (page 183) is a form genus with approximately 1,000 species, most being plant pathogens. Many of the species names come from their hosts. Obviously, using the host to name the fungal species leads to confusion, the proliferation of species, and questionable scientific designations. The pycnidia of *Septoria* are dark, globose, ostiolate, erumpent; they enclose short conidiophores bearing long, thin scolecospores. Therefore, the dark pycnidia are round, have an opening, and break out through the surface of the substratum and produce endogenous narrow-elongate conidia.

Germinating cralamydospores of *Cylindrocladlum scoparium.*



Bristle-covered pycnidia of *Chaetomella* sp.

FORM ORDER MELANCONIALES

Species in this form order are recognized by a saucer-shaped fruiting body, the acervulus (page 188 through 195). There is only one form family, Melanconiaceae. Two common form genera are *Gloeosporium* (page 189) and *Colletotrichum* (page 189). They are both very similar in appearance, except that the latter has prominent dark setae associated with the conidiophores. The many species of the two genera have conidia which are hyaline, one-celled, and ovoid to oblong. Under certain cultural conditions, however, the setae of *Colletotrichum* fail to form, thereby making it impossible to distinguish between the two genera. *Glomerella,* an ascomycete, is the teleomorph of both form genera which indicates that, because of their similar anamorphic states, they should really be in one genus. Another common genus is *Pestalotia,* which produces multiseptate conidia with pointed ends and apical appendages (page 193). Species can be either pathogenic or saprotrophic. Careful scrutiny will show that species of *Cylindrosporium* (page 193) are difficult to differentiate from species of *Gloeosporium.* Similar appearing species of different genera present problems even to those who are familiar with the fungi.

FORM ORDER MYCELIA STERILIA

Species placed here have no known anamorphic or teleomorphic states. They do however, produce somatic sporodochium-like bodies, chlamydospores, sclerotia or bulbils. These diversified fungi are grouped into approximately 20 genera and because of their heterogeneity there are no form families. No asexual or sexual structures are found in these fungi, and therefore they are identified solely by mycelial characteristics. *Rhizoctonia* and *Sclerotium* (page 197) are two common form genera, both containing plant pathogenic species. Clamp connections on their hyphae provide evidence to basidiomycetous affinities. *Papulospora,* another frequently encountered member of this form order produces bulbils (shown on page 197) which are sclerotium-like and serve in survival and reproduction. Species of *Papulospora* are saprotrophs of decaying vegetation and are pathogenic to storage structures of some plants.

The imperfect fungi include a diverse array of fungi which occupy every conceivable ecosystem within the Biosphere. There are aquatic and terrestrial species; some are saprotrophic, and some are pathogenic to humans, animals, plants, microorganisms and to even other fungi. Their many spore and somatic types have led to dispersal and invasion of may environments resulting in the evolution of this highly diverse group of fungi.

CYTOLOGICAL AND MORPHOLOGICAL FEATURES OF IMPERFECT FUNGI

The eucaryotic cellular structure, composition and ultrastructure of the imperfect fungi (DeuterOmycetes) have been thoroughly investigated using light and electron microscopy (4, 5, 7, 8, 11, 12). Cells of imperfect fungi, like most fungi, are arranged in filaments or threads called hyphae. One filament of the hyphae is a hypha, and all hyphae of one fungus constitutes the mycelium. Fungal hyphal cells vary in size, color and in their extracellular matrix, when present. However, since hyphae among different kinds of fungi are more alike than different, they usually cannot be used as a differentiating character.

The cells of a hypha are separated from one another by crosswalls called septa. Imperfect fungi have one, two or more nuclei in their septate hyphal cells and can possess mitochondria, endoplasmic reticuli with ribosomes, microtubules, Golgi bodies, vacuoles, glycogen and lipid. Woronin bodies and Spitzenkorpers (8), which are unique structures involved in apical hyphal growth may also be present. Often, mitochondria and Golgi bodies are found to be closely associated in the cytoplasm. This ultrastructural feature has been seen only in imperfect fungi and ascomycetes. Consequently, this association suggests a relationship unique to these fungi that differentiates them from other fungi and other life forms (13). Therefore, they have cells, organelles and inclusions similar to, yet different in some respects, from protists, metaphytans and metazoans. The asexual spores of deuteromycetes, the conidia, contain similar organelles and inclusions. Under light microscopy however, the cytoplasm of the typical imperfect fungus appears translucent and granular and lacking discernible nuclei, organelles or other inclusions.

The hyphae and conidia of *Verticillium albo-atrum* and V. *nigrescens* are representative of imperfect fungi since they are uninucleate and possess most of the aforementioned intracellular structures within their plasma membranes (3). Newhouse *et al.* found these typical organelles, along with mycoviruses in the hyphal cells of *Cryphonectria parasitica* (14). The majority of fungal viruses do not appear to have any deleterious affect upon fungi, but some can debilitate their hosts and cause changes in colony morphology, growth rate and pigmentation. This can result in an infected fungal isolate having a cultural appearance far different from other fungi of the same species. This is an important consideration in fungal identification. Light microscopy of fungal cells reveals little cytological detail; however, transmission electron microscopy (TEM) and scanning electron microscopy (SEM) show with clarity the organelles, some inclusions, and nuclei within the fungal cell.

Alexopoulus *et al.* provide excellent information on fungal ultrastructure and cellular relationships of many and diverse fungi (1). Under light microscopy, the nuclei and organelles of the imperfects are minute and difficult to observe without killing the cells and applying one or more cytological stains. Consequently, intracellular characteristics of the cell(s) are of no value for identification. There is one notable feature of the hyphae that is easily seen with the light microscope and enables differentiation of an imperfect fungus from a typical phycomycete. This structure is the septum which separates individual hyphal cells. All imperfect fungi have septa, unlike most phycomycetes which are coenocytic (lack septa and are multinucleate). Ascomycetous and basidiomycetous fungi also possess septa. Within the septum there may be one or several pores which provide cytoplasmic continuity between cells. The pores are easily observed via TEM but not with light microscopy. Transmission electron micrographs demonstrate that nuclei and various organelles can traverse the pores thus moving from cell to cell. Woronin bodies or septal pore plugs are known to block pores, especially in hyphal cells that are old or damaged. Imperfect fungi with known ascomycetous teleomorphs usually have simple septa, whereas basidiomycetous teleomorphs have much more elaborate and complex dolipore septa.

External to the plasma membrane of the hyphal cell is the cell wall. This is apparent by light microscopy and by TEM. This of course is a major difference between metazoans and most protists which lack cell walls. Metaphytans also possess cell walls, but the chemical composition of the

microbibrils is different. The imperfect fungal cell wall, in conjunction with microtubules and microfilaments that comprise the cytoskeleton, preserve the cytoplasmic integrity of cells and also determines the shape of the hyphal cell. Hyphal cells of *Sclerotium rolfsii* possess an actin cytoskeleton (15).

Cell growth of the filamentous fungi occurs almost exclusively at the hyphal tip. Transmission electron micrographs of the hyphal apex by Grove, 1978 (6), and Grove and Bracker, 1970 (7), show apical vesicles which are spherical and membrane bound. The apical vesicles contain the necessary elements for plasma membrane extension and cell wall synthesis. More recent studies by Wessels in 1986 (19) and 1988 (20) provide evidence that the hyphal tip is elastic but ultimately becomes rigid with age.

Hyphae are the microscopic somatic structures of fungi which are embedded in various organic, substrates or in soils. It is the hyphae that absorb nutrients required for growth and reproduction. The organization and size of the *mycelium* is predicated upon substrate availability and nutrient status. While additional structures are not usually formed by growing hyphae, some fungi form discrete microscopic and/or macroscopic somatic and reproductive structures. Hyphae of some fungi can develop two dlifferent kinds of fungal tissues (plectenchyma). These tissues develop from the apical growth of the hyphae. Prosenchyma tissue are evident by their loosely woven organization in which the hyphae are still mostly discernible. When the hyphae are not discernible and the cells become plant-like, the tissue is pseudoparenchyma. Many resistant and reproductive structures develop from the two types of plectenchymous tissue.

One type of somatic tissue structure is the rhizomorph which results from the thickening of the hyphae. Sclerotia (page 97) and microsclerotia are other structures in which the hyphae lose their typical thread-like appearance and become a mass of cells which are resistant to various adverse conditions. Another somatic structure, the stroma, is formed as a mass of fungal cells that usually supports various types of reproductive structures. Rhizomorphs, sclerotia, microsclerotia and stroma are important structures in determining the type and, in some few instances, the identity of an unknown fungus. The more identifiable structures (mainly reproductive, but also somatic) that can be determined for an unknown fungus, the easier it will be to identify.

The conidial cells, their conidiophores, acervuli, pycnidia, sporodochia, synnemata and chlamydospores are other cellular structures of imperfect fungi which are easily discernible with the light microscope, and are routinely used in identification. These structures are illustrated and discussed throughout this book. Complete familiarity with these structures will facilitate use of the keys for identifying unknown imperfect fungi.

FACTORS AFFECTING GROWTH AND SPORULATION OF IMPERFECT FUNGI

The imperfect fungi are adapted to *live* under diverse environmental and nutritional conditions. Conidia of some species often survive for years in a cold or dry environment and germinate upon exposure to favorable conditions. The conditions that favor or inhibit growth and sporulation of a given fungus are correlated with its habitat. For example, *Bispora*, which obtains its nutrients from decaying wood, is limited in growth only by temperature and moisture, whereas, other fungi have more precise requirements, such as for living tissue or preformed vitamins. In fact, the dissemination of plant pathogenic conidia is often limited to the growing season of the host plant, and the production of conidia at that time. This and other types of adaptation have led to the survival of the deuteromycetes that exist today. Several types of fungal responses to nutrition and environment are presented.

TEMPERATURE

Temperature and moisture are universal factors that affect all organisms and must be favorable for them to survive, grow and reproduce. The cardinal temperatures i.e. minimum, optimum, and maximum, are used to describe the range at which individual imperfect fungi can grow. The exact ranges are influenced by other factors. There is a great variation among the responses to temperature of the imperfect fungi; however, they all produce some growth at mesophilic temperatures. When growing unknown, fungi it is best to select a temperature between 20 and 30 degrees Centigrade for their initial incubation.

MOISTURE

Imperfect fungi are capable of growing in liquid nutrient solutions provided that sufficient oxygen is present. However, many deuteromycetes can grow in the absence of liquid water. *Botrytis cinerea* and *Penicillium expansum* are plant pathogens which cause rots of plant parts and obtain moisture from the decomposing plant cells. Species of *Aspergillus, Penicillium, Cladosporium,* and *Aureobasidium* are common decomposing agents of cloth, paper, leather, wood and even painted surfaces where there is no free moisture. *Aspergillus* and *Penicillium* spp. proliferate in stored grains when the moisture content is greater than 14%. Another *Aspergillus* sp., *A, glaucas* and its close relatives are well known for their ability to grow under conditions of severe physiological drought.

In contrast there are the many imperfect species that cannot grow without liquid water or a saturated atmosphere. Spores of most deuteromycetes require moisture for germination.

LIGHT

Imperfect fungi respond to light (radiation) in a myriad of ways, but are not photosynthetic. Like all fungi they are incapable of reducing $C0_2$ to carbohydrate via radiation. Nevertheless, phototropic growth of conidiophores has been amply demonstrated for *Aspergillus giganteus, A. clavatus, Penicillium claviforme* and numerous other fungi. When cultures receive unilateral illumination, the conidiophores grow toward the white light, irrespective of the position of the culture. Certain frequencies of radiation are also known to enhance or be necessary for the induction of sexual structures of imperfects having known teleomorphic states. Radiation also may affect the chemical composition of media thereby promoting growth patterns different from those that would occur when the media were stored in the dark.

Radiation has the greatest impact on sporulation of imperfect fungi. Sporulation of imperfects is either induced (i.e., light is necessary) or enhanced by exposure to different wavelengths of radiation. Ultraviolet, near ultraviolet, blue (most common), a wide band of blue-green-yellow and far red all affect fungal sporulation, albeit, quite differently. The red band is seldom effective for inducing sporulation.

White light may be as effective as any given color if the intensity is nearly equal. The intensity of white light necessary for sporulation by *Epicoccum nigrum* varied inversely with duration of exposure. An exposure of mycelial cultures on agar to sunlight (7,000 ft. candles) for 15 minutes induced the production of about as many conidia as a single exposure of 24 hours at 50 ft candles or 6 hours at 100 ft. candles. Spores were produced only in the zone of young hyphae at the time of exposure. It is well known that ultraviolet radiation is inhibitory, yet there are few^ concrete examples of inhibition of imperfect fungi by visible light. Remember, when growing imperfects which do not sporulate in culture, the absence of light or too little of it, may be an important factor. In general, expose fungal cultures to alternating periods of light and dark to induce sporulation.

HYDROGEN-ION CONCENTRATION (pH)

Most fungi grow optimally when the substrate is slightly acid between pH 5.0 and 6.0. However, they will generally achieve fair to good growth over a much wider range, from about pH 3.0 to 8.0. Certain species are able to tolerate even greater ranges: *Aspergillus niger,* pH 2.8 to 8.8; *A. oryzae,* 1 . 6 to 9.3; *PenicilUum italicum,* 1 . 9 to 9.3; *Fusarium oxysporum,* 1 . 8 to 11.1; *Botrytis cinerea,* 2.8 to 7.4; and *Rhizoctonia solani,* 2.5 to 8.5. When fungi are growing on most culture media, they alter the pH of the substrate. The extent of the pH change depends on the composition of the substrate as well as on the genetics of the imperfect fungus.

CARBON AND NITROGEN SOURCES

The requirement of fungi for carbon is greater than any other nutrient, however a source of nitrogen must also provided. The ubiquitous nature of most deuteromycetes indicates that they possess the genetic determinants (synthesis of enzymes) to utilize carbon from many different sources; among these, cellulose is the most abundant utilizable source. Seldom does a fungus in nature encounter a pure carbon source, but rather will preferentially select from what is available.

To determine the ability of specific fungi to utilize single carbon sources, experiments in the laboratory must be conducted under controlled conditions, using a medium that is complete for all nutrients except carbon. Imperfect fungi respond to different carbon sources, and their preferred source is usually associated with the niche they occupy in the ecosystem. Growth on glucose, fructose and mannose are approximately the same for all fungi. Most natural media have more than one carbon source from which a fungus can obtain carbon requirements for growth and reproduction.

In nature, organic materials provide the nitrogen needed for growth; however, most fungi can use sources of inorganic nitrogen as well. Most imperfect fungi utilize nitrate, ammonium and amino acids as sources of nitrogen. Growth on inorganic nitrogen is often less than on a mixture of amino acids or on a complex organic nitrogen source. If one merely desires to cultivate deuteromycetes on a laboratory medium, yeast extract or casein hydrolysate is excellent. To study the relative rate of utilization of nitrogen sources, one should use single amino acids, such as asparagine, aspartic acid or glutamic acid.

VITAMINS

Most imperfect fungi are capable of synthesizing required vitamins from living or non-living substrates. Some imperfects, however, are deficient and cannot synthesize certain vitamins. Such deficiencies can be determined only by cultivation in suitable synthetic media with and without added vitamins. When imperfects are vitamin-deficient, it is usually thiamine that they are unable to synthesize. A deficiency may be single or multiple, complete or partial. Most species of *Aspergillus* synthesize all

required vitamins. *Botrytis cinerea,* species of *Penicillium, Cylindrocladium scoparium, Gliocladium roseum* and other imperfect fungi are also able to synthesize their vitamin requirements. The pycnidial producer, *Dendrophoma obscurans,* must have a preformed source of thiamine as do some species of the dermatophyte genus, *Trichophyton.* Biotin is needed for *Diplodia macrospora* and for *Stachybotrys atra.*

INORGANIC SALTS AND MICROELEMENTS

Natural organic compounds often furnish all of the inorganic salts necessary for growth. However, if one needs to culture imperfects on synthetic or semi-synthetic media, it is necessary to add certain compounds. Monobasic potassium phosphate (KH_2P0_4) and magnesium sulfate ($MgS0_4$) will supply potassium, phosphorus, magnesium and sulfur. The microelements Fe, Zn, Mn, Cu and Ca are frequently added to synthetic media to supply additional inorganic elements needed for optimal fungal growth.

ISOLATION, CULTURE MEDIA, MAINTENANCE OF STOCK CULTURES, AND PHYSIOLOGY

Information on these topics can be found on pages 1-3.

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PART I
PHYSIOLOGY

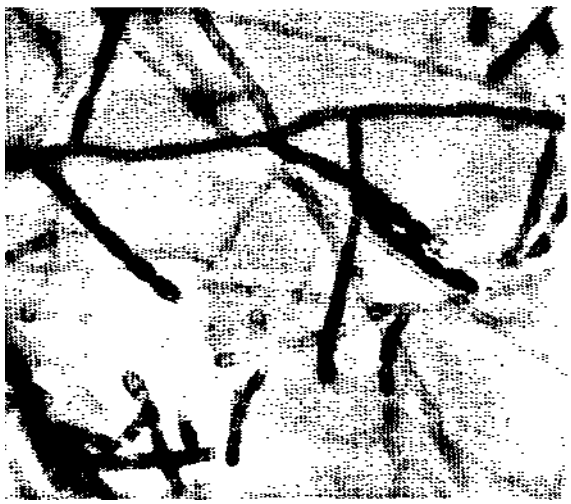
ISOLATION

Many different techniques for the isolation of fungi in pure culture have been described (246, 390). One should select and try first a method that is simple and easy, using a general purpose medium. Many species, especialJy common .saprophytic hyphomycetes, sporulate readily in a moist chamber on pieces of wood, leaves, or other plant pans. Conidia may be lifted from the sporulating conidiophores by touching with a small bit of agar on the tip of a needle, while looking through a stereoscopic microscope. This simple method often results in a high percentage of cultures free of contamination. It can also be used to obtain conidia from oozing acervuli or pycnidia. Species growing in habitats with an abundance of bacteria may require the use of dilution plates or antibiotic agar (219). A water agar substrate may even be useful, but a rose bengal streptomycin agar has been recommended (390). A highly specialized medium containing antibiotics was used for isolation of *Vertirtcladiella procera* from diseased pine roots (428).

The use of geranium leaves placed on the soil surface has been recommended for recovering species of *Cylindrocladium* from soil (310). *Botrytis cinerea* and other soft rot fungi can be obtained easily in pure culture by passage through apples or other fruits. Pathogenic fungi within plant tissue often require surface sterilization with 10% chlorox for 2 minutes before plating the material on agar (246). The common method of obtaining the oak wilt fungus from diseased trees was stripping bark from twigs, dipping in 95% alcohol, and flaming (445). Wood chips were then plated on agar.

The necrotrophic mycoparasites, such as *Gliociadium roseum* and species of *Trichuderma,* do not require a special medium for isolation. However, the biotrophic mycoparasites are a highly specialized group in regard to nutrition, are usually isolated with a host species, and are best maintained as two-mem be red cultures.

Nematode trapping fungi may often be obtained by placing a bit of horse manure or soil rich in humus on an agar plate. Nematodes are usually abundant after a few days and the trapping fungi, if present, should appear a few days later. Transfers from pure cultures of these species to the plates with nematodes will assure the formation of the characteristic loops, rings, or nets. Common species belong to the genera *Arthrobutrys, Dactylella, Monacrosporium,* or close relatives (106).



Conidia of *Bispora* sp. Note the formation of a new conidium at the apex of the con i d i a l chain.

A synnematous fungus (Briosia sp.) growing from decayed vegetation.

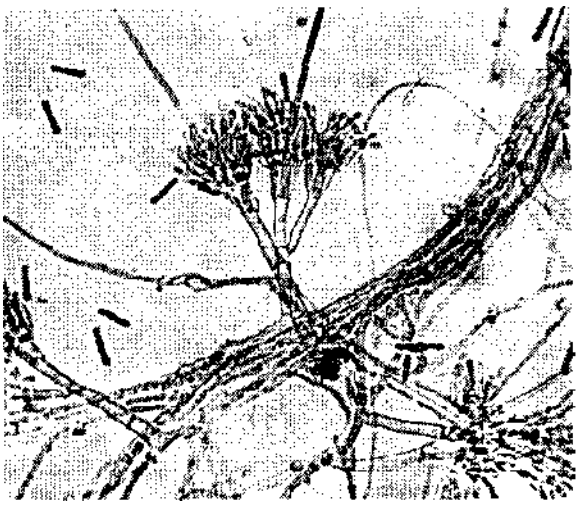
CULTURE MEDIA

A satisfactory general culture medium must contain all of the nutrients required by the fungus: utilizable carbon and nitrogen sources, certain salts and microelements, and water. Some species are favored by added vitamins or growth factors. Many plant parts or products contain these nutrients but not always in quantities optimum for growth or sporulation. A potato-dextrose (glucose) agar medium has been the favorite of many plant pathologists for many years. Other natural media have been developed and used by mycologists for specific fungi. A list of one hundred media is given in the *Mycological Guidebook* (390). The authors prefer a general medium containing 5 to 10 g glucose, I to 2 g yeast extract, and 1000 ml water. Addition of agar and changes in concentrations may be made as desired. This medium is easy to make, and the pH need not be adjusted.

The use of a synthetic medium, in which each nutrient and its concentration is known and can be altered as desired, is preferred in critical studies of fungus physiology. Such media can be duplicated exactly, and the effects of each nutrient can be measured. One satisfactory synthetic medium contains glucose (5 to 10 g), $KN0_3$. asparagine or glutamic acid (1 to 2 g), KH_2P0_4 (1.0 g), $MgS0_4$ (0.5 g), microelements (Fe, Mn, Zn) (trace), and distilled water (1000 ml). Vitamins thiamine (100 */jg).* biotin (5 *fig),* and pyridoxinc (JOO/ig) may be added routinely for the deficient species (259). This liquid medium may be used in flasks, or agar may be added for tube or plate culture, Five species of biotrophic mycoparasites require the new growth factor mycotrophein, which is a naturally occurring product in most filamentous ascomycetes and imperfects. It may be obtained in crude form by extracting from the mycelium with hot water (10, 12, 48, 138, 220,469).

MAINTENANCE OF STOCK CULTURES

The choice of a method for keeping viable cultures over a long period of time depends on the period of time they are to be maintained and the convenience of the method (259). Frequent transfer of mycelium from a culture to a fresh agar slant in test tubes is satisfactory for short periods. Long term maintenance of viable mycelium can be accomplished using screw-cap test tubes. Allow mycelium to grow until it reaches the edge of the agar slant, then screw the caps down tightly and store at about $5^{U}C$. Transfer cultures after 6 to 12 mo. The use of screw cap tubes has the additional advantage of excluding mites. Many eonidia remain viable for months when collected and stored dry at low temperatures, or simply frozen. Mycelium of some fungi may be cultured on bits of wood or other plant tissue and stored dry-



Fruiting structures of *Cylindrocladium parvum* growing in culture.

Conidial heads of *Aspergillus niger.*

PHYSIOLOGY: NUTRITION AND ENVIRONMENT

See references 141, 157, 162, and 259 for textbooks on fungus physiology.

The same nutrients that favor vegetative growth are also generally favorable to sporulation, but often in different concentrations or ratios. A low concentration of available carbon usually favors sporulation. Sporulation by species pycnidia is often delayed until growth reaches a maximum.

Among the common carbon sources, glucose, fructose, mannose, and maltose are utilized most readify; xylose and sucrose intermediately; whereas lactose and sorbose are often poorly utilized or not at all.

The table lists as examples the relative amount of vegetative growth of selected species on several sugars (3 = good to excellent; 2 = fair; 1 = poor; 0 = not utilized) (218).

	A	B	C	D	E	F	G	H
Alternaria solani	14	3	3	1	3	3	2	2
Aspergillus niger	7	3	2	2	3	3	3	1
Colletotrichum lindemuthianum	14	3	3	0	1	2	2	2
Cordana pauciseptata	14	3	3	0	3	1	1	1
Dendrophoma obscurans	14	3	3	1	2	2	2	2
Helminthosporium sativum	7	3	2	1	2	3	3	2
Penicillium expansum	4	3	2	3	3	3	3	1
Rhizoctonia solani	5	3	3	0	3	3	3	2
Thielaviopsis basicola	7	3	3	0	0	3	3	0
Choanephora cucurbitarum	3	3	3	0	I	3	0	0

A = days
B = glucose, fructose, mannose
C = galactose
D = sorbose
E = xylose
F = maltose
G = sucrose
H = lactose

Temperature is a universal factor affecting all physiological processes in fungi, most of which grow well within a range of 25 to 30 °C, but there is much variation. The approximate cardinal temperatures are given below for selected species (218).

	Minimum	Optimum	Maximum
Aspergillus fumigatus	<20	35	50
Botrytis cierea	0	20	30
Diplodia zeae	10	30	35
Epicoccum nigrum	< 5	25	35
Helminthosporium sativum	< 5	25-30	35
Humicola grisea v. *thermoides*	24	38-46	56
Rhizoctonia solani	2	25-30	35
Trichothecium roseum	<10	30	35
Verticillium albo-atrum	5	25	35

Visible white light may affect imperfect fungi in different ways. Some species show a decided positive phototropism of the conidiophores (e.g., *Aspergillus giganteus, A. clavatus,* and *Penicillium claviforme).* The conidiophores grow directly toward the source of light, regardless of the position of the culture (259).

Sporulation of a number of species of imperfects is either induced (light is essential) or favored (increased) by exposure of the mycelium to radiation. In general, only the mycelium that is young at the time of exposure responds to radiation. Different species respond to different wave lengths, blue being the most effective range for most fungi. Some species that respond to exposure to white light or to specific wave lenghths are: *Botrytis cinerea* (uv), *Cylindrocladium citri* (blue to far red), *Cyllndrocladium* spp. (uv, near uv, blue), *Dendrophoma obscurans* (blue), some isolates of *Epicoccum nigrum* (uv), *Helminthosporium vagans* (near uv), and *Trichoderma lignorum* (blue). The intensity of white light required to induce sporulation by one isolate of *Epicoccus nigrum* varied inversely with the duration (430). Note that a long exposure to intense ultraviolet radiation is lethal to fungus mycelium.

USE OF IMPERFECT FUNGI TO ILLUSTRATE BIOLOGICAL PRINCIPLES

Certain species work well in demonstrating the effects of nutritional and environmental factors on growth and sporulation. A few demonstrations that can be easily performed in the classroom, together with the species used, are suggested below.

Effects of white light on production of conidia: ***Trichoderma Ugnorum, Epicoccum nigrum*** **(390).** Inoculate plates of general purpose agar at the center with conidia or mycelium. Place some cultures in-continuous light, some in alternate light and darkness, and some in total darkness at 20 to 25 °C. Examine after 4 to 6 days. *E. nigrum* may also be used to demonstrate an inverse intensity-duration relationship required for sporulation (i.e., long exposures at low intensity compared with short exposures at high light intensity (429). Try a range from 5 to 1000 footcandles.

Positive phototropism of conidiophores: ***Aspergillus clavatus.*** Inoculate several plates of general purpose medium with conidia. Place some cultures beneath continuous light, some with single directional light, and some in total darkness. Wrap some in light-tight paper or foil, and cut one or two small windows. Examine after 4 or 5 days.

Effect of color (wave length) of light on fruiting: ***Dendrophoma obscurans*** **(32).** Place cultures of this fungus under white light, under blue, yellow, green, and red filters, and in darkness. Examine after 7 days.

Natural products may replace the light requirement for production of pycnidia: ***Dendrophoma obscurans.*** Use a synthetic agar medium with thiamine. Place on some plates autoclaved strawberry leaflets on the surface of the agar. Incubate cultures in alternate light (50 footcandles or more) and darkness for a few days, and examine for pycnidia.

Special light requirements for production of conidia: ***Choanephora cucurbitarum*** **(11).** Use plates of glucose-asparagine agar plus thiamine. Petri dishes with loose-fitting lids will allow adequate aeration. Place cultures under the following conditions: continuous light; continuous darkness; 2 days light — 12 hours darkness; 2 days darkness — 12 hours light. Examine for conidia in 3-day-old cultures.

Need for adequate aeration for production of conidia: ***Choanephora cucurbitarum.*** This can be done simultaneously with the light requirement demonstration. Provide adequate aeration of some of the cultures by using loose-fitting lids, and prevent exchange of gases in other cultures by taping dishes closed (II). Incubate in alternate light and darkness.

Sugar concentration affects growth of mycelium and production of conidia: ***Helminthosporium sativum, Choanephora cucurbitarum,*** **or** ***Mektnconium JuKgenium*** **(or other species sporulating readily).** Use a glucose-yeast extract medium, with glucose concentrations of 1, 5, 20, and 5 g/liter.

Sugar concentration affects size of conidia: ***Helminthosporium victoriae*** **(or some other species of this genus) (110).** Prepare the same medium as above, and measure the length of conidia formed at the different concentrations.

Thiamine deficiency: ***Dendrophoma obscurans*** **or** ***Choanephora cucurbitarum*** **(11).** Use a liquid glucose-asparagine medium (see section on media above) in small flasks (25-ml to 250-ml flasks are satisfactory). To half of the medium add thiamine at the rate of 1 0 0 //g/liter. Observe growth daily. If an accurate measure of growth is desired, the mycelium can be collected on a cloth or filter paper, dried and weighed.

Biotin deficiency: ***Diplodia macrospora*** **(259).** Repeat above procedure, except use biotin at the rate of 5 ^g/liter.

Multiple deficiency for thiamine and biotin: ***Arthrobotrys musiformis.*** Use the same basal medium as above; add vitamins singly and in combination, using basal medium as control.

Pyridoxine deficiency: ***Graphium*** **sp. (9).** Use the same basal medium as above, adding pyridoxine at the rate of 1 0 0 /ig/liter.

Destruction of pyridoxineby Ijght(9): ***Graphiumsp.*** Preparea medium containing pyridoxine (liquid or agar). Store part of the medium under continuous bright light, and the remaining medium under total darkness for 10 to 14 days, Inoculate both media, and observe growth,

Trapping and consuming small nematodes (106). ***Arthrobotrys*** **spp.** Use of a glucose-yeast extract medium is suggested. Nematodes can be obtained easily by placing a bit of horse manure on agar plates. After a few days use a stereoscope to check for the presence of *Arthrobotrys.* If none is present, use pure culture of fungus to inoculate cultures of the nematodes. Observe after a few days for rings, nets, or other traps and for trapped nematodes.

Necrotrophic mycoparatism: ***Trichoderma lignorum, Gtiochdium roseum*** **(10, 13).** Prepare 3- to 5-day-old cultures of several common fungi. Inoculate these cultures at the edge of the mycelium with one of the above suggested species. Observe daily for the parasite overgrowing the host colony, and examine microscopically for destroyed host cells.

PART II

TAXONOMY AND IDENTIFICATION

THE SACCARDO SYSTEM OF CLASSIFICATION

The Saccardo System has long been in use for the classification of imperfect fungi. The primary basis of this system is the morphology of the sporulating structures as they are known in nature, as well as the morphology and pigmentation of conidia and conidiophores. In artificial culture, some species of imperfects fail to form typical fruiting structures (e.g., acervuli. sporodochia. and synnemaia).

Although an alternate system of classification may be more convenient for mycologists who have studied the different methods of conidium development, the authors recommend that others use the illustrations and key based on the Saccardo System. Moniliaceac and Dcmatiaceae, the two largest families, are presented according to the Hughes-Tubaki-Barron System of Classification beginning on page 41.

ORDERS INCLUDED

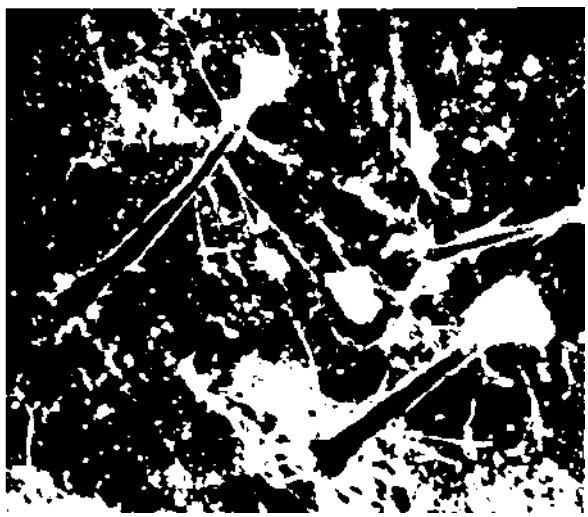
Conidia! Phycomycetes. Mycelium typically coenocytic; septa absent or infrequent; conidia (sporangioles) present; typical large, muUispored sporangia may also be present in some genera. This group is included here because of similarity to some genera of the imperfect fungi.

MUCORALES 8

Mostly saprophytic, but some species parasitic on plants or other fungi.

Fungi Imperfeeii. Mycelium (if present) typically septate with frequent septa; conidia normally present except in a few genera. Classification and identification are based on the conidial state, although the perfect state is often known and sometimes also present.

Fruiting heads of *Verticlciadielia procera.*



Synnemata and conidia of the Dutch elm fungus, *Pesotum ulmi.*

SPHAEROPSIDALES 28

Conidia produced in well defined asexual fruit bodies, pycnidia.

MELANCONIALES 33

Conidia typically produced in acervuli under natural conditions; in culture conidiophores may be single or in compact groups, resembling sporodochia of the Moniliales.

MONILIALES

Conidia produced directly on the mycelium, on separate conidiogenous cells, or on distinct conidiophores that may be separate, in clusters, or in tightly packed groups. This is the largest and most common order.

MYCELIA STERILIA 34

No conidia produced. Usually sclerotia or other structures are formed for survival. This group does not include those fungi that do not sporulate because of unfavorable nutritional or environmental conditions.

FAMILIES OF MONILIALES

TUBERCULARIACEAE 25

Condiophores typically compacted into a rounded or flat sporodochium, often not well developed in artificial culture. Some species of Melanconiales produce structures resembling sporodochia in culture.

STILBACEAE 26

Condiophores typically compacted into synnemata, which may be more abundant in aging cultures. Single conidiophores may also be present in some cultures or may be the only conidial state present. Such cultures may be identified in one of the following families.

MONILIACEAE AND DEMATIACEAE 10, 17

Conidiophores mostly single and separate or produced in loose clusters. These two families are considered together because the only described difference is the hyaline conidia of the former and the pigmented (dark) conidia or conidiophores of the latter. Conidia are considered pigmented if the walls appear dark either separate or in mass.

Only within this order (Moniliales) are families used in the identification of genera.

In the Saccardo System orders and families may be broken into sections as follows: Amerosporae, conidia 1-celled; Didymosporae, conidia 2-celled; Phragmosporae, conidia with transverse septa only; Dictyopsorae, conidia with both transverse and oblique septations; Scolecosporae, conidia filiform; Staurosporae, conidia stellate or branched; Helicosporae, conidia typically coiled. The prefixes Hyalo- and Phaeo- are sometimes added to each section name to indicate hyaline or darkly pigmented conidia, respectively.

KEY TO GENERA

Note that there is a separate key for each order.

MUCORALES

la	Conidia (sporangioles) globose, borne singly on apex of conidiophores (sporangiophores) or branches	*Mortierella*	*60*
lb	Conidia (sporangioles) globose to elongate, borne in clusters or in heads		2
2a	Special spore-bearing branches (sporocladia) bearing conidia only on one side (upper or lower)		3
2b	Sporocladia not present		7
3a	Sporocladia borne on coiled or recurved branches		4
3b	Sporocladia not on coiled or recurved branches		5
4a	Sporocladia on coiled branches; conidia short ellipsoid	*Spirodactylon*	*64*
4b	Sporocladia in umbels on recurved branches; conidia obovoid	*Martensiomyces*	*64*
4c	Sporocladia arising from loosely spiraled branches; conidia globose to subglobose	*Spiromyces*	*66*
5a	Conidia borne only on upper (inner) side of sporocladium		6
5b	Conidia borne only on lower (outer) side of sporocladium	*Coemansia*	*62*
6a	Conidiophore simple, bearing a few lateral or apical sporocladia	*Martensella*	*64*
6b	Conidiophore simple, bearing a whorl of sporocladia on an apical disc	*Kickxella*	*64*
6c	Conidiophore long, branched, bearing lateral, dome-shaped sporocladia	*Linderina*	*64*
7a	Conidia produced in rows, or sporangioles in chains, often breaking up into rows of spores		8
7b	Conidia not in rows (chainlike); sporangioles do not break up into rows of spores		12
8a	Conidiophores nonseptate, simple or branched; conidia radiating apex		9
8b	Conidiophores septate, distinctly branched		10
9a	Conidiophores simple, with basal rhizoids	*Syncephalis*	*62*
9b	Conidiophores usually branched; rhizoids absent	*Syncephalastrum*	*66*
10a	Conidiophore branches dichotomous, all fertile	*Piptocephalis*	*62*
10b	Conidiophore branches verticillate, all fertile	*Dimargaris*	*62*

10c	Conidiophore branches irregular, some with sterile tips		11
1 la	Fertile branches enlarged, bearing a head of cylindrical conidia	*Dispira*	***66***
1 lb	Fertile branches repeatedly branched; conidia not in compact heads	*Tieghemiomyces*	*62*
12a	Conidiophores with lateral or terminal branches		13
12b	Conidiophores simple		14
13a	Spore-bearing head compound; conidia ellipsoid, usually colored	*Choanephora*	***66***
13b	Spore-bearing head compound; conidia hyaline, reniform to ellipsoid	*Radiomycea*	*64*
13c	Spore-bearing head simple; conidia hyaline, globose to subglobose	*Cunninghamella*	*60*
14a	Conidia not produced in slime, dry		15
(4b	Conidia produced in slime drop in a head	*Helicocephalum*	***60***
J 5a	Conidia borne *on* enlarged globose apex	*Rhopalomyces*	***60***
15b	Conidia borne on cylindrical upper portion of conidiophore	*Mycotypha*	***60***

MONILIALES

la	Conidia more or less coiled or spirally curved, hyaline or dark (parts of Moniliaceae, Dematiaceae and Tubercula riaceae)	2
lb	Conidia not coiled	10

HELICOSPORES

2a	Conidiophores forming a sporodochium		3
2b	Conidiophores single or in loose clusters		4
3a	Conidial coil flat; sporodochium stalked	*Everhartia*	***150***
3b	Conidial coil in a loose spiral; sporodochium not stalked	*Hobsonia*	***150***
4a	Conidial coil more or less flattened		5
4b	Conidial coil spiral		9
5a	Conidia thick in proportion *to* length		6
5b	Conidia slender		8
6a	Conidia hyaline or dark, with transverse septa only		7
6b	Conidia dark, with transverse and oblique septa	*Xenosporium*	***136***
C_7a	/Parasitic on higher plants	*Helkomina*	***136***
7b	Saprophytic on wood or bark	*Helicotna*	***136***
8a	Conidiophores hyaline, short	*Helicomyces*	***136***

8b	Conidiophores pigmented, pale or dark, tall	*Helicosporium*	***136***
9a	Conidia borne singly	*Helicoon*	***136***
9b	Conidia catenulate	*Helicodendron*	***136***

NOT HEUCOSPORES

10a	Both conidia and conidiophores (if present) hyaline or brightly colored; conidiophores single or in loose clusters	*Moniliaceae*	11
10b	Either conidia or comdiophores (or both) with distinct dark pigment; comdiophores single or in loose clusters	*Dematiaceae*	105
10c	Conidiospores compacted into sporodochia	*Tuberculariaceae*	202
lOd	Conidiophores typically united into synnemata	*Stilbaceae*	225

MONILIACEAE

11a	Conidia typically 1-celled, globose to several times longer than wide		12
1! b	Conidia typically 2-cellcd, mostly ovoid to cylindrical		62
11 c	Conidia typically 3- or more-celled, shape variable		74
12a	Conidiophores absent or like the mycelium, or reduced to phialidcs or peglike denticles		13
12b	Conidiophores distinct, although sometimes short		19
V 13a	Pathogenic to humans		14
13b	Saprophytic or parasitic, mostly soil or on plant parts		15
14a	Filamentous in cultures at 25°C, with large chlamydospores..	*Blastomyces, Histoplasma*	*80, 82*
I4b	Both filamentous and yeastlike cells at 25 °C, without large chlamydospores	*Candida*	*70*
15a	Conidia (arthrospores) segment from branches of conidiophores, rounded	*Chrysosporium*	*68*
15b	Conidia (arthrospores) formed by segmentation of hyphae, rod-shaped —	*Geotrichum* ,	*68*
15c	Conidia not arthrospores, not formed by segmentation		16
16a	Setae absent		17
16b	Setae present, mostly circinate, unbranched	*Circinotrichum*	*90*
16c	Setae present, branched, circinate or wavy	*Gyrothrix*	*90*
17a	Mycelium with clamp connections	*Itersonilia*	*70*
17b	Mycelium without clamp connections		18
18a	Conidia produced on sterigmata and forcibly discharged	*Sporobolomyces*	*70*
18b	Conidia borne on sides of mycelium or formed by budding, not forcibly discharged	*Candida*	*70*

19a	Conidial state of powdery mildew; conidia catenulate	*Oidium*	*68*
19b	Conidial state of powdery mildew; conidia not catenulate	*Ovulariopsis*	*70*
19c	Not conidial state of powdery mildew ,		20
20a	Conidia distinct in shape from apical cells of conidiophore		21
20b	Conidia (arthrospores) gradually become rounded from apical cells of conidiophore	*Wallemia*	*92*
20c	Conidia (blastospores) globose to ellipsoid, similar to apical cells of conidiophore	*Monilia*	*72*
20d	Conidia (blastospores) elongate, slender, much like cells of conidiophore	*Tilletiopsis*	*12*
21a	Conidiophores (or phialides) typically simple or with few branches; phialides, if present, not tightly clustered into heads		22
21b	Conidiophores mostly branched; phialides, if present, clustered into groups or heads —		38
22a	Conidia catenulate		23
22b	Conidia not catenulate		29
23a	Conidia endogenous; phialides prominent, simple		24
23b	Conidia exogenous; conidiophores simple or branched		26
24a	Dark aleuriospores (chlamydospores) present, rounded, usually single	*Chalaropsis*	*90*
24b	Dark aleuriospores (chlamydospores) in short chains of truncate cells, breaking up	*Ihielaviopsis*	*92*
24c	Dark aleuriospores rarely formed		25
25a	Dark setae present	*Chaetochalara*	*90*
25b	Dark setae absent	*Chalara*	*90*
26a	Conidia blastospores or botryoblastospores		27
26b	Conidia otherwise		28
27a	Conidia in chains on slender conidiophores	*Hyalodendron*	*72*
27b	Conidia on enlarged apex and nodes of conidiophores	*Gonatorrhodiella*	*78*
28a	Conidia phialospores; phialides simple	*Monocillium*	*86*
28b	Conidia arthropsores, nearly globose with a flat base	*Basipetospora*	*70*
28c	Conidia arthrospores, rod-shaped	*Oidiodendron*	*68*
29a	Conidiophores or conidiogenous cells short or indefinite	*Chrysosporium*	*68*
29b	Conidiophores or conidiogenous cells distinct; fertile portion rachislikc	*Tritirachium, Beauveria*	*100*
29c	Conidiophores or conidiogenous cells distinct, fertile portion not rachislike		30
30a	Conidiophores not inflated or only slightly so		31
30b	Conidiophores or fertile cells distinctly inflated at middle or apex		37

31a	Conidia curved; aquatic on dead leaves	*Lunulospora*	***138***
31 b	Conidia globose to ovoid; not aquatic		32
32a	Conidia sympodulospores		34
32b	Conidia aleuriospores		35
32c	Conidia blastospores or phialospores; single		33
33a	Conidia blastospores, on long denticles, dry	*Otpitrichum*	*74*
33b	Conidia phialospores, in moist heads		36
34a	Conidiophores clustered	*Ovularia*	***104***
34b	Conidiophores single, separate	*Sporothrix*	*98*
35a	Conidiophores single, simple, forked at apex	*Glomerularia*	*86*
35b	Conidiophores usually have branches arising from an enlarged cell	*Umbelopsis*	*86*
35c	Conidiophores with variable short lateral branches	*Staphylotrichum*	***80***
36a	Conidiophores branched verticillately	*Vertkillium*	*92*
36b	Conidiophores in acervuli in nature; in culture, conidiophores separate or in poorly formed groups	*Gloeosporium*	***188***
36c	Conidiophores simple or with few branches, never in acervuli	*Cephalosporium*	*94*
37a	Fertile cells globose; conidiophores short, stout	*Phymaiotrkhum*	*78*
37b	Fertile cells globose, single, apical; conidiophores slender	*Oedocephalum*	*76*
37c	Fertile cells globose, apical and intercalary	*Gonatobotrys*	*76*
37d	Fertile cells somewhat elongated; conidia borne on short denticles	*Rhinotrichum*	*76*
37e	Fertile cells somewhat elongated; conidia borne on long pegs or branches	*Acladium*	*76*
37f	Fertile cells elongated, cylindrical, enlarged branches of conidiophorc; conidia on short denticles	*Chromelosporium*	***80***
38a	Conidia in more or less compact heads; conidiophores simple		39
38b	Conidia not in compact heads; conidiophores simple or branched near the apex		41
39a	Conidia in dry heads	*Aspergillus*	*94*
39b	Conidia held in heads of slime		40
40a	Simple diverging sterile arms subtending heads	*Gliocephalotrichum*	*94*
40b	No sterile arms below conidial heads	*Gliocephalis*	*94*
4!a	Conidia in basipetal chains		42
41 b	Conidial chains formed by segmentation of cells or branches of conidiophore		44

41 c	Conidia not catenulate		45
42a	Conidiophores usually separate, not in columns or cushions		43
42b	Conidiophores and conidia in tall aggregates	*Metarrhizium*	*94*
42c	Conidiophores and conidia in slimy cushions	*Myroihecium*	*146*
43a	Conidia phialospores; phialides divergent, loose	*Paecihmyces*	*94*
43b	Conidia phialospores; phialides upright, brushlike	*Pemcillium*	*94*
43c	Conidia annelospores	*Scopulariopsis*	*98*
44a	Arthrospores barrel-shaped, separated by prominent slender cells	*Amblyosporium*	*68*
44b	Arthrospores rod-shaped to globose, separating cells not prominent	*Oidiodendron*	*68*
45a	Rough-walled aleuriospores (chlamydospores) present		46
45b	Rough-walled aleuriospores absent		48
46a	Aleuriospores 1-celled, with attached hyaline cells	*Stephanoma*	*82*
46b	Aleuriospores 1 -celled, smooth walled	*Botryoderma*	*86*
46c	Aleuriospores 1-celled, rough walled, without attached cells	*Sepedonium*	*82*
46d	Aleuriospores 2-celled; apical cell large, rough, basal cell small, smooth		47
47a	Phialospore state verticillate (like Verticillium)	*Mycogone*	*82*
47b	Phialospore state aspergilliform (like Aspergillus)	*Chlamydomyces*	*82*
48a	Conidia produced at or near apex of phialides or branches of conidiophores		49
48b	Conidia attached both at apex and side of conidiophore or its branches		57
49a	Larger conidiophores (at least) verticillate		50
49b	Branches of conidiophores irregular, not verticillate		51
50a	Phialospores in mucilaginous clusters	*Verticillium*	*92*
50b	Sympodulospores in dry clusters	*Calcarisporium*	*102*
51a	Conidia not aggregated in slime drops		52
51 b	Conidia held in heads by slime drops		54
52a	Conidia abundant, borne on inflated apical cells		53
52b	Conidia single or in small clusters, not on inflated cells		55
53a	Conidiophores tall, with one (or few) central axis and several equal, lateral branches	*Botryosporium*	*76*
53b	Conidiophores tall, with irregular branches	*Botrytis*	*76*
53c	Conidiophores tall, with regular dichotomous branching	*Dichobotrys*	*78*
53d	Conidiophores short, with few branches	*Phymatotrichum*	*78*
54a	Conidiophore branches brushlike, similar to *Peniciltium*	*Gliocladium*	*92*

54b	Conidiophore branches spreading, not brushlike	*Trichoderma*	*92*
55a	Conidiophore branches loose, conidia present		56
55b	Reproductive structure compacted, globose or pyramidal, bearing globose cells but no true conidia	*Cristulariella*	*74*
56a	Saprophytic on leaves	*Hansfordia*	*98*
56b	Saprophytic on wood; conidial state of *Hypoxylon*	*Nodulosporium*	***100***
57a	Fertile portion of conidiophore (or sporogenous cell) zig-zag rachishke		58
57b	Fertile portion of conidiophore (or cell) not zig-zag, or rachislike		60
58a	Conidiophores simple or verticillately branched		59
58b	Conidiophores irregularly branched	*Geniculosporium*	***100***
59a	Conidiophores bulbous at base; parasitic on insects	*Beauveria*	***100***
59b	Conidiophores slender, not bulbous; not parasitic on insects	*Tritirachium*	***100***
60a	Conidia borne on short denticles		61
60b	Conidia apical on branches, not on denticles	*Botryoderma*	*86*
6!a	Conidiophores slender, with slender branches from main axis; not dichotomous	*Calcarisporium*	***102***
61b	Conidiophores slender to stout; fertile cells somewhat inflated	*Chromelosporium*	***80***
62a	Conidiophores well developed, branched		63
62b	Conidiophores mostly simple or with few branches		66
62c	Conidiophores none, reduced to cells of stroma	*Rhynchosporium*	***108***
63a	Conidia ovoid to oblong		64
63b	Conidia (sympodulospores) obovoid	*Genicularia*	***110***
63c	Conidia (phialospores) slender, cylindrical	*Cylindrocladium*	***108***
64a	Conidiophore branches restricted to apical region	*Candelabrella*	***110***
64b	Conidiophore branches not restricted to apical region		65
65a	Conidia in loose moist clusters	*Diplosporium*	*108*
65b	Conidia in loose tangled chains	*Cladobotryum*	*108*
66a	Apical cell of conidium much larger than basal cell		67
66b	Conidial cells not differing greatly in size		70
67a	Aquatic on submerged leaves	*Heliscus*	*108*
67b	Not aquatic		68
68a	Both cells of conidium smooth walled	*Genicularia*	***110***
68b	Apical cell of conidium rough walled; basal cell smooth		69

69a	Microconidial state, if present, similar to *Aspergillus*	*Chlamydomyces*	*82*
69b	Microconidial state, if present, similar to *Verticiltium*	*Mycogone*	*82*
70a	Conidiophores single, not clustered; mostly saprophytic		71
70b	Conidiophores clustered; parasitic on leaves		73
71a	Conidia borne singly on short pegs or denticles at or near apex of comdiophore		72
71 b	Conidia borne successively at pointed apex of comdiophore	*Trichothecium*	***108***
72a	Conidiophores tall, slender; conidia obovate to oblong	*Arthrobotrys*	***110***
72b	Conidiophores short; conidia cylindrical to clavate	*Dactylaria*	***110***
73a	Conidia cylindrical, often in short chains	*Ramularia*	***110***
73b	Conidia ovoid to oblong, not catenulate	*Didymaria*	***110***
74a	Conidia long, cylindrical, often bent or curved; aquatic		75
74b	Conidia shorter or not cylindrical; aquatic or not		76
75a	Conidiophores branched near apex; conidia 1 - or few-celled	*Flagelhspora*	***138***
75b	Conidiophores simple; conidia single, apical	*Anguillospora*	***140***
76a	Conidia *2*- to several-celled, phragmosporous, not branched		77
76b	Conidia branched, staurosporous		84
77a	Causing dermatomycoses of man or animals		78
77b	Saprophytic or parasitic on plants		79
78a	Macroconidia clavate, rounded at apex	*Trichophyton*	***116***
78b	Macroconidia spindle-shaped to ellipsoid	*Microsporum*	***116***
79a	Macroconidia typically curved, pointed (canoe-shaped), small conidia usually also present	*Fusarium*	***130***
79b	Other than in macroconidia, not canoe-shaped		80
80a	Conidiophores short, mostly simple or with few branches		81
80b	Conidiophores tall, simple or branched		85
81 a	Conidia cylindrical, mostly straight, *or* slightly curved		82
81 b	Conidia ellipsoid or long attenuated		83
82a	Conidia catenulate; conidiophores clustered	*Septocylindrium*	***128***
82b	Conidia not catenulate (sympodulospores); conidiophores single	*Scolecobasidium*	***114***
82c	Conidia not catenulate (phialospores); conidiophores single	*Cylindrocarpon*	***130***
83a	Conidia ellipsoid, rounded at apex	*Fusoma*	***116***
83b	Conidia cylindrical to filiform		84

84a	Conidium with apical appendage	*Spermospora*	***128***
84b	Conidia without appendages	*Cercosporella*	***128***
85a	Conidiophores mostly simple, seldom branched		86
85b	Conidiophores typically branched		95
86a	Parasitic on grasses	*Pyricularia*	***128***
86b	Saprophytic or parasitic on nematodes		87
87a	Middle cell of conidium greatly enlarged	*Monacrosporium*	***118***
87b	Middle cell only slightly or not at all enlarged		88
88a	Conidia ovoid to clavate to cylindrical	*Dactylaria*	***110***
88b	Conidia fusiform to cylindrical	*Dactylella*	***128***
89a	Branches of conidiophore (phialides) verticillate	*Dactylium*	***130***
89b	Conidiophores terminating in penicilliate branches	*Cylindrocladium*	***108***
90a	True staurosporous conidia formed		91
90b	No true conidia known; "conidial" branches forming a well defined globose or conical structure, similar to a loosly formed sclerotium	*Cristulariella*	*74*
91 a	Conidiophores reduced, not evident	*Thallospora*	***142***
91b	Conidiophores distinct, well formed, length variable		92
92a	Conidial branches not greatly divergent		93
92b	Conidial branches widely divergent		94
93a	Conidial branches typically 2-pronged	*Dicranidion*	***138***
93b	Conidial branches typically 3-pronged	*Tridentaria*	***140***
94a	Central cell of conidium much enlarged		95
94b	Central cell of conidium not enlarged		97
95a	Conidia pyriform or clavate, with 3 slender branches	*Clavariopsis*	***140***
95b	Conidia with central globose cell and 4 to 5 slender branches	*Actinospora*	***140***
95c	Conidia with 3 to 4 broad cells in main axis and 2 to 4 slender appendages		96
96a	Conidial appendages attenuated, pointed	*Ingoldia*	***138***
96b	Conidial appendages not distinctly attenuated	*CuHcidospora*	***140***
97a	Conidia borne on phialides or phialide-Iike branches of the conidiophore		98
97b	Conidia borne otherwise		99
98a	Conidium with elongated axis and 2 lateral branches arising side by side	*Alatospora*	***142***
98b	Conidium with 4 divergent branches arising near base of conidium	*Lemonniera*	***138***

99a	Conidial branches formed one at a time		100
99b	Conidial branches formed simultaneously		103
100a	Conidial branches 4 or more		101
100b	Conidial branches 3 or less		104
101a	Main axis of conidium broader than branches	*Tetracladium*	***140***
101b	Main axis of conidium about the same width as branches		102
102a	Number of branches variable mostly arising from one side of main axis	*Varicosporium*	***138***
102b	Conidial branches dendroid, not limited to one side of main axis	*Dendrospora*	***140***
103a	Conidial branches arising from different levels	*Tricladiutn*	***138***
103b	Conidial branches arising from base of central axis	*Triscelophorus*	***138***
104a	Conidial branches arising from near apex of main axis	*Articulospora*	***142***
104b	Two conidial branches arising about midway of slender axis	*Tetrachaetum*	***140***

DEMATIACEAE

105a	Conidia typically 1-celled		106
105b	Conidia typically 2-celled		145
105c	Conidia typically 3- or more-ceiled phragmospores		156
105d	Conidia typically 3- or more-celleddictyospores		184
106a	Conidiophores absent or, if present, often poorly developed, consisting of 1 to few cells		107
106b	Conidiophores mostly tall and well developed, cells distinct from conidia, simple or branched		122
107a	Blastospores borne directly on sides of mycelium, budding freely	*Aureobasidium*	*70*
107b	Dark globose cells of the mycelium breaking up to form 1- to several-celled segments; conidiophorelike structures may also be present	*Torula*	*74*
107c	Conidia appearing as blastospores, not budding, broadly ovoid to lenticular, with a hyaline slit on one side	*Papularia*	***82***
107d	Conidia other than blastospores, not normally budding; conidiophore cells usually distinct but short		108
108a	Conidiophores extending slightly in length; conidia formed as meristem arthrospores	*Wailemia*	*92*
108b	Conidia other than arthrospores		109
109a	Conidia formed as aleuriospores		110
109b	Conidia formed as phialospores, sympodulospores, or annellospores		114
110a	Conidia globose		Ill

I !0b	Conidia ellipsoid or pointed at apex		112
II la	Conidia black and shiny, borne singly, apically on a special flat hyaline cell	*Nigrospora*	*82*
11 lb	Conidia apical, brown, not on a flat special cell	*Humicola*	*84*
11 lc	Conidiophore reduced to one cell; conidia single, with a hyaline germ pore on one side	*Gilmaniella*	*84*
11 Id	Conidia single on short branch; no germ pore evident; dark setae present	*Botryothchwn*	*84*
112a	Conidia rough-walled, pointed at apex	*Echinobotryum*	*84*
112b	Conidia smooth-walled, ellipsoid		113
113a	Conidiophores short, hyaline, repeatedly branched	*Wardomyces*	*84*
II 3b	Conidiophore branches few; conidia borne on slender stalks	*Asteromyces*	*84*
113c	Conidiophore branches few; conidia sessile; germ slit evident on one side	*Mammaria*	*84*
I I4a	Conidiophores separate; sympodulospores hyaline, somewhat curved	*Idriella*	***102***
114b	Conidiophores compacted into stromalike layers; sympodulospores dark, pointed at apex	*Fusicladium*	***112***
114c	Conidiophores compacted into stromalike layer; annellospores dark, pointed at apex	*Spilocaea*	***106***
1 1 4 d	Conidia formed as phialospores		115
115a	Conidia slightly curved, narrowly ellipsoid; simple curved setae present..	*Circinotrichum*	*90*
U5b	Conidia slightly curved, narrowly ellipsoid; branched, curved setae present...	*Gyrothrix*	*90*
115c	Conidia ovoid to rod-shaped; no setae present		116
116a	Conidia with slender appendage at each end; conidiophore branched	*Menispora*	*88*
116b	Conidia with slender appendage at each end; conidiophore unbranched	*Codinae*	*88*
1 1 6 c	Conidia without appendage		117
117a	Conidia ovoid, hyaline to dark, often in chains, not in heads	*Monilochaetes*	*86*
117b	Conidia mostly ovoid, in small slimy heads, not catenulate		118
1 1 7 c	Conidia rod-shaped, with blunt ends, little or no slime, often present in long chains		119
118a	Phialides often with enlarged base with flaring collar; conidia hyaline	*Phialophora*	*88*
118b	Phialides slender, collar not noticeably flared; conidia hyaline	*Chloridium*	*88*
118c	Phialides slender, collar not flaring; conidia dark	*Gliomastix*	*86*
1 1 9 a	Dark chlamydospores present		120
1 1 9 b	No dark chlamydospores present		121
120a	Chlamydospores nearly globose, mostly single	*Chalaropsis*	*90*
120b	Chlamydospores formed in a row, breaking up into single cells	*Thielaviopsis*	*92*

121a	Dark, simple, pointed setae present	*Chaetochalara*	*90*
121b	No setae present	*Chalara*	*90*
122a	Conidia, sympodulospores, formed on new growing points on conidiophores		123
122b	Conidia formed in other ways, not sympodulospores		130
123a	Conidiophores simple		124
123b	Conidiophores branched		125
124a	Apex of conidiophores enlarged, rounded, bearing numerous hyaline conidia on short sporogenous cells	*Basidiobotrys*	***100***
I24b	Conidiophores pointed at apex; conidia hyaline, ovoid, attached at tip and sides of conidiophores	*Rhinocladiella*	***104***
124c	Conidia obconic, pointed at apex, dark	*Beltrania*	***104***
125a	Conidiophore branches or phialides borne on side of conidiophore		126
125b	Branches of conidiophore confined to area near apex		127
125c	Branches *of* conidiophores irregular		128
126a	Branches in whorls; conidia somewhat curved	*Selenosporella*	***102***
126b	Conidia in unbranched chains, rod-shaped	*Sympodiella*	***104***
Mid.	Branches loosely arranged; conidia dark, without slime	*Periconiella*	***104***
127b	Conidiophores repeatedly branched; branches compact; conidia hyaline in slime heads	*Verticicladiella*	***104***
I27c	Conidiophores repeatedly branched near apex; conidia not borne in slime heads , ,	*Verticicladium*	***104***
128a	Conidia borne on somewhat enlarged branch tips	*Nodulosporium*	***100***
128b	Conidia borne on elongated fertile portion of conidiophore branches		129
129a	Conidiophores with main axis and numerous lateral branches; conidia dark…	*Conoplea*	***102***
129b	Main axis of conidiophore not evident; conidia hyaline, symmetric	*Geniculosporium*	***100***
129c	Main axis of conidiophores not evident; conidia dark, asymmetric	*Virgaria*	***100***
130a	Conidia blastospores or appearing to be produced as such		131
130b	Other than in conidia, not blastospores		136
13la	Conidia hyaline		132
13Jb	Conidia dark		133
132a	Dark special cells (falcs) bearing sporogenous cells	*Zygosporium*	*72*
132b	Without dark falcs on conidiophores	*Haplographium*	*80*
133a	Dark pointed setae present		134
133b	Without dark setae		135

134a	Conidiophore with enlarged rounded apical cell	*Lacellinopsis*	*78*
134b	Conidiophores with slender apical cells	*Lacellina*	*78*
135a	Conidia borne on apical inflated cells	*Periconia*	*74*
135b	Conidia borne on inflated cells at apex and intercalary cells of conidiophores	*Gonatobotryutn*	*78*
135c	Conidia borne in acropetal chains of variable size and with scars	*Cladosporium*	***106***
136a	Conidia (phialophores) borne at apex of conidiophores		137
136b	Conidia not phialospores		143
137a	Conidiophores simple, unbranched		138
137b	Conidiophores branched		139
138a	Conidia in moist (slimy) heads	*Stachybotrys*	***88***
138b	Conidia in dry chains; apex of conidiophores not enlarged	*Memnoniella*	***88***
138c	Conidia in dry chains; apex of conidiophores enlarged, rounded	*Aspergillus*	*94*
139a	Branches of conidiophores lateral; conidiophores with sterile apex		140
139b	Conidiophore branches clustered at or near apex, without sterile apex		141
140a	Conidia ovoid; phialides dark	*Gonytrichum*	*98*
140b	Conidia oblong, cylindrical; phialides hyaline	*Chaetopsina*	*96*
141a	Conidiophores hyaline; few conidia large, dark, lemon-shaped	*Phialomyces*	94
14Tb	Conidiophores dark; other than in conidia		142
142a	Conidia rod-shaped, elongate with blunt ends, catenulate	*Phialocephala*	*96*
142b	Conidia elongate fusoid, ends pointed	*Thysanophora*	*96*
142c	Conidia ovoid, not catenulate	*Stachylidium*	*92*
143a	Conidia formed as meristem arthrospores; conidiophores with thick dark septa	*Arthrinium*	*74*
143b	Conidia and conidiophores not as above		144
144a	Conidia annellospores, conidia in slime heads	*Leptographium*	*98*
144b	Conidia aleuriospores; conidiophores simple with two dark conidia at apex	*Microclavia*	***80***
144c	Conidia aleuriospores; conidiophores irregularly branched	*Staphylotrichum*	***80***
145a	Conidia catenulate		146
145b	Conidia not catenulate		147
146a	Conidiophores simple, tall, segmenting into rod-shaped arthrospores	*Ampuliferina*	***106***
146b	Conidia formed in acropetalous unbranched chains (blastospores)	*Bispora*	***106***
146c	Conidia formed in branched chains, single-celled conidia also present (blasto spores)	*Cladosporium*	***106***
146d	Conidia formed as rows of dark chlamydospores (aleuriospores)	*Trichocladium*	***118***

146e	Conidia formed as lateral branches through pores (porospores)	*Diplococcium*	***114***
147a	Conidiophores clustered on surface or breaking out from stroma		148
I47b	Other than in conidiophores, mostly single		153
148a	Conidiophores wavy, in loose clusters on surface of leaves	*Polythrincium*	***112***
148b	Conidiophores not wavy, arising from within leaf		149
149a	Conidia on stroma, with apical, rounded cells	*Asperisporium*	***112***
149b	Conidia on stroma, apical cell pointed		150
150a	Conidiophores very short, on flat stroma		151
150b	Conidiophores tall		152
151a	Conidia annellospores	*Spilocaea*	***106***
151b	Conidia sympodulospores	*Fusicladium*	***112***
152a	Conidiophores branched	*Passalora*	***112***
152b	Conidiophores unbranched	*Scolecotrichum*	***112***
}53a	Conidiophores simple		154
153b	Conidiophores branched		155
154a	Conidiophores short, stout, composed usually of 1 or 2 cells	*Scolecobasidium*	***114***
154b	Conidiophores tall, slender; conidia clustered at apex	*Cordana*	***112***
154c	Conidiophores tall, slender; conidia formed from lateral pores	*Spadicoides*	***114***
155a	Branches restricted to apical area where radiating sporogenous cells form	*Pseudobotrytis*	***106***
155b	Several lateral branches of conidiophores end in sterile apical point	*Chaeiopsis*	*96*
155c	Conidiophore branches short, irregular, on short conidiophore	*Balanium*	***106***
156a	Conidia endogenous; conidiophore with a single swollen, terminal phialide	*Sporoschisma*	***130***
156b	Conidia exogenous; other than in conidiophores		157
157a	Conidiophores typically branched		158
157b	Conidiophores typically simple, rarely branched		159
158a	Conidial chains basipetal, conidia not truly end to end	*Fusariella*	***130***
158b	Conidia] chains acropetal, conidia truly end to end	*Septonema*	***116***
159a	Conidia slender, much longer than wide	*Cladosporiella*	*92*
i59b	Conidia much broader, usually length not 3 to 4 times width		160
160a	Conidia with very thick wall, formed by expansion of apical conidiophore cells	*Murogenella*	***114***

160b	Conidia formed distinct from conidiophore cells		161
161a	Conidiophores clustered or fascicled		162
161b	Conidiophorcs single, separate		165
162a	Conidiophores in tall fascicles	*Phragmocephala*	***118***
162b	Conidiophores in small, compact cushion-shaped structures	*Cercosporidium*	***122***
162c	Conidiophores clustered at base; upper portion divergent		163
163a	Conidiophores short, bearing annellospores	*Stigmina*	***120***
163b	Conidiophores tall, showing sympodial growth		164
164a	Conidia dark, oblong	*Heterosporium*	***122***
164b	Conidia long, slender, hyaline	*Cercospora*	***128***
165a	Conidiophores short, consisting of 1 to few cells, or absent		166
165b	Conidiophores tall, typically consisting of several cells		172
I66a	Conidia of two kinds, dark phragmospores, and lighter scolecospores		167
166b	Dark phragmospores only		168
167a	Conidia in acropetalous chains	*Pseudotorula*	***116***
167b	Conidia not in chains	*Dwayabeeja*	***116***
168a	Conidia botryoblastospores	*Cephaliophora*	***116***
168b	Conidia annellospores	*Deightoniella*	***118***
I68c	Conidia aleuriospores		169
169a	Conidia much longer than broad		170
169b	Conidia not much longer than broad		**171**
170a	Conidia long-cylindrical, separating cell at tip of conidiophore evident	*Camposporium*	***116***
170b	Conidia somewhat broader at middle, apical cell attenuated or hooked; no separating cell	*Ceratophorum*	***118***
170c	Conidia long, broadest at middle, narrowed toward each end; no separating cell	*Clasiei'o.sporium*	***118***
171a	Conidia rounded, nearly globose (may appear as a chain of chlamydospores)	*Trichocladium*	***118***
I7Ib	Conidia broadly ellipsoid, phragmospores and dictyospores may be present	*Pithoniyces*	***132***
172a	Conidiophores determinate, not elongating with successive conidial formation		173
172b	Conidiophorcs indeterminate, elongating after each successive conidial formation		174
173a	Conidia produced through pores at sides of conidiophores	*Spadicoidcs*	***114***

173b	Conidia apical, single, several-celled, parasitic on leaves	*Corynespora*	***120***
173c	Conidia apical, several-celled, saprophytic	*Sporidesmium*	***120***
173d	Conidia apical, 3- to 5-celled, saprophytic	*Endophragmia*	***118***
174a	Conidiophores proliferating at apex, leaving annulate scars		175
174b	Conidiophores elongating sympodially		176
175a	Conidia narrowed or pointed at apex	*Annellophora*	***118***
175b	Conidia mostly ovoid with rounded apex	*Endophragmia*	***118***
176a	Conidia with 1 to 4 slender hyaline appendages	*Pleiochaeta*	***128***
176b	Conidia without appendages		177
177a	Conidia in apical clusters or heads		178
177b	Conidia not confined to apex of conidiophore		181
178a	Conidia borne on slender pedicels	*Brachysporium*	***126***
178b	Conidia not borne on slender pedicels		179
179a	Conidia hyaline	*Pleurothecium*	***126***
179b	Conidia dark		180
180a	Conidia borne on short hyaline projection through apex of conidiophore	*Cacumisporium*	***124***
180b	Conidia borne near apex but not on special cell of conidiophore	*Pleurographium*	***126***
181a	Conidia distinctly narrowed at both ends		182
181b	Conidia straight or only slightly narrowed, ends rounded		183
182a	Conidia porospores, borne in whorls on cells of straight, simple conidiophores	*Helminthosporium*	***124***
182b	Conidia sympodulospores	*Nakataea*	***128***
183a	Conidia catenulate	*Dendryphion*	***124***
183b	Conidia not catenulate, usually 4-celled, bent by enlargement of one of middle cells	*Curvulana*	***122***
183c	Conidia not catenulate, several-celled, straight or slightly curved	*Drechslera, Bipolaris*	***122,126***
184a	Conidia catenulate		185
184b	Conidia not catenulate		186
185a	Conidial development basipetal	*Coniosporium*	***134***
185b	Conidial development acropetal	*Alternaria*	***132***
186a	Conidium with large swollen apical cell	*Acrospeira*	***132***
186b	Apical cell of conidium not distinctly swollen		187

187a	Conidiophores well developed, usually longer than conidia		188
187b	Conidiophores poorly developed or none		192
188a	Conidia apical, single		189
188b	Conidia appearing apical and lateral due to growth of conidiophore		192
189a	Conidia sharply attenuated at apex	*Alternaria*	***132***
I89b	Conidia somewhat narrower or not at apex		190
190a	Conidia subglobose, ovoid, or broadly ellipsoid	*Stemphylium*	***132***
190b	Conidia elongate, straight to flexuous	*Sirosporium*	***134***
191a	Conidia with 4 cells, cross-shaped	*Dictyoarthrmium*	***134***
191 b	Conidia several celled, not cross-shaped, broadly elliptical, ends rounded	*Ulocladium*	***132***
191c	Conidia several-celled, narrowly elliptical, ends pointed	*Dactylosporium*	***134***
I92a	Conidiophores single, not clustered		193
192b	Conidiophores clustered, often into a loose sporodochiumlike structure		194
193a	On living leaves, parasitic	*Stigmella*	***134***
193b	Saprophytic in soil or humus	*Pithomyces*	***132***
194a	Conidia globose to subglobose	*Epicoccum*	*150*
194b	Conidia very large, oblong to obovoid	*Berkleasmium*	***134***
195a	Branches of conidium upright, parallel, or slightly divergent		196
195b	Branches of conidium upright or lateral, widely divergent		197
196a	Conidial branches connected	*Dictyosponum*	***144***
196b	Conidial branches separate; conidia catenulate or produced successively	*Ceratosporella*	***144***
196c	Conidial branches separate; conidia apical, single	*Speiropsis*	***142***
197'a	Conidiophores present, distinct, length variable		198
197b	Conidiophores absent or reduced to short pegs		199
198a	Conidia (aleuriospores) apical, single	*Triposporium*	***144***
198b	Conidia (sympodulospores) apical on new sympodial growing points	*Diplodadiella*	***142***
199a	Conidia with 2 to 3 straight or curved upright horns		200
199b	Conidia with 3 to 4 basal cells, each attenuated above	*Tetrapha*	***142***
199c	Conidia with 4 to 5 divergent arms at wide angles	*Tripospermum*	***142***
200a	Parasitic on leaves	*Hirudinaria*	***144***
200b	Saprophytic, mostly on wood	*Ceratosporium*	***144***
201a	Conidiophores united into sporodochia (Tuberculanaceae). Sporodochia may be poorly formed in culture; some species may be similar in appearance to Melanconiales		202

201b	Conidiophores united into synnemata (Stilbaceae); free conidiophores often also present		225

TUBERCULARIACEAE

202a	Conidia I-celled, hyaline or dark		203
202b	Conidia 2-ceIIed, dark	*Pucciniopsis*	***148***
202c	Conidia typically more than 2-celled, hyaline or dark		215
203a	Conidia hyaline or brightly colored		204
203b	Conidia or sporodochia with dark pigment		213
204a	Sporodochia stromalike, spreading, on developing grain	*Sphacelia*	***148***
204b	Sporodochia cushion-shaped to discoid, not on grain		205
205a	Sporodochia with prominent setae or sterile hairs	*Myrothecium*	***146***
205b	Sporodochia without setae or sterile hairs		206
206a	Sporodochia developing in rust pustules on plants	*Tuberculina*	***148***
206b	Sporodochia superficial, not in rust pustules		207
207a	Conidia catenulate or in pillarlike masses		208
207b	Conidia not catenulate or in pillarlike structures		210
208a	Conidia hyaline or yellowish in mass	*Sphaerosporium*	***146***
208b	Conidia usually greenish in mass		209
209a	Conidiophores and conidia in tall columnar aggregates	*Metarrhizium*	*94*
209b	Conidiophores and conidia in slimy masses or loose columns	*Myrothecium*	***146***
210a	Sporodochia discoid, flattened	*Hymenella*	***146***
210b	Sporodochia cushion-shaped to hemispherical		211
21 la	Conidiophores verticillately branched	*Dendrodochium*	***146***
21 lb	Conidiophore branching irregular		212
212a	On wood or bark	*Tubercularia*	***146***
212b	On leaves	*Illosporium*	***146***
2 J 3a	On scale insects	*Aegerita*	*150*
213b	Not on scale insects		214
214a	Sporodochia erumpent from leaves	*Hadrotrichum*	***146***
214b	Sporodochia superficial on bark or wood	*Strumella*	***146***
215a	Conidia hyaline or brightly colored		216

215b	Conidia with dark pigment		218
216a	Conidia large, cylindrical to ellipsoid; yellowish in mass	*Bactridium*	***148***
216b	Conidia slender, hyaline in mass		217
217a	Macroconidia canoe-shaped; I-celled conidia also may be present	*Fusarium*	***130***
217b	Conidia curved but not canoe-shaped	*Ramulispora*	***148***
218a	Conidia branched or lobed		219
218b	Conidia not branched or lobed		220
219a	Conidia with short, compact upright branches	*Cheiromyces*	***150***
219b	Conidia 4-lobed, cross-shaped	*Spegazzinia*	***150***
220a	Conidia (dictyospores) muriform		221
220b	Conidia (phragmospores) 3- to several-celled		223
221a	Conidia globose to subglobose	*Epicoccum*	***150***
221 b	Conidia broadly cylindrical to ovoid, very large	*Berkleasmium*	***134***
222a	Sporodochia without setae		223
222b	Sporodochia with dark setae	*Excipularia*	***148***
223a	Conidiophores arising from special enlarged cells	*Camptomeris*	***150***
223b	Conidiophores not arising from special enlarged cells	*Bactrodesmium*	***150***

STILBACEAE

225a	Not parasitic (or saprophytic) on insects or spiders	226
225b	Parasitic (and probably saprophytic) on insects or spiders	243
226a	Conidia 1-celled	227
226b	Conidia 2- or more-celled	236
227a	Conidia hyaline	228
227b	Conidia dark	233
228a	Comdiogenous portion of synnemata located or near apex in more or less globose head	***229***
228b	Conidiogenous portion of synnemata elongate to cylindrical	232
229a	Head composed of loosely arranged conidiogenous hyphae	230
229b	Head composed of compact conidiogenous hyphae	231

230a	Head with numerous radiating sterile hyphae	*Heterocephalum*	***152***
230b	Radiating sterile hyphae not present	*Tharoopama*	***156***
231a	Stalks of synnemata hyaline	*Stilbum*	***152***
231b	Stalks of synnemata dark	*Graphium, Peso turn*	***152***
232a	Synnema with tall, central seta	*Menisporopsis*	***152*** ,
232b	Central seta absent	*Harpographium*	***156***
233a	Conidiogenous portion of synnemata confined to compact apical region		234
233b	Conidiogenous region cylindrical		235
234a	Synnemata funnel-shaped with narrow base	*Endocalyx*	***152***
234b	Synnema slender, uniform, with globose head	*Briosia*	***152***
235a	Sterile hairs or setae present among conidiophores	*Trichurus*	***156***
235b	Sterile hairs not present	*Doratomyees*	***154***
236a	Conidia 2-celled		237
236b	Conidia 3- or more-celled		238
237a	Synnemata and conidia hyaline	*Didymostilbe*	***154***
237b	Synnemata and conidia dark	*Didymobotryum*	***156***
238a	Conidiogenous portion of synnema only at or near apex		239
238b	Conidiogenous portion of synnema longer, cylindrical		242
239a	Conidial portion in compact, more or less globose heads		240
239b	Conidial portion with loose conidiophores, not so compact		241
240a	Conidia with cross walls only (phragmosphores)	*Arthrobotryum*	***154***
240b	Conidia with both cross and oblique walls (dictyospores)	*Sclerographium*	***158***
241a	Conidial branches at apex, short; conidia pointed at apex	*Acarocybe*	***158***
241 b	Conidiophores in a loose fascicle, not branched; conidia pointed at apex	*hariopsis*	***154***
241c	Conidiophores compact at base, diverging near apex, conidia rounded at ends	*Dendrographium*	***154***
242a	Conidia hyaline	*Arthrosporium*	***154***
242b	Conidia dark, borne singly at apex of conidiophore	*Podosporium*	***154***
242c	Conidia dark, borne on sympodial conidiophore	*Spiropes*	***158***
243a	Phialides in globose or wedge-shaped heads	*Gibellula*	***160***
243b	Phialides not in definite heads		244

244a	Phialides short, in compact layer		245
244b	Phialides usually large, not in compact layer		246
245a	Synnemata cylindrical; phialides obtuse at apex	*Hymenostilbe*	***158***
245b	Synnemata clavate; phialides pointed at apex	*Insecticola*	***158***
245c	Synnemata cylindrical to attenuated; phialides pointed	*Akanthomyces*	***158***
246a	Phialides elongate, slender; conidia covered with slime		247
246b	Phialides not elongate; conidia dry	*Isaria*	***156***
247a	Phialides enlarged at base; conidia not in heads	*Hirsutella*	***160***
247b	Phialides not enlarged at base; conidia in heads	*Synnematium*	***160***

SPHAEROPSIDALES

la	Conidia globose to oblong or ellipsoid, not filiform		2
lb	Conidia filiform, at least several times longer than wide, I- to several-celled (scolecosporous)		62
2a	Conidia 1 -celled		3
2b	Conidia typically 2-cclled		45
2c	Conidia typically 3- to several-celled		52
3a	Conidia hyaline, or sometimes brightly pigmented in mass		4
3b	Conidia with dark pigment, evident at least in mass		40
4a	Pycnidia complete, or with well developed base		5
4b	Pycnidia not complete, with only the upper portion well developed		37
5a	Pycnidia separate, not in stromata		6
5b	Pycnidia in stromata, frequently evident only by pycnidial cavities		29
6a	Pycnidia mostly ovoid; parasitic on powdery mildews	*Ampelomyces*	***166***
6b	Pycnidia with long beak or neck; not parasitic on powdery mildews		7
6c	Pycnidial beak short or absent; not parasitic on powdery mildews		9
7a	Pycnidial walls dark	*Sphaeronaema*	***168***
7b	Pycnidial wall hyaline or light colored		8
8a	Pycnidia] wall composed of long parallel hyphae	*Hyalopycnis*	***168***
8b	Pycnidial wall composed of short, angled pseudoparenchymetous cells ..	*Eleutheromyces*	***168***
9a	Pycnidia breaking open irregularly, without a distinct ostiole		10
9b	Pycnidia opening by distinct ostioles		18
10a	Pycnidia with dark setae		11

10b	Pycnidia without dark setae		12
I la	Conidia with a slender appendage at each end	*Dinemasporium*	***172***
II b	Conidia without appendages	*A merosporium*	***172***
I2a	Pycnidia superficial, on surface of substratum		13
12b	Pycnidia at least partially within substratum		14
13a	Pycnidia soft, leathery, subglobose, not on subiculum	*Cannula*	***172***
13b	Pycnidia hard, irregular, on subiculum	*Chaetophoma*	***164***
14a	Pycnidia large, resembling sclerotia; conidia ellipsoid	*Sclerotiopsis*	***166***
14b	Pycnidia not resembling sclerotia; conidia ovoid to ellipsoid		15
15a	Pycnidia fleshy, bright colored when fresh	*Hainesia*	***174***
15b	Pycnidia hard, dark		16
16a	Pycnidia subcortical, on woody twigs	*Dothichiza*	***172***
16b	Pycnidia subepidermal, on fleshy tissue or leaves		17
17a	Pycnidia discoid, dehiscing radiately	*Sporonema*	***172***
17b	Pycnidia globose, opening at apex	*Plenodomus*	***162***
18a	Pycnidia on subiculum of radiating hyphae	*Asteromella*	***164***
18b	Pycnidia *not on* subiculum ,		19
19a	Conidia of 2 kinds: short-ovoid and long-curved or bent	*Phomopsis*	***164***
19b	Conidia all of one kind		20
20a	Conidia typically lunate	*Seienophoma*	***162***
20b	Conidia ovoid; dark dictyosporous chlamydosphores present	*Peyronellaea*	***164***
20c	Conidia globose to ellipsoid, straight or slightly curved; without dictyosporous chlamydospores		21
21 a	Conidiophores branched		22
21	b Conidiophores simple		23
22a	Conidia with apical appendages	*Eleutheromycella*	***168***
22b	Conidia without appendages	*Dendrophoma*	***162***
23a	Conidia with hyaline membraneous appendages		24
23b	Conidia without appendages		25
24a	Conidial appendage apical, obconical	*Neottiospora*	***166***
24b	Conidial appendage slender, turned back	*Anthasthoopa*	***174***
25a	Pycnidia superficial on natural substratum		26
25b	Pycnidia embedded in natural substratum		27

26a	Pycnidia tapering below into a short stalk	*Rhizosphaera*	***164***
26b	Pycnidia not tapering at base	*Aposphaeria*	***162***
27a	Conidia longer than 15 microns	*Macrophoma*	***164***
27b	Conidia 15 microns or shorter		28
28a	Setae present on pycnidia	*Pyrenochaeta*	***162***
28b	No setae present on pycnidia	*Phyllosticta, Phoma*	***162***
29a	Conidia having one or more apical appendages		30
29b	Conidia without appendages		3 J
30a	Conidia with an apical and a basal appendage	*Shanoria*	***172***
30b	Conidia with short branched appendages at both ends	*Dilophospora*	***166***
31a	Stromata superficial, soft, brightly colored	*Aschersonia*	***174***
31b	Stromata subepidermal or subcortical, dark		32
32a	Conidia fusoid, ends pointed	*Fusicoccum*	***170***
32b	Conidia not fusoid, ends rounded		33
33a	Conidiophores tall, slender, septate		34
33b	Conidiophores short, seldom septate		35
34a	Conidia borne apically only on conidiophores *	*Rabenhorstia*	***170***
34b	Conidia borne apically and laterally on conidiophore	*Pleurostromella*	***170***
35a	Conidia ovoid to broadly ellipsoid; pycnidial cavaties globose	*Dothiorella*	***166***
35b	Conidia narrow, ovoid to filiform; pycnidial cavities irregular		36
36a	Conidia mostly filiform, bent or curved	*Cytosporina*	***166***
36b	Conidia short, curved	*Cytospora*	***170***
36c	Conidia short, not curved	*Cytosporella*	***170***
37a	Pycnidia shield-shaped, with or without ostiole		38
37b	Pycnidia flat, opening wide at maturity		39
38a	Pycnidia borne on a short stalk or column	*Actinopelte*	***174***
38b	Pycnidia without stalk or column	*Leptothyrium*	***174***
39a	Stroma present	*Melasmia*	***174***
39b	Stroma absent	*Leptostroma*	***176***
40a	Pycnidia with prominent dark bristles (setae)	*Chaetomella*	***176***
40b	Pycnidia without bristles (setae)		**41**
41a	Pycnidia light colored; conidiophores long, filiform	*Harknessia*	***176***

41 b	Pycnidia dark; conidiophores short		42
42a	Parasitic on powdery mildews	*Ampelomyces*	***166***
42b	Not parasitic on powdery mildews		43
43a	Stromata embedded in bark or wood	*Haplosporetta*	***178***
43b	Pycnidia not in stromata		44
44a	Conidia large, ovoid to elongate	*Sphaeropsis*	***176***
44b	Conidia small, globose to ovoid; without dark chlamydospores	*Coniothyrium*	***176***
44c	Conidia small, ovoid; dark dictyosporous chlamydospores present	*Peyronellaea*	***164***
45a	Conidia hyaline		46
45b	Conidia with distinct dark pigment		51
46a	Pycnidia in rust pustules; parasitic on rusts	*Darluca*	***178***
46b	Not parasitic on rusts		47
47a	Conidia without appendages		48
47b	Conidia with appendages		50
48a	Pycnidia in necrotic spots on leaves, etc	*Ascochyta*	***178***
48b	Pycnidia not in necrotic spots		49
49a	Pycnidia with distinct beaks	*Rhynchophoma*	***178***
49b	Pycnidia without distinct beaks	*Diplodina*	***178***
50a	Conidia with an apical awl-shaped unbranched appendage	*Kellermannia*	***178***
50b	Conidia with 3 to 4 hyaline appendages at one end	*Robillarda*	***178***
51a	Pycnidia separate, not in stroma	*Diplodia*	***180***
51 b	Pycnidia clustered in stroma	*Botryodipiodia*	***180***
52-d	Conidia with transverse septa only (phragmosporous)		53
52b	Conidia dictyosporous or staurosporous		59
53a	Conidia with apical appendages		54
53b	Conidia without appendages		55
54a	Pycnidia flattened; conidia with 1 appendage at each end	*Discosia*	***182***
54b	Pycnidia globose; conidia with 3 to 4 appendages	*Bartilinia*	***182***
55a	Pycnidia brightly colored with cushionlike stroma	*Aschersonia*	***174***
55b	Pycnidia brown or black, without stroma		56
55c	Pycnidia dark, in stroma		58
56a	Pycnidia with dark spines near ostiole; conidia hyaline	*Aristatoma*	***180***

56b	Pycnidia without spines; conidia hyaline	*Stagonospora*	***180***
56c	Pycnidia without spines; conidia dark when mature		57
57a	Conidia single on conidiophores	*Hendersonula*	***180***
57b	Conidia grouped at apex of conidiophores	*Prosthemium*	***186***
58a	Conidia dark	*Hendersonia*	***184***
58b	Conidia hyaline	*Dothistroma*	***180***
59a	Conidia dictyosporous, globose to ellipsoid		60
59b	Conidia staurosporous		61
60a	Pycnidia within a stroma	*Dichomera*	***186***
60b	Pycnidia not in a stroma	*Camarosporium*	***186***
61a	Conidia typically with 4 equal radiating arms	*Tetranacrium*	***182***
61b	Conidia with 3 to 5 equal arms	*Prosthemium*	***186***
62a	Pycnidia in dark hard stroma		63
62b	Pycnidia not in stroma, not gelatinous		64
62c	Pycnidia gelatinous or with gelatinous stroma		72
63a	Conidia 1-celled, bent or curved	*Cytosporina*	***166***
63b	Conidia several-celled, long, cylindrical, straight	*Dothistroma*	***180***
64a	Pycnidia clavate or with long beak		65
64b	Pycnidia globose or flattened		66
65a	Conidia hyaline, 1- to 2-celled, filiform-fusoid	*Sphaerographium*	***184***
65b	Conidia dark, several-celled, elongate	*Cornularia*	***186***
66a	Pycnidia with distinct ostiolc		67
66b	Pycnidia opening by wide mouth or slit		70
67a	Conidia pigmented, yellow to light brown	*Phaeoseptoria*	***184***
67b	Conidia hyaline		68
68a	Pycnidia in necrotic spots on leaves, etc		69
68b	Pycnidia not in necrotic spots	*Rhabdospora*	***184***
69a	Pycnidia with setae near ostiole	*Chaetoseptoria*	***184***
69b	Pycnidia without setae	*Septoria*	***182***
70a	Conidia 1-celled, bent or curved	*Phlyctaena*	***186***
70b	Conidia several-celled, straight or curved		71
71a	Pycnidia flattened, irregular, opening by a slit; conidia not segmenting ..	*Leptostromella*	***184***

71b	Pycnidia globose or cupulate, opening by a wide mouth	*Phleospura*	***186***
72a	Conidia I-celled; stroma smutlike, on grass	*Ephelis*	***184***
72b	Conidia several-celled; stroma not smutlike, on wood or bark		73
73a	Stroma elongate, stalked	*Chondropudium*	***186***
73b	Stroma rounded to irregular, not stalked		74
74a	Stromal tissue waxy	*Mkropera*	***182***
74b	Stromal tissue cartilaginous	*Gelatinosporium*	***182***

MELANCONIALES

la	Conidia 1-celled, short, not filiform		2
lb	Conidia 2- to several-celled, not filiform, didymosporous or phragmosporous		7
lc	Conidia filiform, 1- to several-celled		12
Id	Conidia dictyosporous or staurosporous		14
2a	Conidia with distinct dark pigment	*Melanconium*	***190***
2b	Conidia hyaline		3
3a	Conidia produced laterally on conidiophore	*Catenophora*	***188***
3b	Conidia produced apically on conidiophore		4
4a	Conidia with apical, hyaline branched appendages	*Pestalozziella*	***188***
4b	Conidia without appendages		5
5a	Dark setae present in acervulus	*Colletotrichum*	***188***
5b	Dark setae absent		6
6a	Conidiophores arising from a stromalike base	*Sphaceloma*	***188***
6b	Stromalike base absent or poorly developed	*Gloeosporium*	***188***
7a	Conidia 2-celled, didymospores		8
7b	Conidia 3- to several-celled, phragmospores		9
8a	Conidia unequally 2-celled, hyaline, without appendages	*Marssonina*	***190***
8b	Conidia equally 2-celled, hyaline, with one appendage at each end	*Myculeptodiscus*	***190***
8c	Conidia typically 2-celled, dark, with basal appendages	*Polynema*	***192***
9a	Conidia hyaline	*Sepioglueum*	***190***
9b	Conidia with distinct dark pigment		10
10a	All cells of conidia dark	*Coryneum*	***194***

10b	End cells of conidia hyaline, middle cells dark		11
I la	Single beaklike appendages at apex of conidia	*Monochaetia*	***192***
II b	With 2 to 3 appendages at apex of conidia	*Pestalotia*	*192*
1 lc	Conidia with single apical and basal appendages	*Seimatosporium*	***192***
12a	Saprophytic on wood or bark	*Libertella*	***190***
12b	Parasitic on leaves		13
13a	Conidia becoming septate	*Cylindrosporium*	***192***
13b	Conidia remaining 1-celled	*Cryptosporium*	***190***
14a	Conidia dictyosporous; some phragmospores may be present		15
14b	Conidia straurosporous		16
15a	Conidia catenulate	*Phragmotrichum*	***194***
15b	Conidia not catenulate	*Steganosporium*	***194***
16a	Conidia hyaline	*Entomosporium*	***194***
16b	Conidia with distinct dark pigment	*Asterosporium*	***194***

MYCELIA STERILIA

la	Entire "conidiophore" (except stalk) closely branched, forming a globose or pyramidal reproductive structure, hyaline, dark sclerotia in culture and often on leaves	*Cristulariella*	*74*
1 b	Conidiophorelike structures absent		2
2a	Sclerotia variable in form, pale to dark brown or black; usually formed on loosely woven, dark hyphae	*Rhizoctonia*	***196***
2b	Sclerotia rounded, variable in size, black; mycelium hyaline	*Sclerotium*	***196***
2c	Dark brown bulbils or small clusters of compact cells present; hyphae becoming dark brown	*Papulospora*	***196***

SIMPLIFIED KEY TO SOME SELECTED COMMON GENERA

la	Having characteristics of the Mucorales; coenocytic mycelium and sporangioles that segment or otherwise appear as conidia		2
I b	Having septate mycelium and other characteristics of the imperfect fungi		3
2a	Conidiophores (sporangiophores) unbranched except near apex where loose heads of dark spores are borne	*Choanephora*	*66*
2b	Conidiophores (sporangiophores) unbranched, bearing an apical cluster of elongate sporangioles that break up into 1-celled spores	*Syncephalastrum*	*66*
2c	Conidiophores (sporangiophores) very slender, dichotomously branched, bearing a cluster of slender sporangioles that segment into short rod-shaped spores..	*Piptocephalis*	*62*
3a	Conidiophores distinct although short or reduced to pegs in some genera; conidia typically I-celled, occasionally 2-celled		4
3b	Conidiophores distinct or reduced to pegs; conidia typically and predominately with 2 or more cells		35
3c	Conidiophores indefinite or absent; conidia rod-shaped with truncate ends, formed by fragmentation of the mycelium	*Geotrichum*	*68*
3d	No true conidiophores or conidia present; reproduction by sclerotia or similar structures ,		53
4a	Conidiophores contained within a pycnidium		5
4b	Conidiophores compacted into an acervulus or sporodochium in nature, but may be evident as loosely arranged structure in culture		9
4c	Conidiophore stalks compacted into synnemata		12
4d	Conidiophores separate, not tightly clustered in any manner	*	15
5a	Pycnidia separate, not in a stroma		6
5b	Pycnidia embedded in a stroma		8
6a	Conidia relatively large, with dark pigment	*Sphaeropsis*	*176*
6b	Conidia small, hyaline, no pigment present		7
7a	Conidiophores with a few upright branches	*Dendrophoma*	*162*
7b	Conidiophores short, simple, unbranched	*Phoma* or *Phyllosticta*	*162*
8a	Pycnidia formed as irregular cavities in a stroma; conidia small	*Cytospora*	*170*
8b	Pycnidia rounded, regular; conidia large	*Dothiorella*	*166*
9a	Conidia held together in moist, slimy masses		10

9b	Conidia dry, without slime		11
10a	Conidia with dark pigment, more evident in mass	*Melanconium*	***190***
10b	Conidia hyaline; dark setae present	*Colletotrichum*	***188***
10c	Conidia hyaline; setae absent	*Gloeosporium*	***188,***
I la	On leaves, twigs, or fruit; conidia dark, with pointed apex.."	*Spilocaea*	***106***
II b	On wood or bark; conidia hyaline, ovoid	*Tubercularia*	***146***
12a	Both stalks or synnemata and conidia hyaline		13
12b	Both stalks of synnemata and conidia dark		14
12c	Stalks of synnemata dark; conidia hyaline	*Graphium, Pesotum*	***152***
13a	Conidia held in moist, slimy heads	*Stilbum*	***152***
13b	Conidia in dry clusters, not slimy	*Isaria*	***156***
14a	Conidial heads rounded, ovoid to subglobose; parasitic on buds of Azalea or Rhododendron	*Briosia*	***152***
14b	Conidial portion elongated, usually narrowed at apex and base, saprophytic	*Doratomyces*	***154***
15a	Conidiophores branched or bearing a cluster of branches or phialides near or at the apex		16
15b	Conidiophores typically simple or only occasionally branched		26
16a	Conidia remaining together in chains of two or more		17
16b	Conidia not remaining together in chains		22
17a	Conidia acropetal, with youngest at the apex of chain		18
17b	Conidia basipetal, with the youngest at the base of chain		19
18a	Conidia dark, variable in shape, ovoid, lemon-shaped to oblong, mostly 1-celled, some may be 2- to 3-celled	*Cladosporium*	***106***
1 8b	Conidia dark, uniformly globose, and 1-celled	*Perkonia*	*74*
18c	Conidia hyaline, uniformly ovoid to short cylindrical	*Monilia*	*72*
19a	Conidiogenous cells (phialides) borne on apex or swollen apex of conidiophores	*Aspergillus*	***94***
19b	Conidiogenous cells borne on slender branches, not on swollen apex of conidiophore …		20
20a	Conidiogenous cells bearing annulate scars of previous conidia	*Scopulariopsis*	***98***
20b	Annulate scars not present on conidiogenous cells		21
21 a	Conidiogenous cells (phialides) closely arranged in a brushlike head	*PenicilUum*	***94***
21 b	Conidiogenous cells divergent, not in a close head	*Paecilomyces*	***94***
22a	Conidia in small clusters held together by slime		23

22b	Conidia dry, not held in slime		24
23a	Conidiophore branches verticillate, often 3 or more branches arise from the same level	*Verticiliium*	*92*
23b	Conidiophore branches irregular, not verticillate	*Thchoderma*	*92*
24a	Conidia formed successively at apex of conidiophore, which continues to elongate	*Nociulosporium*	*100*
24b	Conidia formed in a head on the more or less swollen apex of the conidiophore		25
25a	Apical sporogenous cell of conidiophore or branches slightly enlarged, globose	*Botrytis*	*76*
25b	Apical conidiogenous portion and branches distinctly enlarged, cylindrical, or club-shaped	*Chromelospohum*	*80*
26a	Conidia (chlamydospores, aleuriospores) terminal, single, globose		27
26b	Conidia otherwise		28
27a	Conidia black, shiny, smooth	*Nigrospora*	*82*
27b	Conidia with yellow pigment, rough-walled	*Sepedonium*	*82*
28a	Parasitic on plants, conidial states of powdery mildews	*Oidium*	*68*
28b	Not conidial states of powdery mildews		29
29a	Conidiophores indeterminate, apex elongating as new conidia are produced		30
29b	Conidiophores determinate, not elongating as new conidia are produced		31
30a	Conidiogenous portion of conidiophore zig-zag, elongating to appear rachislike	*Beauveria*	*100*
30b	Conidiogenous portion of conidiophore limited, not rachislike	*Sporothrix*	*98*
31a	Conidia produced simultaneously on swollen apex of conidiophore	*Oedocephalum*	*76*
31b	Conidia produced single or successively at apex of conidiophore or phialide		32
32a	Conidia exogenous, ovoid to globose, borne singly or in pairs on a dark hook (falc) of conidiophore	*Zygosporium*	*72*
32b	Conidia endogenous, rod-shaped, often catenulate; no falcs present	*Chalara*	*90*
32c	Conidia ovoid to globose, held together in small apical clusters by slime; falcs absent …		33
33a	Conidiophores or phialides slender, hyaline	*Cephahsporiwn*	*94*
33b	Conidiophores or phialides slender or somewhat inflated, with some dark pigment		34
34a	Conidiophores tall, slender, uniform in width	*Chhridium*	*88*
34b	Conidiophores short or sometimes absent, often somewhat inflated	*Phialophora*	*88*
35a	Conidia typically and uniformly 2-celled, seldom with fewer or more cells		36
35b	Conidia typically has more than 3 cells, sometimes variable		43
36a	Conidia hyaline, no pigment in walls		37

36b	Conidia with dark pigment in walls		41
37a	Conidiophores compacted into an acervulus in nature	*Marssonina*	***190***
37b	Conidiophores separate, not clustered or compacted		38
38a	Conidiophores branched, with a sterile terminal branch and swollen apex; conidia long, cylindrical	*Cyiindrocladium*	***108***
38b	Conidiophores simple; conidia ovoid or ellipsoid		39
39a	Conidia borne singly, apical on sympodial growing points		40
39b	Conidia produced basipetally in irregular groups, not on sympodial growing points	*Trichothecium*	***108***
40a	Conidia ellipsoid-elongate, cells equal	*Dactylaria*	***110***
40b	Conidia ovoid to elongate, apical cell somewhat larger	*Arthrobotrys*	***110***
41a	Conidiophores and conidia borne in a typical pycnidium	*Diplodia*	***180***
41b	Conidiophores and conidia in an acervulus or a stroma in nature	*Spilocaea*	***106***
41c	Conidiophores separate or in loose clusters		42
42a	Conidiophores slender, conidia in short acropetalous chains	*Bispora*	***106***
42b	Conidiophores rather stout, zig-zag in appearance; conidia apical, not in chains	*Polyihrincium*	***112***
43a	Conidia spiral or in coil	*Helicomyces*	***136***
43b	Conidia phragmosporous, with cross but not oblique walls		44
43c	Conidia dictyosporous, with both cross and oblique walls		52
44a	Conidia with slender appendages, at least at apex	*Pestalotia*	***192***
44b	Conidia without appendages		45
45a	Conidia dark		46
45b	Conidia hyaline		51
46a	Conidia borne in acervuli in bark	*Coryneum*	***194***
46b	Conidia not borne in acervuli		47
47a	Conidia in acropetalous chains; some conidia with 1 or 2 cells	*Cladosporium*	***106***
47b	Conidia single, not in chains		48
48a	Conidiophores with several upright branches	*Dendryphiopsis*	***120***
48b	Conidiophores simple, without branches		49
49a	Conidia produced through pores on sides of conidiophores	*Helminthusporium*	***124***
49b	Conidia borne apically on new sympodial growing points		50
50a	Conidia straight or slightly curved; cells nearly equal	*Hipolaris*	***126***
50b	Conidia, with one median cell larger than others	*Curvuhria*	***122***

51a	Conidiophores simple, clustered, dark; conidia long, attenuated	*Cercospora*	***128***
51b	Conidiophores hyaline, branched; conidia long, cylindrical	*Cylindrodadium*	***108***
51c	Conidiophores short, simple or branched, hyaline; larger conidia typically canoe-shaped, 1-celled conidia usually present	*Fusarium*	***130***
5 Id	Conidiophore tall, slender, simple; conidia with pointed apex and rounded base	*Pyrkularia*	***128***
52a	Conidia borne in acervuli in bark	*Steganosporium*	***194***
52b	Conidia borne typically in small sporodochia	*Epicoccum*	***150***
52c	Conidia borne on separate conidiophores		53
53a	Conidia attenuate or pointed at apex, often in chains	*Ahernaria*	***132***
53b	Conidia rounded, borne singly	*Stemphylium*	***132***
54a	No conidiophores, no conidia formed; sclerotia more or less globose, compact	*Sclerotium*	***196***
54b	No conidiophores, no conidia formed; sclerotia mostly flattened or irregular, often loose	*Rhizoctonia*	***196***
54c	Large conidiophorelike structures present on leaves; many branches compacted into globose or pointed structures	*CristularieUa*	*74*

THE HUGHES-TUBAKI-BARRON SYSTEM OF CLASSIFICATION

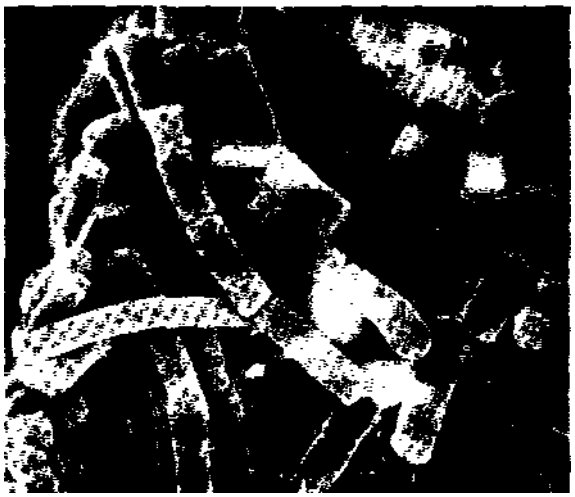
This newer system is based primarily on the development of the conidia and to a lesser extent on the development of the conidiophores. Shape, pigmentation, and septation of conidia are reduced to secondary characteristics. Although this classification, followed by Barron (1968), is not complete for all genera of imperfect fungi, it is well established and accepted by many mycologists and can be applied accurately to most of the Moniliales. The authors do not dispute the validity of the more recent system of classification proposed by the Kananaskis Conference (1971) and followed by Ellis (1971), but do not believe the time has come to shift to that system for the identification of genera by the student.

The following key to series, sections, and genera of the two largest families (Moniliaceae and Dematiaceae) is included for the convenience of those who can easily recognize and distinguish the types of conidia. It may not be helpful in identifying those genera in which the mode of conidial formation is unclear or indefinite. In these cases, use of the key based on the Saccardo System is recommended.

ALTERNATE KEY TO SERIES AND GENERA (Moniliaceae and Dematiaceae)

Tubercula.riaceae and Stilbaceae, as well as some genera in which there is inadequate knowledge of conidial formation, are excluded from this key.

Conidia (arthrospores) formed by segmentation *of* vegetative hyphae or branches of nonmeristcmatic conidiophores; mature conidia usually with truncate ends, ellipsoid or cylindrical . . . (Examples: *Geotrichum, Amblyosporium)...* Series ARTHROSPORAE



Arthrosporae, *Geotrichum*

lb Conidia (arthrospores) developing in basipetal succession by meristemic growth of the special portion of conidiophore, resulting in a gradual change from conidiophore to conidium; conidia usually, but not necessarily, hanging together in chains . . . (Examples: *Oidium, Basipetospora)* . . . Scries MER1STEM ARTHROSPORAE. . . . . .

Meristem Arthrosporae, Oidium

Conidia (aleuriospores) usually single and apical on conidiophore or sporogenous cells, often thick-walled and pigmented but may be hyaline, often not easily deciduous or deciduous by means of a special cell at apex of conidiophore; accessory conidial states often present . . . (Examples: *Humicola, Sepedonium, Microsporum)* Series ALEURIOSPORAE. 10

Aleuriosporae, *Nigrospora*

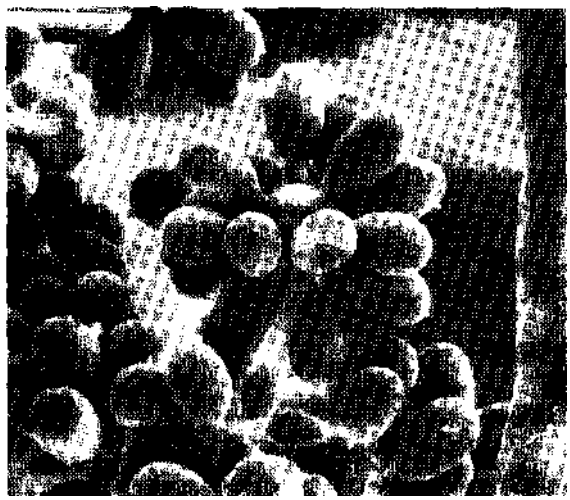
Conidia (anncllospores) produced successively on apex of conidiogenous cells or conidiophore which increases slightly in length by pereurrent proliferation through previous conidial scars; successive scars appear as faint anncllations at apex of conidiogenous cell... (Examples; *Spilocaea, Scopulariopsis)* ... Series ANNELEOSPORAE 52

Annellosporae, *Spilocaea*

Conidia (blastospores) developing as buds from simple or branched conidiophores, or directly from vegetative cells or previous conidia, often forming simple or branched acropetalous chains ... (Examples; *Aitreobasidiutn, Montlia, Cladosporium)* ... Series BLASTOSPORAE. 59

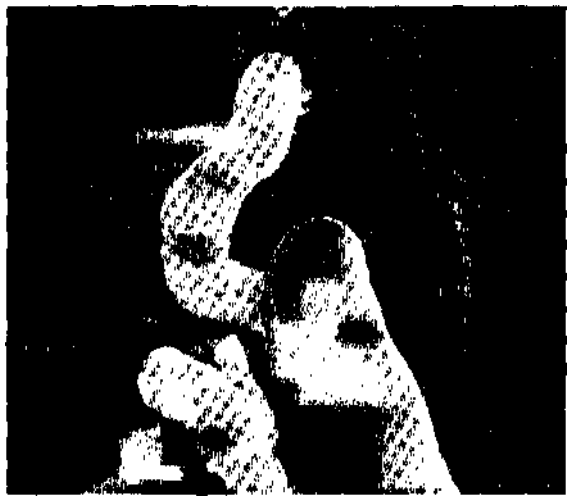
Blastosporae, *Monilia*

Conidia (blastospores) produced on well differentiated swollen cells which bear many conidia simultaneously, forming clusters or heads, solitary or in simple or branched aeropetalous chains; mature conidia easily deciduous revealing small denticles on sporogenous cells ... (Examples: *Oecfotvphalum, Boirviis, Gonuiohoirvs)...* Series BOf RYOBLASTO'SPORAE. . . . .



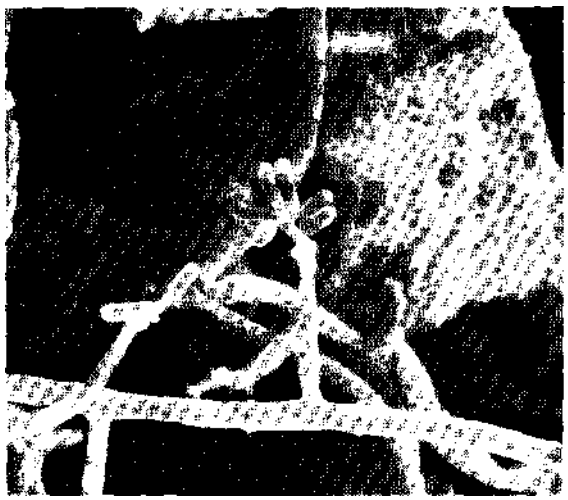
Botryoblastosporae, *Batrytis*

Conidia (porospores) developing through pores in outer wall at apex or side of eonidiophore, single or in some genera produced on successive new growing points formed by sympodial proliferation ... (Examples: *Helminthosporium, Bipolarts, Stemphvfium)* . . . Scries POROSPORAE. 90



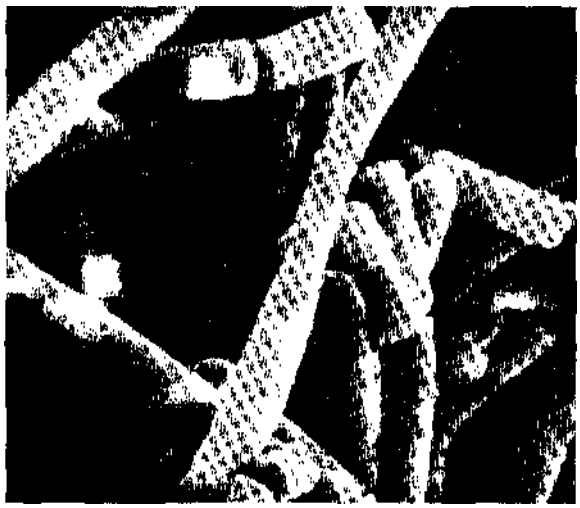
Porosporae, Bipo/an's

Conidia (syrnpodulospores) developing at tips of conidiophores or conidiogenous cells (not from pores in outer wall) and forming successively on new growing tips by sympodial proliferation; increase may be slight but conidia are of different ages; (this key includes some genera placed by some authors in the Porosporae) .. . (Examples: *Fusiclactium, Tri! irachium, Ccrcospora)* Series SYMPODULOSPORAE. 102



Sympodulosporae, *Sporothrix*

ti	Conidia (phialospores) formed successively from open apex of conidiophore or conidiogenous cell (phialide), which ordinarily does not increase in length; conidia often collect in droplet of mucilage or slime at apex or remain attached in basipetal chains; in a few genera the simple conidiophore proliferates percurrently and forms new phialides ... (Examples: *Chalara, Phialophora, Verticillium, Aspergillus)* .,. Series PHIALOSPORAE.		151



Phialosporae, *Chahra*

ARTHROSPORAE

2a	Conidiophores poorly developed or none		3
2b	Conidiophores distinct and well developed		4
3a	Conidia truncate at both ends, formed by segmentation of mycelium	*Geotrichum*	*68*
3b	Conidia rounded with truncate base, formed by segmentation of mycelium	*Chrysosporium*	*68*
4a	Conidiophores simple		5
4b	Conidiophores branched		6
5a	Conidia globose	*Wallemia*	*92*
5b	Comdia cylindrical with truncate ends	*Ampulliferina*	*106*
6a	Conidiophores stout, branched only near apex	*Amblyosporium*	*68*
6b	Conidiophores slender with both apical and lateral branches	*Oidiodendron*	*68*

MERISTEM ARTHROSPORAE

7a	Parasitic on plants, powdery mildews		8
7b	Saprophytic or weakly parasitic, not powdery mildews		9
8a	Conidia in basipetal chains	*Oidium*	*68*
8b	Older conidia falling off before new one is formed	*Ovulariopsis*	*70*
9a	Conidia 1-celled, hyaline	*Basipetospora*	*70*
9b	Conidia 2-celled, hyaline	*Trichothecium*	*108*
9c	Conidia dictyosporous, dark	*Coniosporium*	*134*

ALEURIOSPORAE

10a	Conidia long, slender (scolecosporous), I- to several-celled	*Anguillospora*	***140***
10b	Conidia typically 1- to 2-celled, globose to oblong		II
10c	Conidia typically 3- to several-celled		24
1 la	Conidia hyaline or subhyaline (with slight pigment)		12
lib	Conidia with distinct dark pigment		17
12a	Pathogenic to man; macroconidia tuberculate	*Histoplasma*	*82*
12b	Pathogenic to man; macroconidia smooth	*Blastomyces*	***80***
12c	Saprophytic or parasitic on plants or fungi		13
13a	Conidia 1-celled, in small groups at apex of forked conidiophores	*Glomerularia*	***86***
13b	Conidia 1- or 2-celled, not in clusters at apex of conidiophores		**14**
14a	Conidiogenous cells slender, radiating from swollen cell	*Umbelopsis*	***86***
14b	Conidiogenous cells short, stout; conidia smooth	*Botryoderma*	***86***
I4c	Conidiogenous cells slender; conidia rough-walled or with attached smooth cells		15
15a	Conidia with attached small smooth cells	*Stephanoma*	*82*
15b	Conidia 1-celled, without attached smooth cells	*Sepedonium*	*82*
15c	Conidia with large apical rough-walled cell and smaller smooth basal cell		16
16a	Basal cell of conidia rounded	*Mycogone*	*82*
16b	Basal cell wedge-shaped	*Chlamydomyces*	*82*
17a	Conidiophores short, poorly developed, or missing		18
17b	Conidiophores usually well developed		22
18a	Conidia with broad truncate base and pointed apex	*Echinobotryum*	***84***
18b	Conidia ovoid to obclavate with rounded apex	*Asteromyces*	***84***
18c	Conidia globose to broadly ellipsoid		19
19a	Conidia 1-celled, subglobose, shiny black, situated on a flat hyaline vesicle ..	*Nigrospora*	*82*
19b	Conidia 2- or more-celled		20
19c	Conidia I-celled, light to dark, not on vesicle		21
20a	Conidiophores tall, slender, simple, dark	*Endophragmia*	***118***
20b	Conidiophores mostly short, simple hyaline	*Trichocladium*	***118***
20c	Conidiophores well developed, branched	*Balanium*	***106***
21a	Setae present	*Botryotrichum*	***84***
21b	Setae absent	*Humkola*	***84***
22a	Conidia with small hyaline cells attached	*Stephanoma*	*82*

22b	Conidia without attached hyaline cells		23
23a	Conidiophores short, thick, branched	*Wardomyces*	***84***
23b	Conidiophores tall, slender, repeatedly branched	*Staphylotrichum*	*80*
23c	Conidiophores tall, simple	*Microclavia*	*80*
24a	Conidia typically 3- to several-celled (phragmosporous)		25
24b	Conidia with cross and oblique septa (dictyosporous		34
24c	Conidia (or propagules) branched (staurosporous)		38
24d	Conidia curved or coiled (helicosporous)	*Xenosporium*	***136***
25a	Conidia hyaline or subhyaline		26
25b	Conidia with distinct dark pigment		29
26a	Parasitic on plants	*Fusoma*	***116***
26b	Causing dermato mycoses of man or animals		27
26c	Saprophytic or trapping nematodes		28
27a	Macroconidia spindle-shaped or ellipsoid	*Microsporum*	***116***
28a	Conidia ellipsoid, with broad enlarged middle cell	*Monacrosporium*	***118***
28b	Conidia cylindrical to long and sometimes tapering, with distinctly enlarged middle cell	*Daciylella*	***128***
29a	Conidia ovoid to ellipsoid to oblong		30
29b	Conidia much longer than wide ,		32
30a	Conidiophores tall, simple, single or clustered	*Endophragmia, Phragmocephala*	***118***
30b	Conidiophores short, poorly developed, clustered	*Bactrodesmium*	*150*
30c	Conidiophores usually short, single		31
31a	Conidia mostly 2- to 3-celled; ovoid to clavate	*Trichocladium*	***118***
31 b	Conidia 3- to several-celled; broadly ellipsoid wall not unusually thick	*Pithomyces*	***132***
31c	Conidia several-celled, ellipsoid, wall very thick	*Murogeneila*	***114***
32a	Conidia cylindrical	*Camposporium*	***116***
32b	Conidia narrower at ends, especially at apex ,		33
33a	Apical cell of conidia attenuated, hooked or pointed	*Ceratophorum*	***118***
33b	Apical cell of conidia rounded, not attenuated	*Clasterosporium*	***118***
34a	Conidiophores clustered, sometimes in loose sporodochia		35
34b	Conidiophores single, not clustered		36

35a	Conidia globose or subglobose	*Epicoccum*	***150***
35b	Conidia large, elongate to obovoid	*Berkleasmium*	***134***
36a	Apical cell of conidia darker, much enlarged	*Acrospeira*	***132***
36b	Apical cell of conidia not enlarged, equally pigmented		37
37a	Conidia broadly ellipsoid, most septa transverse	*Pithomyces*	***132***
37b	Conidia globose to ovoid, most septa oblique	*Stigmella*	***134***
38a	Conidia hyaline or subhyaline		39
38b	Conidia with distinct dark pigment		49
39a	Propagule with many branches compacted into a large globoid or conical structure; no true conidia produced	*Cristulariella*	*74*
39b	Conidia with few branches, symmetrical or nearly so		40
39c	Conidia with few branches distinctly asymmetrical		43
40a	Main axis of conidia distinctly swollen, with large cell		41
40b	Main axis of conidia slender or short, without swollen cell		42
41a	Central cell of conidia globose, with 4 slender radiating arms	*Actinospora*	***140***
41 b	Main axis of conidia 2-celled, with 3 slender radiating arms	*Clavariopsis*	***140***
42a	Main axis of conidia long, slender	*Tetrachaetum*	***140***
Alb	Main axis of conidia short; arms widely divergent	*Triscelophorus*	***138***
42c	Main axis of conidia short; arms not widely divergent	*Tridentaria*	***140***
43a	Not aquatic, parasitic on higher plants	*Thaltospora*	***142***
43b	Aquatic, in fresh water on decaying leaves		44
44a	Branches of conidia developed one at a time		45
44b	Branches of conidia developed simultaneously		46
45a	Conidia with 3 slender branches on slender main axis	*Articulospora*	***142***
45b	Conidia with 3 slender branches on thick main axis	*Culicidospora*	***140***
46a	Conidia with 2 branches arising from primary axis		47
46b	Conidia with 3 or more branches arising from primary axis		48
47a	Branches of conidia long, tapering to fine point	*fngoldia*	***138***
Alb	Branches of conidia slender but not tapering to fine point	*Tricladium*	***138***
48a	Branches of conidia more or less upright	*Tetracladium*	***140***
48b	Branches of conidia widely divergent, irregular	*Dendrospora*	***140***
49a	Conidiophores distinct; conidia triangular *or* with several upright branches		*50*
49b	Conidiophores reduced to a short peg; conidia with 2 to 3 upright or spreading "horns"		51
50a	Conidia triangular, with 3 short, radiating arms	*Triposporium*	***144***

50b	Conidia with several close upright branches	*Dictyosporium*	***144***
51a	Mostly parasitic on leaves	*Hirudinaria*	***144***
51b	Mostly saprophytic on wood	*Ceratosporium*	***144***

ANNELLOSPORAE

52a	Conidia typically 1- to 2-celled		53
52b	Conidia mostly 3- to several-celled		55
53a	Conidiophores hyaline	*Scopulariopsis*	*98*
53b	Conidiophores dark		54
54a	Conidiophores tall, branched; conidia in moist heads	*Leptographiwn*	*98*
54b	Conidiophores short, simple, not in heads	*Spihcaea*	*106*
55a	Conidia with 2 or more upright branches	*Ceratosporella*	***144***
55b	Conidia unbranched		56
56a	Mostly parasitic; mycelium within leaves; conidiophores short		57
56b	Saprophytic or with external mycelium; conidiophores short		58
57a	Conidiophores single, arising from epidermal cells	*Deightonielh*	***118***
57b	Conidiophores clustered, arising through stomata	*Stigmina*	***120***
58a	Conidiophore apex with distinct cuplike structures	*Endophragmia*	***118***
58b	Conidiophore apex with conidial scars or rings, not cuplike	*Annellophora*	***118***

BLASTOSPORAE

59a	Conidiophores arising from basal globose mother cells, with thick dark septa, increasing in length only in basal region		60
59b	Conidiophores, if present, not as above		61
60a	Conidia 1-celled	*Arthrinium*	*74*
60b	Conidia 4-celled, cross-shaped	*Dictyoarthrinium*	***134***
61a	Conidia more or less coiled (helicosporous)		62
61 b	Conidia branched (staurosporous)		63
61c	Conidia neither coiled nor branched		66
62a	Small conidia produced by budding of large conidia	*Helkodendron*	***136***
62b	Conidia not budding	*Helkoon*	***136***
63a	Conidiophores present, distinct		64
63b	Conidiophores absent		65

64a	Conidia hyaline, with slender divergent arms	*Varicosporium*	***138***
64b	Conidia dark, branches more or less upright	*Speiropsis*	***142***
65a	Conidia with 3 to 4 upright to spreading branches	*Tetraploa*	***142***
65b	Conidia with 4 to 5 widely divergent branches	*TYipospermum*	***142***
66a	"Conidiophores" (propagules) compactly branched, globose to conical, ultimate cells globose, conidialike; no true conidia produced	*Cristulariella*	*74*
66b	Conidiophores poorly formed or reduced to pegs or short conidiogenous cells		67
66c	Conidiophores distinct, simple or loosely branched		70
67a	Mycelium with clamp connections; conidia forcibly discharged	*Itersonilia*	*70*
67b	With neither clamp connections nor forcibly discharged conidia		68
68a	Parasitic on grasses; conidia 2-celled, not budding	*Rhynchosporium*	***108***
68b	Usually saprophytic; conidia !-celled, budding		69
69a	Mycelium and conidia hyaline	*Candida*	*70*
69b	Mycelium and conidia with dark pigment	*Aureobasidium*	*70*
70a	Conidia hyaline, 2-celled	*Trichothecium*	***108***
70b	Conidia hyaline or subhyaline, 1-celled		71
70c	Conidia with distinct dark pigment		74
71a	Conidia borne in acropetalous chains		72
71 b	Conidia not in chains !		73
72a	Conidiophores dark; conidia in moist heads	*Haplographium*	***80***
72b	Conidiophores hyaline; conidia uniform globose to short ellipsoid, in long branched chains	*Manilla*	*72*
72c	Conidiophores hyaline branched; conidia variable, in short chains	*Hyaiodendron*	*72*
72d	Conidiophores subhyaline, conidia elongate, slender	*Tilletiopsis*	*72*
73a	Conidiophores dark; conidia ovoid, 2 to 3 on each swollen dark cell	*Zygosporium*	*72*
73b	Conidiophores hyaline; conidia lunulate, not clustered	*Lunulospora*	***138***
73c	Conidiophores hyaline; conidia globose to broad ellipsoid, single, apical on long denticles	*Olpitrichum*	*74*
74a	Conidia all or mostly 1-celled		75
74b	Conidia mostly 2-celled		77
74c	Conidia 3- to several-celled (phragmosporous) ,		78
75a	Conidia variable, some typically lemon-shaped	*Cladosporium*	***106***
75b	Conidia uniform, mostly ovoid to ellipsoid	*Papularia*	***82***
75c	Conidia uniformly globose		76

76a	Setae present; apex of conidiophore globose	*LaceHinopsis*	*78*
76b	Setae present; apex of conidiophore not enlarged	*Lacellina*	*78*
76c	Setae absent	*Periconia*	*74*
11a.	Conidiophores branched; conidia variable	*Cladosporium*	*106*
lib	Conidiophores mostly simple; conidia uniformly ellipsoid	*Bispora*	*106*
78a	Conidia borne on special globose cells		79
78b	Conidia not borne on special globose cells		80
79a	Conidia catenulate	*Pseudotorula*	*116*
79b	Conidia not catenulate	*Dwayabeeja*	*116*
80a	Conidia catenulate, cylindrical	*Septonema*	*116*
80b	Conidia catenulate, cells strongly rounded	*Torula*	*74*
80c	Conidia not catenulate	*Gonatophragmium*	*122*

BOTRYOBLASTOSPORAE

81 a	Conidia in simple or branched chains of 2 or more		82
81b	Conidia not catenulate		83
82a	Conidiophores tall, dark; conidia dark	*Gonatobotryum*	*78*
82b	Conidiophores variable, hyaline; conidia hyaline	*Gonatorrhodiella*	*78*
83a	Conidia dark, phragmosporous	*Cephaliophora*	*116*
83b	Conidia hyaline, 1-celled		84
84a	Conidiophores short, reduced to 1 or few cells	*Phymotolrichum*	*78*
84b	Conidiophores tall, well developed		85
85a	Conidiogenous cells globose or with globose lobes		86
85b	Conidiogenous cells or fertile portion of conidiophore elongated to irregular		89
86a	Conidiophores simple or with few branches		87
86b	Conidiophores with several branches, at least near apex		88
87a	Conidiophores determinate, with a single head of conidia	*Oedocephalum*	*76*
87b	Conidiophores proliferating percurrently, with several clusters of conidia	*Gonatobotrys*	*76*
88a	Conidiophore branches many, lateral on main axis	*Botryosporium*	*76*
88b	Conidiophore branches regularly dichotomous	*Dichobotrys*	*78*
88c	Conidiophore branches irregular	*Botrytis*	*76*
89a	Conidiophore branches dichotomous near apex	*Chromelosporium*	*80*
89b	Conidiophore branches irregular	*Aciadium*	*76*

POROSPORAE

90a	Conidia with transverse and oblique septa (dictyosporous)		91
90b	Conidia with transverse septa only (phragmosporous)		93
90c	Conidia 2-celled, catenulate	*Diplococcium*	***114***
91a	Conidia long-beaked, obclavate, or ovoid	*Allernaria*	***132***
91 b	Conidia not beaked, globose to broadly ellipsoid		92
92a	Conidiophores elongating sympodially	*Ulocladium*	***132***
92b	Conidiophores elongating percurrently	*Stemphylium*	***132***
93a	Conidiophores tall, branched; conidia catenulate	*Dendryphion*	***124***
93b	Conidiophores tall, branched; conidia not catenulate		94
93c	Conidiophores mostly simple		96
94a	Conidiophores dichotomous near apex; conidia mostly several-celled	*Dichotomophthora*	***120***
94b	Conidiophores not dichotomous near apex		95
95a	Conidia mostly 3-celled	*Spondylocladiella*	***120***
95b	Conidia 4- to several-celled	*Dendryphiopsis*	***120***
96a	Conidia in acropetalous chains, often breaking up into 1- to several-celled fragments	*Torula*	*74*
96b	Conidia not catenulate		97
97a	Conidiophores indeterminate, extending sympodially		98
97b	Conidiophores determinate		1 0 0
98a	Conidia bent by enlargement of one cell	*Curvularia*	***122***
98b	Conidia not bent by enlarged cell, straight or slightly curved		99
99a	Mid-cells of conidia larger than end cells; germ tubes originate from any cell	*Drechslera*	***122***
99b	Mid-cells of conidia not distinctly larger than others; germ tubes only from end cells	*Bipolaris*	***126***
100a	Conidiophores clustered; conidia apical	*Exosporium*	***148***
100b	Conidiophores single; conidia apical and lateral		1 0 1
100c	Conidiophores single; conidia single, apical	*Corynespora*, *Sporidesmium*	***120***
101a	Conidia several-celled, cylindrical to obclavate	*Helminthosporium*	***124***
101b	Conidia often less than 4-celled, ellipsoid to obovoid	*Spadicoides*	***114***

SYMPODULOSPORAE

Note: The key to this section includes some genera described as producing porospores and in which the conidiophores commonly extend by sympodial growth.

102a	Conidia coiled, helicosporous		103 -
I02b	Conidia not coiled		106
103a	Conidia thick in proportion to length, not hygroscopic		105
103b	Conidia thin in proportion to length, hygroscopic		104
104a	Parasitic on higher plants; some conidia nearly straight	*Helicomina*	*136*
104b	Saprophytic on wood or bark; conidia uniformly coiled	*Heiicoma*	*136*
105a	Conidiophores and conidia hyaline	*Helicomyces*	*136*
I05b	Conidiophores dark; conidia pale to dark	*Helicosporium*	*136*
106a	On living plants in nature, principally on leaves, mostly parasitic		1 0 7
106b	Closely associated with other fungi, often parasitic on them		122
106c	Saprophytic on various substrata		123
107a	Conidia hyaline or subhyaline		108
107b	Conidia distinctly pigmented, pale brown to dark		116
108a	Conidia predominantly 1-celled		109
108b	Conidia typically 2- to several-celled		Ill
109a	Conidiophores relatively short, simple	*Idriella*	*102*
I09b	Conidiophores tall, repeatedly branched near apex		110
110a	Conidia collecting in moist slimy heads	*Verticicladiella*	*104*
110b	Conidia dry, not in moist heads	*Verticicladium*	*104*
11 la	Conidia catenulate in acropetalous chains		112
111b	Conidia not catenulate		113
112a	Conidia mostly 2-celled, with some 1-celled	*Ramularia*	*110*
112b	Conidia mostly with 3 or more cells	*Septocylindrium*	*128*
113a	Conidia filiform to cylindrical or long ellipsoid		114
113b	Conidia shorter, ovoid to pyriform or short ellipsoid		115
114a	Conidiophores hyaline; conidia with attenuated apical cell	*Spermospora*	*128*
114b	Conidiophores hyaline; conidia! cell not attenuated	*Cercosporetta*	*128*
114c	Conidiophores dark; conidial cell not distinctly attenuated	*Cercospora, Cercosporidium*	*128,122*
115a	Conidia broader near base; cells unequal	*Pyricularia*	*128*

115b	Conidia oblong; cells nearly equal	*Didymaria*	***110***
116a	Conidiophores tall, dark, simple below, branched near apex and bearing a number of conidiogenous cells	*Periconiella*	***104***
116b	Conidiophores and conidiogenous cells not as above		117
! 17a	Conidia mostly 1- to 2-celled		118
117b	Conidia 3- to several-celled (phragmosporous)		121
118a	Conidia rough-walled, cells equal	*Asperisporium*	***112***
118b	Conidia smooth, cells unequal		119
I I9a	Conidiophores distinctly wavy in appearance	*Polythrincium*	***112***
\ 19b	Conidiophores often irregular but not distinctly wavy		120
120a	Conidiophores usually arise from beneath cutical layer	*Fusicladiwn*	***112***
120b	Conidiophores emerging through stomata or from surface of leaves	*Scolecotrichum, Passalora*	***112***
121a	Conidia with 1 to 4 hyaline appendages on apical cells	*Pleiochaeta*	***128***
121b	Conidia without appendages	*Nakataea*	***128***
122a	Conidiophores and conidia hyaline; conidia 1-celled	*Calcarisporium*	***102***
122b	Conidiophores and conidia hyaline; conidia 3- to 4-celled, mostly ovoid	*Dactylium*	***130***
122c	Conidiophores and conidia dark; conidia long, slender	*Cladosporietta*	*92*
123a	Conidia hyaline *to* subhyaline (slightly pigmented)		124
J23b	Conidia with distinct dark pigment		139
124a	Conidia typically 1-celled		125
124b	Conidia typically 2-celled		135
124c	Conidia 3- to several-celled		137
125a	Conidiophores variously branched, rarely simple		126
125b	Conidiophores typically simple, rarely branched		131
126a	Conidiophores branched only near apex		127
126b	Conidiophore branches lower or lateral on main axis		128
127a	Conidia in moist heads of slime	*Verticicladiella*	***104***
I27b	Conidia dry, not in moist heads	*Verlicicladium*	***104***
128a	Conidiophore branches verticillate on main axis		129
128b	Conidiophore branches irregular; conidiogenous cells may be verticillate		130
129a	Conidiophores hyaline; conidia ovoid	*Tritirachium*	***100***
I29b	Conidiophores pigmented; conidia long, slender	*Selenosporella*	***102***

130a	Fertile area of conidiogenous cell slender, not enlarged	*Hamfordia*	*98*
130b	Fertile area of conidiogenous cell somewhat enlarged, at least at apex ..	*Nodulosporium*	***100***
130c	Fertile area of conidiogenous cell much elongated; not enlarged	*Geniculosporium*	***100***
13la	Conidia catenulate	*Sympodiella*	***104***
131b	Conidia not catenulate		-132
132a	Fertile area of conidiogenous cell slender, rachislike		133
132b	Fertile area of conidiogenous cell not slender or rachislike		134
133a	Base of conidiophore enlarged; mostly on insects	*Beauveria*	***100***
133b	Base of conidiophore not enlarged; saprophytic	*Tritirachium*	***100***
134a	Conidiophores slender, hyaline, single, only slightly enlarged at apex	*Sporothrix*	*98*
134b	Conidiophores pigmented, single, greatly enlarged at apex	*Basidiobotrys*	***100***
134c	Conidiophores hyaline, in clusters	*Ovularia*	***104***
135a	Apical cell of conidium equal to or smaller than basal cell, sometimes elongated	*Dactylaria*	***110***
135b	Apical cell of conidium larger or wider than basal cell, rounded		136
136a	Conidia in loose clusters, on short denticles	*Arihrobotrys*	***110***
136b	Conidia in loose clusters, on long pegs	*Candelabrelta*	***110***
136c	Conidia single on sympodial branches of conidiophore	*Genicularia*	***110***
137a	Conidia forked, with 2 parallel prongs	*Dkranidion*	***138***
I37b	Conidia not forked		138
138a	Conidiophores short, hyaline; conidia cylindric to clavate	*Dactylaria*	***110***
138b	Conidiophores tall, hyaline; conidia cylindric to fusoid	*Dactylella*	***128***
138c	Conidiophores tall, dark; conidia fusoid	*Pleurothecium*	***126***
139a	Conidiophores tall, dark, slender, bearing at apex several divergent conidiogenous cells	*Pseudobotrylis*	***106***
139b	Conidiophores and conidiogenous cells not as above		140
140a	Conidia 1-celled		141
I4()b	At least some conidia 2- or more-celled		147
141a	Conidia biconie, tapering toward both ends	*Beltrania*	***104***
141b	Conidia otherwise		**142**
142a	Conidia oblong-elongate	*Selenosporella*	***102***
I42b	Conidia mostly globose or ovoid		143
143a	Conidia symmetric, both sides rounded		144
143b	Conidia asymmetric, one side flat or concave	*Virgaria*	***100***

144a	Conidiophores branched irregularly; conidiogenous cells somewhat enlarged, at least at apex	*Noduhsporium*	***100***
144b	Conidiophores simple or branched; conidiogenous cells not enlarged at apex		145
145a	Conidiophore branches somewhat spiral, appearing wavy	*Conoplea*	***102***
145b	Conidiophores or branches more or less straight, not wavy	*Rhinocladiella*	***104***
146a	Conidiophores or conidiogenous cells, short, mostly]- to 3-celled		147
146b	Conidiophores tall, well developed		148
147a	Conidia 1- to 2-celled, ovate, oblong or T-shaped	*Scolecobasidium*	***114***
147b	Conidia staurosporous, several-celled, Y-shaped, with 2 pointed arms	*Diplocladiella*	***142***
147c	Conidia staurosporous, with 3 or more branches	*Speiropsis*	***142***
148a	Conidia dictyosporous, some phragmospores present	*Dactylosporium, Sirosporium*	***134***
148b	Conidia typically phragmosphorous		149
149a	Conidia often catenulate	*Heterosporium*	***122***
149b	Conidia not catenulate		150
150a	Conidia attached by slender pedicels to apex of conidiophores	*Brachysporium*	***126***
150b	Conidia attached directly to hyaline apex of conidiophores	*Cacumisporium*	***124***

PHIALOSPORAE

151a	Normally aquatic, growing on decaying vegetation		152
151b	Not normally aquatic		154
152a	Conidia or branches long, slender		153
152b	Conidia unbranched	*Heliscus*	***108***
153a	Conidia long, slender, unbranched	*Flagellospora*	***138***
153b	Conidia each with 4 slender arms	*Lemonniera*	***138***
154a	Conidia typically 2- to several-celled		155
154b	Conidia typically I-celled		159
155a	Conidiophores with dark pigment		156
155b	Conidiophores (or conidiogenous cells) hyaline		157
156a	Conidiophores tall with lateral branches and sterile apex; conidia not catenulate	*Chaetopsis*	*96*
156b	Conidiophores with few branches near apex; conidia catenulate but not end to end	*Fusariella*	***130***
156c	Conidiophores simple; conidia endogenous in end-to-end chains	*Sporochisma*	***130***
157a	Conidiophores repeatedly branched; *one* sterile branch typically with swollen apex	*Cylindrodadium*	***108***

157b	Conidiophores simple or irregularly branched; without sterile branches		158
158a	Conidia mostly cylindrical, straight, 2- to several-celled	*Cylindrocarpon*	***130***
158b	Conidia ovoid, 2-celled, not in slime heads	*Cladobotryum*	***108***
158c	Conidia ovoid, 2-celled, in small slime heads	*Diplosporium*	***108***
158d	Macroconidia typically canoe-shaped, several-celled; microconidia 1-celled	*Fusarium*	***130***
159a	Apex of conidiophore much enlarged, covered with flask-shaped phialides; conidia in dry chains	*Aspergillus*	*94*
159b	Conidiophores, phialides or conidia otherwise		160
160a	Conidia hyaline or subhyaline		161
160b	Conidia distinctly pigmented, at least in mass		178
161a	Conidia crescent-shaped, typically with hyaline apical appendages		162
161b	Conidia globose, ovoid, oblong, or hooked, without appendages		163
162a	Apical collarette of phialide small, inconspicuous	*Menispora*	***88***
162b	Apical collarette of phialide large, flaring	*Codinaea*	***88***
163a	Conidia produced well within phialide (endogenous), mostly rod-shaped		164
163b	Conidia produced at apex of phialide, not rod-shaped		167
164a	Dark aleuriospores (chlamydospores) also present		165
164b	Dark aleuriospores absent		166
165a	Aleuriospores rounded, 1-celled, single or in short chains	*Chalaropsis*	*90*
165b	Aleuriospores cylindrical, breaking up into 1-celled fragments	*Thielaviopsis*	*92*
166a	Tall dark setae present	*Chaetochalara*	*90*
166b	Dark setae absent	*Chalara*	*90*
167a	Conidiophores short or mostly reduced to a single phialide		168
167b	Conidiophores well developed, simple or branched		169
168a	Conidia in dry chains, no slime present	*Monocilliwn*	*86*
168b	Conidia in small, moist, slimy heads	*Cephalosporium*	*94*
169a	Conidia dry, not in moist heads		170
169b	Conidia held together in moist slimy heads		172
170a	Conidiophores mostly simple, dark; conidia single or catenulate	*Monihchaetes*	*86*
170b	Conidiophores branched, dark; conidia catenulate	*Thysanophora*	*96*
170c	Conidiophores branched, hyaline; conidia catenulate		171
171a	Conidia cylindrical, aggregated into dry columns	*Metarrhizium*	*94*

171b	Conidia globose, ovoid or rod-shaped; conidiophore "brush" compact	*Penkillium*	*94*
1 7 lc	Conidia fusiform to lemon-shaped; conidiophore "brush" loose	*Paecilomyces*	*94*
172a	Conidiophores simple or reduced to short, 1-celled phialides		173
172b	Conidiophores variously branched, at least at apex		174
173a	Conidiophores dark; coiled setae absent	*Chloridium*	*88*
173b	Conidiophores (phialides) hyaline; coiled setae present, unbranched	*Circinotrichum*	*90*
173c	Conidiophores (phialides) hyaline, with coiled branched setae	*Gyroihrix*	*90*
174a	Conidial masses large, only at apex of conidiophore		175
174b	Conidial masses small, at apex of conidiophore		177
175a	Conidiophores hyaline, apex often enlarged, branches Aspergillus-Iike		176
175b	Conidiophores hyaline, branches Penicillium-like	*Gliocladium*	*92*
175c	Conidiophores dark, branches Penicillium-like	*Phiahcephala*	*96*
176a	Conidial mass subtended by sterile arms	*Gliocephalotrichum*	*94*
176b	Conidial mass not subtended by sterile arms	*Gliocephahs*	*94*
177a	Conidiophores hyaline, branches (or phialides) verticillate	*Verticillium*	*92*
177b	Conidiophores hyaline, branches irregular	*Trichoderma*	*92*
177c	Conidiophores dark, branches arising at points on main axis	*Gonylrichum*	*98*
178a	Conidiophores mostly reduced to phialides		179
178b	Conidiophores well developed		180
179a	Phialides slender, tapering upward; collarette not evident	*Gliomastix*	*86*
179b	Phialides cylindrical to inflated; collarette often flaring	*Phiahphora*	*88*
180a	Upper portion of conidiophores branched; phialides long, slender; conidia dark, in small, moist heads	*Stachylidium*	*92*
180b	Upper portion of conidiophores branched; conidia dry, dark, lemon-shaped, catenulate	*Phialomyces*	*94*
180c	Conidiophores unbranched; short thick phialides at base of simple conidiophores		181
181a	Conidia in moist slimy heads, not catenulate	*Stachybotrys*	*88*
18lb	Conidia not in slimy heads, catenulate	*Memnoniella*	*88*

171b	Conidia globose, ovoid or rod-shaped; conidiophore "brush" compact	*Penkillium*	*94*
1 7 lc	Conidia fusiform to lemon-shaped; conidiophore "brush" loose	*Paecilomyces*	*94*
172a	Conidiophores simple or reduced to short, 1-celled phialides		173
172b	Conidiophores variously branched, at least at apex		174
173a	Conidiophores dark; coiled setae absent	*Chloridium*	*88*
173b	Conidiophores (phialides) hyaline; coiled setae present, unbranched	*Circinotrichum*	*90*
173c	Conidiophores (phialides) hyaline, with coiled branched setae	*Gyroihrix*	*90*
174a	Conidial masses large, only at apex of conidiophore		175
174b	Conidial masses small, at apex of conidiophore		177
175a	Conidiophores hyaline, apex often enlarged, branches Aspergillus-Iike		176
175b	Conidiophores hyaline, branches Penicillium-like	*Gliocladium*	*92*
175c	Conidiophores dark, branches Penicillium-like	*Phiahcephala*	*96*
176a	Conidial mass subtended by sterile arms	*Gliocephalotrichum*	*94*
176b	Conidial mass not subtended by sterile arms	*Gliocephahs*	*94*
177a	Conidiophores hyaline, branches (or phialides) verticillate	*Verticillium*	*92*
177b	Conidiophores hyaline, branches irregular	*Trichoderma*	*92*
177c	Conidiophores dark, branches arising at points on main axis	*Gonylrichum*	*98*
178a	Conidiophores mostly reduced to phialides		179
178b	Conidiophores well developed		180
179a	Phialides slender, tapering upward; collarette not evident	*Gliomastix*	*86*
179b	Phialides cylindrical to inflated; collarette often flaring	*Phiahphora*	*88*
180a	Upper portion of conidiophores branched; phialides long, slender; conidia dark, in small, moist heads	*Stachylidium*	*92*
180b	Upper portion of conidiophores branched; conidia dry, dark, lemon-shaped, catenulate	*Phialomyces*	*94*
180c	Conidiophores unbranched; short thick phialides at base of simple conidiophores		181
181a	Conidia in moist slimy heads, not catenulate	*Stachybotrys*	*88*
18lb	Conidia not in slimy heads, catenulate	*Memnoniella*	*88*

DESCRIPTIONS AND ILLUSTRATIONS OF GENERA

HELICOCEPHALUM Thaxt. Conidiophores upright, long, slender, simple, nonseptate; conidia produced in a spiral, forming a head held in a slime drop, 1-celled, ellipsoid, hyaline or slightly pigmented; saprophytic on dung or decaying wood.

Illustration: (A) *H. sarcophilum;* redrawn from Thaxter (438); (B) *H. oiigosporum;* original, from material on decayed wood. Other reference (98).

RHOPALOMYCES Corda. Mycelium sparse; conidiophores upright, slender, simple; conidia borne on enlarged tip of conidiophore, which is hexagonally aerolate, 1-celled, hyaline, ellipsoid; saprophytic on plant material, or destroying nematode eggs.

Illustration: *R. strangulatus;* redrawn from Thaxter (436). (A) conidiophore and head of conidia; (B) head of conidia enlarged; (C) conidia. References (36).

CUNNINGHAMELLA Matr. Mycelium white, extensive in culture, nonseptate; conidiophores (sporangiophores) simple or branched, with enlarged tips bearing heads of conidia (sporangioles); conidia hyaline, 1-celled, globose; common saprophytes in soil.

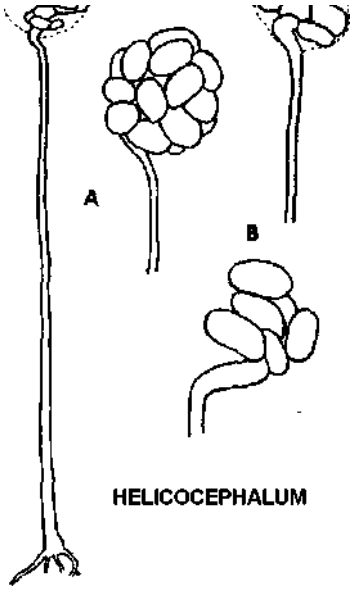
Illustration: *C. elegans;* original, from pure culture. (A) simple conidiophore and head of conidia; (B) branched conidiophore; (C) detail of tip of conidiophore showing denticles; (D) conidia. References (70, **171).**

MYCOTVPHA Fenncr. Mycelium at first nonseptate, later becoming septate, hyaline; conidiophores (sporangiophores) erect, tall, simple, septate; head of spores cylindrical; conidia (sporangioles) i-celled, borne singly on short denticles; saprophytic.

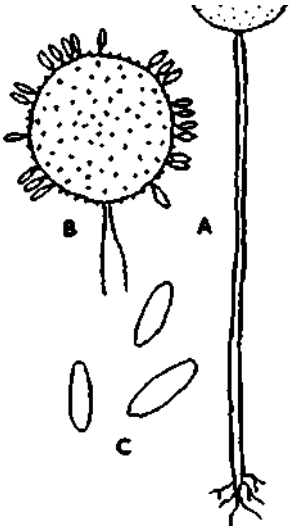
Illustration: *M. microspora;* original, from culture. (A) group of conidiophores; (B) head of conidia enlarged; (C) conidia. Reference (132).

MORTIERELLA Coemans. Mycelium typically appressed to substrate, fine; conidiophores (sporangiophores) hyaline, simple or branched, typically tapering upward; conidia (sporangioles) globose, hyaline, single, apical; typical multispored sporangia present in some species, absent in others; common in soil, saprophytic.

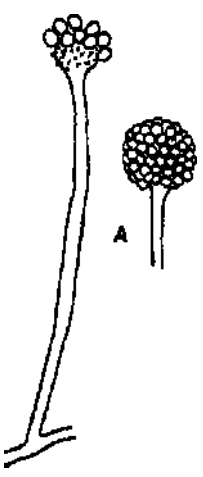
Illustration: *Mortierella* sp; original from culture. Reference (136).

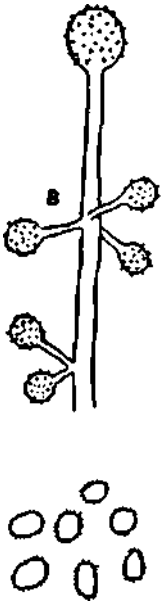


HELICOCEPHALUM

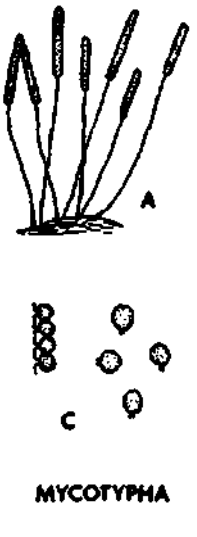


RHOPALOMYCES

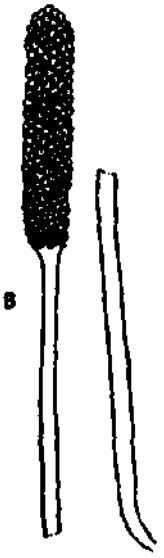


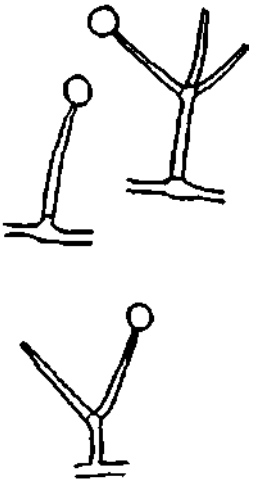


CUNNINGHAMELLA



MYCOTYPHA





MORTIERELLA

SYNCEPHALIS Van Teigh. and Le Monn. Conidiophores (sporangiophores) upright, straight or bent near the apex, with prominent rhizoids at the base; apex enlarged, producing branches, bearing rodlike sporangioles which break up to form short conidia; parasitic on other Mucorales.

Illustration: *S. pycnosperma.* (A) general habit of nearly mature fertile hypha; (B) formation of separate spores; redrawn from Thaxter (440). Other reference (17).

PIPTOCEPHAL1S de Bary. Conidiophores (sporangiophores) erect, septate, repeatedly dichotomously branched, tips more or less swollen, deciduous, bearing cylindrical, rodlike sporangioles; sporangioles break up into short conidia at maturity; haustorial parasites on other fungi, principally Mucorales.

Illustration: *P. virginiana;* original, from a culture on Mucor. (A) conidiophore and sporangioles; (B) heads of spores; (C) chains of spores breaking apart; (D) haustorium of parasite in host mycelium. References (22, 256).

COEMANSIA Van Tiegh and Le Monn. Mycelium sparse, nonseptate; conidiophores upright, slender, septate, sparingly branched, at intervals bearing sporocladia that produce conidia only on the lower (outer) surface; conidia hyaline, 1-celled, ovoid to fusoid; saprophytic on dung.

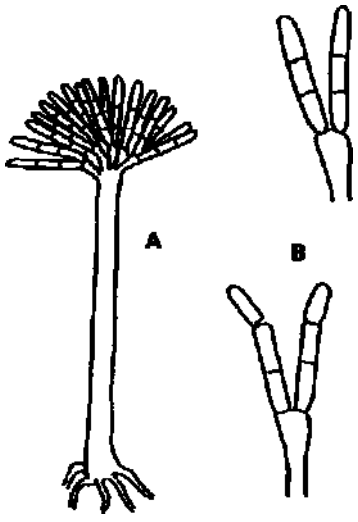
Illustration: C. *erecta;* (A) conidiophores; (B) sporocladia and conidia; redrawn from Linder (268). Other reference (22).

DIMARGARIS Van Tieghem. Conidiophores (sporangiophores) erect, septate, at first simple, becoming irregularly cymosely or verticillately branched and producing fertile terminal heads; sterile branches absent; conidial heads composed of many sporogenous branchlets, consisting of short chains of cells formed by budding, each cell giving rise to a whorl of 2-spored sporangioles; conidia finally separating, immersed in liquid at maturity, ellipsoid or rod-shaped; parasitic on other Mucorales, producing branched haustoria.

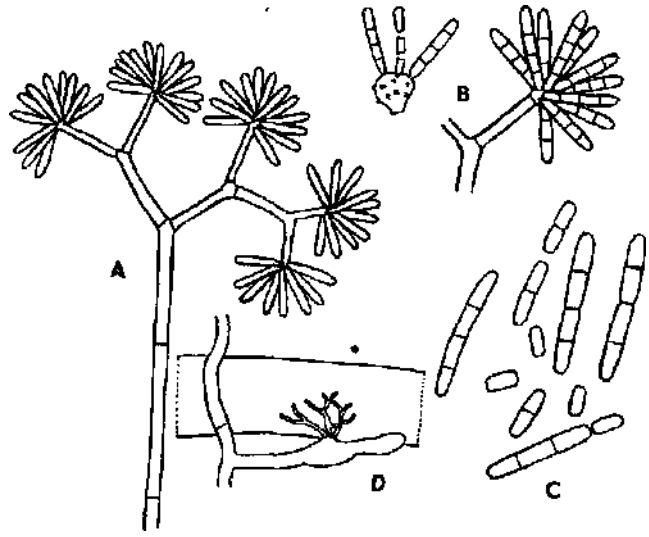
Illustration: *D. vertkillata;* redrawn from Benjamin (23). (A) upper portion of sporangiophore; (B) enlarged branch apex; (C) branchlet with several 2-spored sporangioles; (D) conidia.

TIEGHEMIOMYCES Benjamin. Conidiophores (sporangiophores) erect, septate, simple below, giving rise above to fertile branch systems; branches septate, several repeatedly, irregularly branched, the ends consisting of fertile cells bearing whorls of 2-spored sporangioles; conidia finally separating, smooth subglobose to ovoid, dry at maturity; parasitic on other Mucorales, producing branched haustoria.

Illustration: 7 ." *caHfornicus;* redrawn from Benjamin (23). (A) habit of sporangiophores; (B) branch of sporangiophore; (C) branchlets with 2-spored sporangioles; (D) conidia.

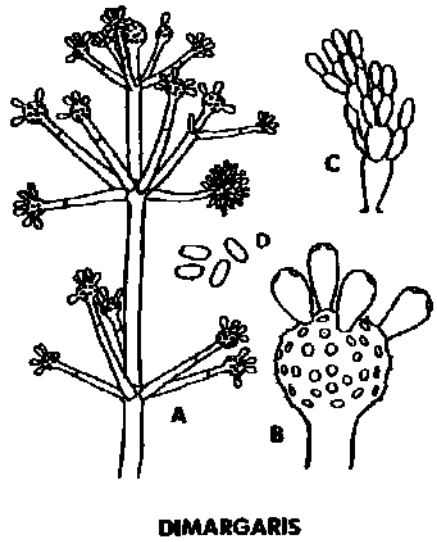


SYNCEPHAUS

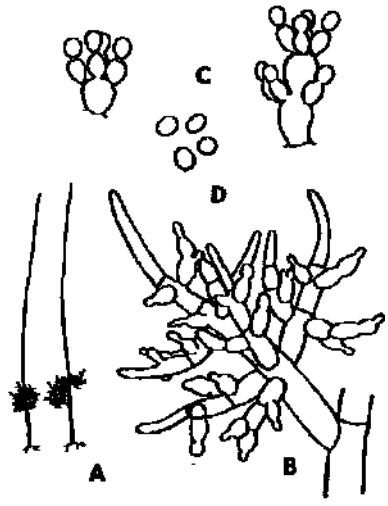


PIPTOCEPHALIS

COEMANSIA



DIMARGARIS



TIEGHEMIOMYCES

RADIOMYOES Embree. Conidiophores (sporangiophores) borne singly or sometimes in pairs near the ends *of* stolons that terminate in rhizoid systems; conidiophores dark brown, terminating *tn* primary vesicles bearing radiate stalks and secondary vesicles; conidia borne on tertiary stalks, subglobose to ellipsoid, conidia hyaline, reniform to oblong-ellipsoid; saprophytic.

Illustration: *R. embreei;* (A) apex of conidiophore with conidia! head; (B) single branch of conidial head; (C) single branch void of conidia; (D) conidia; redrawn from Benjamin (24). Other reference (127).

MARTENSELLA Cocmans. Mycelium sparse; conidiophores upright, simple, bearing lateral or apical sporocladia; conidia borne on upper surface of sporocladia, hyaline, l-celled; saprophytic.

Illustration: *M. corticii;* (A) conidiophores; (B) sporocladia and conidia; redrawn from *Jackson and* Dearden (240). Other references (22, 268).

KICKXEELA Coemans. Mycelium sparse; conidiophores simple with an apical disk bearing sporocladia; conidia produced on the upper surface of sporocladia, hyaline, I-celled; saprophytic on horse dung.

Illustration: *K. alahastrina;* (A) conidiophore; (B) sporocladium and ctfnidia redrawn from Benjamin (22). Other reference (268).

L1NDERINA Rapcr and Fennell. Conidiophores long, septate, branched, bearing several domelike sporocladia with pseudophialides and conidia on the upper surface; conidia hyaline, l-celled, elongated; saprophytic in soil.

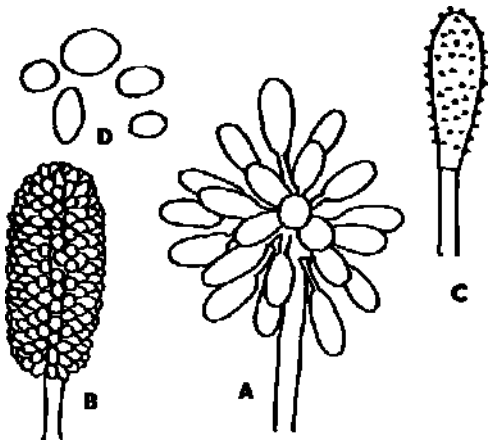
Illustration: *L. pennispora;* (A) diagram showing habit of growth; (B) a single sporocladium; redrawn from Raperand Fennell (348).

MARTENSIOMYCES Meyer. Conidiophores (sporangiophores) erect or ascending, becoming irregularly cymosely branched; sporocladia stalked, borne in umbels on recurved branchlets, producing pseudophialides on one side (resembling *Coemansid)*\ pseud ophialides ellipsoid, each bearing a single conidium (sporangiole); conidia obclavate, hyaline, enveloped in liquid at maturity; saprophytic, from soil.

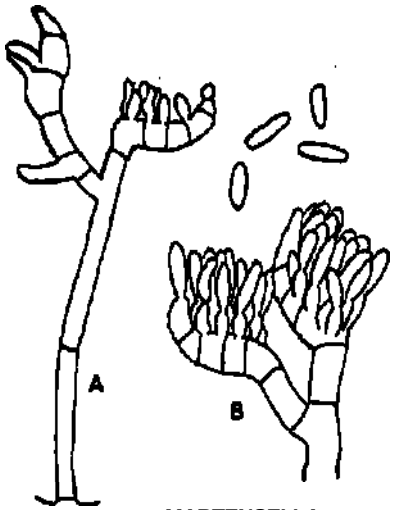
Illustration: *M. pterosporus;* redrawn from Benjamin (23). (A) conidiophore; (B) group of sporocladia; (C) sporocladium; (D) conidium.

SPIRODACTYEON Benjamin. Conidiophores (sporangiophores) erect or ascending, septate, giving rise above to coiled, fertile branches; sporocladia borne successively on the lower surface of the coils, septate, with narrowed apices, producing laterally pseudophialides that bear single sporangioles (conidia); conidia short-ellipsoid, not enveloped in liquid at maturity; saprophytic on dung.

Illustration: *S. aureum;* redrawn from Benjamin (22). (A) conidiophore; (B) group of sporocladia; (C) sporocladium bearing conidia.



RADIOMYCES



MARTENSELLA

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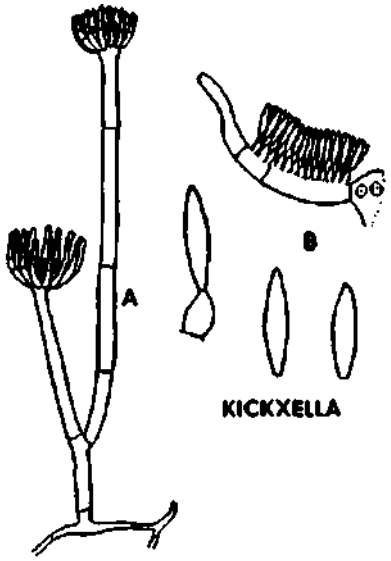
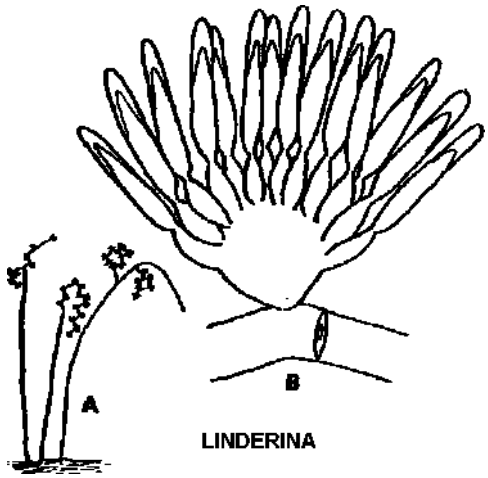
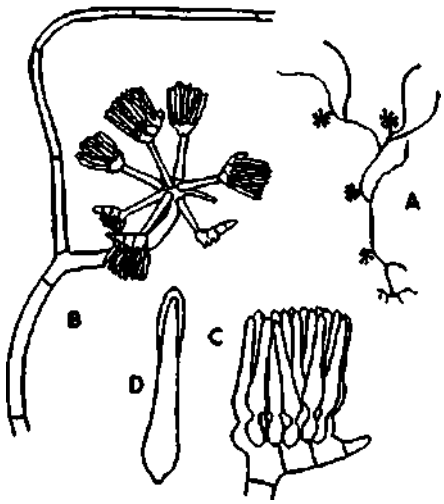


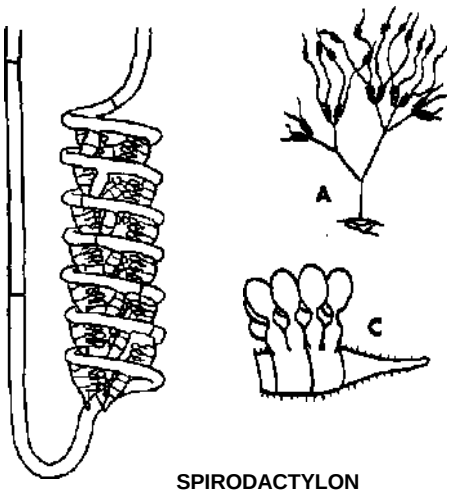
KICKXELLA



LINDERINA



MARTENSIOMYCES



SPIRODACTYLON

SYNCEPHALASTRUM Schroet. Mycelium growing rapidly, abundantly branched; conidiophores (sporangjophores) erect, branched, tips enlarged, bearing a head of rod-shaped sporangioles, each producing a row of nearly spherical conidia; wall of sporangiole dissolving to release conidia; saprophytic.

Illustration: *S. racemosum;* original, from pure culture. (A) conidiophore and head of spores; (B, C) heads of sporangioles and developing conidia, (D-G) stages in formation and release of conidia. References (23, 439).

DISPIRA Van Tiegh. Conidiophores (sporangiophores) erect, branched, the sterile branches slender and spiral, fertile branches enlarged, bearing a head of cylindrical sporangioles that produce rows of short conidia, parasitic on other Mucorales and one species on *Chaetomium.*

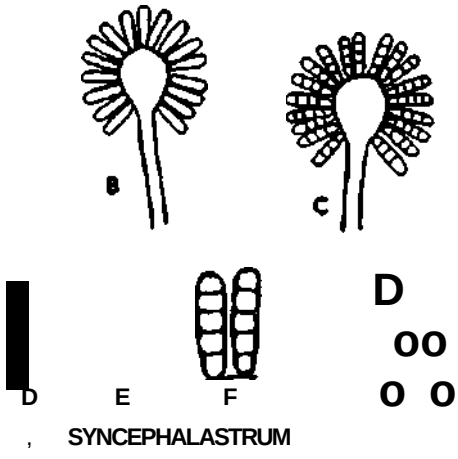
Illustration: *D. cornuta.* (A) terminal portion of fertile hypha; (B) portion of fertile head showing conidia; redrawn from Thaxter (438). Other references (26).

CHOANEPHORA Currey. Mycelium white, extensive and growing rapidly in culture; conidiophores (sporangiophores) long, enlarged, and branched at the apex, each branch bearing a head of conidia (sporangioles); conidia 1-celled, brown or purplish, ellipsoid; sporangia typical of the Mucorales also formed in culture; parasitic on flowers and fruits, or saprophytic, principally curcurbits.

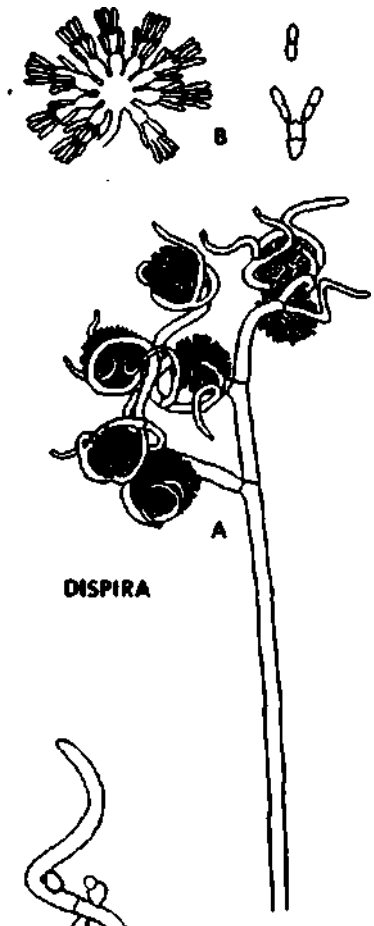
Illustration: *C. curcurbitarum;* original, from culture. (A) conidiophores; (B, D) portion of head of conidia; (D) conidia. References (136, 172, 335, 474, 475).

SPIROMYCES Benjamin. Conidiophores arising from substrate hyphae, forming a loose spiral as they develop upward, septate, each segment giving rise to 2 to 3 short, stout sporocladia, each of which forms a loose cluster of conidia (sporangioles) on terminal globose enlargements on denticles; conidia subglobose to globose; saprophytic.

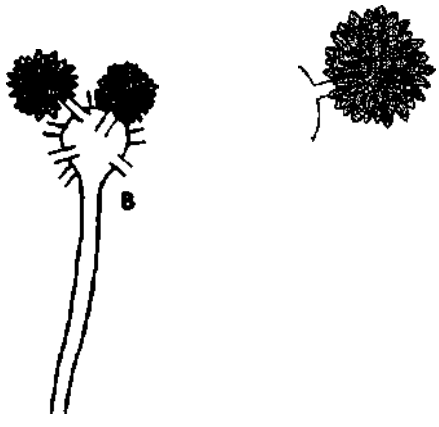
Illustration: *S. minuius;* redrawn from Benjamin (23). (A) portion of conidiophore; (B) enlarged fertile branches.



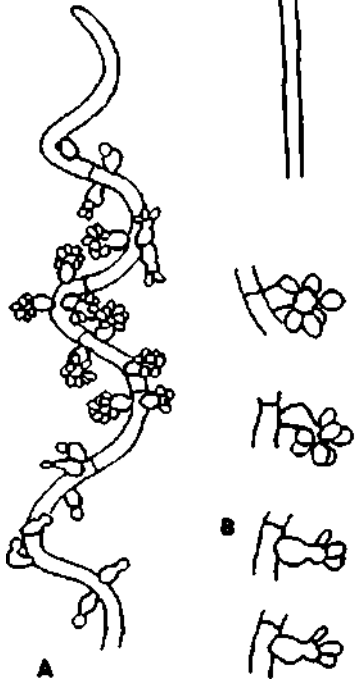
SYNCEPHALASTRUM



DISPIRA



CHOANEPHORA



SPIROMYCES

^ • **GEOTRICHUM** Link. Mycelium white, septate; conidiophores absent; conidia (arthrospores) hyaline, j^ 1-celled, short cylindrical with truncate ends, formed by segmentation of hyphae; mostly saprophytic, common in soil. Some basidiomycetes form conidia in this manner.

{?'-. **Illustration:** (A) *G. candidum;* original, from agar culture; (B) conidial state of *Polyporus adust us;* . -V original from culture. Reference (50).

OIDIODENDRON Robak. Mycelium hyaline to brown; conidiophores sparsely branched only on upper portion, rebranched irregularly, branches segmenting into rod-shaped or rounded conidia, remaining in chains; conidia (arthrospores) 1-celled, hyaline or subhyaline; saprophytic.

IHustration:0. *griseum;* original, from culture. (A) branched conidiophore; (B) segmenting branch; (C) conidia. Reference (15).

AMBLYOSPORIUM Fres. Mycelium pale to yellow-orange; conidiophores erect, septate, lower portion unbranched. bearing a number of irregular branches near or at the apex, from which conidial chains are formed by segmentation; conidia (arthrospores) 1-celled, hyaline or yellow-orange in mass, barrel-shaped, catenulate; saprophytic in soil or often growing on fleshy or woody basidiomycetes.

Illustration: *A. spongiosum;* original, from culture. (A) conidiophore and conidia; (B) stages in development of conidial branches; (C) conidia. References (313, 332).

CHRYSOSPORIUM Corda. Conidiophores poorly differentiated, much like vegetative hyphae, mostly erect and branching irregularly, hyaline; conidia (aleuriospores or arthrospores) hyaline, 1-celled, globose to pyriform, terminal or intercalary, single or in short chains, usually with a broad basal scar; saprophytic. Carmichael (51) describes conidia as aleuriospores.

Illustration: *Chrysosporium* sp.; original from culture. (A) portions of conidiophores and conidia; (B) conidia. Reference (51).

' r- **OIDIUM** Sacc. Mycelium external on host, white; conidiophores upright, simple; upper portion increases in length as conidia are formed; conidia (meristem arthrospores) cylindrical, 1-celled, hyaline, produced in basipetal chains; parasitic on higher plants, producing powdery mildews. See Bisby (35) for relation *of Oidium* Link., *Oidium* Sacc. and *Acrosporium* Nees.

Illustration: *O. monilioides (Erysiphe graminis);* original, from fresh material. (A, B) mycelium with conidiophores and conidia; (C) conidia. ,.

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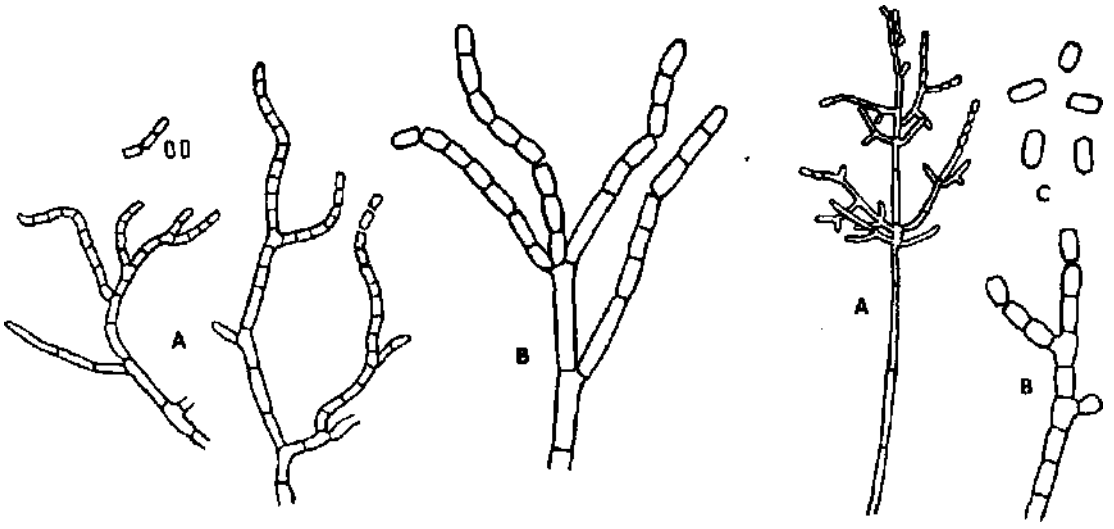
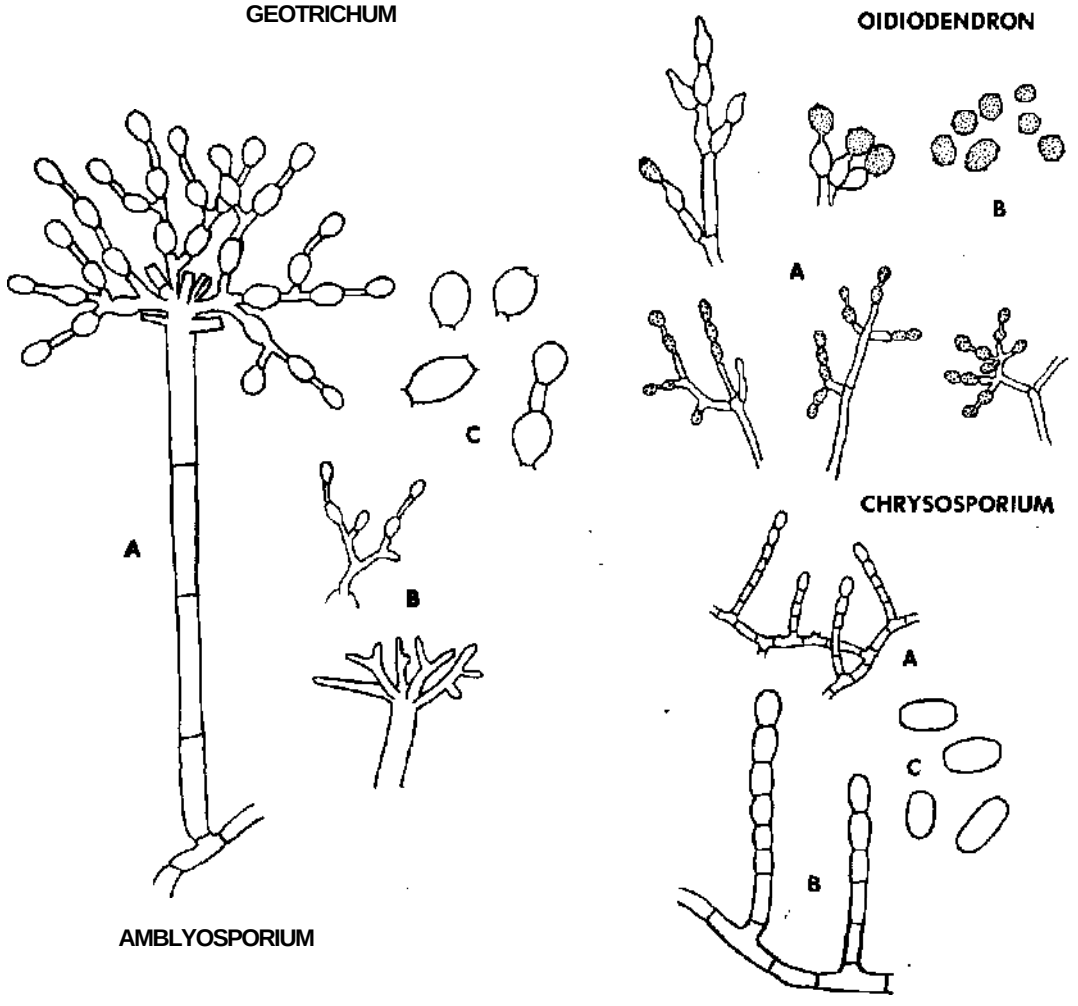


GEOTRICHUM

OIDIODENDRON



CHRYSOSPORIUM

AMBLYOSPORIUM

OIDIUM

SPOROBOLOMYCES K A u y v e r and van Nicl. Cultures usually pink; reproduction principally by budding (blastospores); some cells producing sterigmata, each bearing an asymmetrical conidium that is discharged forcibly; saprophytic.

Illustration: *S. salmonieolor;* original, from culture. (A) hyphae with conidia produced on sterigmata; (B) budding cells. Reference (45).

ITERSONILIA Derx. Mycelium forming clamp connections; aerial hyphae simple, forming a sterigma bearing a single conidium (blastospore); conidia asymmetrical, smooth, hyaline, discharged forcibly; saprophytic or pathogenic on plants.

Illustration: /. *perlexans;* redrawn from Tubaki (446). (A) mycelium with clamp connections; (B) conidia and secondary conidia.

BASIPETOSPORA Cole and Kendrick. Conidiophores simple, resembling vegetative hyphae elongating slightly at apex as conidia are formed; conidia (meristem arthrospores) globose, with truncate base, hyaline to pale brown, l-celled in simple basipetal chains; saprophytic; *B. rubra* is conidial state of *Monascus rubra.*

Illustration: *B. rubra;* original from culture. (A) stages in development of chain of conidia; (B) conidia. Reference (57).

OVULARIOPSIS Pat. and Har. Mycelium and conidiophores as in *Oidium;* conidia (meristem arthrospores) l-celled, hyaline, pyriform to clavate, single at apex or sometimes in short chains; imperfect state of certain powdery mildews.

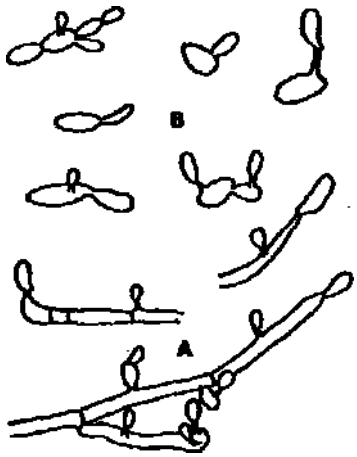
Illustration: *O. erysiphiodes* (conidial state of *Phyllactinia corulea);* redrawn from Salmon (363). (A) conidiophore bearing single conidium; (B) conidia.

CANDIDA Berkhout. Mycelium, not extensive; conidia (blastophores) hyaline, l-celled, ovoid to fusoid, forming short chains by budding; produced apically or laterally on mycelium; mostly common saprophytes; C. *albicans* is described as causing moniliasis of man; frequently considered as a filamentous yeast.

Illustration: *C. albicans;* original, from culture. (A, B) hyphae and conidia; (C) lateral production of conidia; (D) conidia budding. References (17, 59).

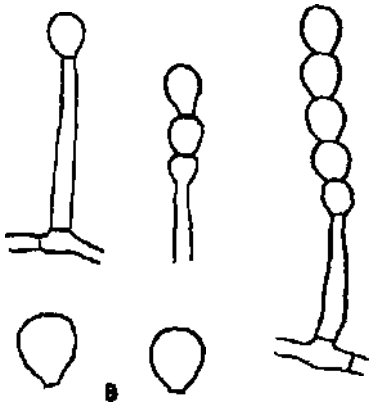
AHJREOBASIDIUM Viola and Boyer. Mycelium not extensive, hyaline when young, becoming dark with age, black and shiny in old cultures, bearing abundant conidia laterally; conidia (blastospores) subhyaline to dark, l-celled, ovoid, producing other conidia by budding; saprophytic or weakly parasitic; common in soil.

Illustration: *A. (Pullularla) pullulans;* original from culture. (A, B) hyphae and conidia. References (17, 63).

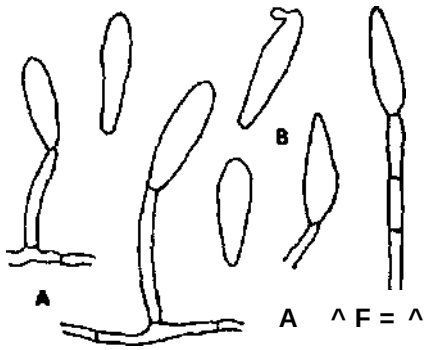


SPOROBOLOMYCES

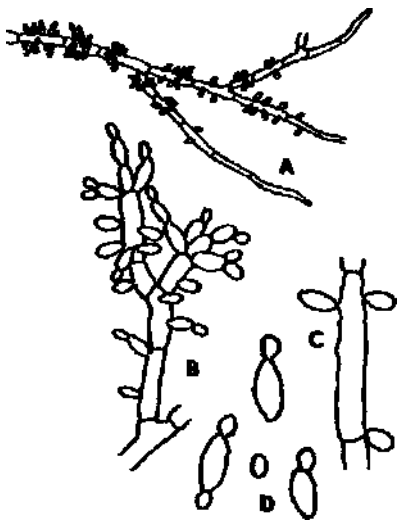
ITERSONILIA



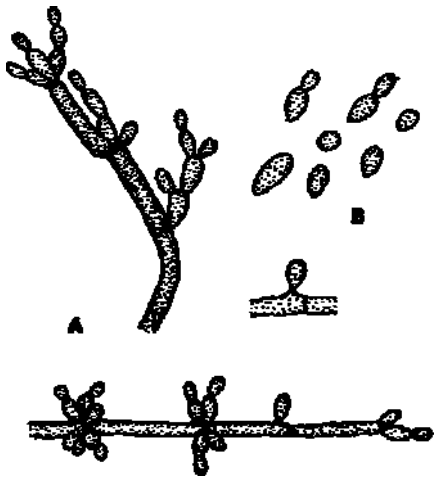
BAS1PETOSPORA



OVULARIOPSIS



CANDIDA



AUREOBASIDIUM

TILLETIOPSIS Derx. Colonies restricted, white to cream colored, mycelium fine; conidiophores short or indefinite; conidia (blastospores) 1-celled, hyaline, curved, catenulate, acropetal; common on surface of leaves; saprophytic, but one species parasitic on powdery mildew. Similar to *Sporobolomyces* in appearance.

Illustration: *Tilletiopsis* sp.; original from culture. Reference (315).

HYALODENDRON Diddens. Mycelium white; conidiophores erect, variable in length, simple or branched, bearing one to a few conidia at the apex of the branches; conidia (blastospores) frequently in small clusters, becoming catenulate by acropetalous formation of new conidia, chains often branched, 1-celled, hyaline, variable in shape, ovoid to cylindrical or oblong; saprophytic or parasitic, mostly on wood; mostly imperfect states of species of *Ceratocystis.* This genus is like *Cladosporium* except for lack of pigmentation.

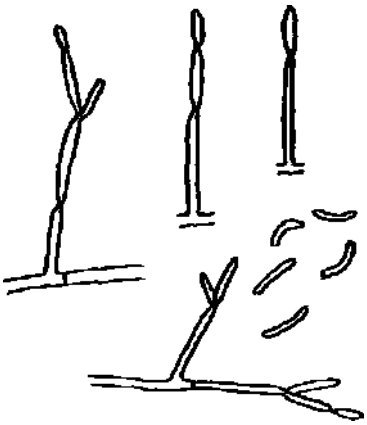
Illustration: *Hyalodendron* sp.; original, from culture. (A) conidiophore and conidia; (B) conidia. References (17, 149).

MONILIA Pers. ex Fr. Mycelium white or gray, abundant in culture; conidiophore branched, its cells differing little from the older conidia; conidia (blastospores) pink, gray, or tan in mass, I-celled, short cylindric to rounded, in acropetalous branched chains. Some species are imperfect states of *Neuropspora* and are common saprophytes; others, whose perfect states are *Molinilia (Sclerotmia)* spp., cause brown rots of fruits.

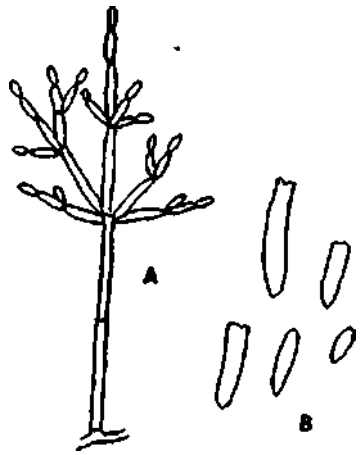
Illustration: (A) *M. (Neurospora) sitophilia;* (B) *M. americana (Monilinia fructicola);* original, from pure culture.

ZYGOSPORIUM Mont. Conidiophores erect, main'axis usually simple, brown at base with hyaline or subhyaline apex, bearing special cells (falces), thick-walJed, dark, and reflexed, each bearing 2 short hyaline conidiogenous cells; conidia (blastospores) 1-celled, hyaline, globose to ellipsoid; saprophytic.

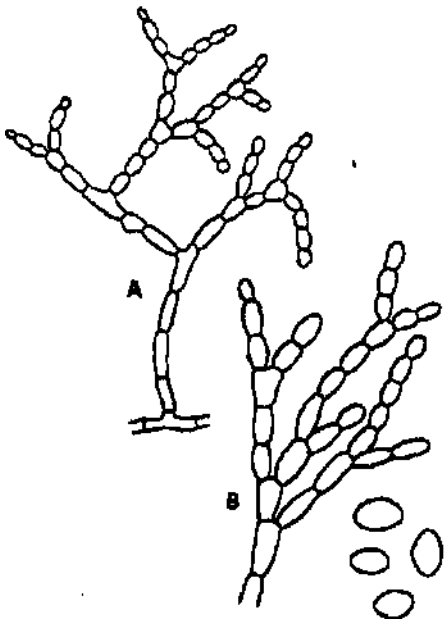
Illustration: *Z. masonii;* original, from culture. (A) conidiophores showing falces and conidia; (B) conidia; (C) *Z. gibbum;* original, from culture. References (188, 462).



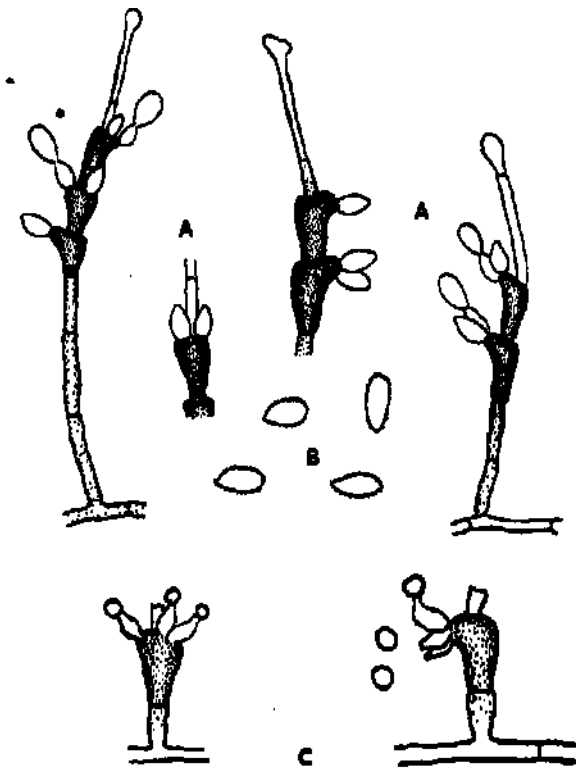
TILLETIOPSIS



HYALODENDRON



MONILIA



ZYGOSPORIUM

TORULA Pers. Conidiophores short, dark, simple, branched or absent; conidia (porospores, blastospores) 1- to several-celled, cells rounded, dark, in acropetalous chains; saprophytic. Barron (17) describes conidia as porospores.

Illustration: *T. herbarum*\ original from culture. Reference (365).

OLPITRICHUM Atkinson. Conidiophores stout, simple or irregularly branched in upper portion; method of branching irregular, often as extensions of the denticles; denticles medium to long, at nearly right angles; fertile portions of conidiophore not swollen as in *Acladium*\ conidia I-celled, hyaline to pale brown, globose or ovoid to ellipsoid, borne singly on the denticles or branches; saprophytic or parasitic on other fungi. Relation to *Adadium* is not clear but separated here because of loose branching and long "denticles." See Subramanian (409) for his views.

Illustration: *O. macrosporum;* original, from culture. (A, B) conidiophores and conidia; (C) phialide state. References (17, 409, 414).

PERICON1A Bon. Conidiophores dark, tall, upright, stout, simple, determinate, somewhat enlarged at apex, which bears a loose head of comdia; conidia (blastospores) dark, 1-celled, globose, in dry chains, arising from globose conidiogenous cells; parasitic or saprophytic.

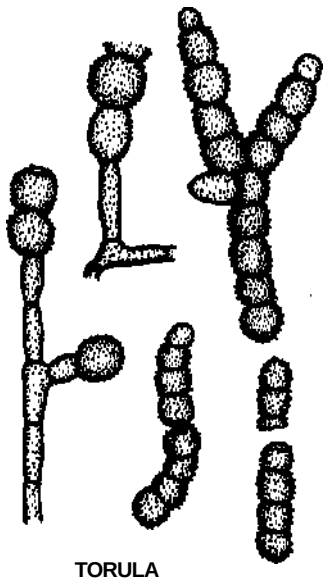
Illustration: *Periconia* sp.; original from fresh material on dead stem. (A) group of conidiophores; (B) conidiophore enlarged; (C) tip of conidiophores bearing conidia; (D) conidium. References (282, 401).

CRISTULARIELLA Hochn. Conidiophore-like structures hyaline, consisting of basal stalk and much branched upper portion that forms a globose or pyramidial head; branches compact and dichotomously or trichotomously rebranched; cells irregular, thick; conidia not produced, although ultimate cells resemble conidia; entire structure disseminated as a propagule; small phialides and microconidia produced in culture, as well as large black sclerotia; causing targetlike spots on living leaves. Niedbalski et al. (314) consider the entire branched structure as a conidium.

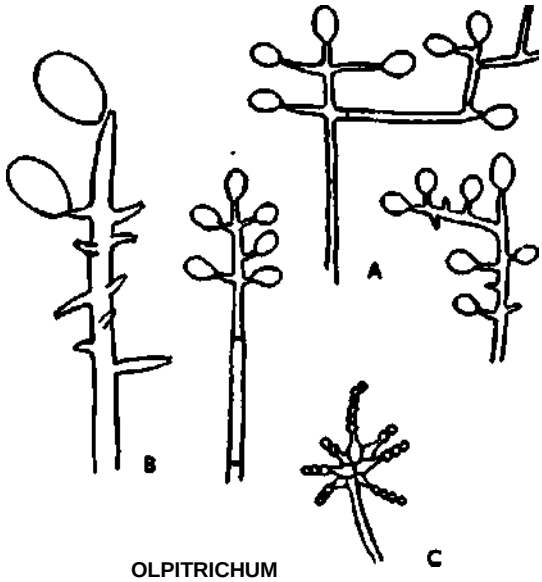
Illustration: (A-C, E) *C. pyramidalis;* (D), *C. depraedans:* original from fresh material on *Acer* leaves; (E), microconidia from culture. References (352, 464).

ARTHRINIUM Kunze ex. Fr. Conidiophore mother cells subspherical; conidiophores simple, mostly hyaline except for thick dark septa, increasing in length near base; conidia (meristem blastospores) dark, 1-celled, broadly fusoid, ovoid, curved to cuspidate, attached on side and apex of conidiophore, often with slight germ slit on one side; saprophytic on plant material.

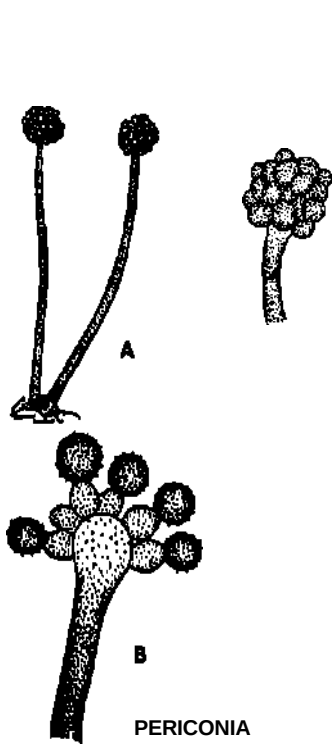
Illustration: (A-C) *A. cuspidatum;* (A) cluster of conidiophores; (B) conidiophores and conidia; (C) conidia; (D) *A. aphaerospermum,* showing basal conidiophore mother cell; redrawn from Ellis (120). References (62, 118, 120, 125).



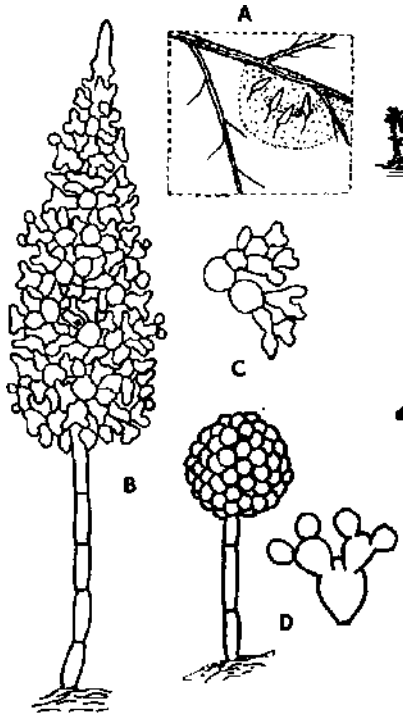
TORULA



OLPITRICHUM



PERICONIA



CRISTULARIELLA Q

ARTHRINIUM

***S** BOTRVTIS** Pers. Conidiophores tall, slender, determinate, hyaline or pigmented, branched irregularly in _. upper portion, apical cells enlarged or rounded, bearing clusters of conidia simultaneously on short Aj&cnticles; conidia (botryoblastospores) hyaline or gray in mass, [-celled, ovoid; black irregular sclerotia often present; causing "gray mold" on many plants or saprophytic. See Hennebert (167) for recent classification.

Illustration: *B. cinerea;* original from culture. (A, B) conidiophores and conidia; (C, D) upper portion of conidiophore showing enlarged conidiogenous cells; (E) conidia. References { 1 7 , 1 6 7 , 294, 295).

OEDOCEPHALUM Preuss. Conidiophores simple, hyaline, enlarged and globose at the apex, bearing a head of dry conidia formed simultaneously; conidia (botryoblastospores) hyaline, 1-celled, globose to ovoid; usually saprophytic on plant materials or in soil. Some species are conidial states of Discomycetes and one species is the conidial state of *Fames annosus.*

Illustration: *Oedocephalum* sp.; original, from culture. (A) conidophores and conidial heads; (B) enlarged apex of conidiophore void of conidia; (C) conidia. References (17, 427, 448).

BOTRYOSPORIUM Corda. Conidiophores tall, slender, hyaline, composed of elongated axis and numerous, lateral branches of nearly equal length, these branches producing two or more secondary branches that are enlarged at the tips and bear heads of conidia; conidia (botryoblastospores) hyaline, 1-celled, ovoid; saprophytic on decaying plant material.

Illustration: *Botryosporium* sp.; original, from decayed leaf in greenhouse. (A) entire conidiophore; (B-F) stages in development of conidiophore branch and production of conidia; (G) conidia. Reference (17).

RHINOTRICHUM Corda *{Oidium* Link). Mycelium often forming a loose or dense substratum; conidiophores erect or suberect, simple or branched; conidium-bearing cells sometimes enlarged; conidia (blastospores) 1-celled, globose to ovoid, hyaline or slightly colored, borne on denticles; saprophytic, mostly on decayed wood. Not *Rhinotrkhum* Auct.

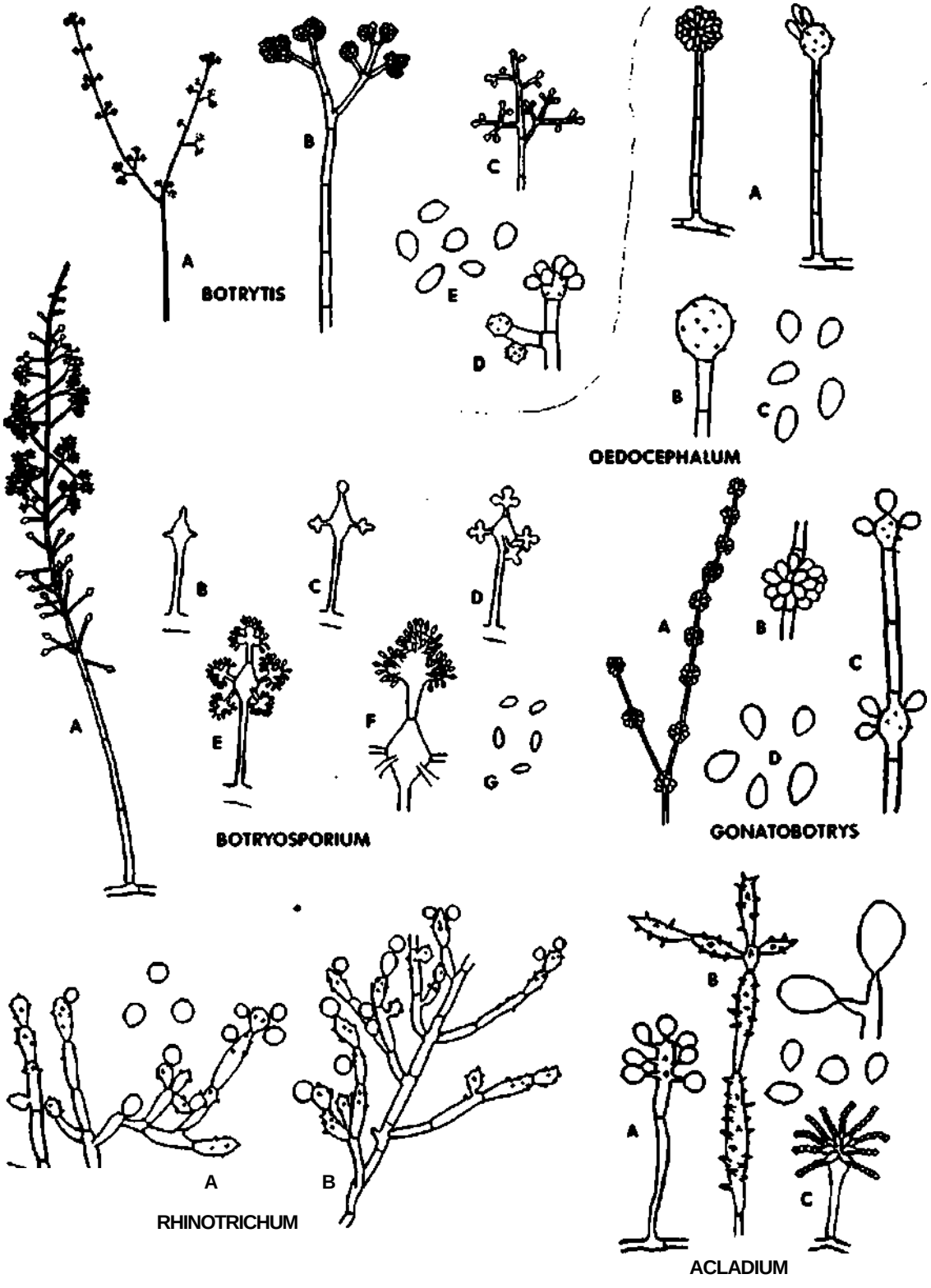
Illustration: *R. curtisii;* original, drawn from herbarium material; (A. B) mycelium, conidiophores and conidia. References (17, 35, 267, 409, **414).**

GONATOBOTRYS Corda. Conidiophores erect, sometimes tall, septate, simple or sparingly branched, percurrent with terminal and intercalary, inflated, denticulate cells bearing conidia simultaneously; conidia (botryoblastospores) borne singly on the teeth, 1-celled, hyaline, ovoid to subglobose; saprophytic or parasitic on other fungi. This genus differs from *Gonatobotryum* in being hyaline throughout, and from *Gonatorrhodiella* in having conidia not in chains. *G. simplex* is a mycoparasite.

Illustration: *G. simplex;* original, from culture. (A) conidiophore with clusters of conidia; (B) cluster of conidia; (C) portion of conidiophore void of conidia; (D) conidia. References (17, 469).

ACLADIUM Link ex Pers. Conidiophores stout, simple or irregularly branched in upper portion, often extending percurrently, resulting in a row of fertile cells; fertile cells irregular, somewhat inflated (not globose); conidia (blastospores) hyaline to pale brown, 1-celled, globose to ellipsoid, borne singly on short or medium denticles; saprophytic or closely associated with other fungi. Isolates are variable, some producing *Aspergilius-Wke* heads of microconidia. The relationship to *Olphrichum* Atkinson and *Rhinotrkhum* Auct. is not clear.

Illustration: *A. teneltum;* (A) young conidiophore and conidia; (B) chain of fertile cells with prominent denticles; (C) phialide state; original, from culture. Reference (409).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BOTRYOSPORIUM
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GONATOBOTRYS
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RHINOTRICHUM
A
B
C
ACLADIUM

DICHOBOTRYS Hennebert. Conidiophores tall, slender, dichotomously branched twice or more from upper half, terminal fertile cells somewhat inflated, globose, producing conidia simultaneously, then collapsing, conidia (botryoblastospores) nearly globose, hyaline, 1-celled, nearly sessile or on short denticles.

Illustration: *D. abundans* (conidial state of *Trichophaea abundans).* (A) upper portion of conidiophore; (B) cluster of conidia; (C) conidia. Original from culture. Reference (167.)

PHYMATOTRICHUM Bon. Conidiophores rather short, stout, simple or branched, with inflated or lobed tips, bearing loose heads of dry conidia; conidia (botryoblastospores) hyaline, 1-celled, produced on mats on surface of soil, globose or ovoid; saprophytic or parasitic on soil, causing root rots; large black sclerotia produced in soil; branched setae often present on mycelium. Hennebert (167 394, 432) places this genus in the newly formed genus *Phymatotrichopsis.*

Illustration: *P. omnivorum;* redrawn from photographs by J. Baniecki. (A) rope of hyphae; (B) mycelium, conidiophores and conidia. Reference (6).

GONATOBOTRYUM Sacc. Conidiophores dark, tall, stout, upright, typically simple, septate, forming a head of dry conidia on an inflated terminal cell, proliferating to form successive conidiogenous nodes; conidia (botryoblastospores) dark, 1-celled, ovoid to short cylindrical. *G. apiculatum* bears conidia in branched chains of several conidia; saprophytic or causing leaf spots of *Hamamelis.*

Illustration: original, from culture. (A) *B. appiculatum,* conidiophores and conidia; (B) *G. fuscum,* conidiophore and conidia. References (255, 459).

GONATORRHODIELLA Thaxter. Conidiophores stout, upright, hyaline, simple or sparingly branched, septate, with inflated apex and intercalary cells that bear loose dry heads of conidia; conidia (botryoblastospores) hyaline, 1-celled, ovoid to ellipsoid, in simple or branched acropetalous chains; frequently associated with *Hypoerea, Hypomyces,* or *Nectria. G highlei* is parasitic on TV *coccinea varfaginaia,* the cause of beech bark disease in New England.

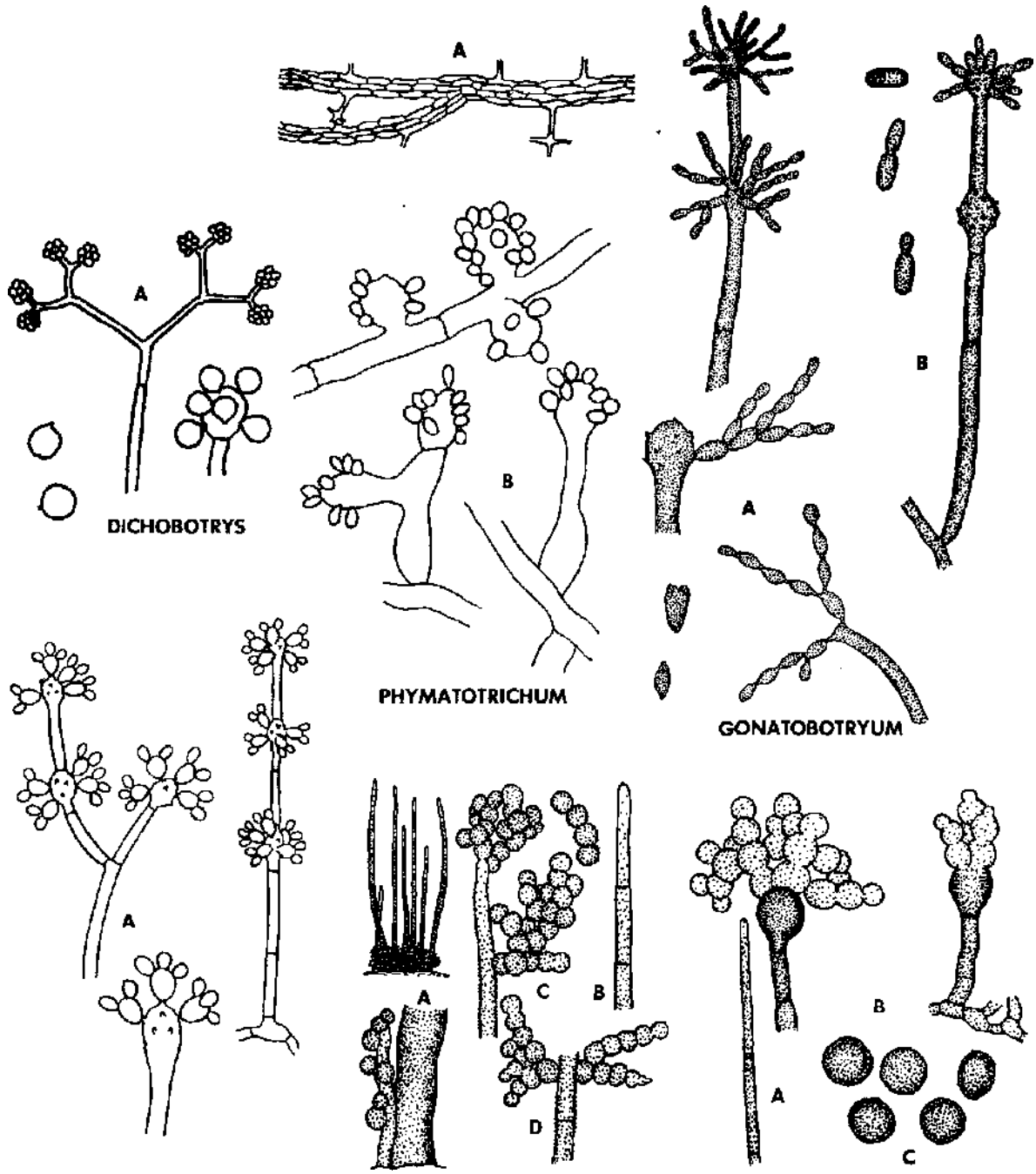
Illustration: *G highlei;* original, from culture. (A) conidiophores and conidia; (B) apex of branch showing denticles; (C) conidia. Other references (138, 437, 459).

LACELLINA Sacc. Setae erect, tall, brown, simple; conidiophores determinate, intermixed with setae, shorter, pale, simple; conidia (blastospores) 1-celled, globose or ovoid, colored, produced at or near the apex in acropetalous chains; saprophytic.

Illustration: *L. graminkola;* (A) habit of setae and conidiophores; (B) tip of seta; (C, D) conidiophores and conidia; redrawn from Subramanian (396).

LACELLINOPSIS Subramanian. Setae simple, septate, brown; conidiophores determinate intermixed with setae, with globose fertile apex, becoming cupulate after detachment of conidia; conidia (blastospores) 1-celled, brown, globose, produced acropetally in chains.

Illustration: *L sacchari:* (A) tip of seta; (B) conidiophores and conidia; (C) mature conidia; redrawn from Subramanian (397).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GONATORRHODIELLA
LACEUINA
LACELUNOPSIS

CHROMELOSPORIUM Corda. Mycelium white to cinnamon, growing rapidly; conidiophores stout, hyaline, erect, main axis unbranched but dichotomously branched near apex, producing several clublike divergent branches that are covered by conidia on slender short denticles; conidia (botryoblastospores) globose, 1-celled, hyaline or nearly so (tan in mass); saprophytic in soil, common in greenhouses.

Illustration: C. *ollare; (Ostracoderma* state of *Peziza ostracoderma);* original, from culture. (A) conidiophore and conidia; (B) fertile branch with conidia. References (17, 168).

HAPLOGRAPHIUM Berk, and Broome. Mycelium dark; conidiophores determinate dark, simple, erect, bearing an apical cluster of pale to hyaline short branches, entire apparatus penicillate; conidia (blastospores) terminal, hyaline, 1-celled, ovoid to oblong, collecting in slimy heads under moist conditions; saprophytic on wood or soil.

Illustration: *Haplographium* sp.; original, from fresh material on decaying wood. (A) conidiophores and conidia; (Q conidia. Reference (17.)

MICROCLAVIA F.S. Stevens. Mycelium superficial; conidiophores simple, determinate, pale, expanded at apex into an obconical or ellipsoid structure, usually composed of 2 cells, apical cell bearing 2 (sometimes 3) large, brown, 1-celled, thick-walled conidia (aleuriospores), subglobose with flattened base, rarely deciduous; overgrowing and probably hyperparasitic on microthyriaceous fungi on leaves.

Illustration: *M. bispora;* redrawn from Deighton (80). (A) conidiophores and conidia; (B) portion of mycelium.

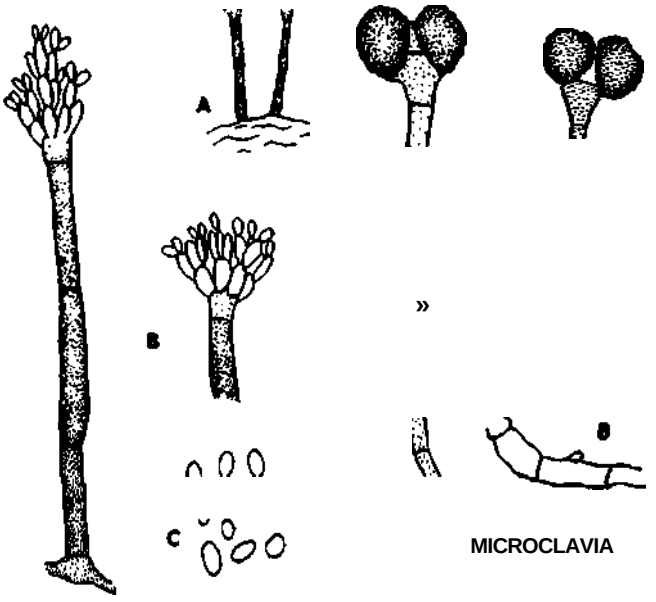
STAPH YLOTRICHUM Meyer and Nicot. Mycelium hyaline to lightly pigmented; conidiophores erect, tall, dark brown but paler above, branched irregularly in upper poriton; conidia (aleuriospores) globose, 1-celled, thick-walled, light brown, apical and single on branches; saprophytic.

Illustration: *S- coccosporum;* original, from culture. References (275, 311).

BLASTOMYCES Cost, and Roll. Mycelium white in culture, filamentous at room temperature, yeastlike at 37 °C; conidia (aleuriospores) thick-walled, budding cells (blastospores) found in lesions; pathogenic in man, causing blastomycosis.

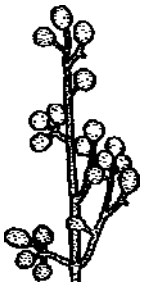
Illustration: *H. dermatitidis;* (A) hyphae and thick-walled cells (aleuriospores) produced in culture; (B) bud-cells produced in tissue; (C) budding cells on media at 37 °C. (A, B) redrawn from DeLamater (86); (C) drawn from a photography by Salvin (364). Other references (59, 129).

CHROMELOSPORIUM

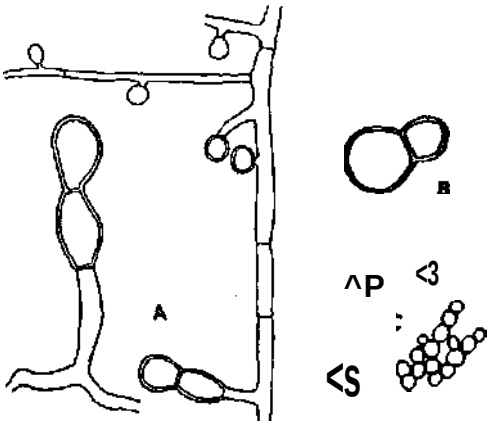


HAPLOGRAPHIUM

MICROCLAVIA



STAPHYLOTR1CHUM



BLASTOMYCES

STEPHANOMA Wallr. Conidiophores slender, hyaline; conidia (aleuriospores) apical on pedicels, hyaline or brown, main cell large, globose, with several cell-like hyaline swellings; phialospore state may be present, with verticillate conidiophores bearing hyaline, I-celled conidia (*Verticillium-like);* parasitic on other fungi; may be imperfect state of *Hypomyces.* The outgrowths on the aleuriospores separate this genus from *Sepedonium. S. phaeospora* has brown conidia, and is a biotophic mycoparasite.

Illustration: *S. tetracoccum;* (A) hyphae and aleuriospores; (B) conidiophore and phialides; redrawn from Howell (178). References (46, 452).

MYCOGONE Link. Conidiophores much like branches of mycelium, simple or branched; conidia (aleuriospores) single, apical, hyaline or brightly colored, 2-celled, the apical cell globose and warted, basal cell smooth; phialospore state may also be present, hyaline, 1-celled *Vertitillium-like;* parasitic on mushrooms, probably imperfect state of *Hypomyces.*

Illustration: *M. perniciosa;* (A) conidiophore and phialides; (B) hyphae and aleuriospores; redrawn from Howell (178). Reference (17.)

SEPEDONIUM Link. Conidiophores indefinite, not differing much from branches of the mycelium, simple or branched; conidia (aleuriospores) single or in loose cluster, hyaline or bright yellow, globose, 1-celled, tuberculate; parasitic on fleshy fungi; a *Verticillium-Yike* state is usually also present; imperfect states of *Hypomyces.* Two species illustrated are similar except for the verticillate conidial state.

Illustration: *S. ampullosporum*\ original, from culture; (A) verticillate conidiophore and conidia; (B) aleuriospores; (C) *S. chrysospermum*\ original, from culture. References (17, 72).

HISTOPLASMA Darling. Cultures similar to *Blastomyces* but large, thick-walled, tuberculate, spherical aleuriospores formed in culture at room temperature; growth yeastlike, at 37 °C; pathogenic in man, causing histoplasmosis.

Illustration: *H. capsulatum.* (A) hyphae and tuberculate conidia; (B) stages in the development of tuberculate aleuriospores; (C) smooth-walled conidia developed below the surface of the agar; redrawn from Howell (178). Other reference (129).

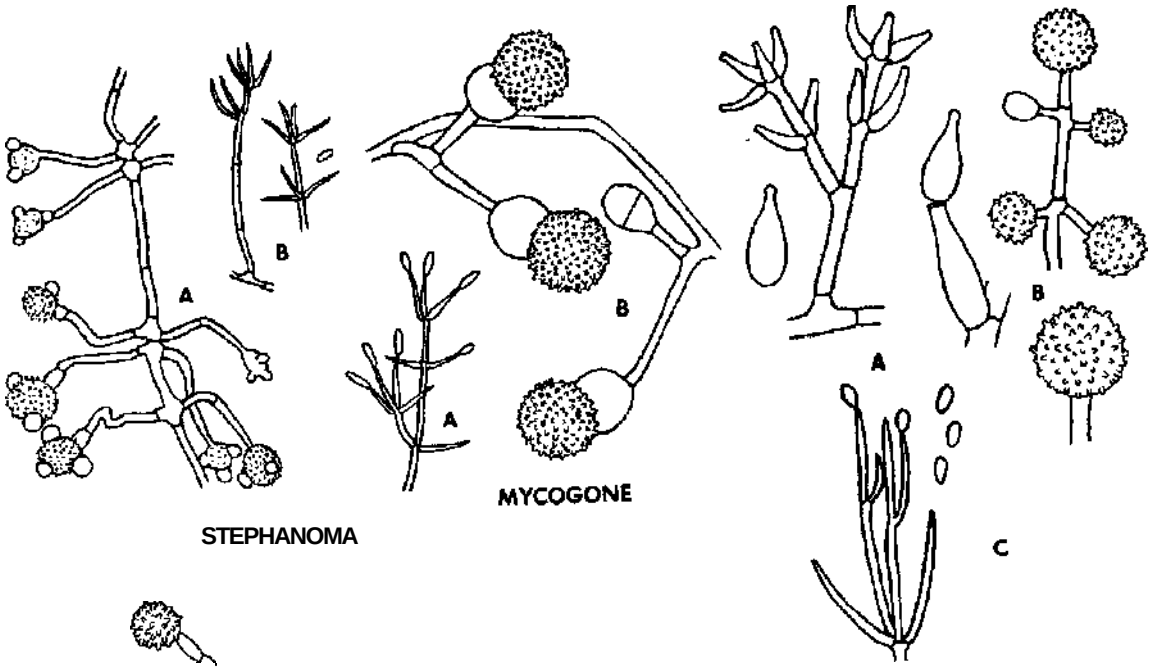
CHLAMYDOMYCES Bain. Conidiophores much like mycelium; conidia borne on slender branches; conidia (aleuriospores) 2-celled, with large tuberculate apical cell and small, smooth wedge-shaped basal cell, hyaline or slightly colored; phialospore state also produced, small, hyaline, 1-celled, borne on short phialides on swollen head; parasitic on mushrooms, probably imperfect state of *Hypomyces.* Compare with *Mycogone,*

NIGROSPORA Zimm. Conidiophores short, mostly simple; conidia (aleuriospores) shiny black, 1-celled, globose, situated on a flattened, hyaline vesicle (cell) at the end of the conidiophore; parasitic on plants or saprophytic.

Illustration: J V . *sphaerica;* original. (A, B) conidiophores and conidia; (C) tip of conidophore showing hyaline vesicle; (B, C) from culture. References (17, 180)

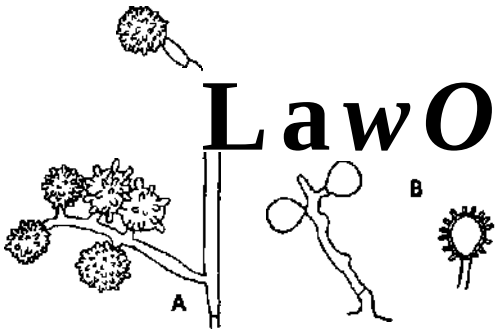
PAPULARIA Fr. Conidiophores poorly developed in culture, mostly simple, hyaline, short branches of mycelium, conidia (blastophores may appear to be aleuriospores in culture) I-celled, dark, ovoid, broadly lenticular or globose, often with a light band seen in side view; saprophytic. Compare with *Arthrinium* and see Ellis (120) for synonymy.

Illustration: *Papularia* sp.; original, from culture. References (124, 125).

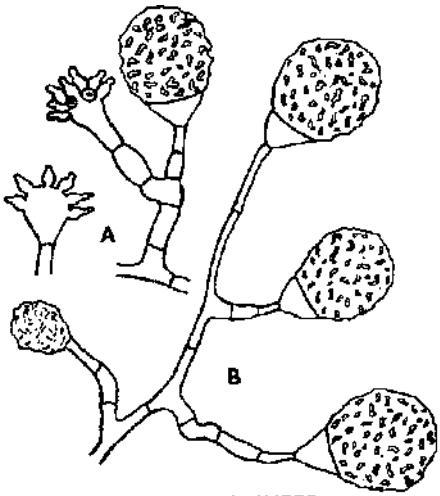


STEPHANOMA

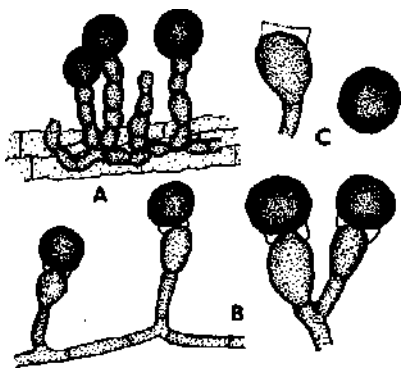
SEPEDONIUM



HISTOPLASMA



CHLAMYDOMYCES



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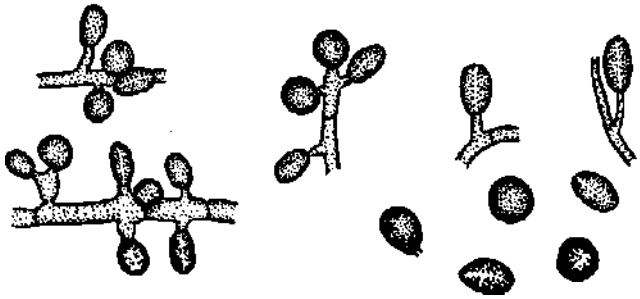


PAPULARIA

ASTEROMYCES Moreau. Hyphae hyaline to brown; conidiogenous cells sessile or with short stalk, dark, inflated as conidia are formed; conidia (aleuriospores) 1-celled, dark, clustered, borne on long denticles, obclavate to pyriform; saprophytic.

IHustration: *A. cruciatus;* redrawn from Hennebert (164). (A) mycelium with short conidiophores; (B) conidiophores and conidia. Redrawn by permission of the National Research Council of Canada from the *Canadian Journal of Botany,* 40, pp. 1203-1216 (1962).

MAMMARIA Cesati. Conidiophores erect or repent, often much like vegetative hyphae, simple or bearing very short branches, pale brown; conidia (aleuriospores) borne directly on aerial hyphae or on conidiophores, 1-celled, dark, ovoid to pointed, truncate at basal scar, with prominent longitudinal germ slit, in groups or clusters; saprophytic.

Illustration: *M. echinobotryoides;* redrawn from Hennebert (17, 166). (A) conidiophores and conidia; (B) mycelium bearing two types of conidia.

HUMICOLA Traaen. Conidiophores, simple or rarely with short branches, dark; conidia (aleuriospores) single, apical, globose or subglobose, brown, 1-celled; some species also produce simple phialides and phialospores in chains; saprophytic.

Illustration: *H.fuscoatra;* original, from culture. (A) conidiophores and conidia; (B) phialides and chains of small conidia. References (64,471).

BOTRYOTRICHUM Sacc. and March. Setae in loose tufts, simple, gray to grown; conidiophores short, irregularly branched, hyaline, bearing a loose cluster of conidia; conidia (aleuriospores) 1-celled, brown, borne singly, globose; saprophytic, frequently in soil. *B. piluliferum* also produces simple phialides and hyaline, I-celled phialospores, in chains.

Illustration; *B. piluliferm;* original, from culture. (A) conidiophores with aleuriospores; (B) philiades with phailospores; (C) seta. References (75, 95).

WARDOMYCES Brooks and Hansford. Conidiophores, hyaline, short, branched repeatedly; conidia (aleuriospores) 1-eelled, brown to black, ovoid to ellipsoid, produced singly at apices of branches; saprophytic.

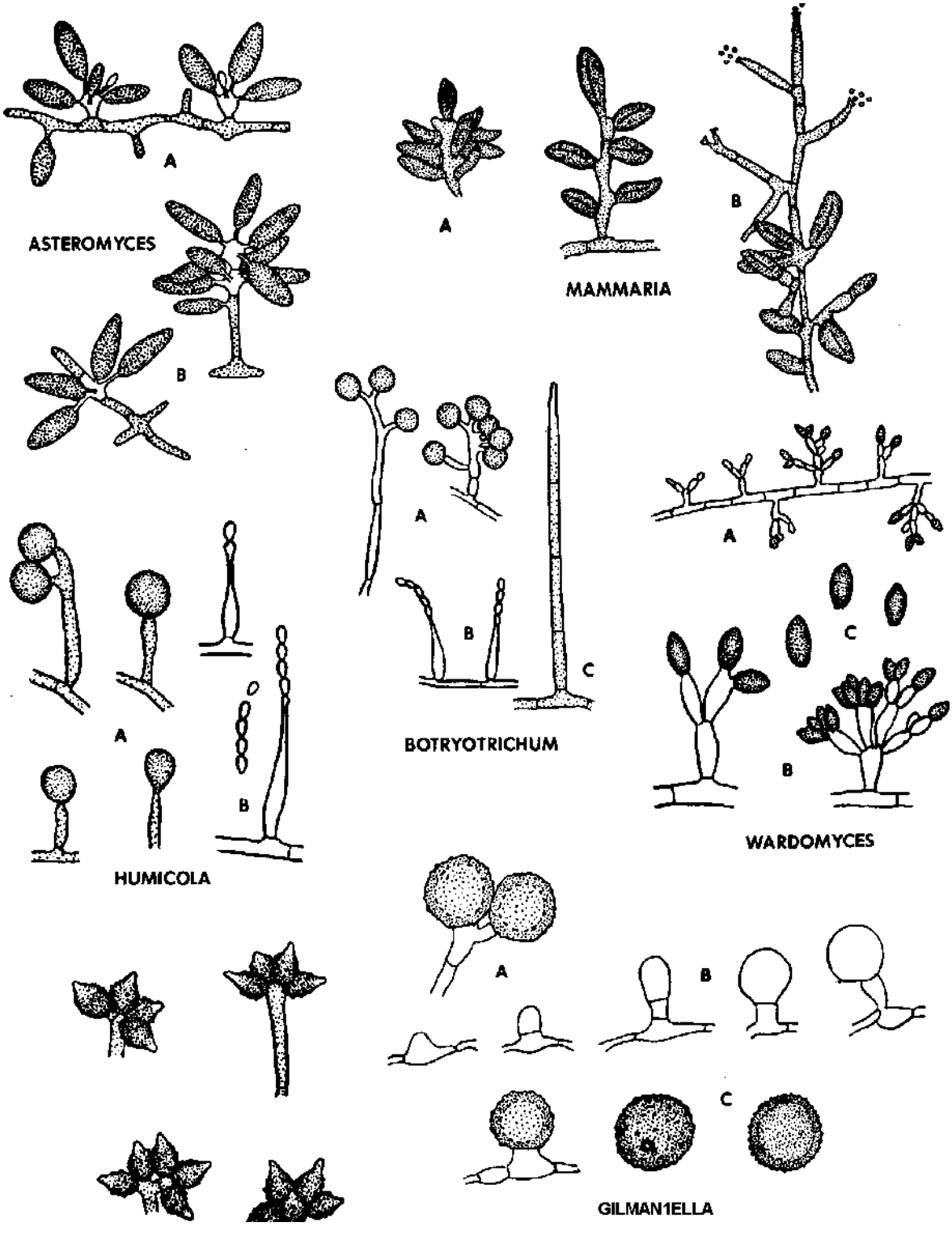
Illustration: *W. anomala;* original, from culture. (A) mycelium producing conidia; (B) conidiophores and conidia; (C) conidia. References (40, 91, 164, 166).

EC HI **NOB OTR YUM** Corda. Conidiophores consisting of short, branched, undifferentiated hyphae, or nearly absent; conidia (aleuriospores) ovoid or somewhat flask-shaped, tapering to a pointed apex, smooth or rough, formed in clusters at hyphal tips, dark, 1-celled.

Illustration: *E. atrum;* original, from culture. Reference (166).

GILMANIELLA Barron. Conidiophores hyaline, short, often stout to inflated, mostly simple; conidia (aleuriospores) apical, single, dark brown or black, 1-celled, globose, with a thick wall, wall smooth or rough, with a prominent germ pore; saprophytic on wood or soil.

Illustration: *Gilmaniella* sp. Original, from decayed wood and from culture. (A) conidiophores and conidia; (B) stages in development of conidiophore and conidium; (C) mature conidia showing germ pore. Reference (16).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ECHINOBOTRYUM

GLOMERULARIA Peck. Conidiophores borne in groups in spots on living leaves, mostly short, hyaline, simple or divided; conidia (aleuriospores) globose, somewhat unequally clustered forming few-spored heads, 1-ceiled, hyaline; parasitic on leaves.

Illustration: *G. corni;* original, from herbarium material on leaves of *Cornus canadensis.* (A) habit on leaf; (B) conidiophores and conidia.

BOTRYODERMA Papendorf and Upadhyay. Mycelium hyaline; conidiophores short, hyaline, variable, sometimes missing; conidiogenous eells subglobose or obpyriform; conidia (aleuriospores) terminal or lateral, sessile or on short sterigmata, I-cclled, broadly ellipsoid to globose, hyaline, smooth, often with prominent scar; saprophytic in soil.

Illustration: *B. lateritium;* redrawn from Papendorf and Upadhyay (321). (A) mycelium and branched conidiophores; (B) conidia.

UMBELOPSIS Amos and Barnett. Conidiophores hyaline, often septate, older conidiophores typically with a swollen apex bearing 2 to several long cylindrical branches, each with a single apical conidium; conidia (aleuriospores) I-celled, hyaline, globose; saprophytic in soil. This fungus may prove to be a *Mortierella,* but because of its similarity to the imperfects it is included here.

Illustration: *U. versiformis:* original, from culture. (A-D) stages in development of conidiophores and conidia. References (2, 17).

MONILOCHAETES Halst. Conidiophores dark, erect, slender, usually simple, septate; conidia (phialospores) hyaline or becoming pigmented in age, borne singly at the apex or produced in chains under conditions of high humidity; parasitic.

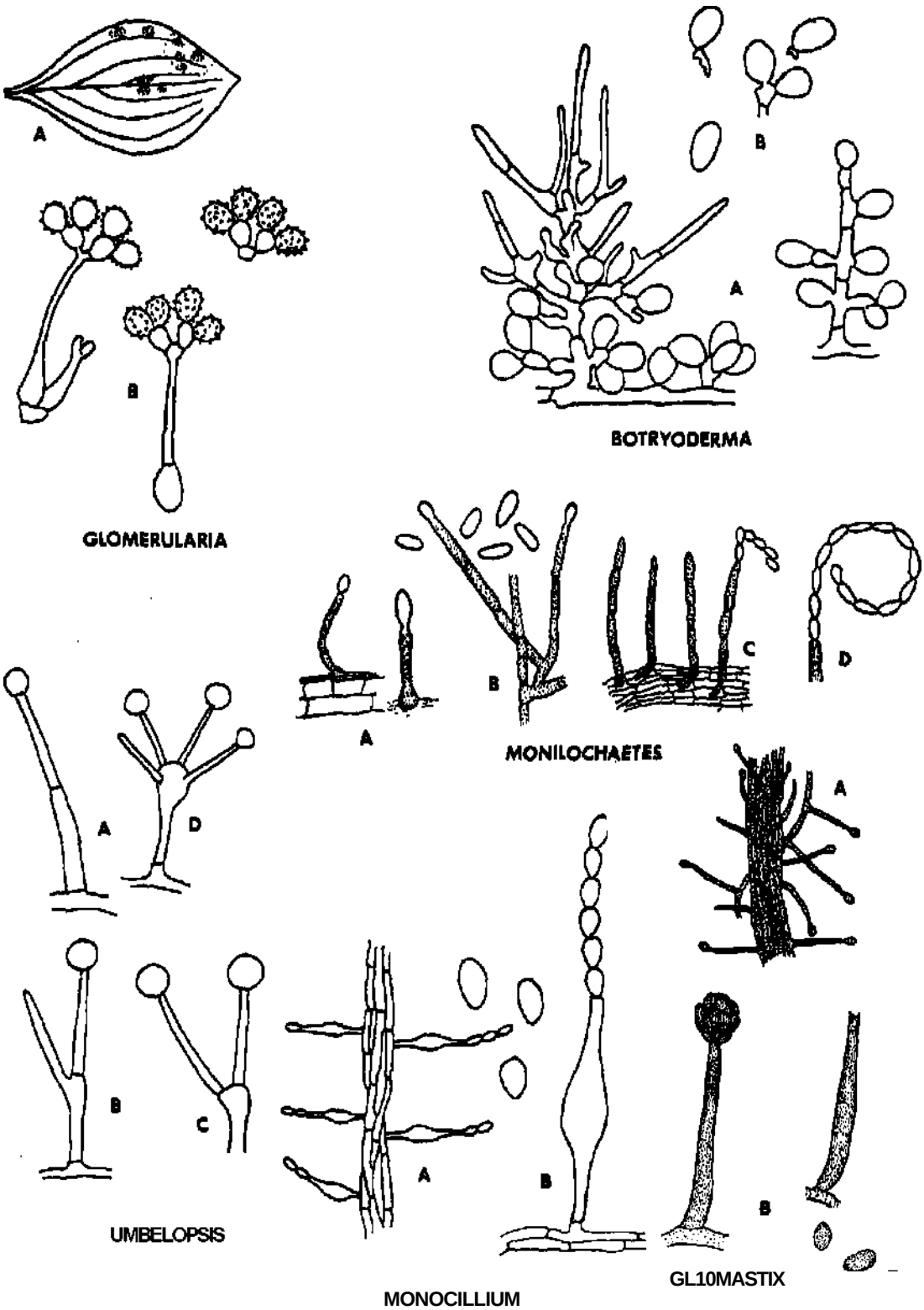
Illustration: *M. infuscans;* (A, C) conidiophores and conidia on sweet potato; (B, C) conidiophores and conidia produced in culture. (A, B) redrawn from Harter (160). (C, D) redrawn from Taubenhaus (431).

MONOCILLIUM Saksena. Conidiophores simple, septate, consisting of a pedicel and a swollen vesicle terminating in a single phialide that bears a long chain of conidia formed basipetally; conidia (phialospores) i-celled, hyaline, ovoid to ellipsoid, smooth; saprophytic, from soil.

Illustration: *M. indicum;* redrawm from Saskena (362). (A) mycelial rope bearing conidiophores; (B) conidiophore and conidia.

GLIOMASTIX Gueg. Mycelium hyaline to dark, forming aerial"ropes" in culture; conidiophores mostly reduced to simple phialides, hyaline or dark, slender, tapering toward the apex; conidia (phialospores) dark, 1-celled, globose to ovoid to ellipsoid, formed in basipetal chains without slime or aggregated in slime droplets; saprophytic.

Illustration: *G. murorum;* original, from culture. (A) mycelial rope; (B) conidiophores (phialides); (C) conidia. References (42, 92).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PHIALOPHORA Medlar. Conidiophores short or reduced to phialides, dark, simple or branched; phialides cylindrical to inflated, often with flaring collarette at apex; conidia (phialospores) subhyaline to dark, 1-celled, globose to ovoid, extruding from phialide in moist heads; parasitic or saprophytic. The genus *Margarinomyces* is often included under *Phialophora,*

Illustration: (A-C) *Phialophora* sp.; original, from culture. (A) rope of mycelium with slime heads of conidia; (B) conidophores (phialides); (C) conidia; (D, E) *Phialophora* sp. *(Margarinomyces bubaki);* original, from culture. (D) mycelium bearing phialides; (E) conidia. References (47, 312, 461, 140).

CHLORIDIUM Link. *(Bisporomyces* van Beyma). Conidiophores erect, simple, septate, dark, frequently proliferating at the apex after producing an apical head of conidia, with a distinct collarette at apex; conidia (phialospores) 1-celled, hyaline, frequently in pairs at the end of the conidiophore or held together in small heads by mucus; aleuriospores (where present) 1-celled, terminal; saprophytic, on decaying wood.

Illustration: *C. chlamydosporis;* original, from culture. (A) group of conidiophores with slime heads; (B) conidiophores with slime heads; (B) conidiophores and conidia; (C) conidia; (D) aleuriospores. References (280,281,318,452).

MENISPORA Pers. Setae (if present) straight, bent or coiled; conidiophores dark, simple, or branched; phialides slender, somewhat curved with an inconspicuous collarette; conidia (phialospores) hyaline, I-celled (sometimes septate), borne apically in slimy masses, narrowly fusiform to curved; conidia of some species have a slender hyaline appendage at each end; saprophytic.

Illustration: (A) *M. cobaltina;* original, from herbarium material on dead leaves of *Nyssa;* conidiophores and conidia; (B) *M. ciliate;* original, from culture; conidiophore and ciliate conidia. References (174, 215).

STACHYBOTRYS Corda. Conidiophores subhyaline to dark, simple, determinate bearing at apex a cluster of thick, short phialides; conidia (phialospores) dark, 1-celled, globose to ovoid, borne in moist heads at the apex of the phialides, not catenulate; saprophytic.

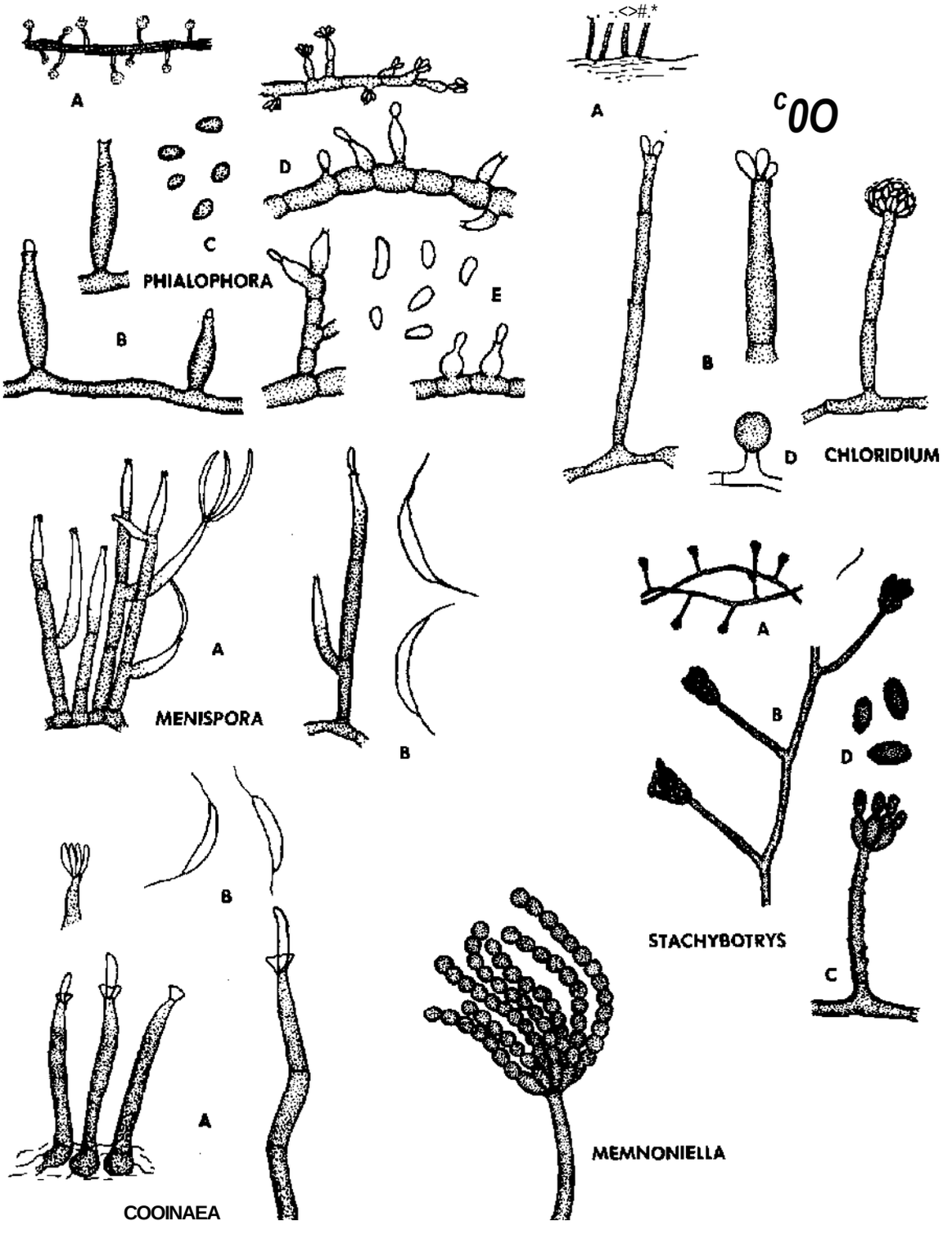
Illustration: *S. atra;* original, from culture isolated from soil. (A) habit sketch; (B, C) conidiophores and clusters of conidia; (D) conidia. References (33, 34, 480).

CODINAEA Maire (MENISPORELLA Agnihothrudu). Setae straight or slightly bent, thick-walled, dark, independent or a sterile portion of conidiophore; phialides mostly terminal, straight, sometimes proliferating, forming conspicuous collarettes that are cupulate, or funnel-shaped, flaring; conidia (phialospores) hyaline, 1-celled (sometimes to 4-celled), with a slender seta at each end; saprophytic on plant material or soil.

Illustration: *Codinaea* sp.; original, from fresh material on over-wintered acorn. (A) conidiophores showing collarette; (B) ciliate conidia. Reference (17).

MEMNONIELLA Hohn. Conidiophores dark, simple, bearing at apex a cluster of thick, short phialides; conidia (phialospores) dark, I-cellcd, globose, catenulate; saprophytic; probably closely related to *Stachybotrys.*

Illustration: *Memnoniella* sp.; drawn from photography by Zuck (480). Reference (34).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COOINAEA
MEMNONIELLA

CIRCINOTRICHUM Nees ex Persoon. Hyphae subhyaline to brown, bearing setae and phialides; setae simple, erect, verrucose, dark, brown, wider at base and tapering toward apex that is paler and circinate; phialides short, obclavate, hyaline or subhyaline, arising from superficial mycelium; conidia (phialospores) hyaline, (-celled, narrowly ellipsoid, straight or curved, aggregated into apical clusters. Saprophytic on leaves or twigs. Compare with *Gyrothrix.*

Illustration: *C. maculiforme;* redrawn from Pirozynski (330). (A) seta; (B) phialides and conidia.

CYROTHKIX (Corda) Corda. Mycelium subhyaline to brown; setae erect, repeatedly branched, straight or flexuous, pale to brown, broader and darker at the base; arising from the mycelium, obclavate, hyaline; conidia (phialospores) hyaline, 1-celled, narrowly ellipsoid, straight *or* curved, often aggregated. Compare with *Circinotrkhum.* Saprophytic on leaves and twigs.

Illustration: *G. circinata;* redrawn from Piro/ynski (330). (A) branched seta; (B) phialides and conidia.

CHALARA Corda. Mycelium typically dark; conidiophore typically has some dark pigment but may be hyaline under some cultural conditions, unicellular or basal portion septate, the apical cell (phialide) sometimes tapering upward slightly and producing conidia endogenously; conidia (phialospores) hyaline, cylindrical, somewhat variable in length, often hanging together in chains; parasitic or saprophytic.

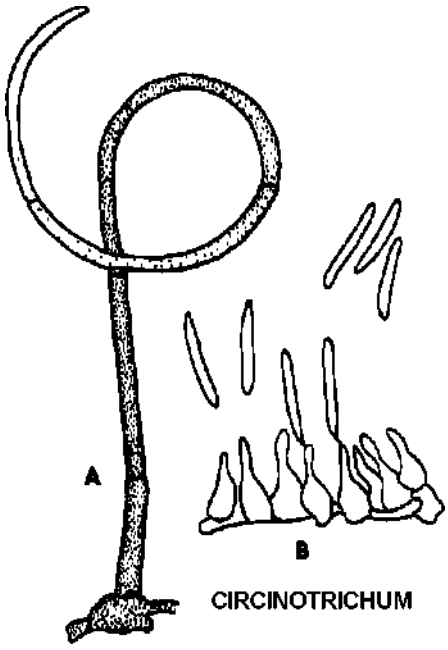
Illustration: (A) *C. quercina (Ceratocystis fagacearum);* original, from pure culture; conidiophores and conidia; (B-D) *Chaiara* sp.; original, from fresh material on rotted wood; (B) habit of conidiophores; (C) enlarged conidiophore showing deep collarette; (D) chain of conidia. References (17, 169).

CHAETOCHALARA Sutton and Pirozynski. Mycelium partly immersed in leaves, emerging through stomata, giving rise directly to brown, simple, pointed setae and to hyaline to brown phialides; phialides cylindrical with swollen rounded base; conidia (phialospores) 1- to 2-celled, hyaline, cylindrical, in chains; saprophytic on leaves.

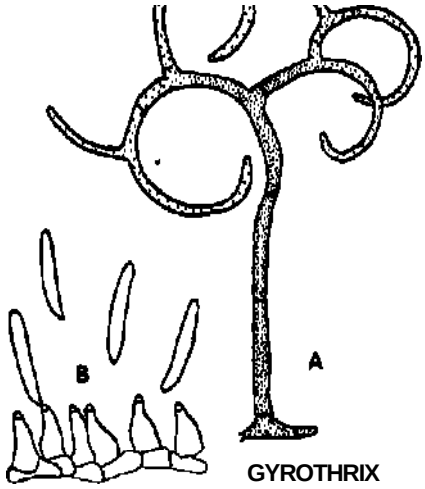
Illustration: *C. cladii;* redrawn from Sutton and Pirozynski (427). (A) phialides and seta; (B) enlarged phialide; (C) conidia.

CHALAROPSIS Peyron. Conidiophores usually pigmented or subhyaline, slender phialides slightly larger near the base and tapering upward; producing conidia endogenously; conidia (phialospores) hyaline, cylindrical, often in chains; aleuriospores present, ovoid, dark, thick-walled, single or in short chains; parasitic or saprophytic; similar to *Chaiara* except for the production of aleuriospores.

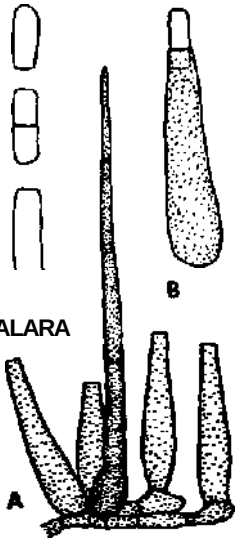
Illustration: *Chalaropsis* sp.; original from pure culture. (A) hyphae producing aleuriospores; (B) conidia and phialide.



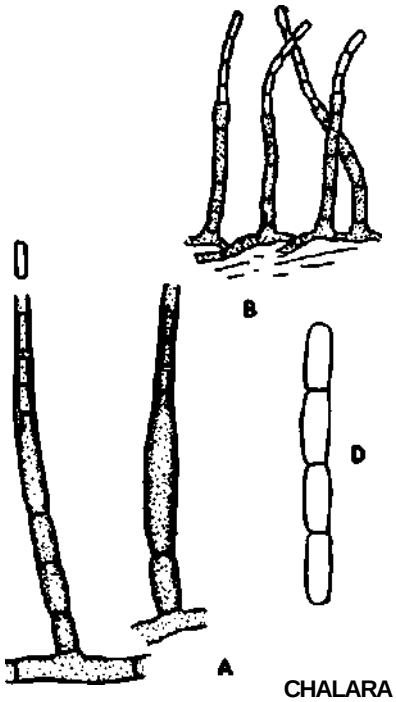
CIRCINOTRICHUM



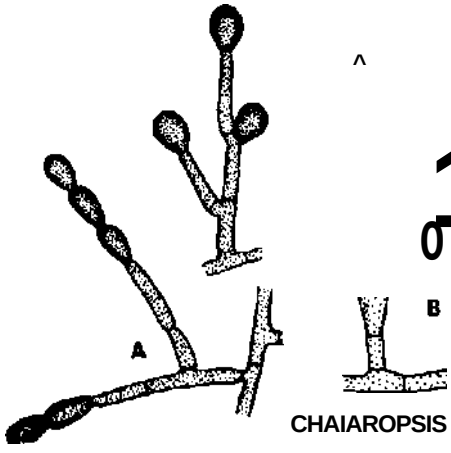
GYROTHRIX



CHAETOCHALARA



CHALARA



CHAIAROPSIS

THIELAVIOPSIS Wctn. Conidiophores, phialides and phialospores like *Chalaropsis:* also forming thick-walled aleuriospores that eventually break apart; parasitic or saprophytic; conidial states of species of *Ceratocystis.*

Illustration: *T. basicola,* original, from culture. (A) phialide and phialospores; (B) chains of aleuriospores; (C) hyphae producing both kinds of spores.

GLIOCLADIUM Corda. Conidiophores hyaline, the upper portion bearing penicillate branches, forming a compact "brush" as in *Penicillium;* conidia (phialospores) hyaline or brightly colored in mass, 1-celled, produced successively apically and collecting in mucilaginous droplets; saprophytic, common in soil. *G. roseum* also produced a *Verticillium* state. See *VertiriUium* figure D.

Illustration: *G. deliquescens;* original, from culture isolated from soil. (A) conidiophores and heads of conidia as seen in dry mount; (B) conidiophores and conidia in water. References {298, 350, 379).

^**VERTICILLIUM** Nees. Conidiophores slender, branched, at least some of the branches or phialides *f*^ verticillate, conidia (phialospores) ovoid to ellipsoid, hyaline, 1-celled, borne singly or in small moist ,^>*' clusters apically; vascular parasites causing wilts on higher plants, parasitic on other fungi, or growing , saprophytically. Also see *Verticillium* states of *Gliocladium roseum, Stilbum, Sepedonium, Mycogone, Y Stephanoma,* etc.

> jC **Illustration:** *V. albo-atrum;* original, from pure culture. (A) conidiophores growing in moist atmosphere; ' (B) conidiophore in water mount; (C) conidia; (D) *Verticillium* state of *Gliocladium roseum.* References *s\f* (44,236,237,359).

STACHYLIDIUM Link. Conidiophores dark, upright, slender, upper portion branched bearing whorls of phialides; conidia (phialospores) subhyaline to brown, 1-celled, ovoid, small, held in heads by slime; saprophytic on vegetable material.

Illustration: *Stachylidium* sp.; original from culture. (A) branched conidiophore; (B) phialides with heads of conidia. References (125, 193).

TRICHODERMA Pers. Conidiophores hyaline, much branched, not verticillate; phialides single or in groups; conidia (phialospores) hyaline, 1-celled, ovoid, borne in small terminal clusters; usually easily recognized by its rapid growth and green patches or cushions of conidia; saprophytic on soil or on wood, very common, some species reported as parasites on other fungi.

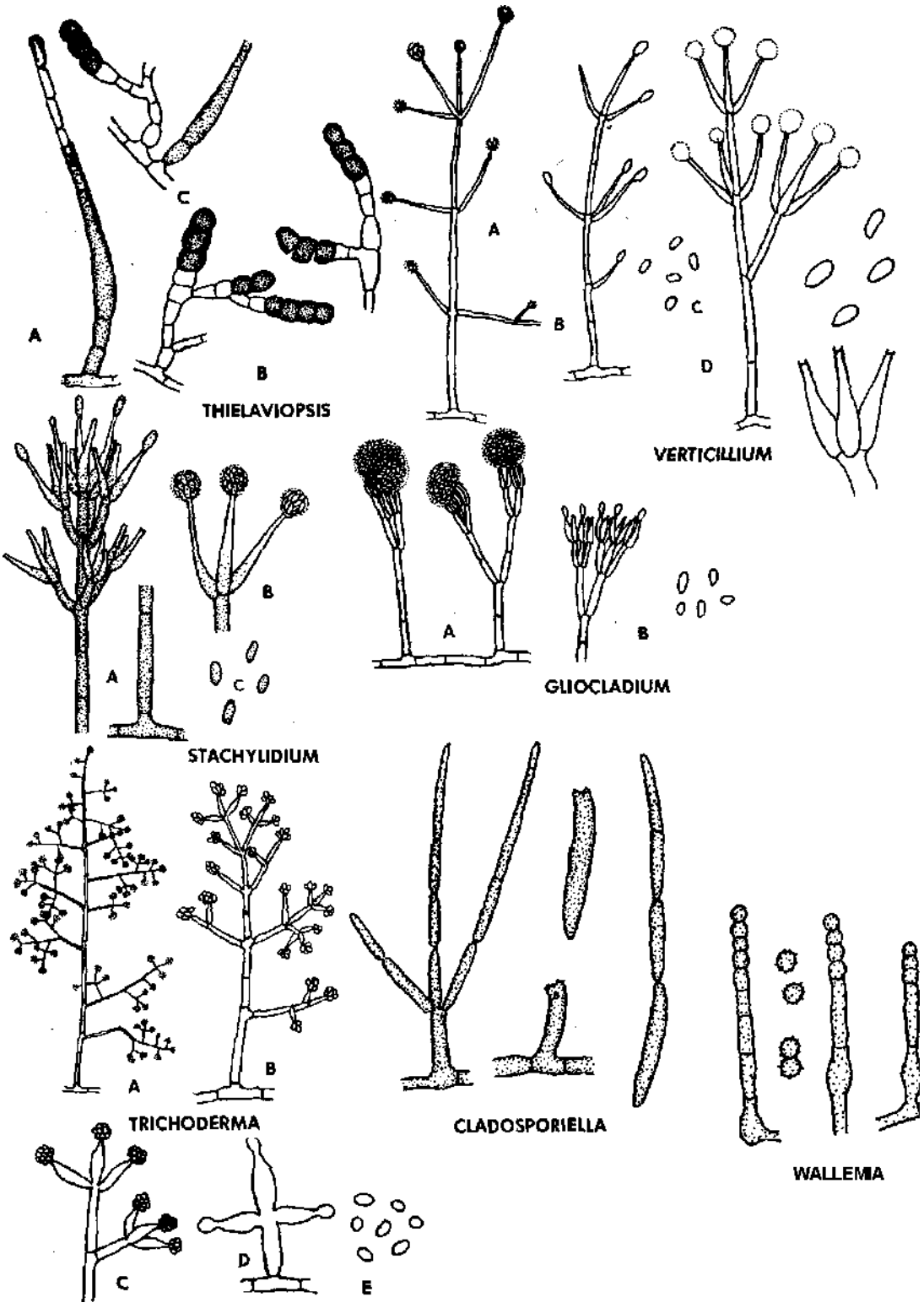
Illustration: *T. viride;* original, from pure culture. (A, B) large conidiophores showing extensive branching; (C, D) phialides showing production of conidia; (E) conidia. Reference (354).

CLADOSPOR1ELLA Deighton. Mycelium slow-growing, dark in culture, conidiophores simple, length variable, pale olive to pale brown, with distinct conidial scars; conidia (sympodulospores) catenulate, acropetal, variable, long-cylindrical to filiform, 1- to several-celled, pale olive-brown, associated with and possibly parasitic on *Cercospora,*

Illustration: *C. cercosporicola;* original from culture.

WALLEMIA .lohan-Olsen. Colonies small, slow-growing, orange-brown to dark brown; conidiophores closely clustered, simple, with phialidelike lower portion with dark collarette, sometimes proliferating percurrcntly, base often somewhat swollen; conidiogenous cell protruding, cylindrical, becoming septate and fragmenting to form arthrospores; conidia subhyaline to brown in mass, 1-celled, becoming globose.

Illustration: *W. seba;* original from culture. References (17, 276).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GLIOCLADIUM
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TRICHODERMA
CLADOSPORIELLA
WALLEMIA
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PAECILOMYCES Bainer. Conidiophores and branches more divergent than in *Penicillium;* conidia (phialospores) in dry basipetal chains, 1-celled, ovoid to fusoid, hyaline; saprophytic.

Illustration: *Paecilomyces* sp.; original, from culture. (A) conidiophores with chains of conidia; (B) conidia. References **(41,** 319).

PENICILLIUM Link. Conidiophores arising from the mycelium singly or less often in synnemata, branched near the apex, penicillate, ending in a group of phialides; conidia (phialospores) hyaline or brightly colored in mass, 1-celled, mostly globose or ovoid, in dry basipetal chains.

Illustration: *Penicillium* sp.; original, from culture. (A, B, C) types of conidiophores; (D) branches, phialides, and chains of conidia. References (349).

ASPERGILLUS Link. Conidiophores upright, simple, terminating in a globose or clavate swelling, bearing phialides at the apex or radiating from the apex or the entire surface; conidia (phialospores) 1-celled, globose, often variously colored in mass, in dry basipetal chains.

Illustration: *Aspergillus* spp.; original, from culture. (A) habit sketch; (B, C) conidiophores with conidial heads. References (349).

PHIALOM YCES Misra and Talbot. Conidiophores tall, slender, hyaline, simple or sparingly branched, a single apical whorl of phialides; conidia (phialospores) 1-celled, dark, lemon-shaped, verrucose, in dry basipetal chains; saprophytic from soil.

Illustration: *P. macrosporus;* redrawn from Misra and Talbot (288). Redrawn by permission of the National Research Council of Canada from the *Canadian Journal of Botany,* 42, pp. 1287-1290 (1964).

METARRHIZIUM Sorok. Conidiophores hyaline, branched, forming **a** sporulating layer; phialides single, in pairs, or in whorls; conidia (phialospores) produced in basipetal chains, compacted into columns, long-ovoid to cylindrical, 1-celled, hyaline or slightly pigmented, olive-green in mass; parasitic on insects, or saprophytic in soil. Compare with *Myrothecium.*

Illustration: *M. anisoplae;* original, from culture. (A) sporulating fungus on insect larva; (B, C) conidiophores; (D) conidia. References (325).

GLIOCEPHALIS Matruchot. This genus is much like *Gftocephahtrichum,* but without sterile arms.

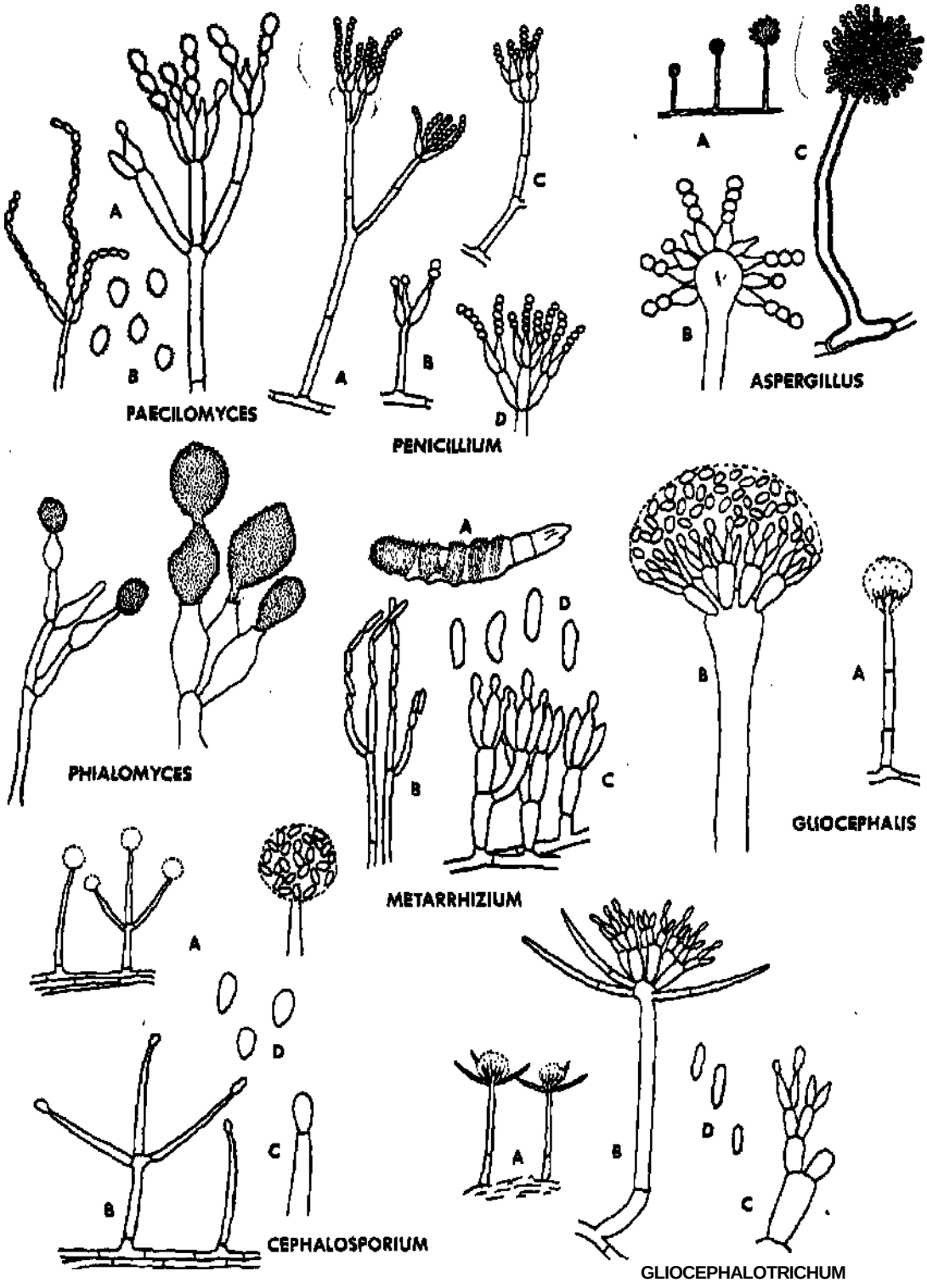
Illustration: *Gliocephalis* sp.; original, diagrammatic. (A) conidiophore and slime head; (B) phialides and conidia. Reference (128).

CEPHALOSPORIUM Corda. Conidiophore and phialides slender, mostly simple; conidia (phialospores) hyaline, 1-celled, collecting in a slime drop; saprophytic or parasitic, some species causing vascular wilts of trees. Microconidia of certain species of *Fusarium* are similar.

Illustration: *Cephalosporium* sp.; (A) conidiophores and conidia in slime heads; (B, C) phialides; (D) conidia; original from culture. References (108, 139, 329).

GLIOCEPHALOTRICHUM Ellis and Hesseltine. Conidiophores tall, simple, stout, bearing at the apex a series of primary and secondary branches that terminate in phialides; fertile area subtended by a few long sterile divergent arms; conidia (phialospores) hyaline, 1-celled, oblong-elliptical, in moist heads; saprophytic.

Illustration: *G. bulbilium;* original from culture. (A, B) conidiophores; (C) phialides; (D) conidia. References (17, **111).**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CHAETOPSINA Rambelli. Conidiophores erect, stout, thick-walled, septate, sometimes swollen at the base, tapering upward to a sterile point; branches with phialides arising about the middle or lower portion of conidiophore; phialides in more or less compact layer, inflated below and tapering upward with a long neck; conidia (phialospores) hyaline, 1-celled, oblong-cylindrical, held in a droplet of slime around the axis of the conidiophore; saprophytic.

Illustration: C. *fulva;* original, from culture. (A) habit of conidiophores and spines. (B) enlarged conidiophore showing phialides and sterile tip; (C) enlarged phialides; (D) conidia. Reference (17).

THYSANOPHORA Kendrick. Conidiophores dark brown, single or clustered, bearing one to several penicilli on a single stipe, proliferating sympodially after producing a cluster of phialides, otherwise simple and ascending; 1-celled, subhyaline to pale brown, dry, in basipetal chains, subglobose to elongate fusoid, minutely roughened; saprophytic.

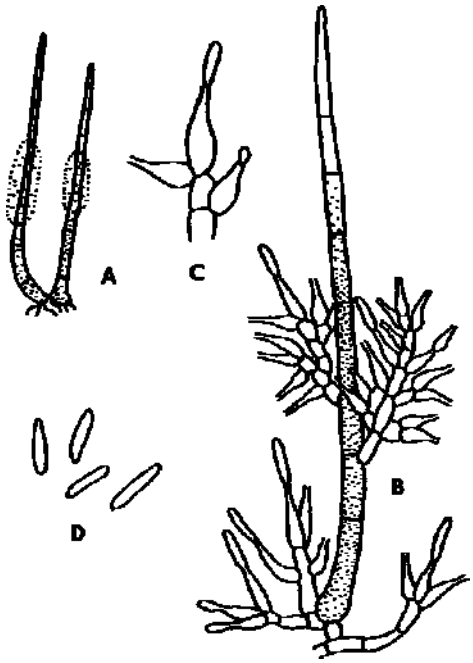
Illustration: *T. longispora* redrawn from Kendrick (248). (A) portion of conidiophore bearing phialides and chains of conidia; (B) conidia. Redrawn by permission of the National Research Council of Canada from the *Canadian Journal of Botany* 39, pp. 817-832 (1961).

CHAETOPSIS Grev. Conidiophores dark, long, main axis slender with long sterile apex, bearing numerous primary side branches and secondary branches (phialides) that elongate and form polyphialides; conidia (phialospores) hyaline or subhyaline, 2-celled, small cylindrical, sticking together in bundles by means of slime; saprophytic on wood and bark.

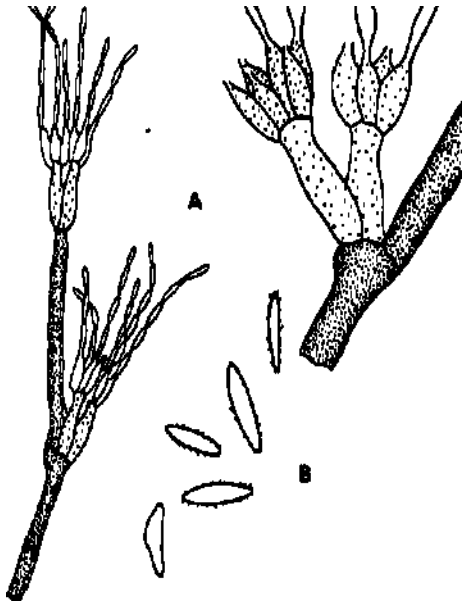
Illustration: *C. griseus;* (A) group of conidiophores; (B) conidiophore and conidia; redrawn from Hughes (93, 193).

PHIALOCEPHALA Kendrick. Conidiophores dark, mostly solitary, with a single stipe bearing an apical, complex fertile head, composed of 3 or 4 series of branches; apical phialides with conspicuous collarettes; conidia (phialospores) hyaline, 1-celled, globose to cylindrical, aggregate into a large head in slime.

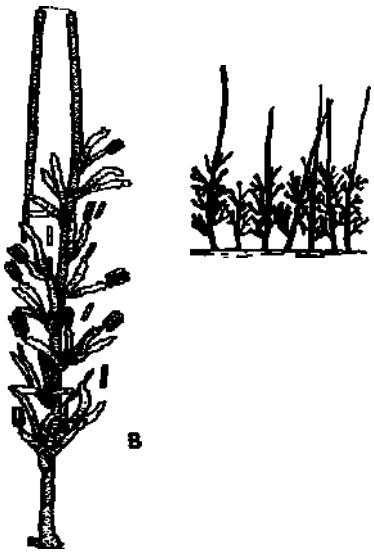
Illustration: *P. bactrospora;* original, from culture. (A) habit of conidiophores; (B) mycelium with short conidiophores; (C) portion of tall conidiophore; (D) enlarged phialides; (E) conidia. Reference (249).



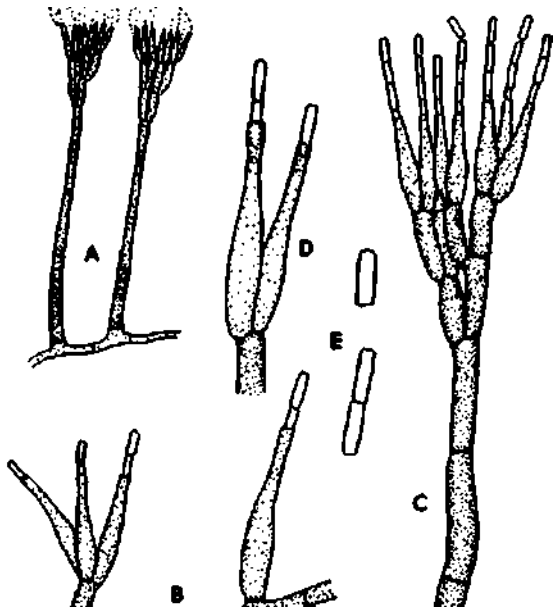
CHAETOPSINA



THYSANOPHORA



CHAETOPSIS



PHIALOCEPHALA

GONYTRICHUM Nees. Conidiophores dark, mostly tall, slender, sometimes terminating in a long, slender sterile tip; phialides borne in groups on short lateral branches along main axis of conidiophore, tapering and often curved; conidia (phialospores) hyaline or subhyaline, ovoid, collecting in small heads; saprophytic.

Illustration: *S. macrodadium;* original, from culture, isolated from soil. (A) conidiophores and conidia, on a dry mount; (B) short simple conidiophores; (C) branch of conidiophore and phialides. Reference (193).

LEPTOGRAPHIUM Lagerb and Melin. Conidiophores upright, single or in clusters, branched, the upper portion with penicillate branches; lower portion dark but variable in shade, upper branches hyaline; conidiogenous cells slender; conidia (anellospores) hyaline, ovoid, held together in rather large heads by slime; parasitic on trees or saprophytic. Probably conidial state of *Ceratocystis.*

Illustration: *Leptographium* sp.; original, from culture. (A) habit of conidiophores; (B) conidiophores bearing conidia; (C) conidiogenous cells showing annellations; (D) conidia. References (77, 148, 369).

SPOROTHRIX Hektoen and Perkins. Conidiophores mostly simple, 1-celled or septate, hyaline, bearing a loose cluster of dry conidia at apex; conidia (sympodulospores) hyaline, 1-celled, globose to ovoid, borne on short, prominent denticles; mostly saprophytic. *S. schenckii (Sporotrichum schenckii)* causes sporotrichosis in humans.

Illustration: *Sporothrix* sp.; original, from culture. (A) conidiophores showing denticles and conidia; (B) conidia. References (17,129).

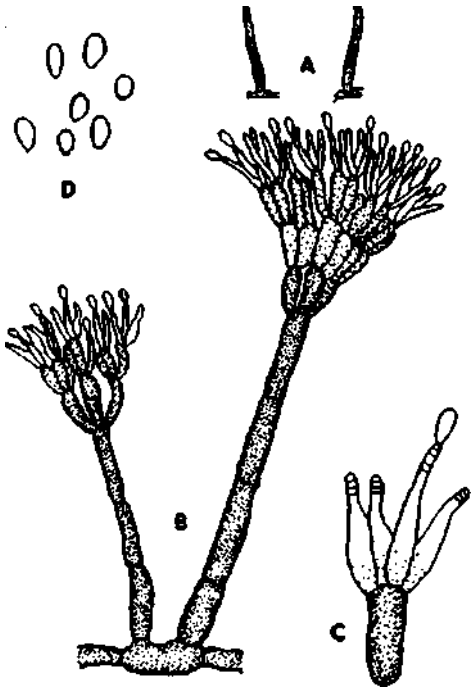
HANSFORDIA Hughes. Conidiophores hyaline or pigmented, erect to repent, branched above repeatedly and irregularly; conidiogenous cells elongated, bearing conidia near the apex on blunt denticles; new growing points arising sympodially; conidia (sympodulospores) 1-celled, hyaline, globose, ovoid or fusoid; saprophytic on leaves.

Illustration: *Hansfordia* sp.; original, from culture. (A) conidiophores bearing conidia; (B) conidia. Reference (187).

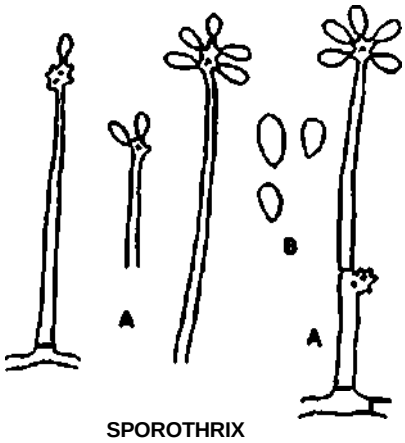
SCOPULARIOPSIS Bain. Conidiophores mostly branched or producing at the apex a cluster of conidiogenous cells that proliferate percurrently before producing succeeding conidia, leaving annellations at the tip; conidia (annelospores) hyaline or subhyaline, 1-celled, globose with a truncate base, produced in basipetal chains; colonies other than green or blue; saprophytic in soil.

Illustration: *Scopulariopsis* sp.; original, from culture. (A) portion of conidiophore bearing conidia in chains; (B) conidiogenous cells showing annellations; (C) conidia. References (303).

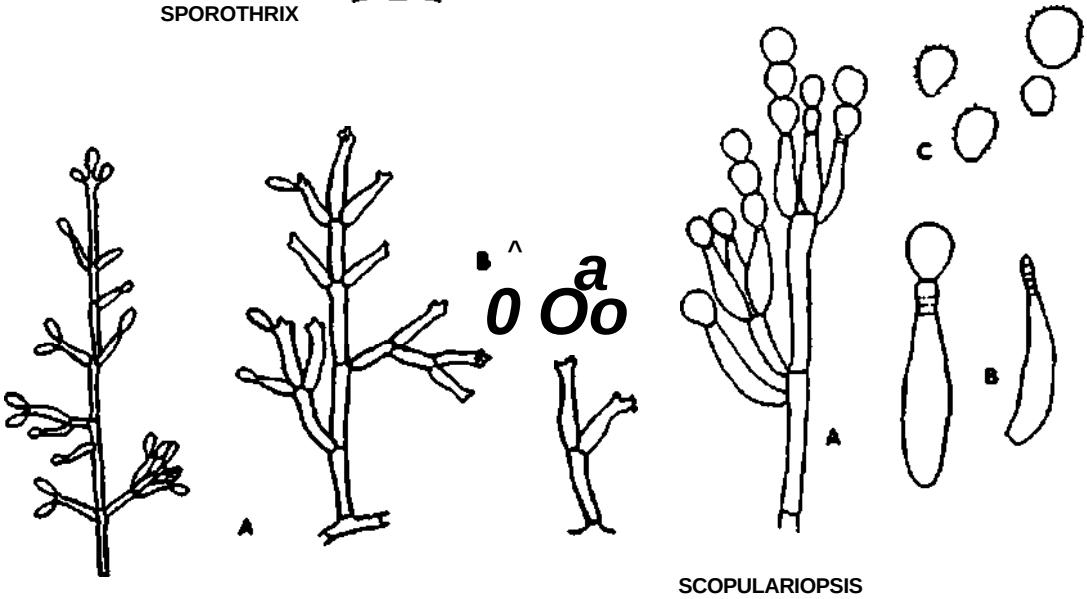
GONYTRICHUM



LEPTOGRAPHIUM



SPOROTHRIX



SCOPULARIOPSIS

HANSFORD) A

NODULOSPORIUM Preuss. Conidiophores erect or suberect, branched, hyaline to pigmented; conidiogenous cells slender or short and thick, attached irregularly or verticillatcly, bearing conidia apically, in succession on new denticles; conidia (sympodulospores) l-celled, hyaline or subhyaline to distinctly pigmented; saprophytic on wood, conidial states of Xylariaceae.

Illustration: *Nodulosporium* spp.; original, from culture. (A) conidiophores and conidia of *Hypoxylon* . sp.; (B, C) conidiophores and conidia of *Hypoxylon atropunctatum.* References (242, 357).

BEAUVERIA Vuill. Mycelium white or slightly colored with a white fluffy to powdery appearance; conidiophores single, irregularly grouped or in vcrticillatc clusters; in some species inflated at the base, tapering to a slender fertile portion that appears zigzag after several conidia are produced; conidia (sympodulospores) hyaline, rounded to ovoid, l-celled, dry, borne singly on small denticles; parasitic on insects.

Illustration: *B. bassiana;* original, from culture obtained from dead Nitidulid beetle. (A) infected beetle; (B, C, D) clusters on conidiophores; (E) single conidiophores; (F) conidia. References (21, 274).

BASIDIOBOTRYS Hohn. Conidiophores dark to subhyaline, elongate-clavate, simple, with an enlarged globose or clavate apex; conidia (sympodulospores) hyaline, fusoid, l-celled, produced on tiny denticles on short thick conidiogenous cells that cover the apex of conidiophore; caused sapwood rot of hardwood trees; conidial state of *Hypoxylon* spp. Jong and Rogers suggest that this fungus should be placed in *Xylocladium* Syd.

Illustration: *Basidiohotrys* sp. (Conidial stage of *Hypoxolon punctulatum);* original, from culture isolated from oak wood. (A-C) conidiophores and heads of conidia; (D) conidia; (E) sporogenous cells showing development of conidia. Reference (7, 242, 243).

TRITIRACHIUM Limber. Conidiophores upright, long, slender, simple or verticil lately branched, conidiogenous branches tapering to a rachislike, zigzag, fertile portion; conidia (sympodulospores) apical on new growing points, hyaline, l-celled, globose or ovoid, saprophytic. Note similarity to *Beauveria.*

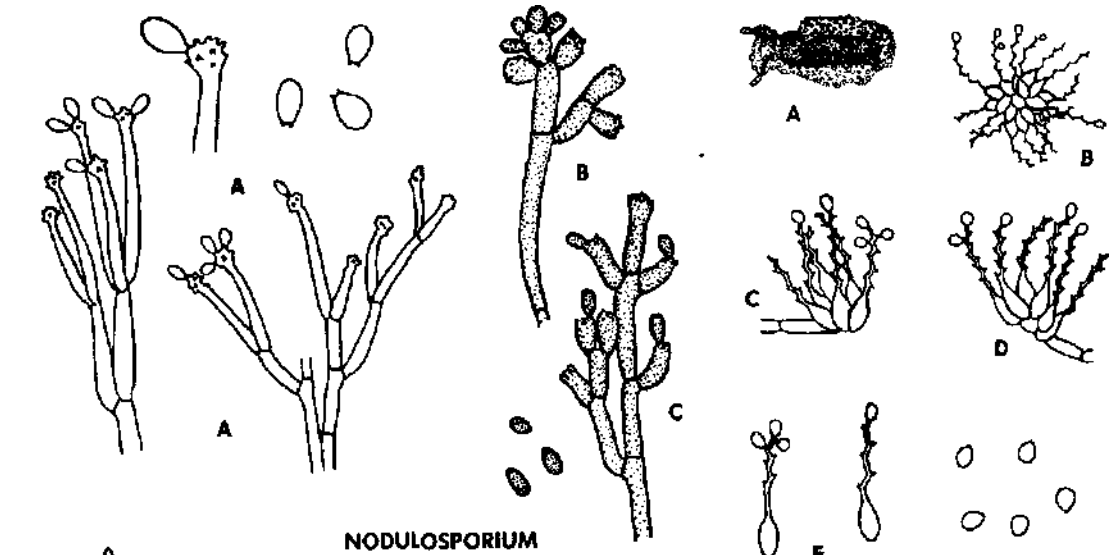
Illustration: *T. album;* original from culture. Reference (274).

VIRGARIA Nees. Conidiophores erect, simple or forked, or scantily upright-branched, septate, dark; conidia (sympodulospores) apical on sympodially formed new growing points, globose or ovoid, asymmetrical, l-celled, dark; saprophytic.

Illustration: *(A) V. nigra;* from herbarium material on bark of *Betula;* (B) *Virgaria* sp.; from culture; both original. Reference (404).

GENICULOSPORIUM Chesters and Greenhalgh. Conidiophores erect, branched, slender, branches originating from lower portion and giving a subdichotomous appearance, with main axis becoming indistinct; apical region of branches bearing conidia on new sympodial growing points, giving a geniculate appearance; conidia (sympodulospores) hyaline to subhyaline, l-celled, ovoid to obovoid with truncate base; imperfect state of *Hypoxylon.*

Illustration: *G. serpens;* redrawn from Chesters and Greenhalgh (53). (A) conidiophores; (B) conidia. Reference (243).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NODULOSPORIUM
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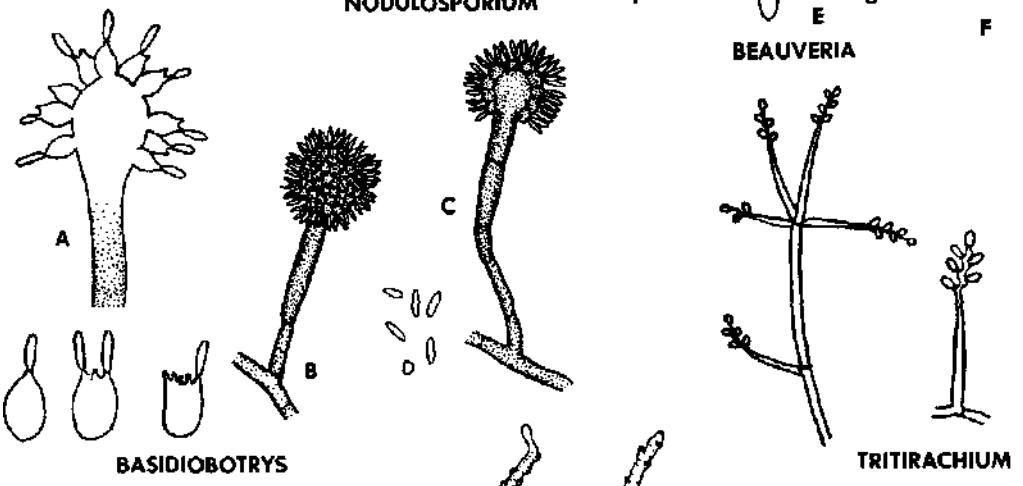
BEAUVERIA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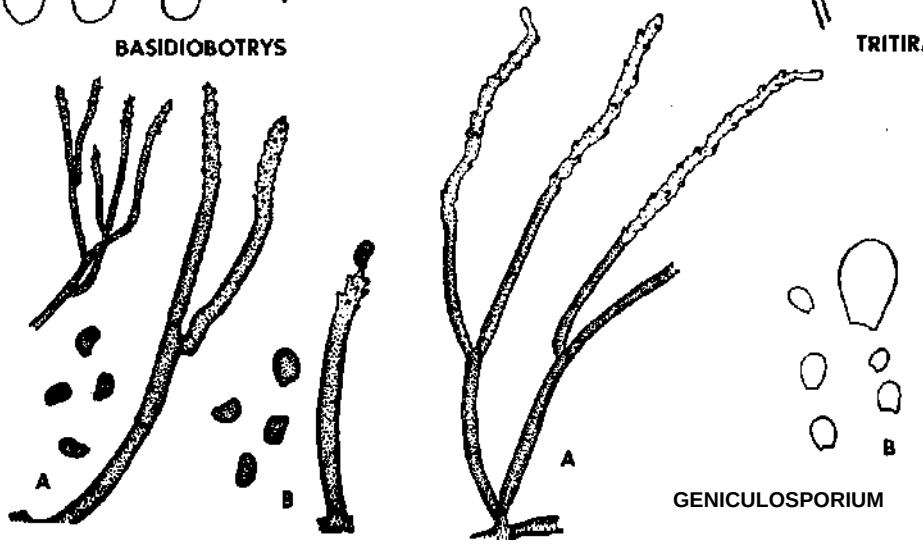
BASIDIOBOTRYS
TRITIRACHIUM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VIRGARIA
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GENICULOSPORIUM

CONOPEEA Pers. ex Mcrat. *(Streptothrix* Corda). Mycelium dark, growing loosely on decaying vegetation; conidiophores erect, tall, branched, branches spirally coiled (appearing wavy); conidia (sympodulospores) single, apical or lateral, sessile or on short peglike structures, 1-celled, dark; saprophytic.

Illustration: *Canopied* sp.; original, from herbarium material on wood. (A) branched conidiophore; (B) branches with conidia; (C) conidia.

1DRIELLA Nelson and Welhclm. Mycelium hyaline to brown; conidiophores brown, simple, nonseptate, narrowed above, with prominent scars; conidia (sympodulospores) lunate to falcate, with pointed ends, produced in clusters near the apex of the conidiophore; aleuriospores brown, several-celled; believed to be parasitic on strawberry roots.

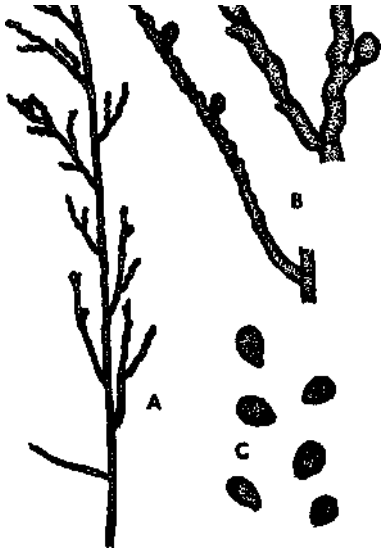
Illustration: /. *lunata;* drawn from photographs by Nelson and Wilhelm (307). (A) apex of conidiophore bearing conidia; (B) conidiophore with detached conidia; (C) chlamydospore.

CALCARISPORIUM Preuss. Conidiophores hyaline, slender, the larger ones verticillately branched, primary branches usually become slender conidiogenous cells; conidia (sympodulospores) hyaline, 1-celled, mostly oblong, borne singly on wartlike teeth on apical portions of the conidiophore branches, forming loose cluster; principally parasitic on other fungi.

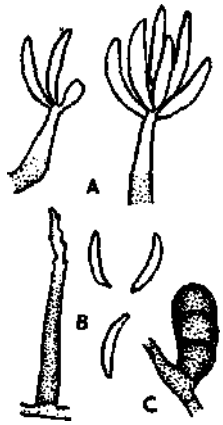
Illustration: (A-C) *C. arbwscula;* original, from culture. (A) branched conidiophore with clusters of conidia; (B) branches with apical denticles; (C) conidia. (D-F) *C. parasiticum;* original, from culture. (D) tall conidiophore; (D) conidiogenous cell with cluster of conidia; (F) conidiogenous cell showing blunt denticles. References (8, 1 8 7 , 465, 466).

SELENOSPORELLA Arnaud. Conidiophores brown, pale toward the apex, tall, branched, bearing several groups of conidiogenous cells verticillately; conidiogenous cells slender, new growing points formed sympodially; conidia (sympodulospores) hyaline or subhyaiine, on short denticles, I-celled, long-cylindrical, may be somewhat curved; saprophytic. Similar to *Calcarisporium* but with dark conidiophore. Description from Ichinoe (221).

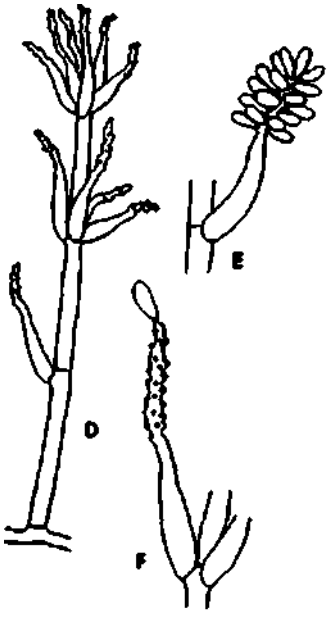
Illustration: *Selenosporella* sp.; original, from fresh materials on decayed wood. (A) conidiophore; (B) conidiogenous cell; (C) conidia.

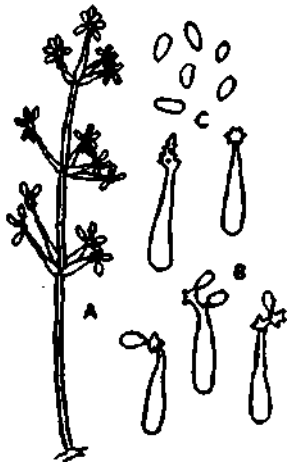


CONOPLEA

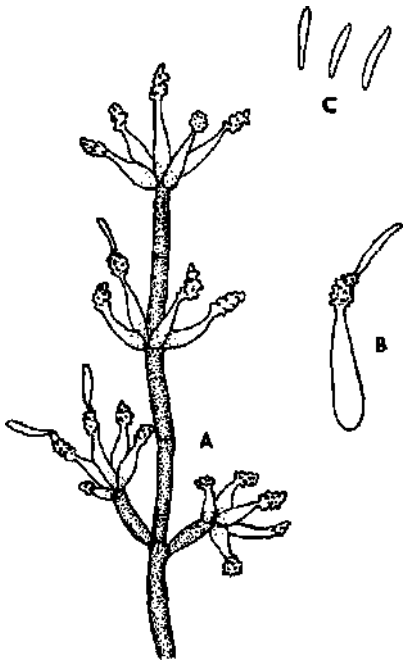


IDRIELLA





CALCARISPORIUM



SELENOSPORELLA

RHINOCLADIELLA Nannf. Conidiophores simple, or branched in some species, brown, upper spore-bearing portion becomes elongated by sympodial growth; conidia (sympodulospores) apical on new growing points, subhyaline to dark, mostly I-celled, ovoid to oblong-ellipsoid, dry; saprophytic; frequently on wood.

Illustration: *Rhinocladielta* sp.; original, from fresh material on decayed wood. (A) habit of conidiophores; (B) conidiophores enlarged; (C) conidia. Reference (17).

PERICONIELLA Sacc. Conidiophores dark, upper portion branched, producing conidiogenous cells and conidia apically and on new sympodial growing points; conidia (sympodulospores) 1-celled, dark, ovoid or oblong.

Illustration: *P. velutina;* original, from herbarium material on *Brajijum stellatifolium.* (A) conidiophores; (B) conidia. Reference (122).

VERTICICLADIUM Preuss. Conidiophores brown, single or in clusters, branched verticillately above; conidia apical on new sympodial growing points; conidia (sympodulospores) 1-celled, hyaline or subhyaline, not in slime droplets; differs from *Verticicladiella* in its dry spores.

Illustration: *V. trijidium;* redrawn from Hughes (187).

SYMPODIELLA Kendrick. Conidiophores solitary, simple, dark; conidia (sympodulospores) 1-celled, hyaline, in unbranched chains, attached apically and laterally, cylindrical, with blunt ends; saprophytic, on pine needles.

Illustration: *S. acicola;* redrawn from Kendrick (247).

OVULARIA Sacc. Conidiophores in clusters, mostly simple; conidia (sympodulospores) hyaline, 1-celled, ovoid or globose, apical on new sympodially formed growing points. See Hughes (210) for synonymy with *Ramularia* Unger.

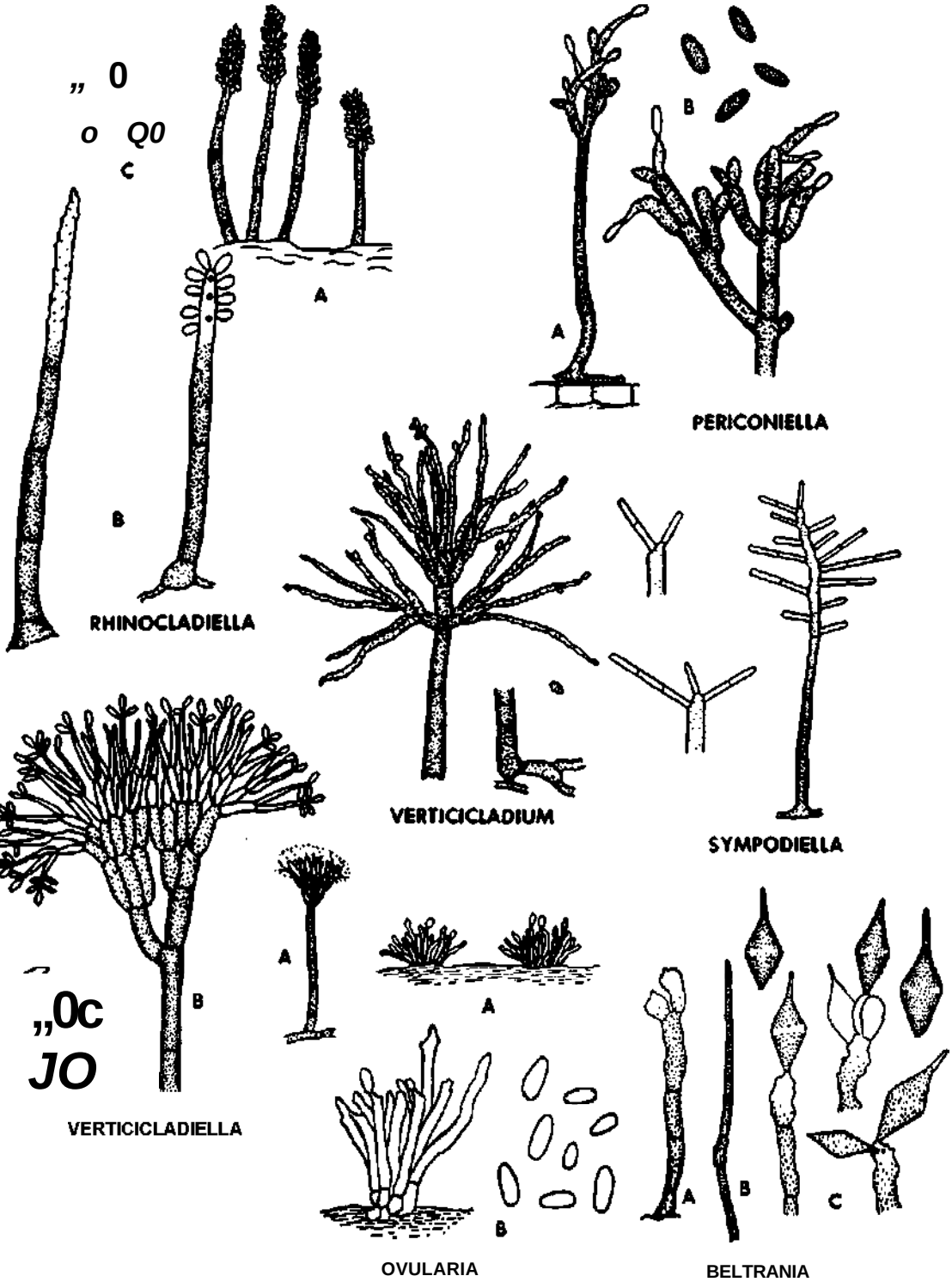
Illustration: *O. avicularis.* (A, B) conidiophores and conidia. Original, drawn from herbarium material on *Polygonum aviculare.* Reference (386).

VERTICICLADIELLA Hughes. Conidiophores upright, tall, brown, branched only near apex, penicillate; conidia (sympodulospores) hyaline, 1-celled, ovoid to clavate, often curved, apical on sympodially formed new growing points, in slime droplets; parasitic or saprophytic. Compare with *Verticicladium* and *Leptographium. V. procera* causes a root rot of white pine.

Illustration: *V. peniciliaia;* redrawn from Kendrick (250). (A) conidiophore with head of moist conidia; (B) portion of conidiophore bearing conidia; (C) conidia. Redrawn by permission of the National Research Council of Canada from the *Canadial Journal of Botany,* 40, pp. 771-779 (1962).

BELTRANIA Penzig. Setae brown, simple, pointed; conidiophores simple or less often forked, brown; conidia (sympodulospores) biconic, 1-celled, brown with a paler middle band, borne single on denticles or ovoid separating cells; saprophytic. Sec Pirozynski (331) for descriptions of related genera.

Illustration: *B. indica;* (A, C) conidiophores and conidia; (B) seta. Redrawn from Subramanian *(395).* Other reference (191).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VERTICICLADIELLA
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OVULARIA
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C
BELTRANIA

BISPORA *Corda.* Mycelium dark; conidiophores dark, short, simple or sparingly branched; conidia (blastophores) dark, oblong to ellipsoid, 2-celled or less often 3-celled, with thick, black septa; produced in acropetalous chains; saprophytic on wood.

Illustration: *B. punctata;* original. (A, E) conidiophores and conidia; (B, C) conidiophores; (D) conidia. (A-D) from fresh material on wood; (E) from culture.

AMPULLIFERINA Sutton. Superficial mycelium brown; hyphopodia lateral, brown, with a pore; conidiophores short, simple, tapering at the base; conidia (arthrospores) 2-celled, brown, cylindrical, truncate at both ends, catcnulate, formed by fragmentation; saprophytic on fallen leaves.

Illustration: *A. persimplex;* redrawn from Sutton (421). (A) mycelium with hyphopodia; (B) conidiophore with chain of conidia; (C) conidia. Redrawn by permission of the National Council of Canada from the *Canadian Journal of Botany,* 47, pp. 609-616 (1969).

CLADOSPORIUM Link. Conidiophores tall, dark, upright, branched variously near the apex, clustered or single; conidia (blastophores) dark, 1- or 2-celled, variable in shape and size, ovoid to cylindrical and irregular, some typically lemon-shaped; often in simple or branched acropetalous chains; parasitic on higher plants or saprophytic. ᵗV*ⁱ*

Illustration: (A) *C.fulvum;* original, from herbarium material on tomato leaf; (B) *C. herbarum;* original, from fresh dead plant material. References (17, 90).

PSEUDOBOTRYTIS Krzem. and Badura. Conidiophores dark, erect, slender, simple, bearing at the apex a number of slender divergent conidiogenous branches arising from the same level and bearing conidia on somewhat enlarged denticulate tips; conidia (sympodulospores) dark, 1- or 2-celled, ovoid to oblong; saprophytic.

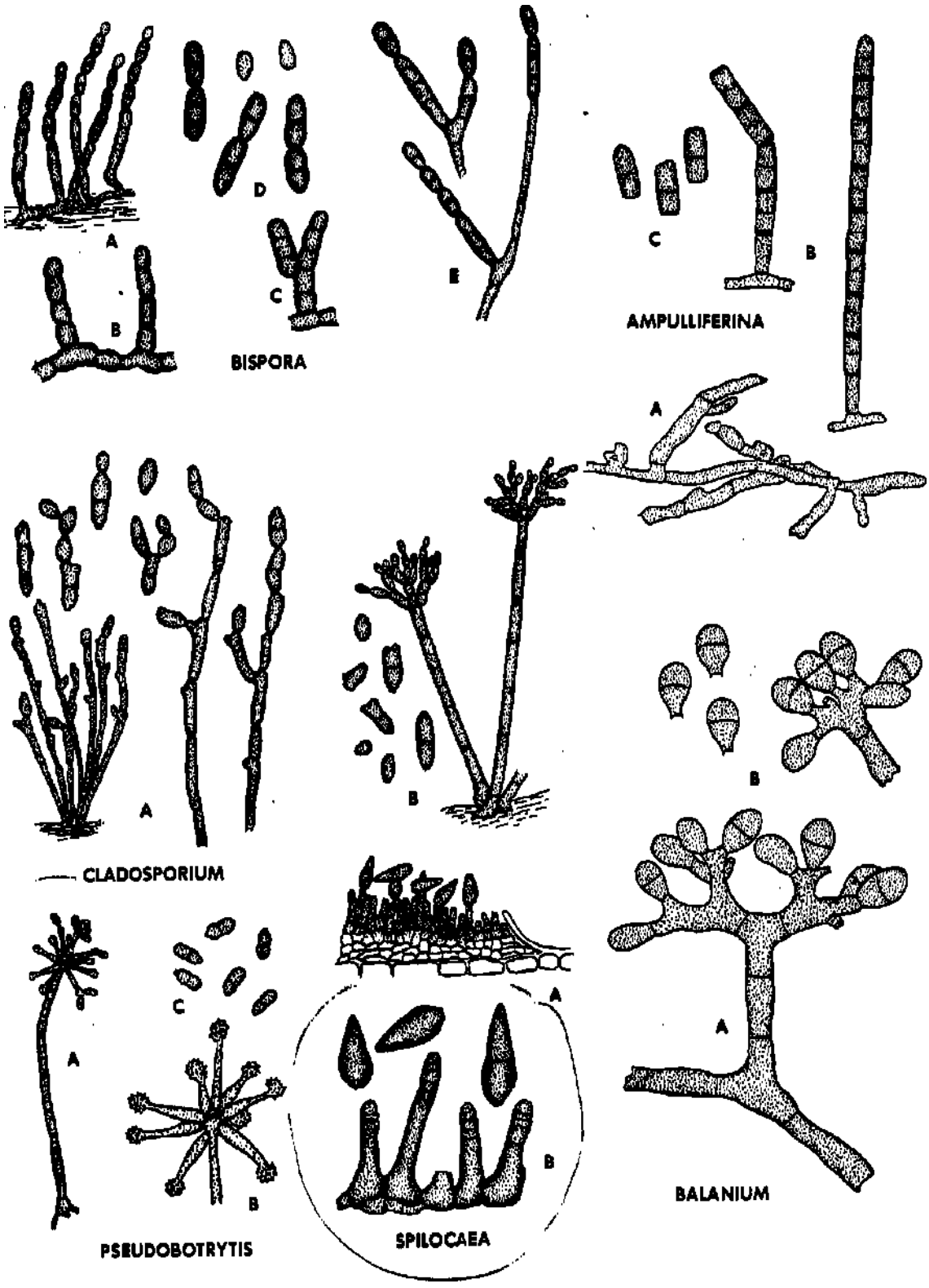
Illustration: *P. terrestris;* (A) redrawn from Subramanian (403); (B, C) redrawn from Morris (299).

^ *Pk* t S/ >-? **SPILOCAEA** Fr. Mycelium subcuticular on the host, forming a stoma that bears upright conidiophores; conidiophores dark, 1-celled, short, simple, markedly annulate near the tip due to the new conidia being pushed out through the apical conidial scars; conidia (annellospores) dark, typically 2-celled, although 1-cetled conidia may predominate, broadly ovoid to pyriform or angled and pointed, with a truncate base; parasitic on higher plants; conidial states of *Venturia.* Compare with *Fusicladium,*

Illustration: *S. pomi (Fusicladium dendriticum, Venturia inequalis);* original. (A) section *through* stroma; (B) conidiophores and conidia from fresh material on apple leaf. References (17, 205).

BALANIIJM Wallroth. Conidiophores solitary or in small groups septate, dark brown, thick, dichotomously branched, terminating in short conidiogenous cells; conidia (aleuriospores) 2-celled, thick-walled, dark brown, smooth, dry, ovoid to pyriform, saprophytic, on decaying wood.

Illustration: *B. stygium;* redrawn from Hughes and Hennebert (214). Redrawn by permission of the National Research Council of Canada from the *Canadian Journal of Botany,* 39, pp. 1505-1508 (1961).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PSEUDOBOTRYTIS
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SPILOCAEA
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BALANIUM

CLADOBOTRYUM Corda. Conidiophores erect, hyaline, often arising from aerial mycelium, branching irregularly or verticillately and repeatedly, terminating in groups of phialides that taper toward the apex; conidia (phialospores) hyaline, mostly 2-celled (sometimes more), ovoid to oblong, held together in irregular or tangled chains; imperfect state of *Hypomyces;* saprophytic or parasitic on fleshy fungi.

Illustration: *Cladobotryum* sp.; original from culture. (A) conidiophore; (B) sporogenous cells; (C) conidia. References (17, 58).

CYLINDROCLADIUM Morgan. Conidiophores upright, hyaline, regularly and repeatedly dichotomously or trichotomously branched, each terminating in two or three phialides; typically with a slender elongated sterile branch terminating in a globose or ellipsoid swelling; conidia (phialospores) hyaline, 2- or several-celled, cylindrical, borne singly but held together in bundles by mucilage; parasitic on roots or saprophytic; small, yellow-brown sclerotia produced.

Illustration: *C. scoparium;* original, from culture. (A) conidiophores; (B) conidiophore with elongated branch and terminal vesicle; (C) conidia. References (37, 39, 302).

DIPLOSPORIL'M I.ink. Conidiophores erect, well developed, septate, irregularly branched, ultimate branches (phialides) tapering upward, hyaline; conidia (phialospores) produced successively at the apex and held together in loose clusters, not catenulate, 2-celled, hyaline; saprophytic.

Illustration: *D. flavum;* redrawn from Tubaki (450). (A) conidiophores; (B) phialides; (C) conidia.

HELISCUS Sacc. Submerged, aquatic, with branched, septate mycelium; conidiophores simple or sparingly branched, bearing one or more phialides; submerged conidia (phialospores) hyaline, 2-celled, broader at the apex, usually bearing 3 short, apical protuberances; saprophytic, aquatic.

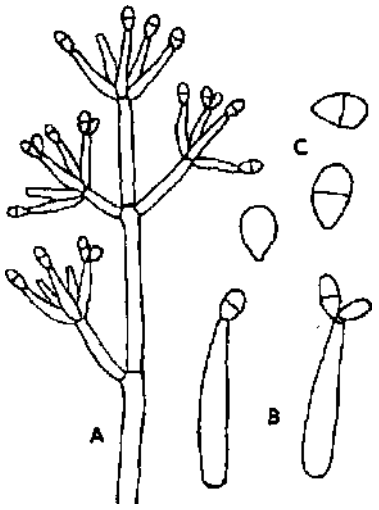
Illustration: *H. aquaticus;* redrawn from Ranzoni (346).

RHYNCHOSPORIUM Heinscn. Mycelium subcuticular at first, later developing into a superficial, loose stroma; conidiophores reduced to cells of stroma; conidia (blastospores) hyaline. 2-celled, frequently unequal, and often with a short lateral beak on the apical cell; parasitic, producing leaf spots, chiefly on grasses.

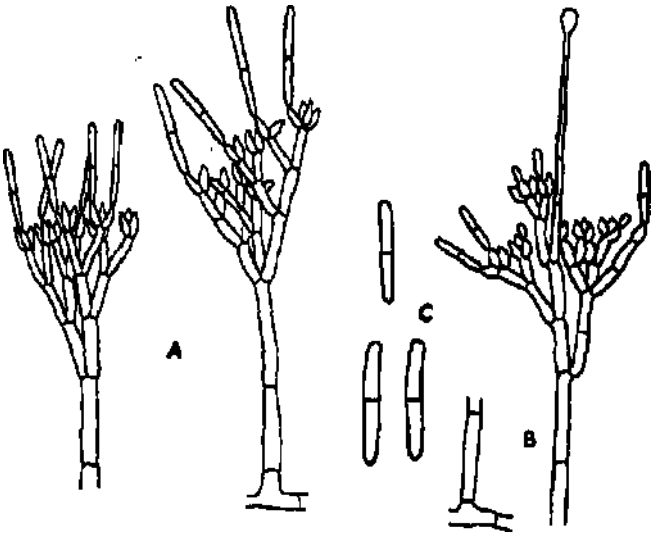
Illustration: *R. secalis;* original, from leaf spot on rye. (A) hyphae from stroma showing conidiogenous cells; (B) conidia. Reference (49).

TRICHOTHECIlfM Link. Conidiophores long, slender, simple, septate, bearing conidia apically. singly, or successively by slight growth of conidiophore apex, held together in groups or chains, not end to end; conidia (meristem arthrospores — may appear to form as blastospores) hyaline or brightly colored, 2-celled, ovoid or ellipsoid; saprophytic or weakly parasitic.

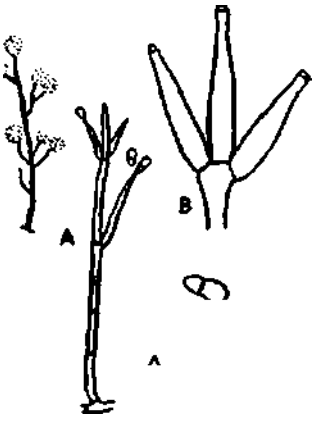
Illustration: *T. roseum;* original, from culture. (A-D) successive development of conidia. References (227, 254).



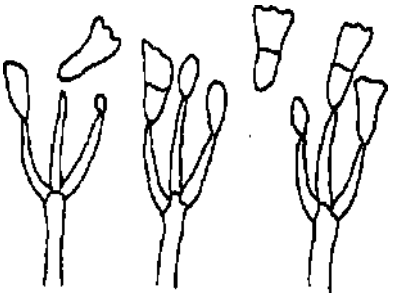
CLADOBOTRYUM



CYIINDROCLADIUM



DIPLOSPORIUM



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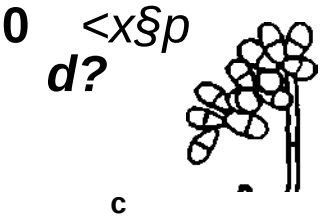
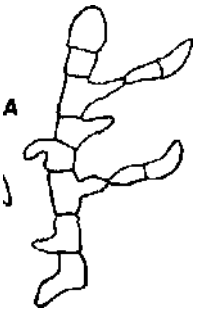


TRICHOTHECIUM



RHYNCHOSPORIUM

ARTHROBOTRYS Corda. Conidiophores long, slender, simple, septate, hyaline, slightly enlarged at the apex and spore-bearing regions. New growing points formed sympodially or irregularly, conidia (sympodulospores) hyaline, unequally 2-celled, ovate-oblong, borne on peglike denticles in loose dry clusters; saprophytic or parasitic on nematodes. Compare with *Candelabrella,*

Illustration: *A. oligospore;* original, from culture. (A) conidiophores bearing conidia and showing prominent denticles; (B) conidia. References (61,106, 159).

CANDELABRELLA Rifai and Cooke. Mycelium hyaline; conidiophores slender, erect, straight, hyaline, tall, terminated by a small candelabrumlike branching system of the conidiophore apex; conidia (sympodulospores) apical and on new sympodial or irregular branches, hyaline, unequally 2-celled, obpyriform to ellipsoid; saprophytic or destroying nematodes. Species formerly placed in *Arthroboirys.*

Illustration: *C. musiformis (Arthrobotrys musiformis);* original, from culture. (A) conidiophores bearing conidia on elongated denticles; (B) conidia. Reference (355).

DACTYLARIA Sacc. Conidiophores more or less erect, simple, short, sometimes little differentiated from mycelium, hyaline, septate, denticulate and sometimes enlarged at the apex; conidia (sympodulospores) hyaline, 2- to several-celled, cylindrical or clavate, sometimes longer and single at apex; saprophytic or parasitic on nematodes. See Bhatt and Kendrick (31) for synonymy of *Diphrhinotrichum.*

Illustration: *Dactylaria* sp.; original, from fresh material on decaying wood. (A) conidiophores; (B) conidia. References (61, [04).

DIDYMARIA Corda. Conidiophores arising from leaf surface in loose groups, simple; conidia (sympodulospores) hyaline, 2-celled, oblong, borne singly; parasitic on leaves.

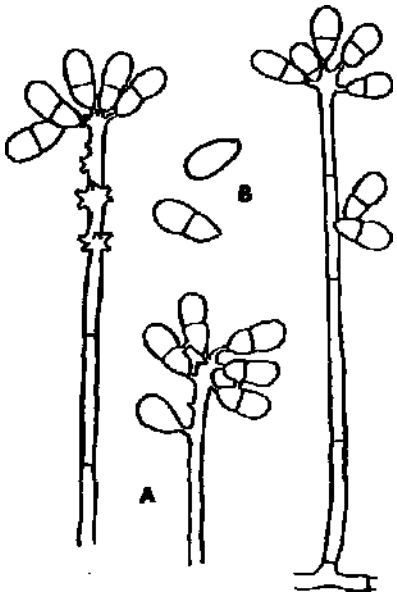
Illustration: *D, conferta;* original, from herbarium material. (A) conidiophores on surface of leaf; (B) group of conidiophores; (C) conidia.

RAMULARIA Sacc. Conidiophores growing out through stomata of host leaves, clustered, short, hyaline or subhyaline, frequently curved or bent, with prominent conidial scars; conidia (sympodulospores) hyaline, cylindrical, typically 2-celled, but many 1-celled and a few 3-celled, frequently in short chains; parasitic on plants, causing leaf spots,

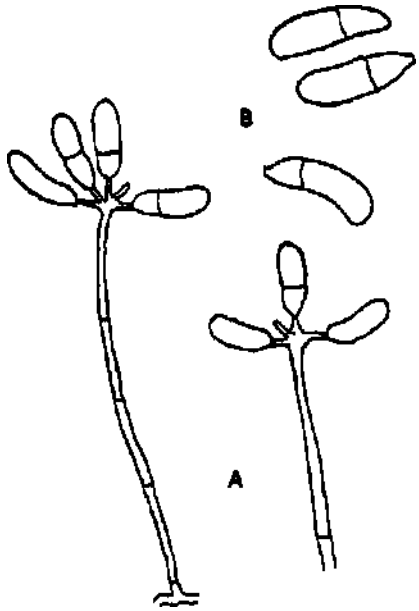
Illustration: *R. lulasnea (Mkosphaereliafragahae);* original, from herbarium material on strawberry leaf. (A) habit on leaflet; (B) conidiophores; (C) conidia.

GENICULARIA Rifai and Cooke. Conidiophores erect or ascending, hyaline, branching sympodially; conidia (sympodulospores) hyaline, unequally 2-celled, with large rounded apical cell, obovoid, formed singly on new extended sympodial branches from below previous conidium; trapping and destroying nematodes or saprophytic.

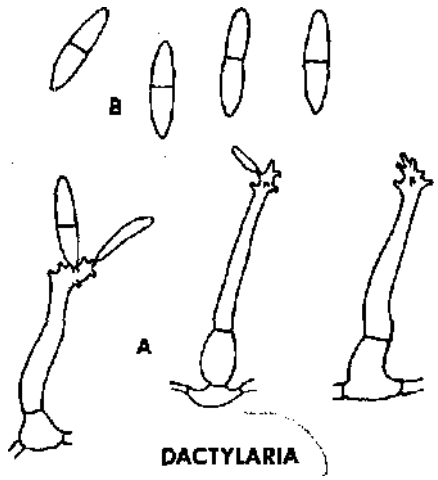
Illustration: *G. cystospora;* redrawn from Rifai and Cooke (355).



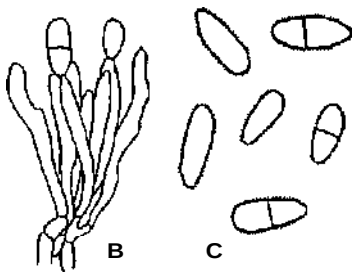
ARTHROBOTRYS



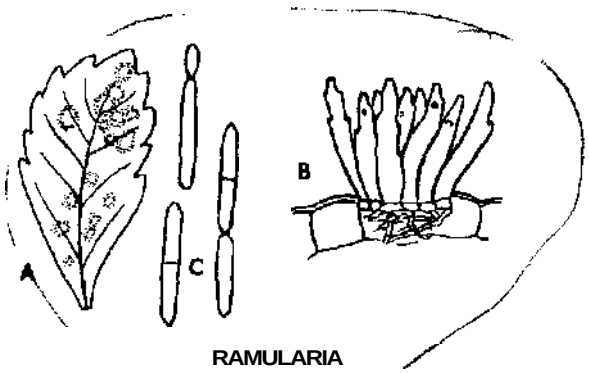
CANDELABRELLA



DACTYLARIA



DIDYMARIA



RAMULARIA

GENICULARIA

PASSALORA Fr. Mycelium internal; conidiophorcs emerging in tufts from stroma, simple or sparingly branched, dark; conidia (sympodulospores) subhyalinc to dark, 2-celled, formed terminally and at apex of sympodial new growing tips; parasitic.

Illustration: *P. bacilligera.* (A) cluster of conidiophores arising from stroma; (C) conidiophores; (CJ conidia; redrawn from Hughes (205). Reference (78).

ASPERISPORIL'M Maubl. Stroma subepidermal in the host, bursting through the epidermis, bearing short, crowded conidiophores; conidia (sympodulospores) dark, rough, 2-celled, produced at apex of sympodially formed new growing tips of conidiophorcs; parasitic.

Illustration: *A. caricae.* (A) section through stroma and cluster of conidiophores; (B) conidia; redrawn from Hughes (205).

SCOLECOTRICHUM Kunzeex Fr. Conidiophores in loose clusters, pigmented, simple, bearing conidia terminally on sympodial new growing points; conidia (sympodulospores) dark, 2-celled, ovoid or oblong, often pointed; parasitic. Similar to and may belong to *Cercosporidium.*

Illustration: *S. graminis:* original, from herbarium material **on** leaves of *Dactylis.* (A) habit of conidiophores on leaf; (B, C) clusters of conidiophores; (D) conidia.

FUSICLADIUM Bon. Mycelium as in *Spihcaea;* conidiophores dark, short, denticulate with conidial scars, young conidia produced successively at apex of sympodial new growing lips; conidia (sympodulospores) dark, ellipsoid to obpyriform, typically 2-celled, although l-cclled may predominate; parasitic on higher plants. Compare with *Spihcaea.* Some species are conidial states of *Venturia.*

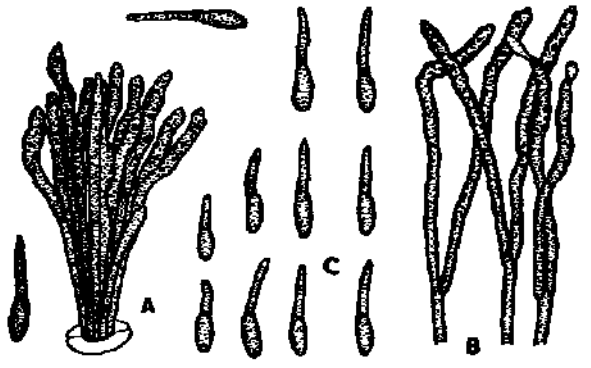
Illustration: *F. pirina* (conidial state of *Venturia pirina);* original, from herbarium material on pear leaf. (A) conidiophores bearing conidia; (B) conidia. References (78, 205).

POLYTHRINCIUM Kunze and Schum. Conidiophores in dense clusters on host leaves, dark, **simple,** with enlarged basal cell, regularly bent, giving a wavy appearance caused by successive sympodial growth at apex; conidial scars prominent, on same side of conidiophore; conidia (sympodulospores) dark, unequally 2-celled, the apical cell broader and rounded, easily deciduous; parasitic on leaves.

Illustration: *P. trijolii* (conidial state of *Cymadothea thfolia);* original, from fresh material on white clover leaf. (A) cluster of conidiophores; (B) wavy conidiophores and conidia; (C) conidia. References (17,199, 475).

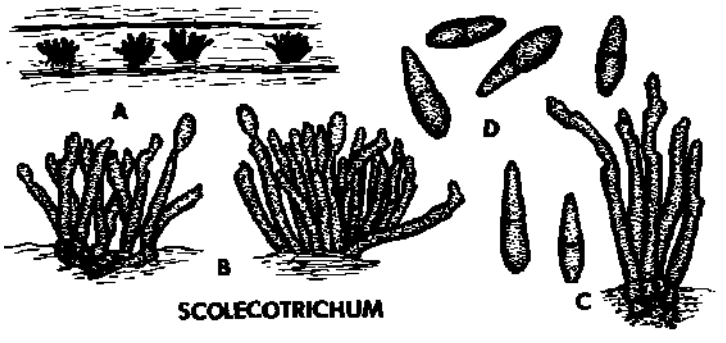
CORDANA Preuss. Mycelium dark; conidiophores dark, upright, slender, simple, bearing a small, compact head of conidia; conidia (sympodulospores) dark, 2-celled, ovoid to broadly ellipsoid; saprophytic.

Illustration: C *pauciseptata;* original, from culture. (A) conidiophore with cluster of conidia; (B) conidiophores; (C) conidia; (D) enlarged apex of conidiophore showing conidial attachment. References (17, 209).

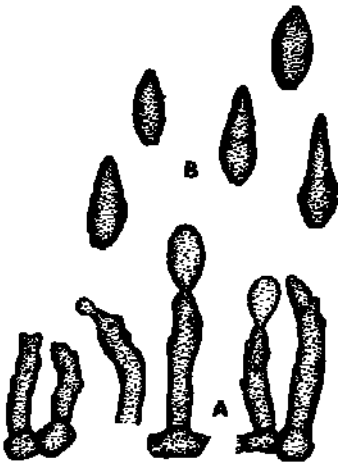


PASSALORA

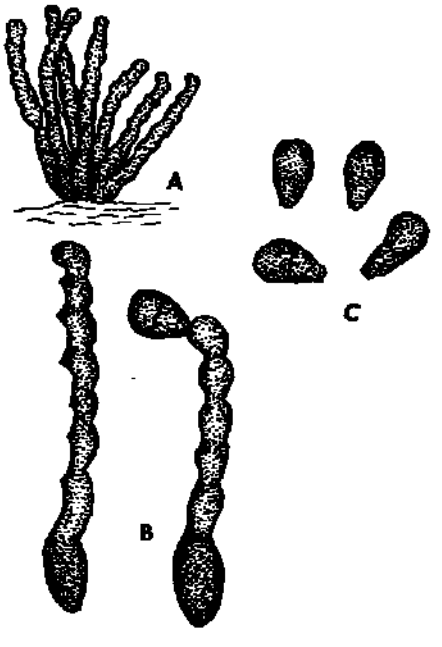
ASPERISPORIUM



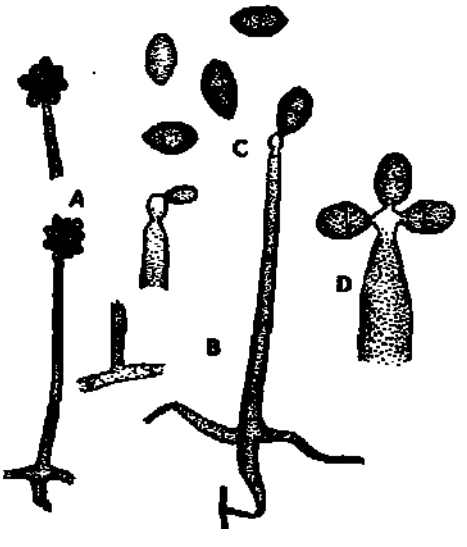
SCOLECOTRICHUM



FUSICLADIUM



POLYTHRINCIUM



CORDANA

SCOIXCOBASID1UM Abbott. Conidiophores (or conidiogenous cells) arising from aerial hyphae or ropes of hyphae, single or in groups, relatively short, sometimes 1-cellcd, irregular in shape; conidia (sympodulospores) olive-brown, I-celled or frequently 2- to 4-celled, ovoid, cylindrical or Y-shaped, produced on prominent denticles at apex of conidiogenous cells; saprophytic.

Illustration: *Scolecobasidium* sp.; original, from fresh material on decayed wood. (A) mycelium and conidiophores; (B) conidiophores with prominent denticles; (C) conidia. References (14, 17).

DIPLOCOCCIUM Grove. Mycelium partly superficial; conidiophores erect or ascending, frequently branched, brown; conidia (porospores) mostly 2-celled, short, brown, usually formed in acropetalous chains, developing through minute pores in wall or upper portion of conidiophores; differs from *Spadkoides* in branched conidiophores and catenulate conidia; saprophytic on wood or bark.

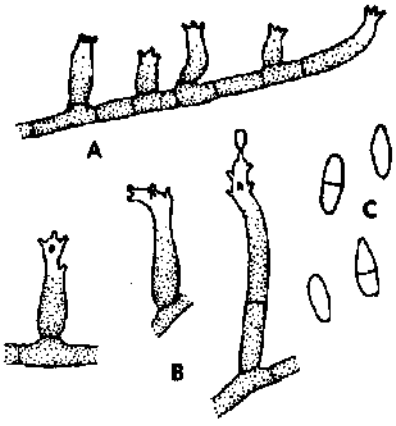
Illustration: *D. spicatum;* redrawn from Ellis (119). (A) branched conidiophore; (B) conidiophores bearing catenulate conidia; (C) conidium.

SPADICOIDES Hughes. Conidiophores mostly simple, erect, determinate, brown; conidia (porospores) develop singly through pores in apical or lateral wall or conidiophore, dark, ovoid to ellipsoid I- to 4-celled in different species; saprophytic on decayed wood. Differs from *Diplococcium* in the simple conidiophores and conidia not in chains.

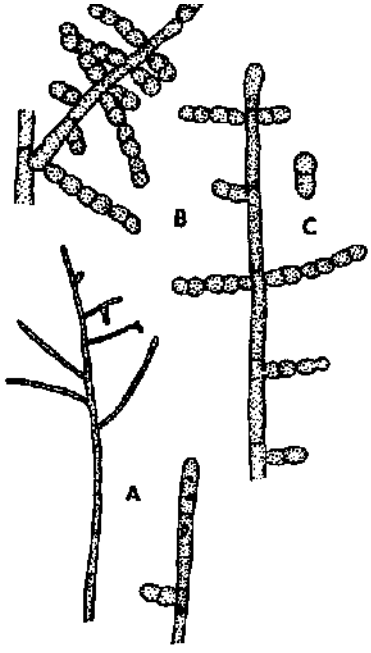
Illustration: (F-F) *S. ohovata;* (A-D) *S. bina;* original, from fresh material on decayed wood. (A) conidiophores with attached conidia; (B) portion of simple conidiophore; (C) enlarged apex of conidiophore showing conidial attachment; (D) conidia. Reference (119).

MtJROGENEl-LA Goos and Morris. Conidiophores variable in length or absent; conidia (alcuriospores) single, terminal, dark, several-celled, ovoid to elliptical; conidia are murogenous (originating as expansions of the entire conidiophore tip); saprophytic in soil.

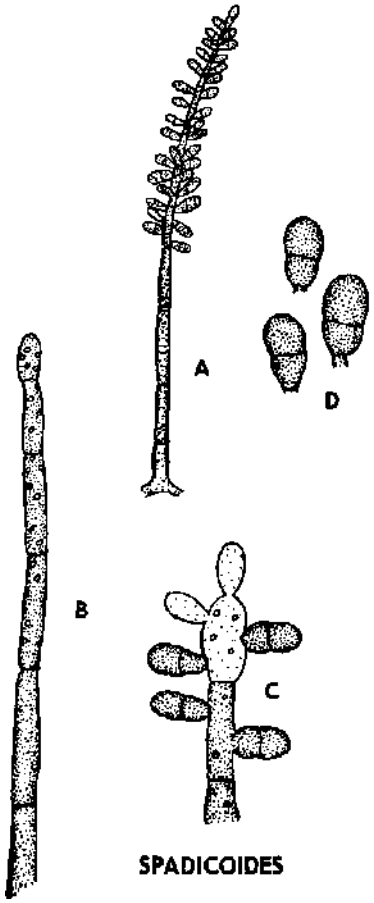
Illustration: *M. terricola;* redrawn from Goos and Morris (153). (A) sessile conidia and conidia produced on short conidiophores; (B) conidia.



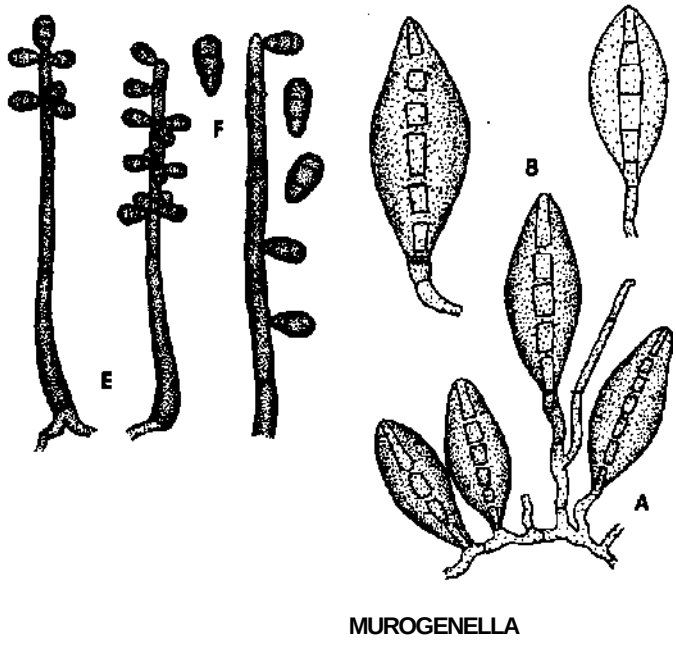
SCOLECOBASIDIUM



DIPLOCOCCIUM



SPADICOIDES



MUROGENELLA

CEPHALIOPHORA Thaxt. Conidiophore short, with enlarged, rounded apical cell, bearing simultaneously a dense cluster of conidia on all sides; conidia (botryoblastospores) lightly pigmented, usually 4- or more-celled, obovoid to elongate, narrower at the base; saprophytic on dung or decaying plant materials.

Illustration: *C. tropica;* redrawn from Thaxter (440). Reference (477).

PSEUDOTORULA Subram. Conidiophores dark, simple, torulose, with apical rounded conidiogenous cell; conidia of two types, brown, 4-celled (blastospores) in acropetalous chains, and long, slender, several-celled scolecospores.

Illustration: *P. heterospora;* redrawn from Subramanian (407). (A) conidiophore and phragmospores; (B) both types of conidia; (C) scolecospore.

DWAYABEEJA Subram. Much like *Pseudoforula* but differing in that conidia (blastospores) are not in chains.

Illustration: *D. sundara;* redrawn from Subramanian (407). (A) conidiophore; (B) phragmospores; (C) scolecospores.

MICROSPORUM Gruby. Conidiophores slender, simple, determinate, bearing apically a single, large macroconidium; macroconidia (aleuriospores) fusoid. several-eel led, hyaline; microconidia also formed on sides of hyphae; causing dermatomycoses of animals and man.

Illustration: *M. gypseum;* original, from culture. (A) conidiophores and conidia; (B) development and separation of conidium. References (59, 129).

TRICHOPHYTON Malmsten. Microconidia hyaline, small, l-celled, on sides of hyphae; macroconidia (aleuriospores) large, several-celled, thin-walled, hyaline, clavate with rounded apex; causing dermatomycoses in man.

Illustration: *T. violaceum.* (A) microconidia; (B) macroconidia; redrawn from Georg (143). References (129,142, 143, 144).

FUSOMA Corda. Conidiophores short, simple, determinate; conidia (aleuriospores) hyaline, several-celled, fusoid to cylindrical; parasitic on higher plants.

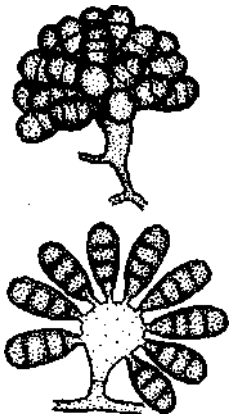
Illustration: *F. rubricosa;* original, from herbarium material of leaves of *Catamagrostis scabra.* (A, B) conidiophores and conidia.

CAMPOSPORIUM Harkn. Conidiophores straight or bent, brown; conidia (aleuriospores) apical, single, cylindrical with rounded ends, pale brown, several-celled, apical cell frequently with I to 3 hyaline, filiform appendages.

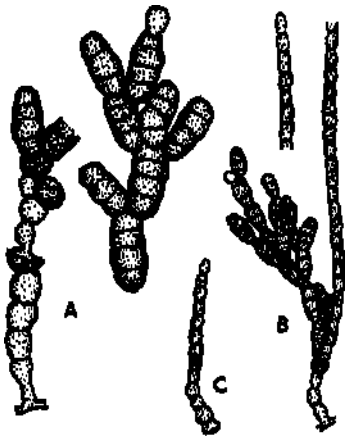
Illustration: *C. antennatum;* redrawn from Tubaki (450). (A-C) conidiophores and conidia. References (450, 194, 347).

SEPTONEMA Corda. Conidiophores dark, branched; conidia (blastospores) subhyaline to dark brown, typically 3- to several-celled; cylindrical to fusoid, catenulate in acropetal simple chains; saprophytic or parasitic.

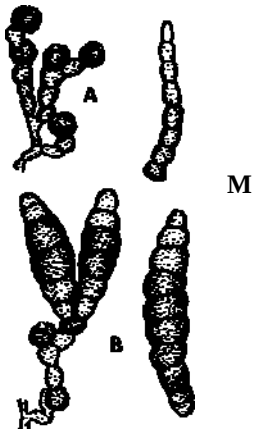
Illustration: *S. secedens;* redrawn from Hughes (196). (A, B) conidiophores with catenulate conidia. References {175, 202).



CEPHALIOPHORA



PSEUDOTORULA



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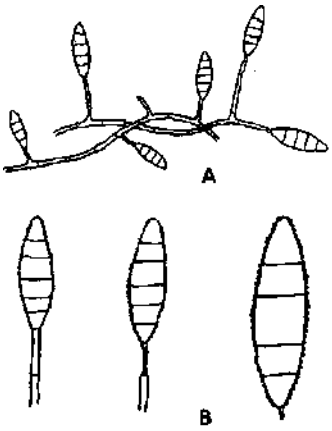
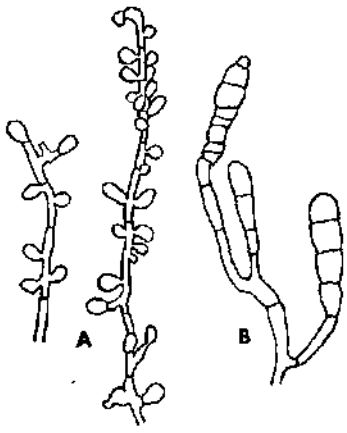
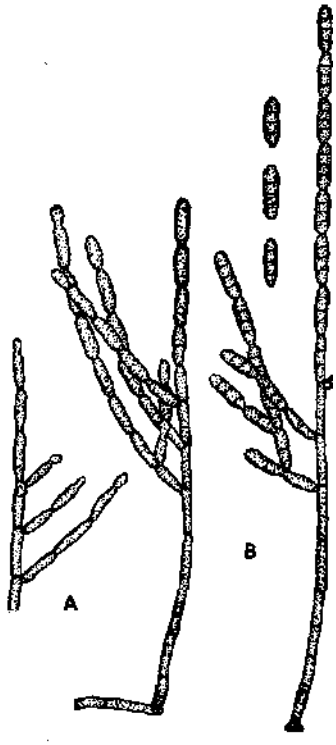
DWAYABEEJA



MICROSPORUM



TRICHOPHYTON



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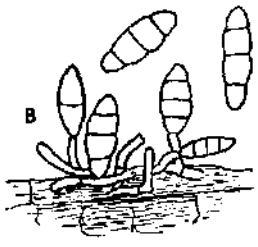

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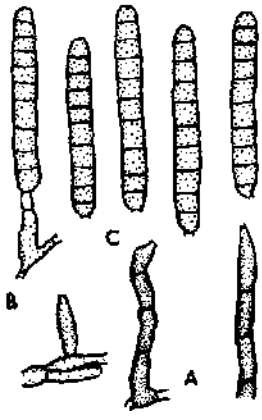


CAMPOSPORIUM

CERATOPHORUM Sacc. Conidiophores dark, short, simple, determinate; conidia (aleuriospores or blastosporcs) dark, 3- to several-celled, single, fusoid to cylindrical, apical cell hyaline, often curved or hooked; saprophytic.

Illustration: *C. uncinalum;* original, drawn from herbarium material on *Hicora* leaves. (A, B) conidiophores and conidia. References (17, 184).

CLASTEROSPORIUM Schw. Mycelium superficial, bearing hyphopodia; conidiophores dark, short, determinate; conidia (aleuriospores) dark, 3- to several-celled, ovoid to long cylindrical, somewhat narrower at the ends; parasitic on higher plants.

Illustration: *C. caricinum;* original, from herbarium material on leave of *Carex.* (A, B) conidiophores, hyphopodia and conidia. References **(113, 114).**

MONACROSPORIUM Subr. Conidiophores tall, usually simple, hyaline, slender, determinate; conidia (aleuriospores) single, apical, hyaline, several-celled, usually fusoid with one cell (near middle) larger; compare with *Dacty/ella;* saprophytic in soil or wood or parasitic on nematodes.

Illustration: *Monacrosporium* sp.; original, from culture. (A) conidiophore and conidium; (B-D) stages of development of a conidium; (E) conidium. Reference (60).

PHRACiMOCEPHALA Mason and Hughes. Conidiophores pigmented, simple, single, fascicled or in synnemata; conidia (aleuriospores) dark, more than 3-celled, ovoid to pyriform, cells unequally colored; saprophytic on dead plant material. Compare with *Endophragmia.*

Illustration: *P. cookei;* redrawn from Mason and Hughes (283). (A) clustered conidiophores with attached conidia; (B) conidia.

ENDOPHRAGMIA Duvernoy and Maire. Conidiophores simple, brown, mostly single, often proliferating pcrcurrently; conidia (aleuriospores) 2- to several-celled, brown to black, single, apical; saprophytic.

Illustration: *E. mirabilis;* original, from decayed wood. (A) conidiophore bearing apical conidia; (B) apex of conidiophores showing annellations; (C) conidia; (D) *E. taxi.* References (4, 114, 117).

ANNEEEOPHORA Hughes. Conidiophores brown, simple, slender, elongating by successive proliferations through the conidial scars; conidia (anncllospores) brown, mostly 3- to several-celled, obclavate to fusoid; mycelium superficial on leaves.

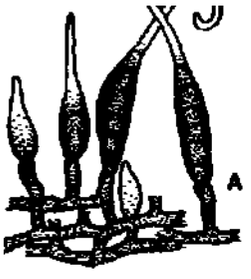
Illustration: *A. solani;* redrawn from Hughes (192). (A) conidiophores showing annellations; (B) conidia. Reference (117).

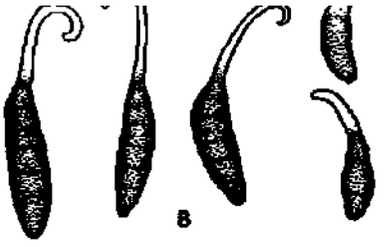
DEIGHTONIEEEA Hughes. Conidiophores arising from within epidermal cells, short, upper portion distinctly annellated; conidia (anncllospores) dark, 3-celled; parasitic.

Illustration: *D. anmdinacea.* (A) conidiophores arsing from epidermis of host; (B) conidia; redrawn from Hughes (205). Reference (17).

TRICHOCEADIUM Har/. Conidiophores short or absent; conidia (aleuriospores) dark, mostly 2- to several-celled, ovoid to ellipsoid to clavate; saprophytic on wood.

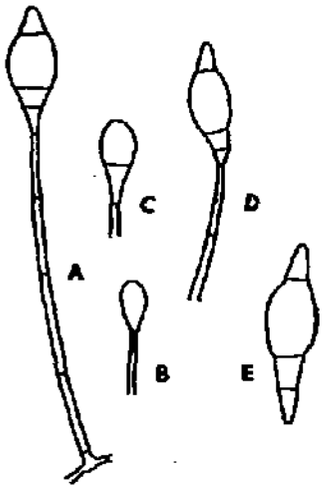
Illustration: *T. catuulense;* original. (A) sessile conidia; (B) conidiophores and conidia. References (158,200,211).



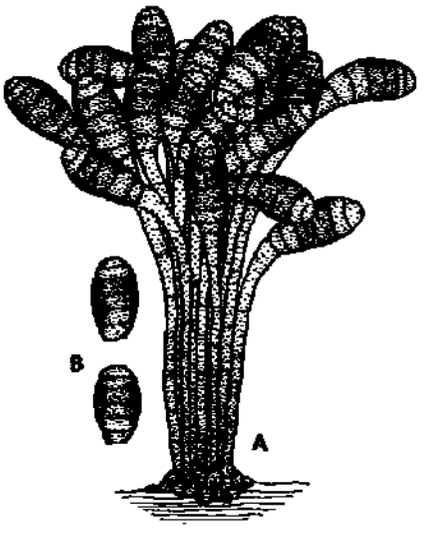


CERATOPHORUM

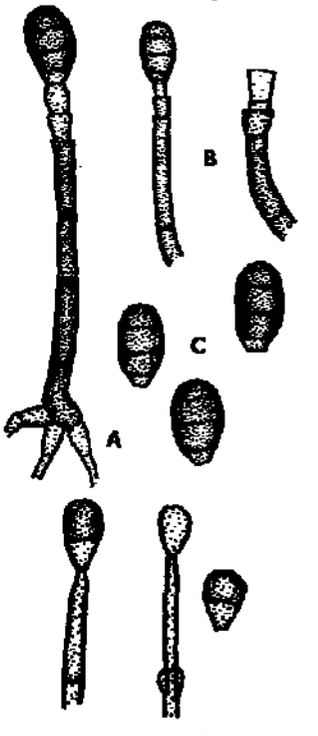
CLASTEROSPORIUM



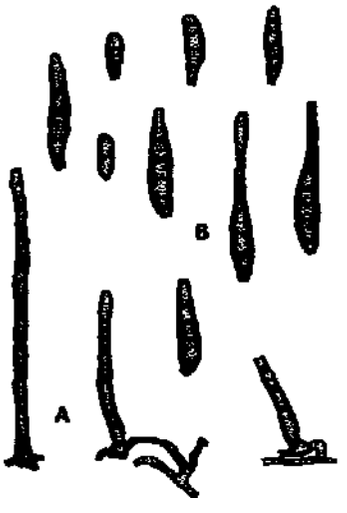
MONACROSPORIUM



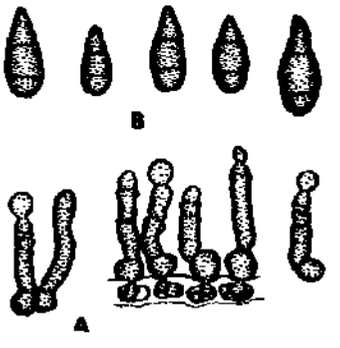
PHRAGMOCEPHALA



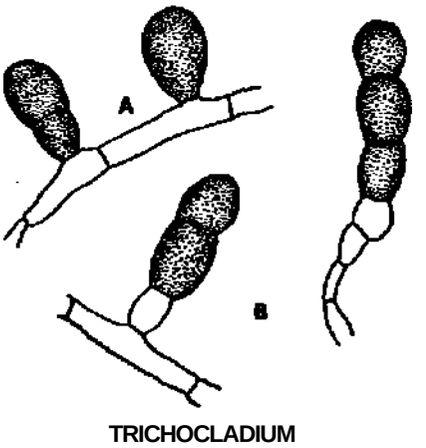
ENDOPHRAGMIA



ANNELLOPHORA



DEIGHTONIELLA



TRICHOCLADIUM

DENDRYPHIOPSIS Hughes. Conidiophores dark, stout, upright, dendritically branched, ultimate branches producing solitary apical conidia; conidia (porospores or blastospores) dark, 4- to several-celled, cylindrical, straight or slightly curved; saprophytic on wood.

Illustration: *D. atra;* original. (A, B) from fresh material on decayed wood; (C) from pure culture isolated from decayed wood. Reference (206).

STIGMINA Sacc. Conidiophores dark, rather short, simple, straight or bent, often arising in clusters from stromalike tissue and protruding through stomata of leaves, producing conidia apically and proliferating through previous spore scars, leaving annellate scars; conidia (annellospores) dark, 3- to several-celled, ovoid to ellipsoid; parasitic or saprophytic.

Illustration: 5 " . *plantani;* original, from h e r b a r i u m material on leaves of *Phntanus occidentalis.* (A) section of leaf through clusters of conidiophores; (B) conidiophores with developing conidia; (C) conidia. References (118, 199, 304).

DICHOTOMOPHTHORA Mehrlick and Fitzpatrick. Conidiophores brown, branching, dichotomous to subdichotomous, elongated, terminally branched, 4- to 8-lobed, each lobe bearing a single conidium; conidia (porospores or blastospores) dark, ovoid to elongate-ovoid, 1- to 6-celled; parasitic on *Portulaca.*

Illustration: /). *portulacae;* redrawn from Mehrlich and Fitzpatrick (285). (A) conidiophore; (B) enlarged portion of conidiophore and conidia; (C) conidia.

SPONDYLOCLADIELLA Linder. Conidiophores dark, single or in small groups, branched; conidiogenous cells short, stubby, single or in groups; conidia (porospores or blastospores) dark, mostly 3-celled, oblong, borne singly, formed through small pores in apex of condiogenous cells; saprophytic, often on hymenomycetes.

Illustration: *S. botrytioides;* redrawn from Linder (265). (A) conidiophores showing short, stubby sporogenous cells; (B) conidia.

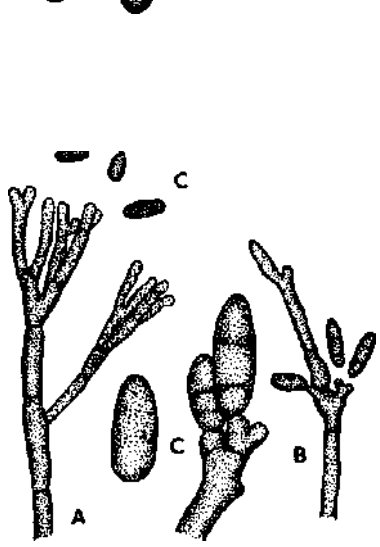
CORYNESPORA Gussow. Mycelium internal in leaf; conidiophores emerge through leaf epidermis, slightly or conspicuously swollen at apex, simple, single, determinate or in tufts, proliferating terminally through scar of previous conidium; conidia (porospores) terminal, single or sometimes in short chains, brown, several-celled (pseudoseptate), with a thick, colorless exospore and prominent, dark basal scar; parasitic on leaves. Compare with *Helminthosporium.*

Illustration: C. *cassiicoia;* redrawn from Luttrell (273). (A) conidiophores and conidia; (B) conidium. References (119, 468).

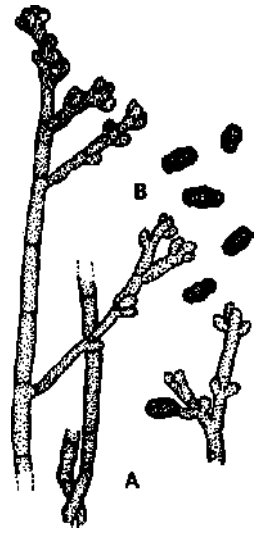
SPORIDESMIUM Link. Conidiophores simple, determinate, brown; conidia (aleuriospores) several-celled, apical, single, brown, obclavate to long, fusoid; saprophytic or parasitic. *S. sderotivorum* is parasitic on sclerotia and has a secondary *Selenosporella* conidial state.

Illustration: (A) *S. tropicale;* (B) *S. folliculatum;* redrawn from Luttrell (273); (C) *S. sderotivorum,* original from culture; (D) *Selenosporella* state. References (118, 119, 455).

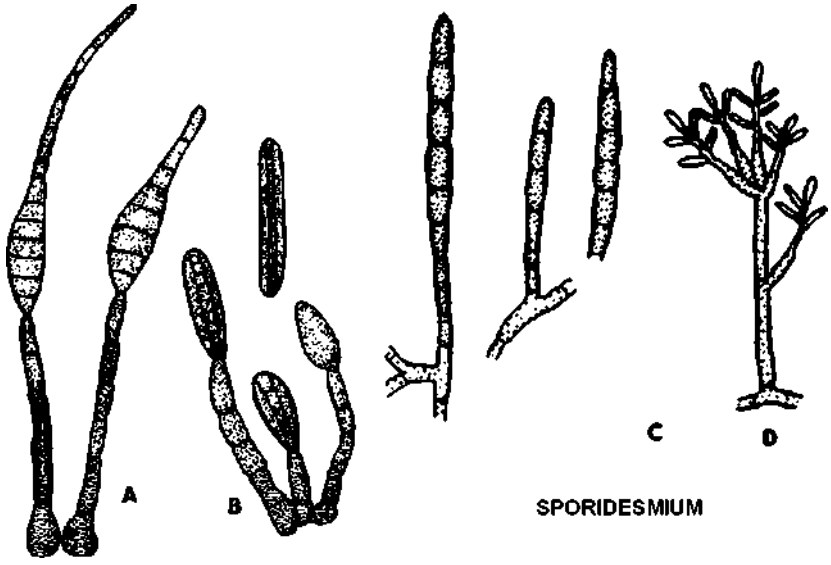
STIGMINA



DICHOTOMOPHTHORA



SPONDYLOCLAD1ELLA



SPORIDESMIUM

.CLIRVULARIA Boedijn. Conidiophores brown, mostly simple, bearing conidia apically or on new sympodial growing points; conidia (porospores) dark, end cells lighter, 3- to 5-celled, more or less fusiform, typically bent, with one of the central cells enlarged; parasitic or saprophytic.

Illustration: *C. lunata;* original, from culture. (A-C) conidiophores and conidia; (D) conidia. References (121, 308, 309, 322, 398).

HETEROSPORIUM Klotzch. Conidiophores dark, simple, conidia (blastospores, sympodulospores) typically 3- to several-celled, cylindrical, wall often echinulate or verrucose, single or in acropetal chains; causing leaf spots or saprophytic. Compare with *Caldosporium.*

Illustration: *H. gracile;* original, from herbarium material on Iris leaf. (A) clusters of conidiophores; (B) conidia. Reference (238).

CERCOSPORIDIUM Erie. Stroma present; conidiophores densely fasciculate, brown, usually simple; conidia (sympodulospores) single and apical on new sympodial growing points, clavate, cylindrical to obclavate, mostly pale brown, few- to several-celled; conidial scars conspicuous; on living leaves, causing leaf spots. Compare with *Fusicladium, Passalora* and *Cercospora.*

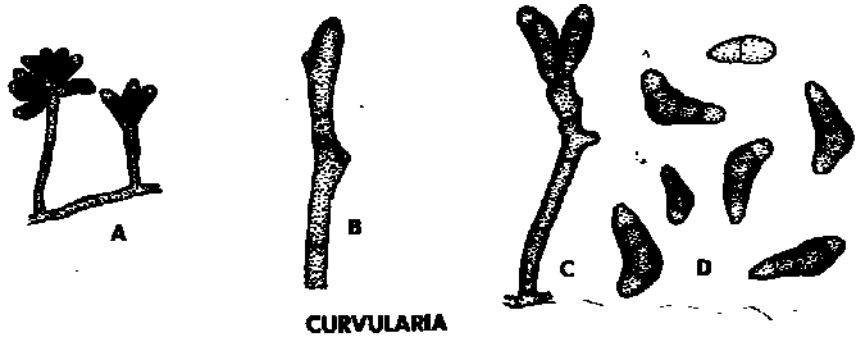
Illustration: *C. personatum;* redrawn from Deighton (78). (A) section through stroma; (B) apex of conidiophores; (C) conidia.

DRECHSLERA Ito. Conidiophores brown, mostly simple, producing conidia singly at apex through small pores, continuing growth sympodially from a point below apex and then forming a second spore on new apex; conidia (porospores) dark, several-celled (phragmosporous), cylindrical, germinating from any or all cells; parasitic or saprophytic. Compare with *Bipolaris.* Formerly included under *Helminthosporium.*

Illustration: (A-C) *D. avenaciwn;* redrawn from Luttrell (272). (A) conidiophores and conidia on leaf; (B) conidiophore showing scars; (C) germinating conidium; (D) *D. maydis,* conidia; (E) *D. carbonum,* conidia. References (96, 273, 372, 373).

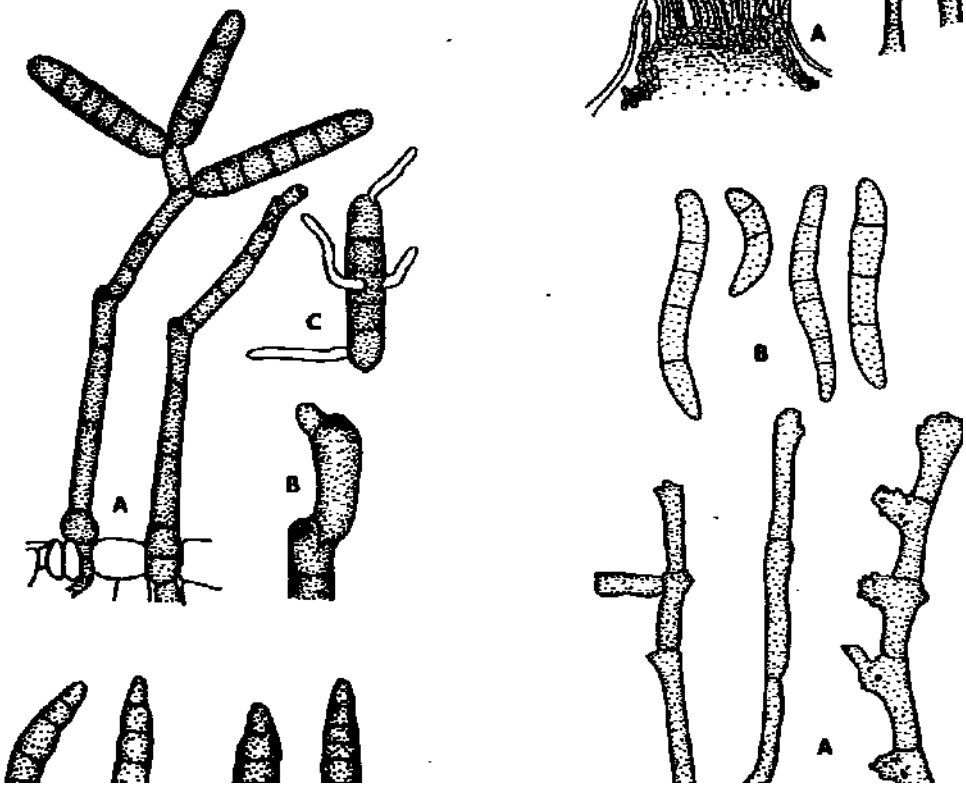
GONATOPHRAGMIUM Deighton. Conidiophores well developed, brown, bearing conidia on short pegs on swellings or nodules; conidia (sympodulospores) mostly 2- to 4-celled, pale brown, cylindrical-clavate; parasitic on leaves.

Illustration: *G. mori;* redrawn from Cejp and Deighton (52). (A) conidiophores; (B) conidia.



CURVULARIA

HETEROSPORIUM



GONATOPHRAGMIU M

DRECHSLERA

HELMINTHOSPORIUM Link ex Fr. Mycelium dark, often in stubstrate; stromata often present; conidiophores single or clustered, tall, erect, brown, simple; conidia (porospores) develop laterally through pores beneath septa while apex of conidiophore is still growing, often appearing in whorls, single, subhyaline to brown, obclavate, phragmosporous, pseudoseptate, with prominent basal scar; parasitic or saprophytic. Shoemaker (372-373) restricts the genus *Helminthospohum* to lignicolous species and classifies grarainicolous species in *Bipolaris* and *Drechslera,*

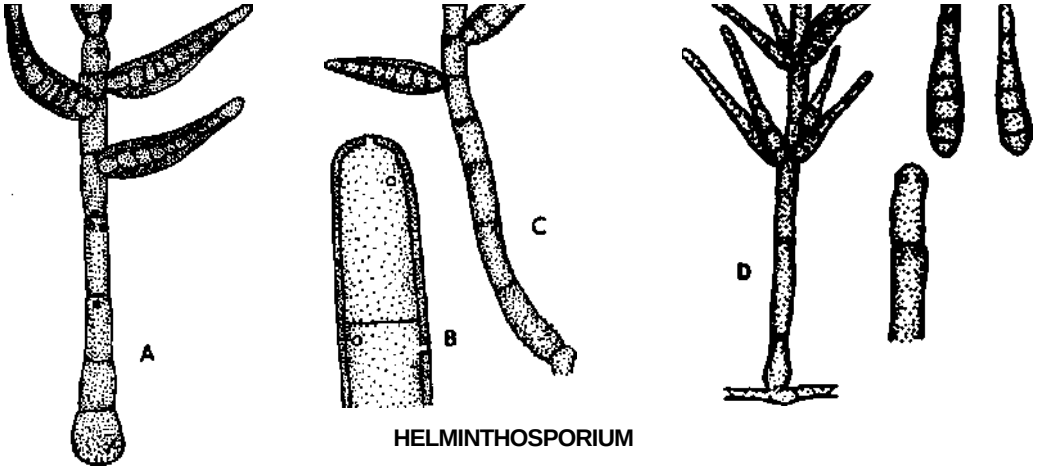
Illustration: *H. velutinum (Spondylocladium atrovirons);* redrawn from Luttrell (273). (A) conidiophores and conidia arising from stroma; (B) enlarged apex of conidiophore showing pores; (C) conidiophores and conidia from culture; (D) *H. solani,* original from culture. References (96, 272, 273, 372, 373, 375).

CACUMISPORIUM Preuss. Conidiophores dark, upright, septate, simple, bearing an apical head of conidia; conidia (sympodulospores or phialospores) dark, at first hyaline, mostly 4-celled, oblong to fusoid, straight or curved, produced on successively new growing points on hyaline projection of the conidiophore and aggregating in moist head; saprophytic. Conidiophorc apex has been interpreted by some as a phialide.

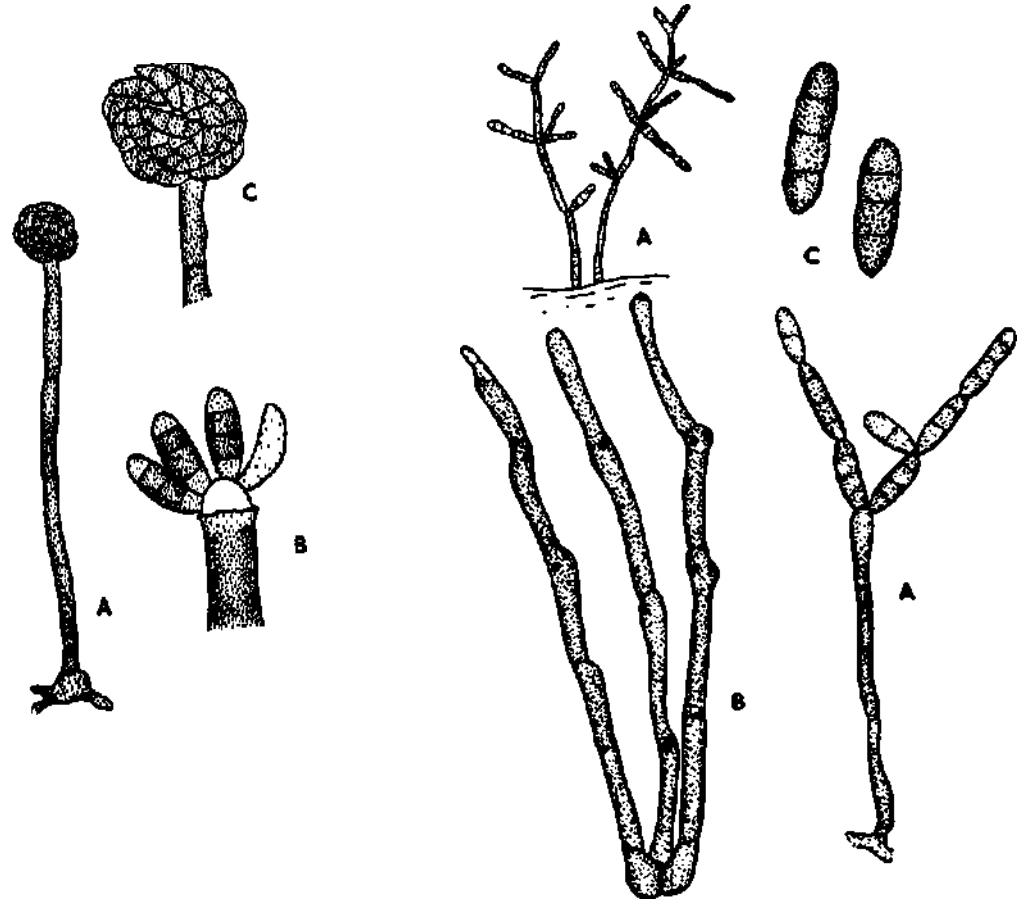
Illustration: *Cacumisporium* sp.; original, from decayed wood. (A) conidiophore and conidia; (B) conidial attachment at apex of conidiophore; (C) enlarged apex of conidiophore with conidia; (D) conidia. References **(151,** 206).

DENDRYPHION Wall. Conidiophores erect, dark, branched variously on upper portion, spore scars prominent; conidia (porospores) several-celled (phragmosporous), dark, catenulate, produced apically through pores in the conidiophores and new sympodial growing points; saprophytic on wood. See Barron (17) and Reisinger (353) for opinions on the genus *Dendryphiella.*

Illustration: *Dendryphion* sp.; original, from culture obtained from decayed wood. (A) conidia and conidiophores; (B) conidiophores; (C) conidia.



HELMINTHOSPORIUM



CACUMISPORIUM

DENDRYPHION

BIPOLARIS Schoemaker. Conidiophores brown, mostly simple, producing conidia through apical pore, resuming growth sympodially and forming conidia on successive new tips; conidia (porospores) brown, several-celled (phragmosporous), elliptical, straight or curved, germinating by one germ tube at each end; parasitic, chiefly on grasses; perfect stage, where known, *Cochliobolus.* Formerly included under *Helminthosporium.* Ellis (124) places this genus in *Drechslera.*

Illustration: *B. sorokinianum (B. sativum);* (A-C) redrawn from Luttrell (272). (A) conidiophore and conidia on leaf; (B) conidiophore showing scars; (C) germinating conidium; (D) original, from pure culture. References (96, 273, 372).

PLEUROPHRAGMIUM Constantin. Stroma sometimes present; conidiophores single or in groups, brown, pale near apex, septate, new growth sympodial; conidia (sympodulospores) pale brown, mostly 3-to 5-celled, phragmosporous, broadly ellipsoid to subclavate with rounded apex; conidial scars, mostly lateral, flat or on raised circles (described by Ellis as borne on denticles); saprophytic on wood or herbaceous stems. Compare with *Spiropes.*

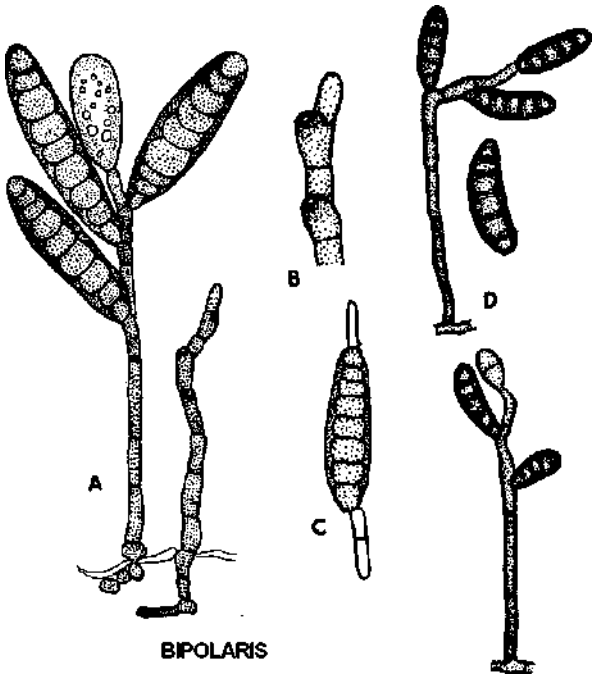
Illustration: *Pleurophragmium* sp.; original, fresh material on decayed wood. (A) habit of conidiophores; (B) simple conidiophore; (C) enlarged apex *of* conidiophores showing *numerous* scars; (D) conidia. Reference (123).

PLEUROTHECIUM Hohnel. Conidiophores single or in loose clusters, simple, dark, narrower and paler at apex; new growing points produced sympodially and producing new conidia; fertile area recurved to produce a curved cyme; conidia (sympodulospores) in moist heads, hyaline, typically 4-celled, ellipsoid or slightly curved.

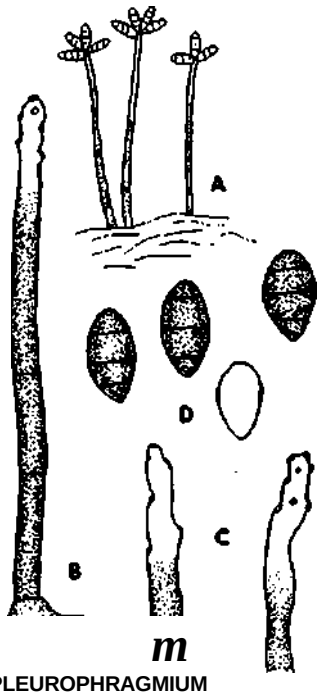
Illustration: *P. recurvaium;* original, from fresh material on decayed wood. (A) habit of conidiophores showing slime heads; (B) conidiophores and conidia; (C) cluster of conidia on conidiophore. Reference **(17,** 152).

BRACHYSPORIUM Sacc. Conidiophores brown, pale at apex, erect, solitary or in small clusters, simple, septate; conidia (sympodulospores) dark, ovoid to obovoid, unequally 3- to 4-celled, basal cell and apical cell may be nonpigmented, attached to apical cell of conidiophore by a slender pedicel, part of which remains attached to the fallen conidium; saprophytic on wood and bark.

Illustration: (A, B) *B. nigrum;* (C, D) *B. obovatum;* all original, from fresh material on decaying wood. References (17, 121, 194).



BIPOLARIS



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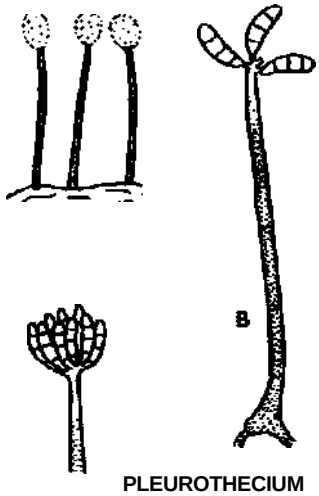
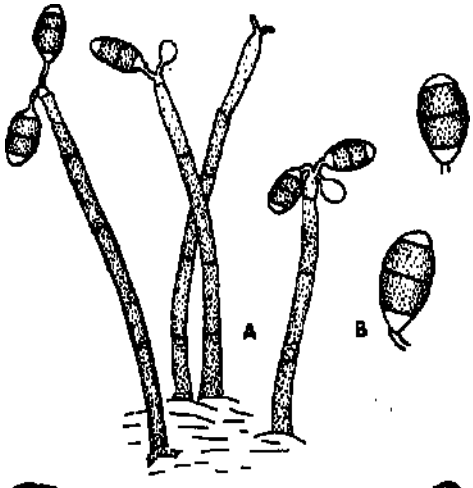
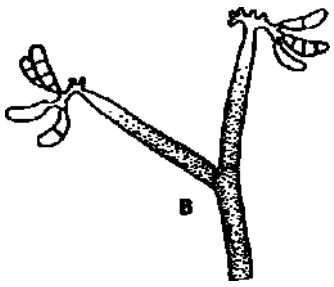
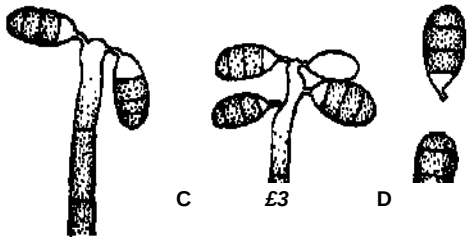
PLEUROPHRAGMIUM



PLEUROTHECIUM







BRACHYSPORIUM

NAKATAEA Hara. (VAKRABEEJA Subram.) Conidiophores simple, single, cylindrical, new growth sympodial, with prominent denticulate conidial scars near apex; conidia (sympodulospores) 3- to few-celled, phragmosporous, fusoid, straight to curved, light brown; parasitic on plants.

Illustration: *V. sigmoidea;* redrawn from Luttrell (272). (A) conidiophores and conidia; (B) apex of conidiophore.

DACTYLELLA Grove. Conidiophores tall, slender, simple, hyaline; conidia (sympodulospores, aleuriospores) hyaline, several-celled, ellipsoid, fusoid to cylindrical, borne singly at apex or in a loose cluster on prominent denticles; saprophytic or parasitic on nematodes.

Illustration: (A-C) *D. brochopaga;* original, from culture. (A-C) conidiophores and conidia; (D) conidiophore and conidium of *D. lepiospora;* original, from material on decaying wood. References (60, 61).

PYRICULARIA Sacc. Conidiophores long, slender, mostly simple; conidia (sympodulospores) obpyriform to nearly ellipsoid, attached at the broader end; hyaline, 2- to 3-celled, parasitic, chiefly on grasses.

Illustration: *P. grisea;* original, from leaf of *Setaria.*

PLEIOCHAETA Hughes. Conidiophores simple; conidia (sympodulospores) dark, mostly 5-celled, cylindrical to ellipsoid, sometimes slightly curved, the middle cell thick-walled and darker, bearing 1 to 4 long, slender, apical, hyaline appendages; parasitic, on plants.

Illustration: *P. setosa;* redrawn from DuPleissis and Truter (107). (A, B) conidiophores and appendaged conidia.

SEPTOCYLINDRIUM Bon. Conidiophores hyaline, simple; conidia (sympodulospores) hyaline, 2- to several-celled; oblong to cylindrical, catenulate; parasitic on higher plants or saprophytic. Compare with *Ramularia.*

Illustration: *S. aromaticum;* original, from herbarium material on leaves of *Acorum calamus.* (A, B) conidiophores and conidia.

CERCOSPORELLA Sac. Conidiophores hyaline, slender; conidia (sympodulospores) hyaline, several-celled, oblong, cylindrical to filiform, straight or curved; parasitic on higher plants; compare with *Cercospora.*

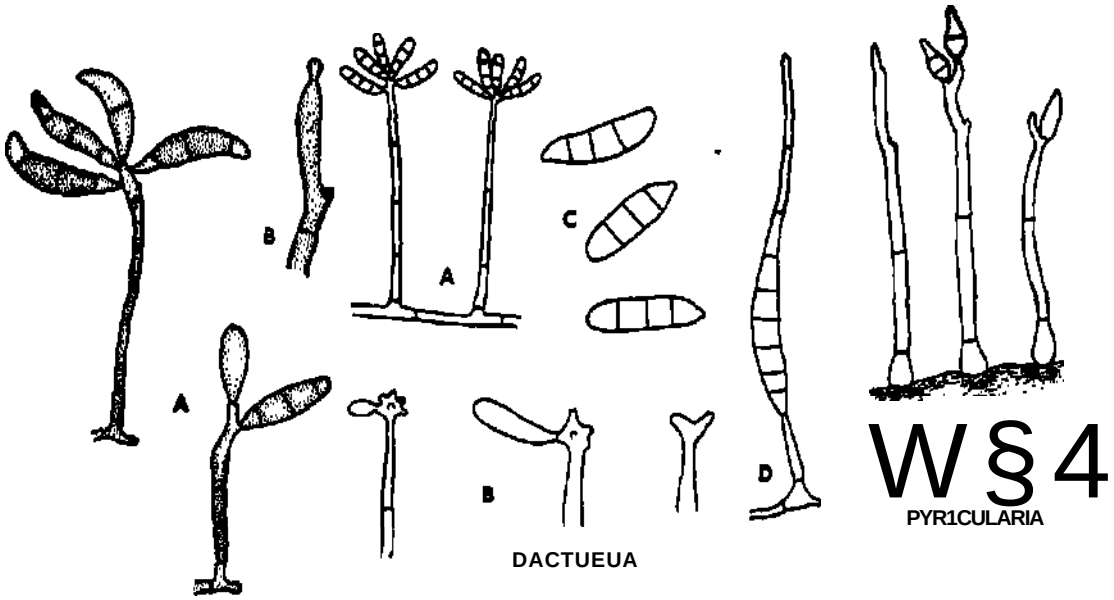
Illustration: C *persica;* original, from herbarium material on peach leaf. (A) conidiophores and conidia; (B) conidia. Reference (81).

.SPERMOSPORA Sprague. Conidiophores hyaline or nearly so, short, grouped; conidia (sympodulo-f^jspores) hyaline, with distal cell elongated, attenuated, mostly 3- to 4-celled; parasitic on grasses, causing " leaf spots. Compare with *Cercospora.*

Illustration: *A. avenae;* original, from culture. (A) conidiophores and conidia; (B) conidia. References (79, 385, 386).

CERCOSPORA Frej^Xonidiophores dark, simple, arising in clusters and bursting out of leaf tissue, , bearing conidia successively on new growing tips; conidia (sympodulospores) hyaline or gray, long (^^cylindrical to filiform, several-celled; parasitic on higher plants, commonly causing leaf spots.

Illustration: *C. apii;* original, from prepared slide of section through leaf. (A) cluster of conidiophores; (B) conidia; (C) *C. zea-niaydis* conidia. References (55, 81, 82, 83, 84).



NAKATAEA

DACTUEUA

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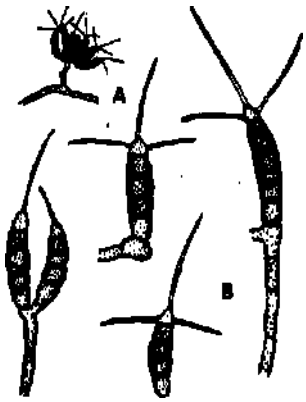
PYR1CULARIA



PIEIOCHAETA

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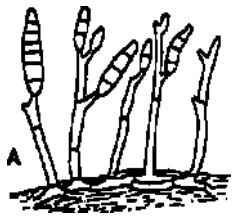
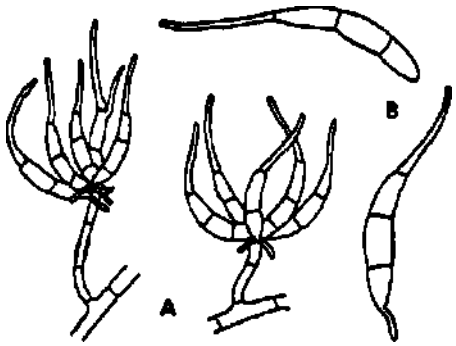
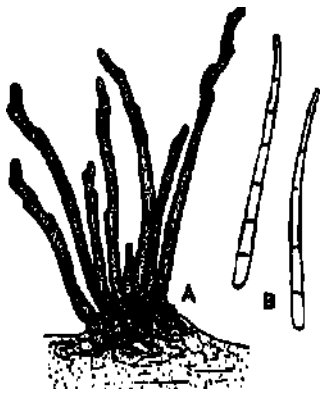
SEPTOCYLINDRIUM



CERCOSPORELLA



SPERMOSPORA



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V

CERCOSPORA

FUSARIUM Link. Mycelium extensive and cotton-like in culture, often with some tinge of pink, purple, or yellow in the mycelium on medium; conidiophores variable, slender, and simple, or stout, short, branched irregularly or bearing a whorl of phialides, single or grouped into sporodochia; conidia (phialospores) hyaline, variable, principally of two kinds, often held in small moist heads; macroconidia several-celled, slightly curved or bent at the pointed ends, typically canoe-shaped; microconidia I-celled, ovoid or oblong, borne singly or in chains; some conidia intermediate, 2- or 3-celled, oblong or slightly curved; parasitic on higher plants or saprophytic on decaying plant material. A large and variable genus, sometimes placed in the *Tuberculariaceae* because some species produce sporodochia. Thick-walled chlamydospores common in some species.

Illustration: *Fusarium* spp.; original, from culture. (A) hyphae with simple conidiophores; (B) variable conidiophores; (C) a loose sporodochium formed by branched conidiophores; (D) conidia. References (370, **444).**

DACTYLIUM Nees. Conidiophores slender, branched verticillately; conidia (phialospores or sympoduiospores) borne singly or in small clusters on slightly elongating branches, hyaline 3- to 4-celled; saprophytic or parasitic on fleshy fungi; conidial states of *Hypomyces.* See Barron (17) for a discussion of *Dactylium.* Compare with *Cladobotryum.*

Illustration: *D. dendroides;* original from culture. (A, B) conidiophores and conidia; (C) conidia enlarged. Reference (258).

CYL1NDROCARPON Wollen. Conidiophores erect, slender, hyaline, simple or branched irregularly, terminating in slender phialides, phialides usually with conspicuous collarette; conidia (phialospores) mostly 3- to 4-celled but often variable, hyaline, cylindrical, produced successively and aggregating in small fascicles; saprophytic or parasitic. Imperfect states of *Necfria.* Resembling *Fusarium* but larger, conidia typically not curved.

Illustration: *Cylindrocarpon* sp.; **original,** from culture. (A) conidiophores with attached conidia; (B) conidia. Reference (38).

FUSARIELLA Sacc. Conidiophores pigmented, typically branched, bearing conidia terminally on slender phialides; conidia (phialospores) dark, 3- to 4-celled, cylindrical, curved, borne in basipetal chains, not end to end, each conidium attached at the side of the conidium below; saprophytic on plant material.

Illustration: *F. obstipa;* drawn from photographs by Pollack (336). (A) conidiophore and developing conidia; (B) chain of conidia. Reference (182).

SPOROSCHISMA Berk, and Dr. Conidiophores dark, upright, stout, simple, bearing conidia endogenously; conidia (phialospores) dark, 3- to 4-celled, cylindrical, sometimes in chains; saprophytic on decaying vegetation.

Illustration: *S. mirabile;* original, from culture. Mycelium, conidiophores, and endoconidia. References ((25, 173, 183).

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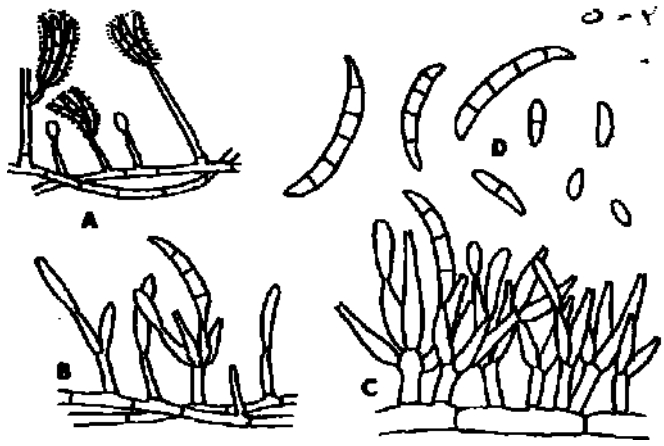
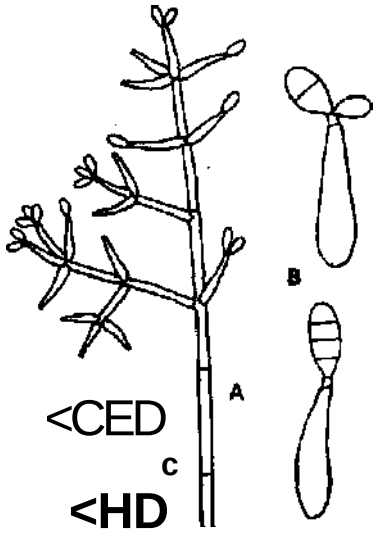
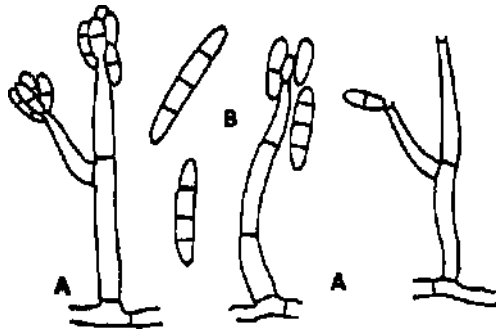


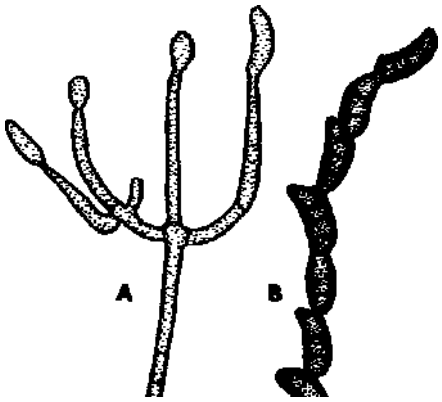
FUSARIUM



DACTYLIUM



CYLINDROCARPON



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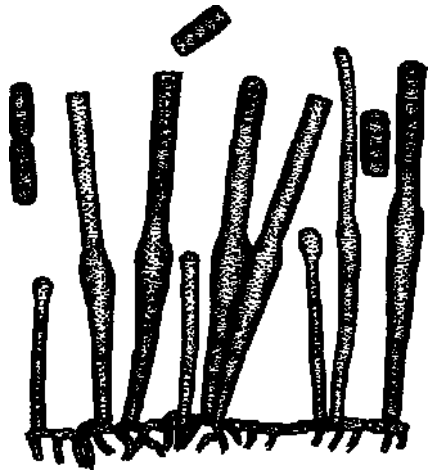


SPOROSCHISMA

ALTERNARIA Nees. Conidiophores dark, mostly simple; determinate or sympodial, rather short or elongate; conidia (porospores) dark, typically with both cross and longitudinal septa; variously shaped, obclavate to elliptical or ovoid, frequently borne acropetally in apical simple or branched appendage; parasitic or saprophytic on plant material.

Illustration: (A-D) *Alternaria* sp.; (E) *A. solani;* both original, from culture. (A) conidiophore and chain of conidia; (B) simple conidiophore showing apical pore; (C) proliferating conidium; (D) conidia. References (239, 306, 376).

STEMPHYL1UM Wallr. Conidiophores dark, mostly simple with darker terminal swelling, short to long, bearing a single, terminal conidium, or successive conidia on new growing tips, conidiophore often proliferating through ofd conidial scar; conidia (porospofes) dark, with cross and longitudinal septa, variable in shape, frequently globose, broadly ellipsoid, or ovoid, often constricted at major septum; parasitic or saprophytic.

Illustration: 5 " . *sarcinaeforme;* original, from culture. (A) conidiophores and conidia; (B) c o n i d i o p h o r e ; (C) conidiophore proliferating through conidial scar. References (376, 377).

ULOCLADIUM Preuss. Conidiophores indeterminate, sympodial, dark, mostly simple, septate; conidia (porospores) dark, dictyosporous, usually without constriction at major septum, borne singly, apical, and on new sympodial growing points; saprophytic. Compare with *Alternaria* and *Stemphylium.*

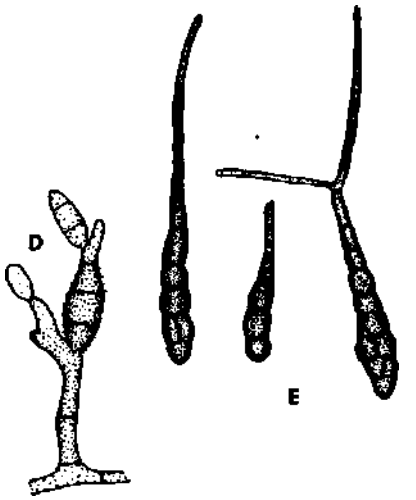
Illustration: *IJlocladiwn* sp.; original, from culture. (A) conidiophores showing development of conidia; (B) conidiophore showing conidial scars; (C) conidia. Reference (376).

PITHOMYCES Berkeley and Broome. Conidiophores short, simple, peglike, arising laterally from mycelium, subhyalinc; conidia (aleuriospores) single, apical, mostly several-celled (dictyosporous), mostly broadly elliptical, oblong *to* pyriform or irregular, commonly vcrrucose or echinulate, usually detached by fracture of wall of conidiophore; saprophytic.

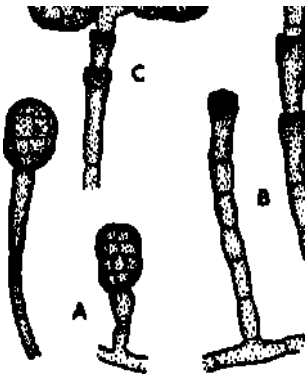
Illustration: *P. chartarum;* original, from culture. (A) mycelium, short conidiophores, and conidia; (B) conidia. Reference (17).

ACROSPEIRA Berk, and Br. Conidiophores short, simple, dark, variable, conidia (aleuriospores) apical, single, mostly 3- or 4-celled, cells arranged irregularly, apical cell enlarged, darker; hyaline phialides *present,* borne singly and producing chains of small, ovoid, hyaline conidia (phialospores).

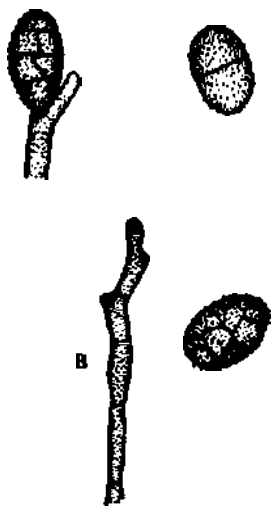
Illustration: *A. mirabilis;* redrawn from Wiltshire (473). (A) dark dictyospores; (B) phialides and chains of small conidia.



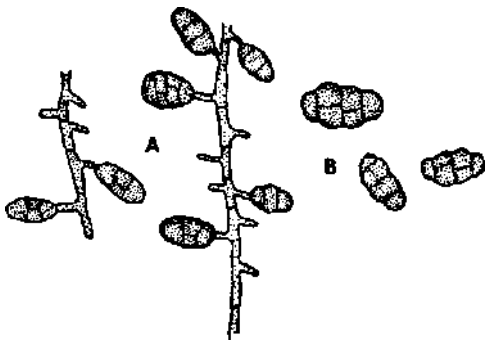
ALTERNARIA



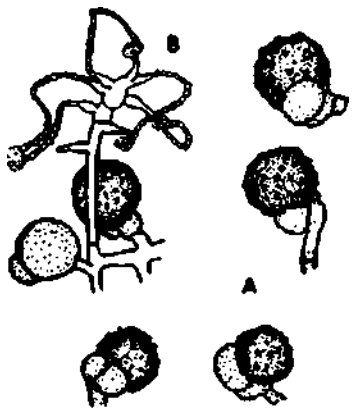
STEMPHYUUM



ULOCLADIUM



PITHOMYCES



ACR05PEIRA

DICTY0ARTHR1NRIM Hughes. Conidiophores much like *Arthrinium* (meristematic at base), simple, crowded, straight or curved, subhyaline, with thick, dark septa; conidia (mcristem blastospores) 4-celled; cross-shaped, dark brown, apical and lateral on conidiophore; saprophytic.

Illustration: *D. quadralum;* redrawn from Subramanian (396). (A) conidiophore and conidia; (B) conidia. Reference (198).

CONIOSPORII'M Link. (= SIRODESM1UM deNot) Conidiophores dark, densely clustered, arising from a stroma, bearing terminal chains of conidia; conidia (meristem arthrospores) dark, elongate, septate, sometimes with longitudinal walls, borne in single chains, developing basipetally; saprophytic on wood.

Illustration: *C. granulosum;* original, from herbarium material on decaying wood. (A) conidiophores and conidia; (B) habit on wood; (C) chain of conidia. References (204).

DACTYLOSPORIUM Harz. Conidiophores dark, simple, paler at the tip, bearing conidia successively on new growing tips; conidia (sympodulospores) brown to subhyaline, ovoid, sometimes inequilateral, with cross and longitudinal or oblique septa; saprophytic.

Illustration: *D. marcopus;* redrawn from Hughes (203).

BERKLEASMIUM Zobel. Conidiophores clustered forming a loose sporodochium, dark, short, simple, each bearing a terminal conidium; conidia (aleuriospores) dark, large, containing many cells irregularly arranged (dictysporous), oblong to obovoid; saprophytic on decaying wood.

Illustration: *B. conkinnum;* original, from herbarium material on decayed wood. Reference (293).

SIROSPORIUM Bubak and Serebianikov. Mycelium immersed in leaves or superficial; stroma may be present; conidiophores arising from hyphae or cells of stroma, simple or branched, brown, each bearing I to several conidial scars; conidia (sympodulospores) apical, single or successively on new growing tips that develop to side of previous conidium, subhyaline to brown, phragmosporous or dictyosporous, obovate to cylindrical, straight or flexuous; parasitic on leaves.

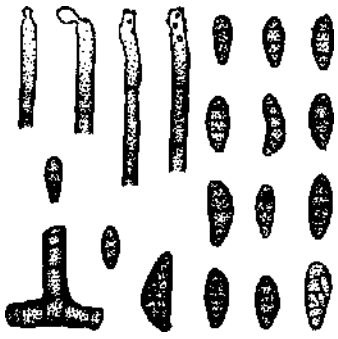
Illustration: *S. antenniforme;* redrawn from Ellis (118). (A) conidiophore and comdia; (B) mycelium and conidiophore; (C) conidia.

STIGMELLA Lev. Conidiophores simple, short, upright, composed of several cells or reduced **to** a peg; conidia (aleuriospores) dictyosporous, dark, single, apical, globose, elliptical, or cylindrical to obovoid, cells irregular in shape.

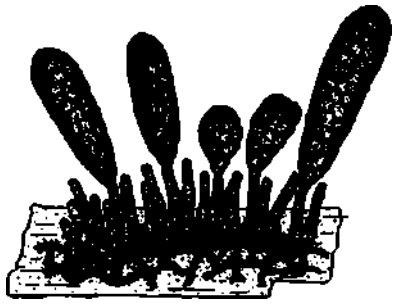
Illustration: *S. crataegi;* original, from herbarium material on leaves of *Crataegus.* (A, B) conidiophores and conidia in section of leaf; (C) conidia. References (113, 199).

DICTYOARTHRINIUM

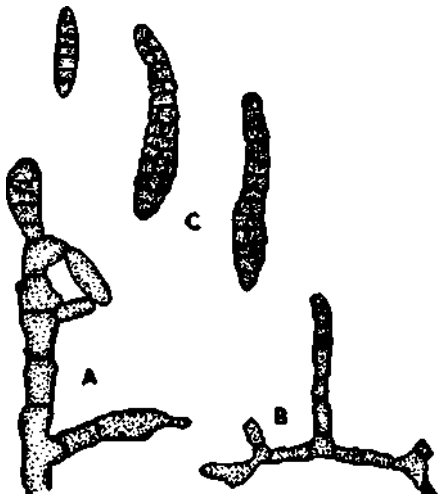
CONIOSPORIUM



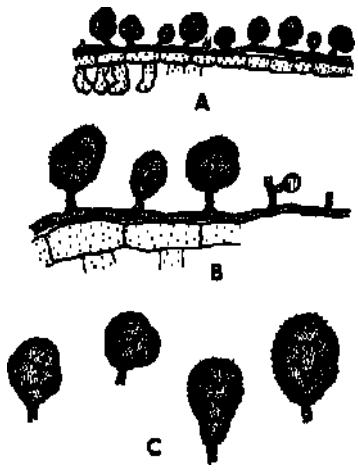
DACTYLOSPORIUM



BERKLEASMIUM



SIROSPORIUM



STIGMELLA

HELICOSPORIUM Nees. Conidiophores tall, slender, brown, septate, simple or branched, bearing conidia apically or laterally; conidia (sympodulosporcs) hyaline to pigmented, septate, coiled; saprophytic on decaying plant material.

Illustration: *Ilelicosporium* sp.; original, from culture. Mycelium, conidiophores, and conidia. References (30,289,290,453).

HFXICOMA Corda. Conidiophores dark, upright, rather stout, septate, mostly simple; conidia (sympodulospores) hyaline or dark, septate, rather tightly curled; saprophytic on wood and bark.

Illustration: *H. muileri;* original, from herbarium material on maple wood, (A) conidiophores; (B) conidia. References (30, 289, 290, 453).

HELICOMIINA Olive. Conidiophores dark, slender, elongate, simple or branched, multiseptate; conidia (sympodulospores) dark, typically curved or coiled but with some straight conidia, septate, produced terminally and laterally; parasitic on higher plants. The genus differs from *Helicoma* in being parasitic and in producing a large number of straight conidia in addition to curved or coiled one.

Illustration: //. *caperoniae;* redrawn from Olive (316). (A) conidiophores; (B) conidia.

HELICOON Morgan. Conidiophores long, slender, simple or branched, hyaline or dark; bearing conidia terminally or laterally; conidia (biastospores or sympodulospores) hyaline or dark, coiled to form an ovoid or ellipsoid conidium, borne singly; saprophytic on decaying wood.

Illustration: (A) ***H.*** *auratum;* redrawn from Linder (264); (B) *H, thaxieri;* redrawn from Linder (265). Reference (289).

XENOSPORIUM Pen/ig. and Sacc. Conidiophores dark, comparatively short and stout, simple or branched, septate; conidia (aleuriospores) dark, tightly coiled, apical, having both transverse and longitudinal septa; saprophytic on decaying plant material.

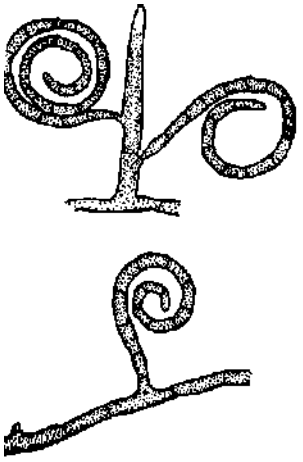
Illustration: *X. berke/eyl;* redrawn from Linder (264). Mycelium, conidiophores, and conidia. References (85, 290).

HELICODENDRON Peyron. Conidiophores hyaline, slender, branched, septate, bearing conidia terminally; conidia (biastospores) subhyaline to brown, coiled to form a large ovoid or ellipsoid spore, smaller, younger spores formed on the sides of the other spores; saprophytic on decaying plant material.

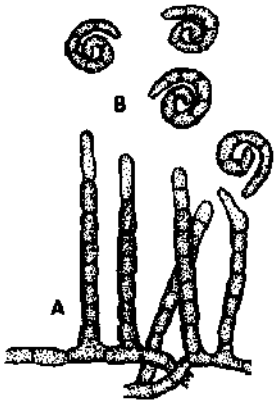
Illustration: *H. gigantium;* redrawn from Glen-Bott (146). Mycelium, conidiophores, and conidia. References (147, 263).

HELICOMYCES Link. Conidiophores hyaline, mostly simple, variable in length; conidia (symposulospores) hyaline or subhyaline, septate, conidial filaments thin, hygroscopic, tightly coiled in one plane; saprophytic on decaying wood.

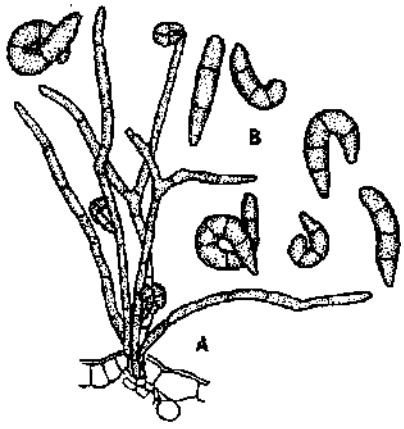
Illustration: (A) ***H.*** *scandens;* (B) *H. roseus;* redrawn from Linder (263). References (221, 289).



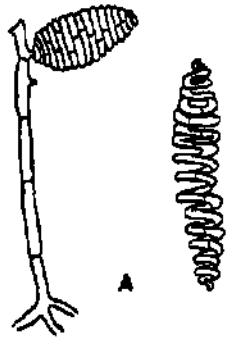
HEUCOSPORIUM



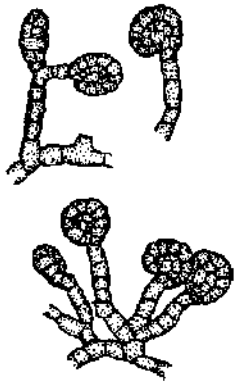
HELICOMA



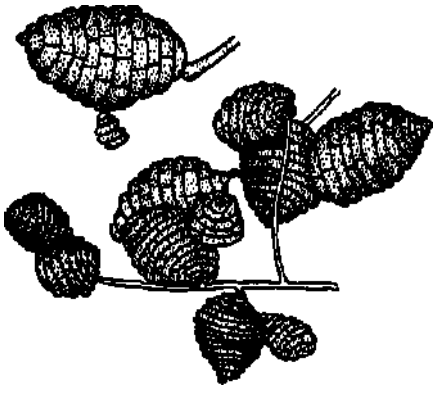
HELICOMtNA



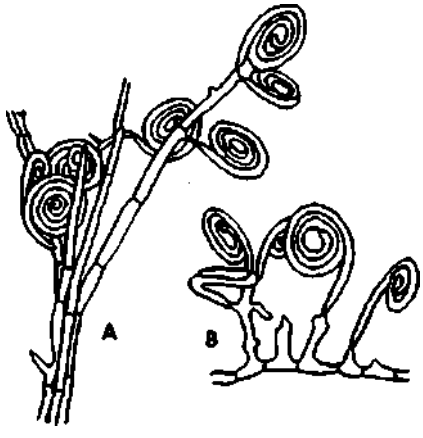
HELICOON



XENOSPORIUM



HELICODENDRON



HELICOMYCES

FLAGELLOSPORA Ingold. Conidiophores long, slender, septate, branched above, ending in phialides that bear single conidia; conidia (phialospores) hyaline, 1- to several-celled, fiagelliform, slender, curved; saprophytic on submerged decaying leaves.

Illustration: *F penicillioides;* redrawn from Ingold (225). (A) portion of conidiophores and conidia; (B) conidia.

TRISCELOPHORUS Ingold. Submerged, aquatic, with branched, septate mycelium; conidiophores simple, slender; conidia single, apical, branched, consisting of (1) an elongated main axis continuous with the conidiophore and (2) elongated branches forming a whorl of 3 slender divergent branches arising from the lower part of the main axis, hyaline; saprophytic on decayng leaves in water.

Illustration: *T. monosporus;* redrawn from Tubaki (449). References (224, 327, 328).

LUNULOSPORA Ingold. Conidiophores long, slender, hyaline, branched **near** the apex, **the** branches bearing single conidia apically; conidia (blastospores) hyaline, 1-celled, elongate to filiform, bent, typically lunate; saprophytic on submerged leaves.

Illustration: *L. curvula;* redrawn from Ingold (223). (A) conidiophores and conidia; (B) conidia. References (327, 346).

LEMONNIERA DeWild. Conidiophores hyaline, slender, branched, ultimate branches bearing a few phialides; conidia apical, hyaline, ultimately septate, with 4 slender, widely divergent arms; saprophytic on submerged, decaying leaves.

Illustration: *L. aquatica;* redrawn from Ingold (223). References (228, 346).

VARICOSPORIUM Kegel. No sharp distinction between conidiophores and conidia; conidiophores simple *or* sparingly branched *near* the apex, bearing conidia apically; conidium consisting of a main elongated axis with 2 or 3 laterals on one side; each lateral is septate and branched again, hyaline; saprophytic, aquatic or in soil.

Illustration: *V. elodeae;* redrawn from Ingold (223). Reference (449).

TRICLADIUM Ingold. Conidiophores hyaline, long, slender, branched; conidia single, apical, hyaline, several-celled, curved, cylindrical, branched, the two branches usually arising from adjacent cells; saprophytic on submerged decaying leaves.

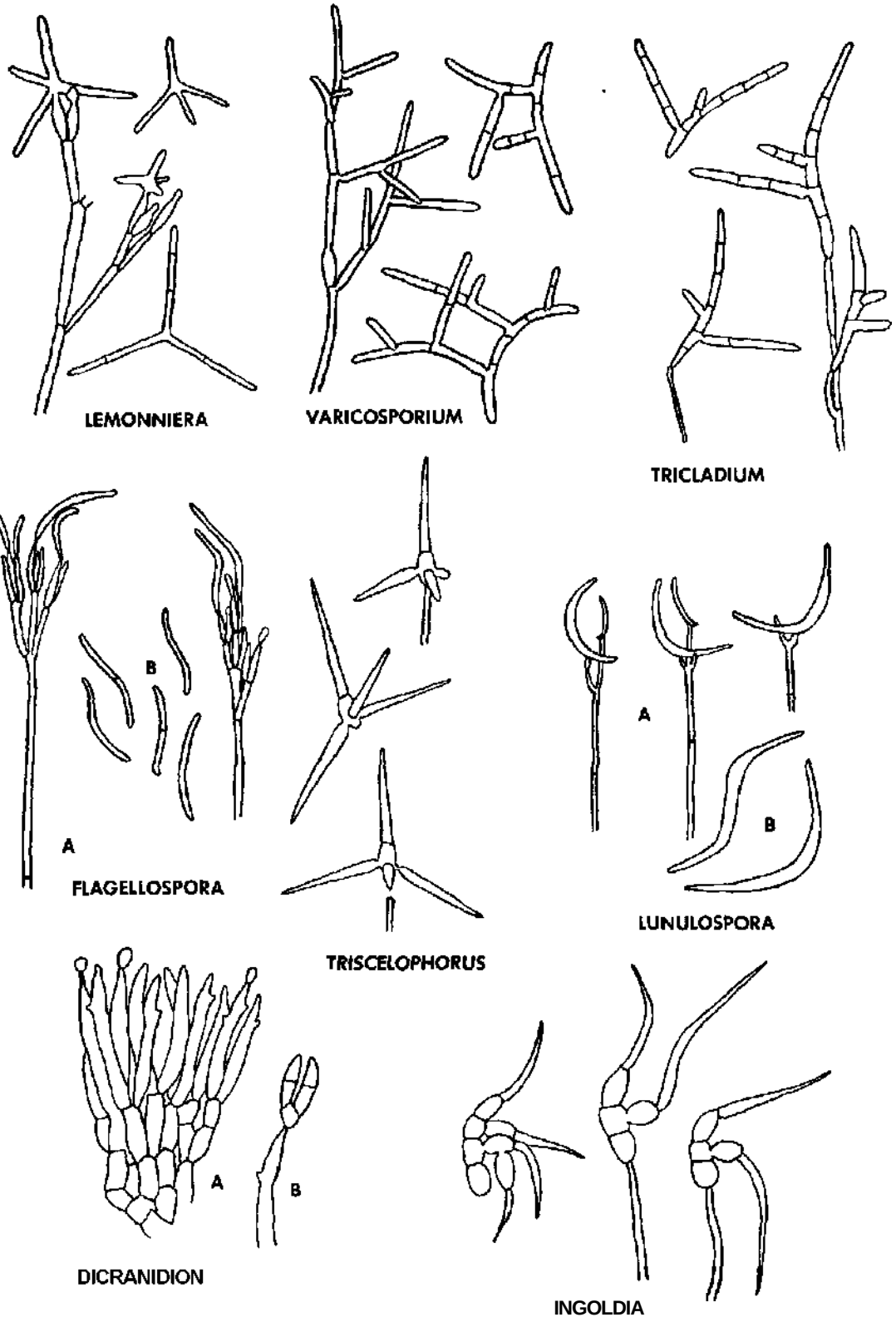
Illustration: *T. splendens;* redrawn from Ingold (223). Reference (327).

DICRANIDION Hark. Conidiophores hyaline, single or in loose masses (sporodochium-like), slender, simple or with a few branches, new growing points produced sympodially; conidia (sympodulospores) 5-celled, produced singly at apex or on new growing points on small denticles; saprophytic on wood.

Illustration: *D. fragile;* original, from decaying wood and from culture. (A) apical portions of conidiophores and immature conidia; (B) portion of conidiophore and mature conidium. Reference (97).

INGOLDIA Petersen. Submerged aquatic with septate mycelium; conidia single, apical, hyaline, septate, consisting of a curved, attenuated axis, two attenuated branches, and a single attenuated secondary branch; on submerged rotting leaves.

Illustration: **I.** craginiformis; redrawn from Petersen (327). References (231).


LEMONNIERA
VARICOSPORIUM
TRICLADIUM
A
B
FLAGELLOSPORA
TRISCELOPHORUS
A
B
LUNULOSPORA
A
B
DICRANIDION
INGOLDIA

TRIDENTARIA Preuss. Conidiophores hyaline, long, slender, simple, septate, bearing a single conidium apically; conidia hyaline, trifurcate, rarely 2- or 4-pronged, the basal cell obconidcal, septate, prongs septate, tapering upward, slightly divergent; parasitic on nematodes or on soil rhizopods, or saprophytic on decayed wood.

Illustration: 77 *implicans;* original, from culture isolated from decayed wood. (A) conidiophores and conidia showing tightly closed prongs as seen in a dry mount; (B) conidiophores and conidium as seen in water mount; (C) two mature conidia and one very young conidium. References (100, 101).

CULICIDOSPORA Petersen. Conidia single, apical, hyaline, elongate-clavate, 5-celled, subapical cell swollen and curved, with 2 straight hyphalike branches on the subapical cell and one on the apical cell; aquatic, on submerged rotting leaves.

Illustration: *C. gravida;* redrawn'from Petersen (328). (A) conidiophores; (B) conidia.

ACTINOSPORA Ingold. Conidiophore hyaline, slender, septate, upper portion dichotomously branched, forming apical conidia singly; conidi hyaline, branched, the main body globose or ovoid, with 4 or 5 slender, radiating, septate branched; saprophytic on submerged twigs.

Illustration: *A. megalospora;* redrawn from Ingold (226).

TETRACHAETUM Ingold. Submerged, aquatic with septate mycelium; conidiophores simple or sparingly branched, slender; conidia single, apical, hyaline, several-celled, consisting of 4 long branches diverging from a common point, with one branch of the conidium (before liberation) continuous with the conidiophore; conidia produced under water, liberated by the breakdown of a special short separating cell.

Illustration: *T. elegans;* redrawn from Ingold (223). Reference (346).

DENDROSPORA Ingold. Submerged, aquatic with branched, septate mycelium; conidiophores simple, slender, hyaline; conidia apical, single branched, several-celled, each consisting of one main axis with several secondary and tertiary branches arising irregularly, hyaline; saprophytic, on decaying leaves in water.

Illustration: *D. erecta;* redrawn from Tubaki (449). Reference (87).

ANGUILLOSPORA Ingold. Submerged, aquatic, conidiophores hyaline, slender, simple; conidia single, apical, slender, several-celled, hyaline, separating from the conidiophore by the breakdown of a special separating cell at the apex; saprophytic.

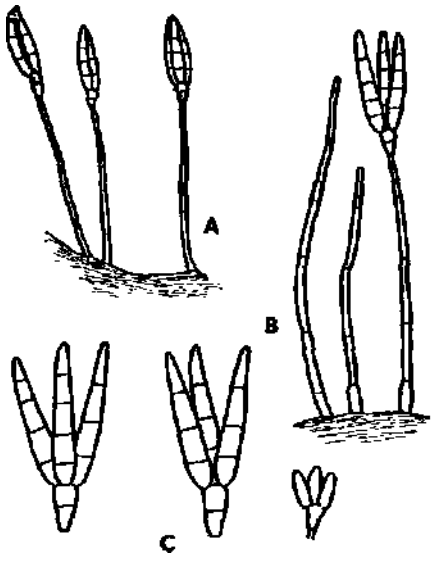
Illustration: *A. longissima;* redrawn from Ingold (223). References (228, 327).

CLAVARIOPSIS DeWild. Conidiophore long, slender, hyaline, simple; conidia hyaline, apical, single, branched, main axis pyriform, 2-celled, the three branches from the upper cell widely divergent at angles of about 120°; saprophytic on submerged decaying leaves.

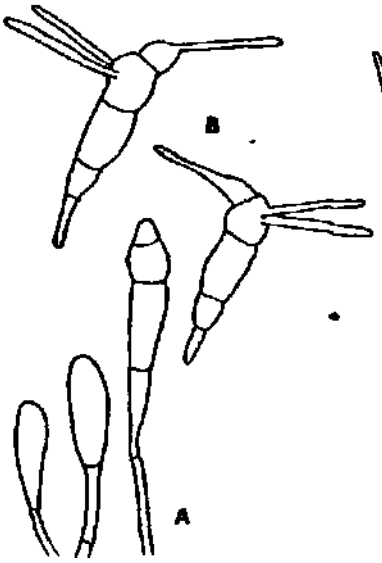
Illustration: C. *aquatica;* redrawn from Tubaki (449). Reference (223).

TETRACLADIUM DeWild. Conidiophores hyaline, slender, septate, simple or branched in upper portion; conidia single, apical, hyaline, branched, the main axis narrowly clavate, finally septate, giving rise to three unequal, divergent, tapering branches; saprophytic on submerged decaying leaves.

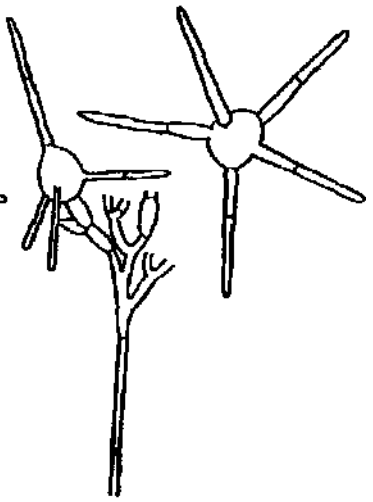
Illustration: 77 *setigerum;* redrawn from Tubaki (449). References (223, 346).



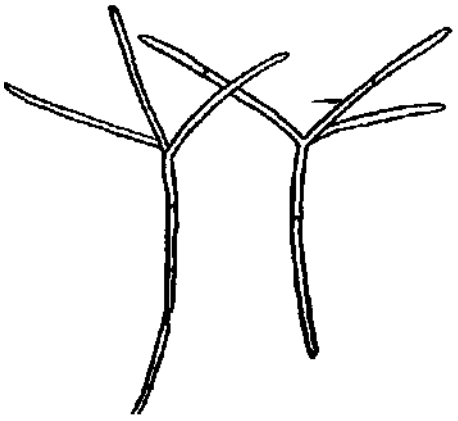
TRIDENTARIA



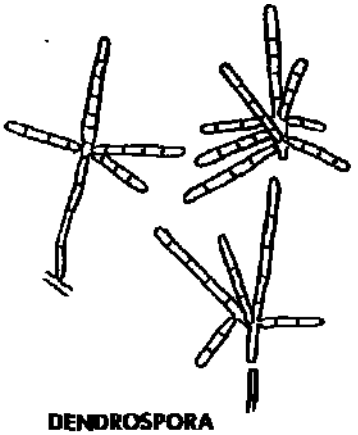
CULICIDOSPORA



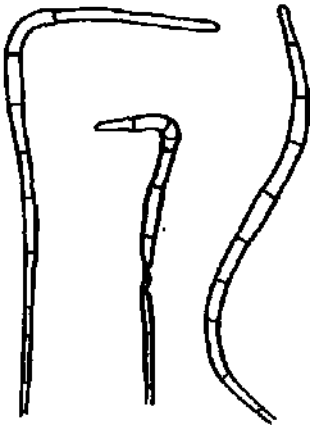
ACTINOSPORA



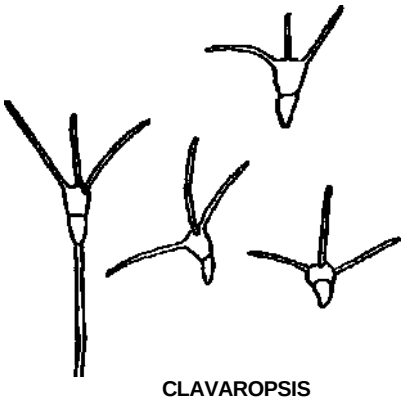
TETRACHAETUM



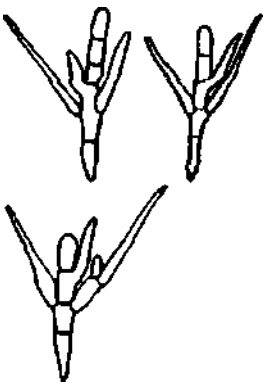
DENDROSPORA



ANGUILLOSPORA



CLAVAROPSIS



TETRACLADIUM

ALATOSPORA Ingold. Submerged, aquatic, with branched, septate mycelium; conidiophore simple or branched near the apex bearing a few phialides; conidia branched, consisting of 4 arms diverging from a common point; the conidium consisting essentially of a curved main axis (forming two arms) and 2 laterals inserted about the middle of the main axis, apical on the conidiophores, hyaline; saprophytic, on submerged leaves.

Illustration: *A. acuminata;* redrawn from Tubaki (449).

THAIXOSPORA Olive. No well developed conidiophores present; conidia develop as direct outgrowths from branching hyphae, slender, dichotomously branched, many-celled, hyaline, produced in a white mass inside the ovary of the host; systemic parasitic on higher plants *(Veronica peregrina).*

Illustration: *T. aspera.* (A, B) conidia; (C, D) conidia developing from hyphae; redrawn from Olive (316).

ARTICUI.OSPORA Ingold. Conidiophores hyaline, slender, upper part sparingly branched; conidia hyaline, apical, branched, septate, slender, the three branches slender and about the same diameter as the main axis; saprophytic on decaying submerged leaves.

Illustration: *A. inflata;* redrawn from Ingold (225). (A) conidiophores bearing conidia; (B) conidium. References (327, 346).

DIPLOCLADIELLA Arnaud. Conidiophores erect, producing apical and lateral conidia; conidia (sympodulospores) consisting of two septate, slender, pointed arms radiating from the basal cells; central cells dark, apical, and basal cells hyaline; saprophytic.

Illustration: *D. scalaroides;* redrawn from Tubaki (450). (A) conidiophores with attached conidia; (B) conidia.

TETRAPLOA Berk and Vr. Conidiophores absent; conidia borne directly on mycelium, each consisting of 3 to 4 initial cells, each of which develops into a long, attenuated, septate appendage, smooth or rough. brown; saprophytic.

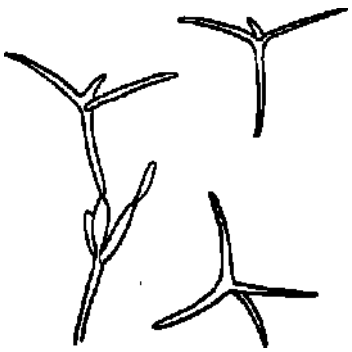
Illustration: (A, B) *T. aristita;* (C) 7' *eliisii;* redrawn from Ellis (112).

SPEIROPSIS Tubaki. Conidiophores erect, simple, straight, septate; conidium single, apical, consisting of a basal cell and 3 to 5 somewhat divergent arms, each arm consisting of an acropetalous chain of cells, pale brown.

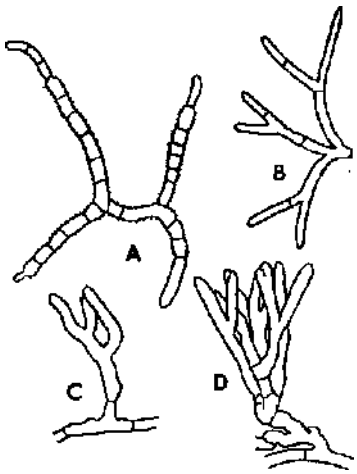
Illustration: *S. pedatospora;* redrawn from Tubaki (450).

TRIPOSPERMUM Speg. Conidiophores absent; conidia (blastospores) subhyaline to dark brown, septate, staurosporous, borne directly on cells of the mycelium and consisting of a stalk and two pairs of divergent, pointed septate arms; branches not formed simultaneously; saprophytic.

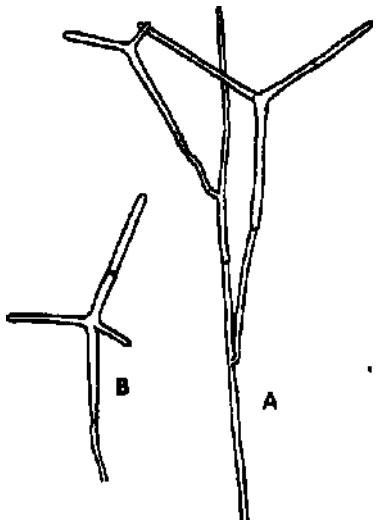
Illustration: *T. myrti;* original, from culture. (A) stages in development of a conidium from a hypha; (B) branched conidia. Reference (17, 234).



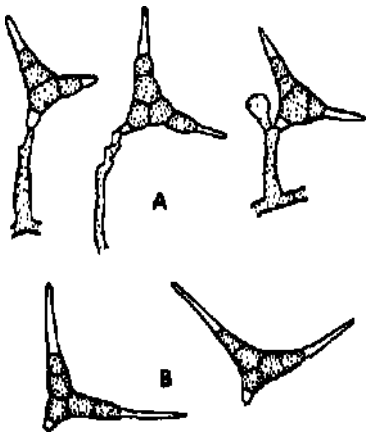
ALATOSPORA



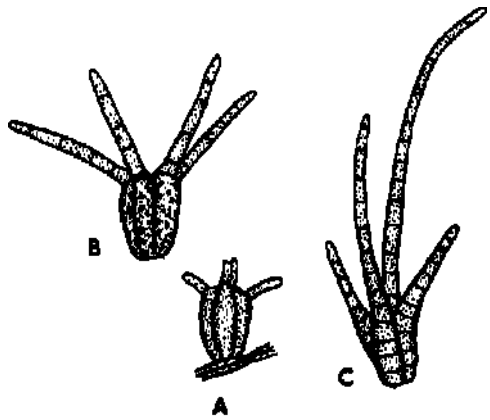
THALLOSPORA



ARTICULOSPORA



DIPLOCLADIELLA



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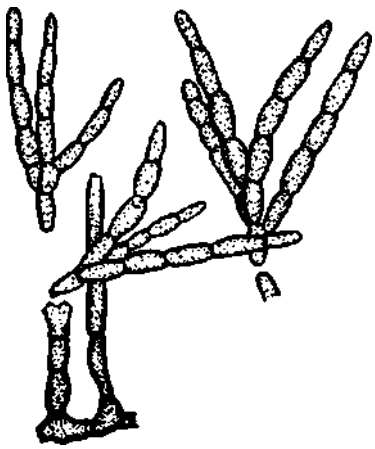
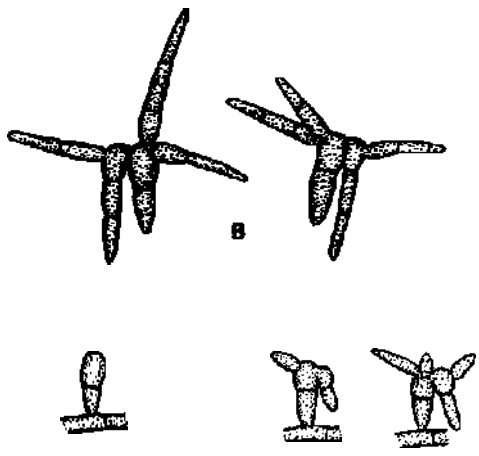


SPEIROPSIS



TRIPOSPERMUM

CERATOSPORELLA Hohn. Conidiophores dark, simple, upright, bearing single conidia successively by protrusion of conidiophore through old conidial scars; conidia (annellospores) dark, composed of 2 or more septate branches, each arising separately from a basal cell; saprophytic.

Illustration: G *stipitata;* redrawn from Hughes (201). (A) conidiophores, some with an apical conidium; (B) conidia. Reference (190).

DICTYOSPORIUM Corda. Conidiophores dark, slender, simple or branched, usually short, bearing a single branched conidium apically; sometimes arranged in sporodochia; conidia with several close septate branches arising from different points (branches do not all arise separately from a basal cell); saprophytic.

Illustration: (A) *D. toruloides;* redrawn from Ellis (125); (B) *Dictyosporium* sp.; original from material on decayed wood. References (73, 190).

TRIPOSPORIUM Corda. Conidiophores dark, simple, slender, septate, bearing a single conidium apically; conidia dark, with three septate arms radiating from a central cell; parasitic on leaves, or saprophytic on plant material.

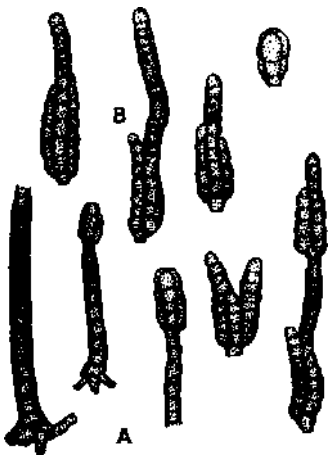
Illustration: *T. elegans;* redrawn from Ellis (125). (A) conidiophores; (B) conidia.

HIRUDINARIA Ces. Mycelium mostly superficial, subhyalinc; conidiophores reduced to short lateral swellings on the mycelium, brown; conidia consisting of 2 (less often 3) straight or curved arms (horns) tapering upward, several-celled, dark; parasitic on leaves.

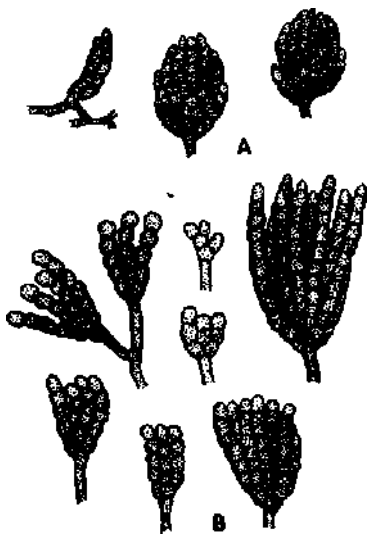
Illustration: *H. macrocarpa;* original, from herbarium material on *Crataegus* leaves. (A) much reduced conidiophores emanating from the mycelium; (B) conidia. Reference (186).

CERATOSPORIUM Schw. Conidiophores consisting of a short cylindrical cell; conidia consisting of 2 or 3 straight or curved arms (horns), tapering upward, several-celled, dark; saprophytic on wood or bark; near *Hirudinaria* morphologically.

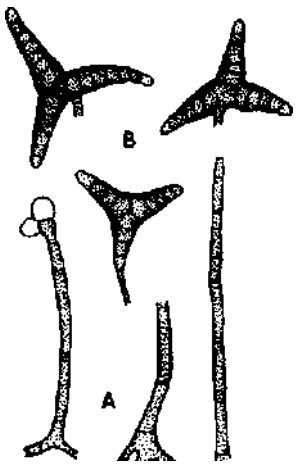
Illustration: *C. fuscescens;* redrawn from Hughes (186). (A) mycelium showing short conidiophores and developing conidia; (B) conidia.



CERATOSPORELLA



DICTYOSPORIUM



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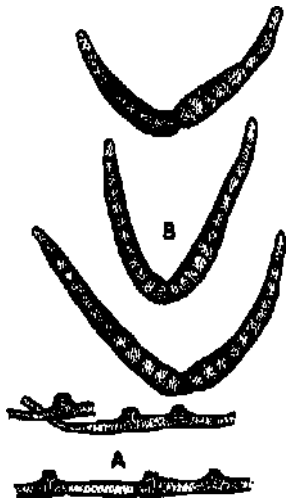
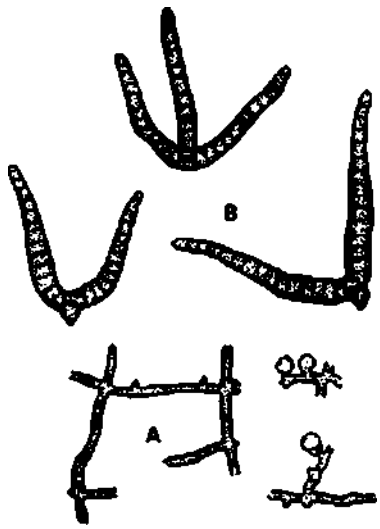


HIRUDINARIA



CERATOSPORIUM

TUBERCULARIA Tode. Sporodochia rather large, light to orange in color, breaking out through the bark; conidiophores hyaline, elongate, repeatedly irregularly branched, and bearing conidia terminally; conidia hyaline, 1-celled, ovoid to elongate in a dry mass on the surface of the sporodochium; mostly saprophytic on wood.

Illustration: *T. vulgaris* (Conidial state of *Neclria cinnabarina);* original, from dried material on twigs. (A) sporodochia on twig; (B) section through sporodochium; (C) conidiophores and conidia.

HADROTRICHUM Fr. Sporodochia cushion-shaped, dark; conidiophores dark, simple, forming a palisade and arising from a stromalike layer; conidia dark, nearly spherical, 1-celled, borne singly; parasitic on leaves; the genus is often placed in the Dematiaceac.

Illustration: *IT blasdalei;* original, from herbarium material on leaves of *Vicia.* (A) sporodochia on leaf; (B) side view of sporodochium; (C) conidiophores and conidia. Reference (205).

ILLOSPORIUM Mart. Sporodochia cushionlike, light colored; conidiophores hyaline, branched, phialides bearing conidia apically; conidia hyaline, ovoid to oblong, collecting on the surface of the sporodochium in gelatinous material; parasitic or saprophytic on leaves, frequently as a secondary invader.

Illustration: /. *malifoliorum;* original, from dried material on apple leaves. (A, B) sporodochia and masses of conidia; (C) conidiophores and conidia.

STRUMELLA Fr. Sporodochia cushionlike, dark; conidiophores dark, branched; conidia dark, 1-celled, ovoid or oblong to irregular; parasitic or saprophytic on wood.

Illustration: *S. coryneoidea* (conidial state of *Urnula craterium);* original, from herbarium material on oak. (A) sporodochia; (B) conidia. Reference (76).

HYMENELLA Fr. Sporodochia somewhat flattened or discoid, light colored; conidiophores hyaline, sparingly to moderately branched, bearing terminal conidia; conidia hyaline, 1-celled, ovoid to oblong, collecting in a dry mass (not in slime) on sporodochium; saprophytic.

Illustration: *H. cerealis;* original, from herbarium material on wheat straw. (A, B) sporodochia; (C) conidiophores and conidia.

SPHAEROSPORIUM Schw. Sporodochia yellowish when fresh, cushion-shaped to hemispherical; conidiophores short, compact, hyaline, bearing apical chains of conidia; conidia I-celled, globose to ovoid, large with prominent scars of attachment, hyaline or yellowish; saprophytic on decayed wood.

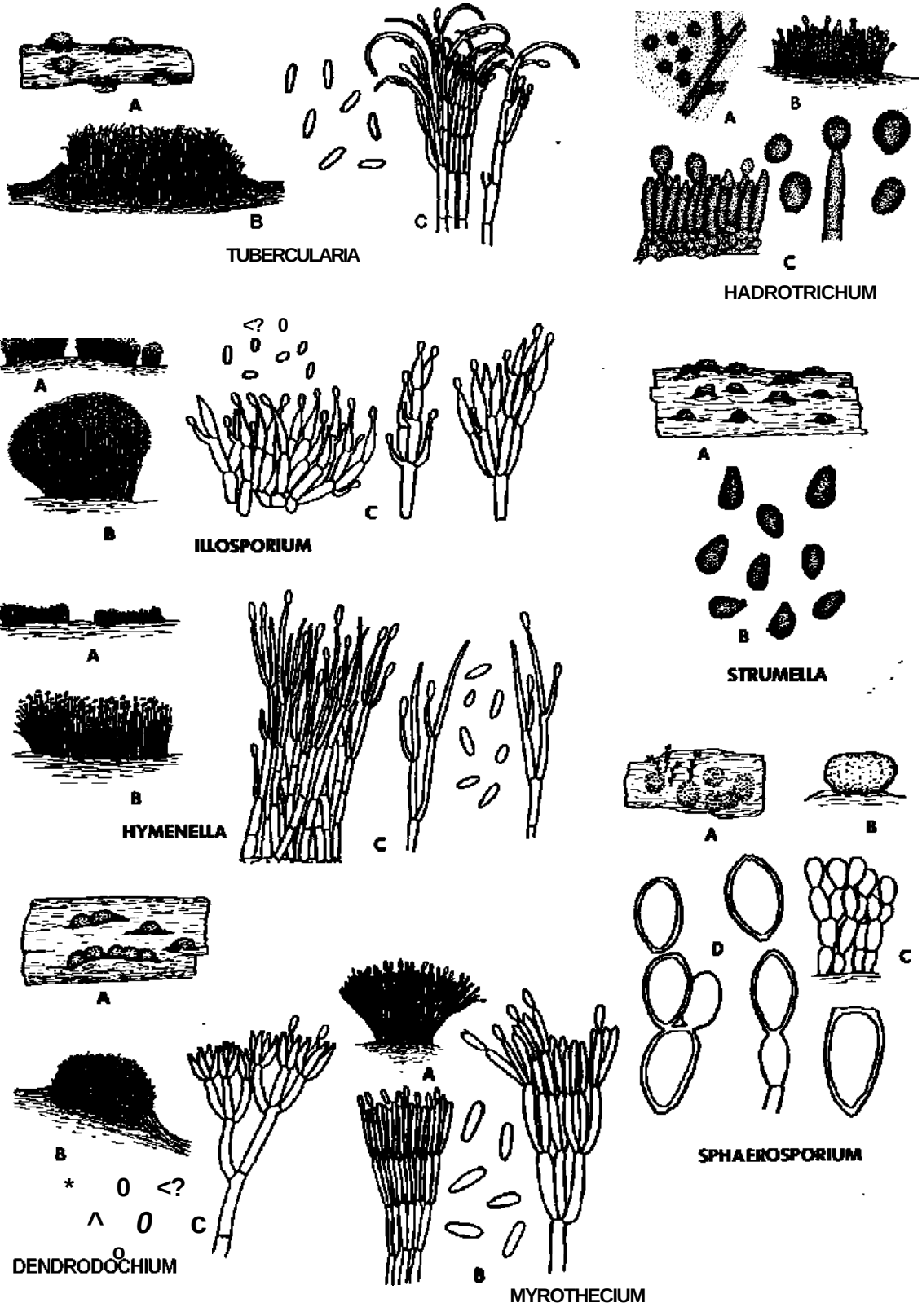
Illustration: *S. lignatile;* original, from fresh material on decayed wood. (A, B) sporodochia on wood; (C) conidiophores; (D) conidia.

DENDRODOCHIUM Bon. Sporodochia cushionlike, light, bursting out of bark; conidiophores hyaline, verticillately branched; conidia hyaline, I-celled, ovoid to oblong, dry in mass; saprophytic on bark.

Illustration: *D. rubellum* var. *microsporum;* original, from herbarium material on bark of *Liriodendron.* (A, B) sporodochia on bark; (C) conidiophorc; (D) conidia.

MYROTHECIUM Tode. Sporodochia cushionlike, sometimes with marginal hyaline setae; conidiophores subhyaHne to colored, repeatedly branched, bearing conidia terminally; conidia subhyaline to dark, 1-celled, ovoid to elongate, dry in mass, parasitic or saprophytic.

Illustration: *M. roridum;* original, from herbarium material on leaf on *Viola.* (A) sporodochium; (B) conidiophores and conidia. References (133, 337, 338, 339, 454).


A
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TUBERCULARIA
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HADROTRICHUM
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ILLOSPORIUM
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STRUMELLA
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HYMENELLA
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D
SPHAEROSPORIUM
A
B
C
DENDRODOCHIUM
A
B
MYROTHECIUM

TIJBERCUIJNA Sacc. Sporodochia small, breaking out in or near rust pustule; conidiophores hyaline, simple, bearing single conidia terminally; conidia hyaline, 1-celled, globose or ovoid to irregular; parasitic on rusts.

Illustration: *T. persincia;* original, from herbarium material on *Euphorbia marginala.* (A) section of sporodochia; (B, C) conidiophores and conidia; (D) aeciospore of rust. Reference (179).

SPHACELIA Lev. Sporodochium stromalike, spreading; conidiophores hyaline, simple, in a compact palisade; conidia hyaline, small, ovoid, 1-celled, produced in a sugary "honey dew"; parasitic in ovary of grain; conidial state of *Claviceps.*

Illustration: *S. segetum (Claviceps purpurea);* original, from prepared slide. (A) section through young sclerotium; (B) portion of A, enlarged; (C) palisade of conidiophores and conidia.

VOLUTELLA Tode. Sporodochia discoid, with marginal dark setae; conidiophores usually simple, in a compact palisade; conidia hyaline, 1-celled, ovoid to oblong; parasitic "or saprophytic.

Illustration: *V. frucii;* original, from herbarium material on apple fruit. (A) erumpent sporodochia on apple fruit; (B) conidiophores, conidia and setae.

PUCCINIOPSIS Speg. Sporodochia dark, cushion-shaped; conidiophores dark, simple, in a layer, bearing conidia apically on successive new growing tips; conidia dark, typically 2-celled, ovoid to oblong; parasitic.

Illustration: *P. caricae;* original, from herbarium material on leaves of *Carica papaya.* (A) sporodochia on leaf; (B) section of sporodochia; (C) conidiophores and conidia. Reference (266).

RAMULISPORA Miura. Sporodochia small, arising from substomatal stromata and pushing through stomata; conidiophores hyaline, simple or branched, short; conidia hyaline, filiform, septate, with short lateral branches, produced in gelatinous material; superficial sclerotia present; parasitic on leaves.

Illustration: *R. sorghi;* redrawn from Olive *et ai* (317). Stroma, conidiophores, and conidia in stoma.

EXCIPULARIA Sacc. Sporodochia superficial, scattered, dark, with setae; setae simple, dark, septate, pointed; conidiophores short, simple, subhyaline; conidia several-celled, dark brown, fusiform, apical, single; saprophytic.

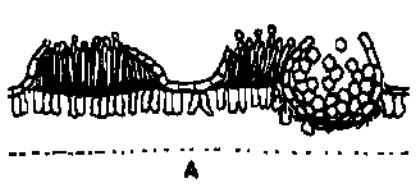
Illustration: *K narsapurensis;* redrawn from Subramanian (403). (A) sporodochium; (B) conidia; (C) seta.

BACTRIDIUM Kunze. Sporodochia cushion-shaped to hemispherical, bright-colored (yellow); conidiophores long, simple or branched, hyaline; conidia apical, single, hyaline or containing yellow pigment, several-celled, very large, cylindrical to long-ellipsoid; saprophytic, on decayed wood.

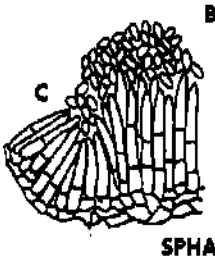
Illustration: *B. flava;* original, from fresh material on wood. (A) sporodochium; (B) conidiophores; (C) conidia.

EXOSPORIUM Link ex Schlech. Mycelium immersed, dark; stromata and sporodochia usually present, often well developed; conidiophores usually grouped, erect, brown; conidiophore growing out laterally or obliquely below conidial scar, splitting side wall, then forming new conidium through pore at apex of new growing point; conidia single, pseudoseptate several-celled, with prominent scar; mostly saprophytic.

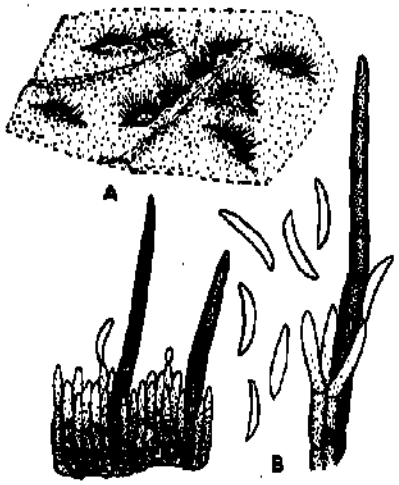
Illustration: *E. tiliae;* (A) sporodochium; (B) conidiophores and conidia; redrawn from Luttrell (272). Reference (117).



TUBERCULINA

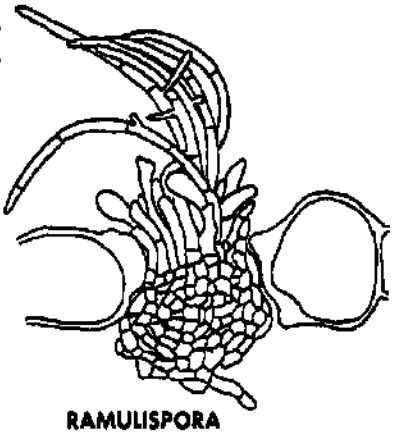


SPHACELIA

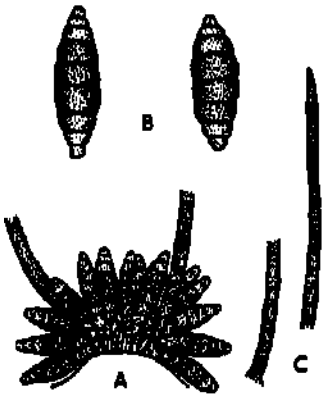


VOLUTELLA

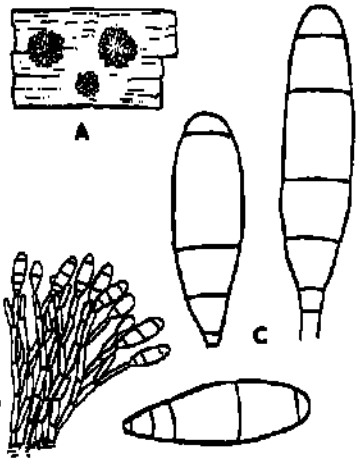
PUCCINIOPSIS



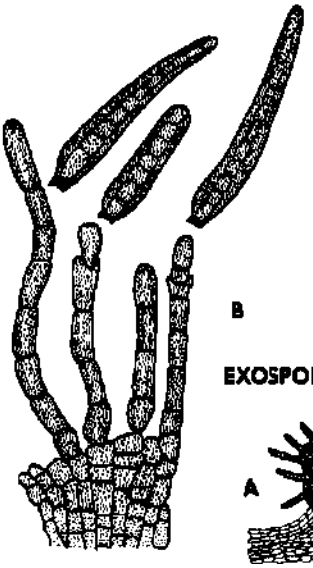
RAMULISPORA



EXCIPULARIA



BACTRIDIUM



EXOSPORIUM

EPICOCCUM Link. Sporodochia dark, more or less cushion-shaped, variable in si?e; conidiophores compact or loose, dark, rather short; conidia dark, several-celled (dictyosporous), globose; mostly saprophytic, or weakly parasitic.

Illustration: *E. nigrum;* original, from fresh material on decayed wood. (A) sporodochia on decayed wood; (B) conidiophores and conidia. Reference (366).

SPEGAZZINIA Sacc. Sporodochium small, dark; conidia of two kinds: (1) 4-ccllcd, spiny, borne apically on a long slender conidiophore; (2) 4-celled, smooth, borne on a short conidiophore; saprophytic on vegetable material; both conidiophore and conidia dark. The smooth conidia and sporodochium are apparently lacking in some species.

Illustration: *S. ornata;* redrawn from Bessey (27). Reference (74).

CHEJROMYCES Berk, and *Curt.* Sporodochium dark; cushionlike *to* hysteroid; conidiophores dark, short, simple or branched; conidia dark, branched into three or more upright arms, which do not all arise from the basal cell; saprophytic on wood. Compare with *Dhtyosporium.*

Illustration: *C. stelhtus;* (A) hysteroid sporodochia; drawn from photograph by Damon (71); (B) original, from herbarium material on decayed wood.

BACTRODESMIl'M Cooke. Conidiophores short, clustered (sometimes into sporodochia), simple or branched, hyaline *to* pale brown, narrow at base, septate; conidia several-celled, pale *to* dark brown, apical cells often darker, apical, single; saprophytic.

Illustration: *Bactrodvsmium* sp.; original, from fresh material on decayed wood. (A) habit on wood; (B) conidiophores bearing conidia emerging from a piece of wood; (C) apical portion of conidiophores showing conidial attachments. Reference (114).

EVERHARTIA Sacc. and Ellis. Sporodochia somewhat stalked, with an expanded top, dark at the base; conidiophores slender, hyaline, branched; conidia hyaline, apical, septate, flat, curved *or* bent; *saprophytic* on wood.

Illustration: *E. lignatilis;* (A) sporodochium; (B) conidiophores and conidia; redrawn from Thaxter (437). References (263, 289).

HOBSONIA Berk. Sporodochia wartlike, light colored; conidiophores hyaline, slender; conidia hyaline, many celled, apical, coiled in a loose spiral; saprophytic on plant material.

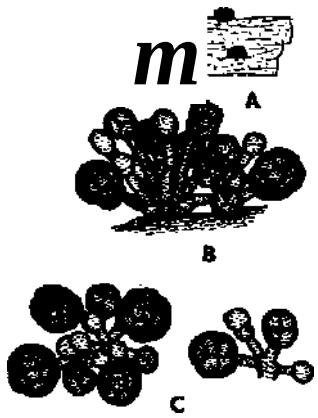
Illustration: //. *mirabilis;* (A) portion of sporodochium; (B) conidia redrawn from Under (263). Reference (289).

CAMPTOMERIS Syd. Sporodochia irregular, dark, poorly developed or lacking in some species;. conidiophores dark, arising from special enlarged cells; conidia dark, 3- or more-celled, elongate, leaf parasites on *Mimosa.*

Illustration: *C. leuvaenae.* (A) sporodochium from above; (B) vertical section through sporodochium; (C) branch of sporodochium bearing three conidiophores; (D) conidia; redrawn from Bessey (29). Reference (199).

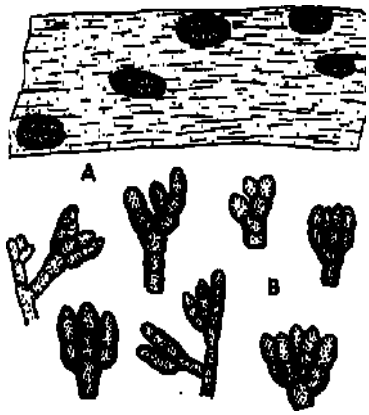
AECERITA Pers. Stroma covering scale insects; sporodochia somewhat spherical, somewhat colored, superficial; conidia spherical, 1-celled; on scale insects.

Illustration: *A. wehberi;* original, from herbarium material on citrus leaf (A) stroma covering scale insect on citrus leaf; (B) section through stroma; (C) two sporodochia showing sterile hyphae and conidium-like cells. Reference (131).

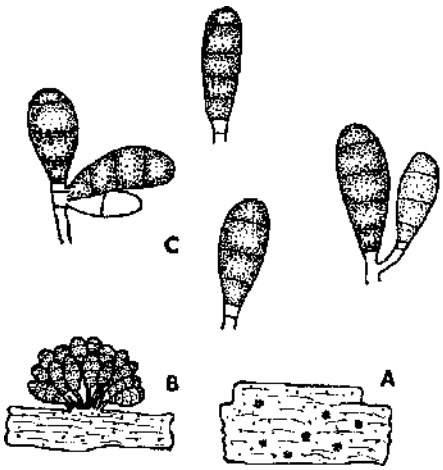


EPICOCCUM

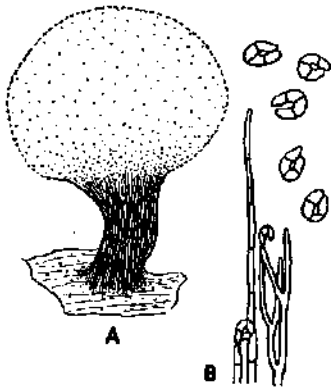
SPEGAZZINIA



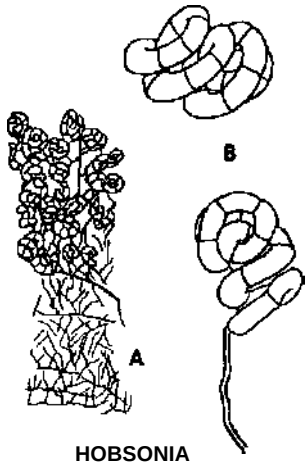
CHEIROMYCES



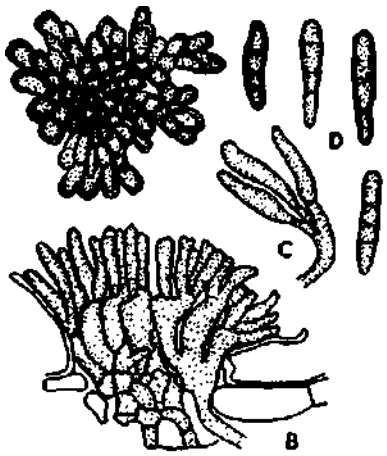
BACTRODESMIUM



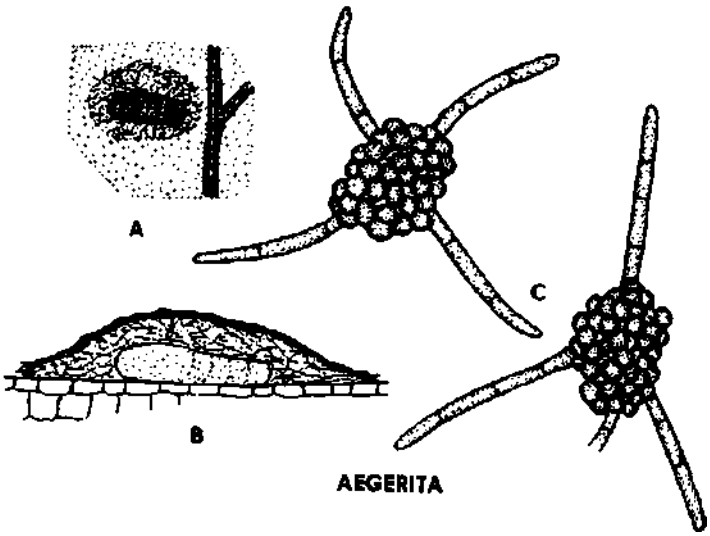
EVERHARTIA



HOBSONIA



CAMPTOMERIS



AEGERITA

HETEROCEPHALUM Thaxt. Synncmata with long, cylindrical stalk composed of a central large strand surrounded by cortical hyphae, fertile head with loose interwoven sterile hyphae and long slender spinelike hyphae surrounding the spore mass; fertile branches thick, terminating in phialides; conidia hyaline, small, ovoid; saprophytic on dung or soil.

Illustration: //. *auranriacum;* (A) young synnema; (B) upper portion of mature synnema; (C) phialides and conidia; redrawn from Thaxter (437). Reference (301).

STILBUM Tode ex. Fr. Synnemata hyaline or bright-colored, stipe cylindrical, bearing a head of conidia; conidiophores slender, verticillatefy branched; conidia 1-celled, hyaline, globose to ellipsoid, enveloped in slime, saprophytic, on bark and wood. Single conidiophores resemble *Veriicillium.*

Illustration: *Stilbum* sp.; original, from culture. (A) synncmata showing spores in head of slime; (B) portion of synnema; (C) single conidiophore; (D) conidia. References (17, 301).

MENISPOROPSIS Hughes. Synnema composed of a central emerging seta and an external shorter cortex; phialides, pale brown; conidia 1-celled, hyaline, curved, with a short filiform appendage at each end, produced in slime; saprophytic.

Illustration: *M. theobromae;* redrawn from Hughes (198). (A) synnema with central seta; (B) conidia. Reference (301).

ENDOCATYX Berk, and Br. Synnemata expanding upward into a funnel that is filled with conidia; conidia sessile or on short branches of conidiophore, 1-celled, brown, flattened, ovoid or irregular, with a germ slit; on twigs.

Illustration: *E. thwaitesii;* redrawn from Hughes (207). (A) synnemata; (B) conidia. Reference (301).

PESOTUM Crane and Schok. Synnemata mostly erect, simple or branched near base, dark brown to black, as in *Graphium;* single conidiophores hyaline, slender, mostly simple; conidia (sympodulospores) 1-celled, hyaline, borne on short blunt denticles; formerly placed in genus *Graphium;* recently described as the conidial state of *Ceratocystis ulmi.*

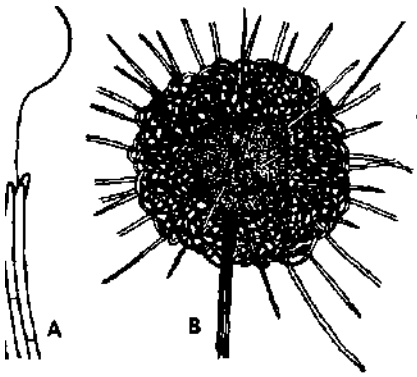
Illustration: *P. ulmi (Graphium ulmi);* original from culture. Reference (65).

GRAPHIUM Corda. Synnemata tall, dark, bearing a rounded, terminal mass of hyaline conidia embedded in slime; simple, hyaline conidiophores also produced in abundance, bearing oblong conidia that reproduce by budding; parasitic, often as vascular pathogens causing wilts of trees, or saprophytic. Some species are imperfect states of *Ceratocystis.* Mode of conidial development variable in different species.

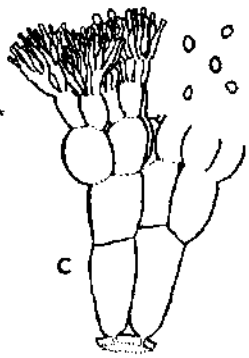
Illustration: *Graphium* sp.; original, from culture obtained from oak wood. (A) habit of synnemata; (B) synnema and conidial head enlarged; (C) conidiophores and conidia from water mount; (D) short, hyaline conidiophores and conidia similar to *Hyalodendron,* Reference (301).

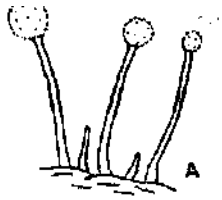
BRIOSIA Cav. Synnemata dark, cylindrical, spore-bearing head ovoid to sub-globose; conidia dark, 1-celled, in chains, collecting in dry masses; parasitic, commonly causing blight of *Azalea* and *Rhododendron* /lower buds.

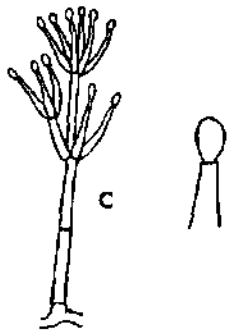
Illustration: *B. azalea;* original, from dried material. (A) synnemata on blasted *Rhododendron* flower; (B) two synnemata as seen under low magnification; (C) synnema showing sporulating head; (D) conidia. Reference (301).



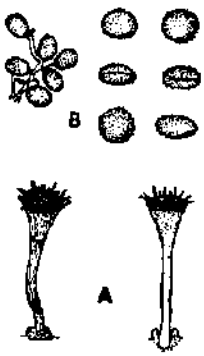
HETEROCEPHALUM





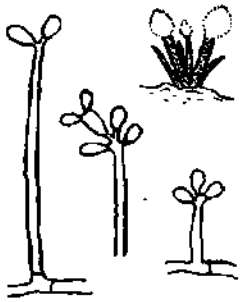


STILBUM

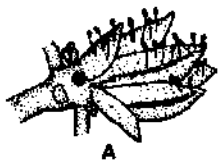


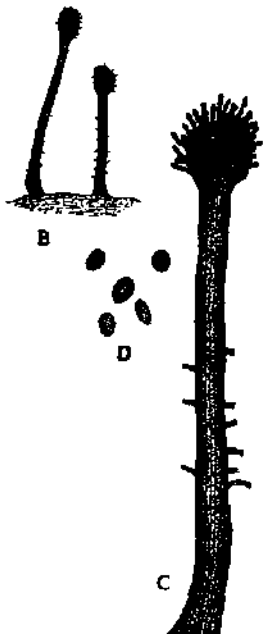
ENDOCALYX

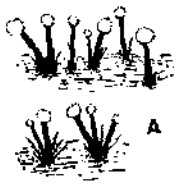
MENISPOROPSIS



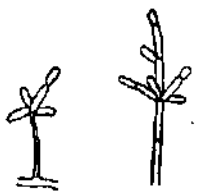
PESOTUM

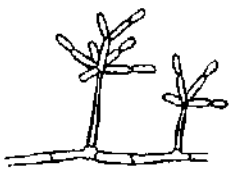






GRAPHIUM





BRIOSIA

DIDYMOSTILBE P. Henn. Synnemata light, stalk cylindrical, with an expanded, ovoid, or rounded spore-bearing head; conidiophores hyaline, branched, short conidiophores produced abundantly in culture, conidia hyaline, 1-cellcd, usually becoming 2-celled, contained in droplets of slime, ovoid to elongate; saprophytic, principally on wood.

Illustration: *Didymostilbe* sp.; original, from culture isolated from stump of *Liriodendron lulipifera.* (A) synnemata showing heads of conidia embedded in slime; (B) synnema dry; (C) synnema moist; (D) synnema showing conidiophores, from water mount; (E) branched conidiophore from synnema; (F) conidia. Reference (301).

ARTHROSPORIUM Sacc. Synnema cylindrical, .subhyaline, with long spore-bearing upper portion; conidiophores diverging, bearing conidia at apex; conidia mostly 4-celled, hyaline to subhyaline, long-fusoid to falcate; saprophytic.

Illustration: *S. compositum;* original from herbarium material on dead bark. (A) synnema; (B) conidiophores; (C) conidia. Reference (301).

PODOSPORIUM Schw. Synnemata erect, clustered, black, cylindrical, with a long, apical fertile portion; conidiophores septate, dark, diverging; conidia several-celled, dark, apical, single.

Illustration: *P. rigidum;* original, from herbarium material on stems of *Ampelopsis quinquefolia.* (A) habit on stem; (B) synnema; (C) conidiophore and conidia. Reference (301).

DENDROGRAPHIUM Massec. Synnema with dark, cylindrical stipe, free ends of hyphae become conidiophores; conidiophores enlarged, radiating, simple or branched; conidia mostly 4-celled, dark, apical, in short acropetalous chains, cylindrical-ovoid; saprophytic.

Illustration: *D. interseminatum;* redrawn from Subramanian (404). (A) synnema with conidia; (B) enlarged apex of synnema with conidiophores bearing catenulate conidia; (C) conidia. Reference (301).

DORATOMYCES Corda. Hyphae dark; conidiophores dark, solitary or compacted into synnema with dense, elongated head of conidiogenous cells and chains of conidia, upper part of conidiophores branched penicillately, producing masses of dry spores apically on conidiogenous cells; conidia (annellospores) mostly dark, I-celled, ovoid; saprophytic. Similar to *Trichurus* but without spines.

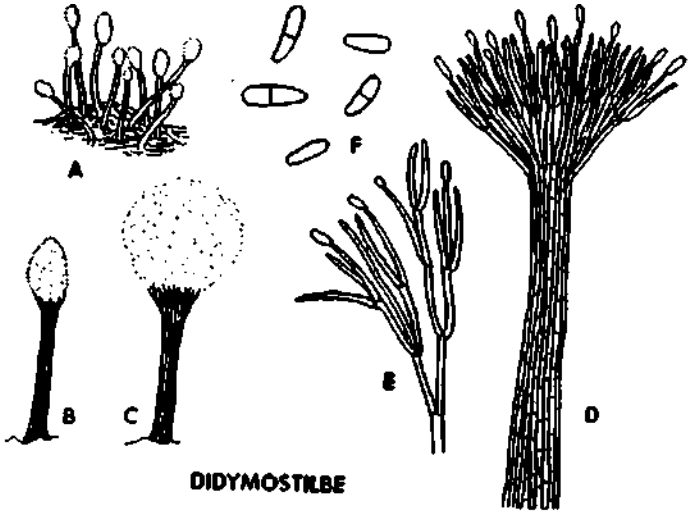
Illustration: *D. stemonitis (Stysanus stemonitis);* original, from culture. (A) synnema; (B) separate conidiophores; (C) conidia. Reference (301, 303).

ISARIOPSIS Fres. Synnemata dark, coposed of loose conidiophores, bearing conidia at or near the tips; conidia dark or pale, 2- or more-celled, cylindrical to obclavate, often curved; parasitic.

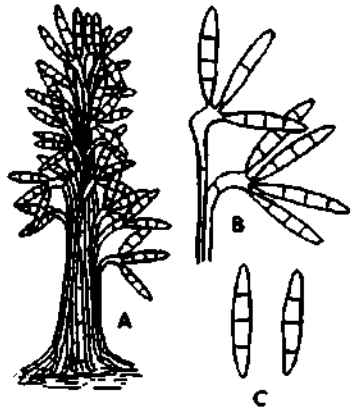
Illustration: /. *griseola;* original, from herbarium matrcrial on bark. (A, B) synnemata; (C) conidia.

ARTHROBOTRYDM Ces. Synnemata dark, cylindrical, with a globose sporulating head; conidia hyaline to dark, 3- to 4-celled, produced in slime; saprophytic on wood.

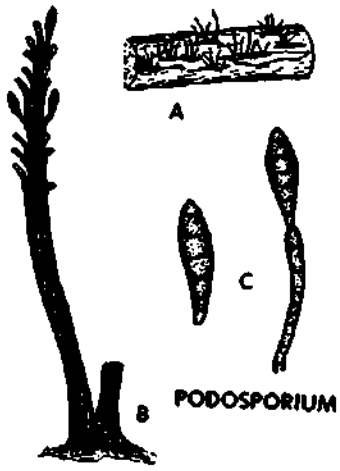
Illustration: *A. stilboideum;* (A) synnemata; (B) conidiophores; (C) conidia; redrawn from Subramanian (405). References (195, 301).



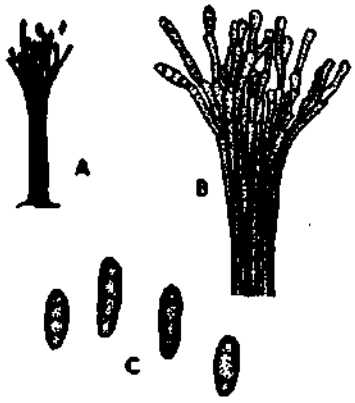
DIDYMOSTILBE



ARTHROSPORIUM

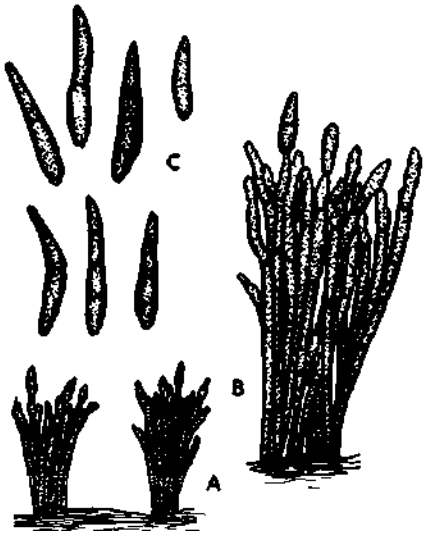


PODOSPORIUM



DENDROGRAPHIUM

DORATOMYCES



ISARIOPSIS

ARTHROBOTRYUM

ISARIA Hers. Synnemata light colored, cylindrical to clavate; conidia hyaline, 1-celled, ovoid, dry, not produced in gelatinous material; saprophytic or parasitic on insects. Some species are imperfect states of *Cordyceps.*

Illustration: /. *cretacea;* original, from culture. (A) synnemata in culture turning toward source of light; (B) portion of synnema; (C) conidiophores and conidia. Reference (301).

THAROOPAMA Subram. Synnemata with well-defined stalk and head, hyphae becoming free to form conidiophores; conidiophores subhyaline to brown, septate, branched 1 to 3 times, with apical hyaline fertile cells; conidia borne on small denticles, 1-celled, hyaline, globose,

Illustration: *T. trina;* redrawn from Subramanian (403). (A) synnema; (B) conidiophores and conidia; (C) conidia. Reference (301).

HARPOGRAPHIUM Sacc. Synnemata dark brown, the upper spore-bearing portion capitate to elongate, fibrous, the hyphae with thick stubby tips; conidia hyaline, more or less falcate, 1-celled; saprophytic on bark and wood.

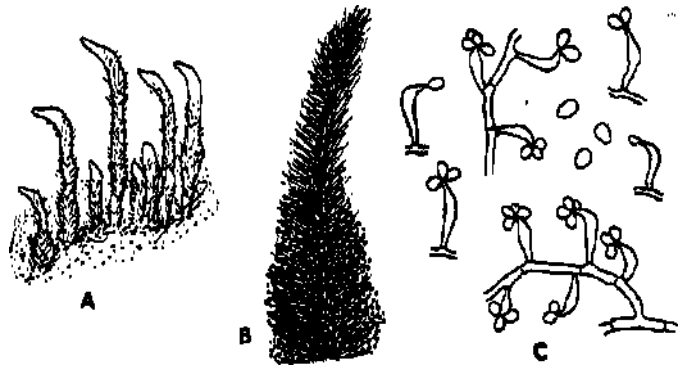
Illustration: //. *fascicuhtum;* original, from herbarium material on bark. (A, B) synnemata; (C) redrawn from Subramanian (405). Reference (301).

TRICHURUS Clem, and Shear. Synnemata dark, stalk slender, conidium-bearing portion expanded; long, black, simple, or branched hairs on spines present among the conidiophores; conidia dark, I-celled, ovoid, catenulate; saprophytic. Similar to *Doratomyces* but with spines.

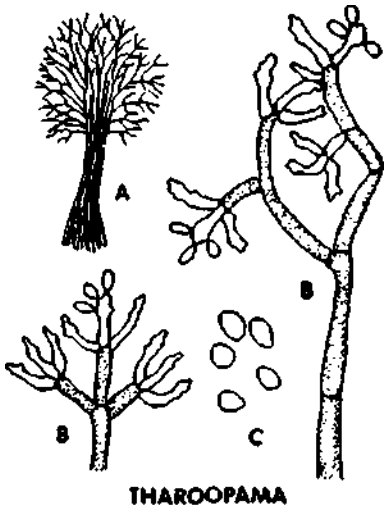
Illustration: *T. terrophilus;* (A) synnema; (B) portions of synnema showing conidiophores and spines; (C) conidia; (D) sporogenous cells bearing conidia; original, from culture. References (301, 430).

DIDYMOBOTRYUM Sacc. Synnema with tall, cylindrical stipe and subglobose head, dark; conidiophores divergent, bearing conidia apically; conidia dark at maturity, 2-celled, oblong or cylindrical; saprophytic.

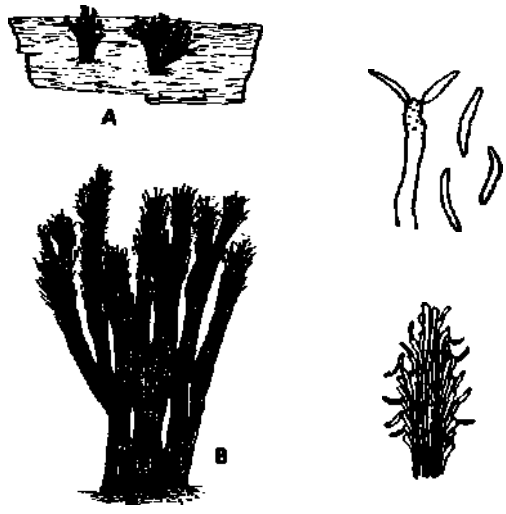
Illustration: *D. cookei:* original from herbarium material on dead stems. (A) habit of synnemata on wood; (B) synnema; (C) conidiophores and conidia. Reference (301).



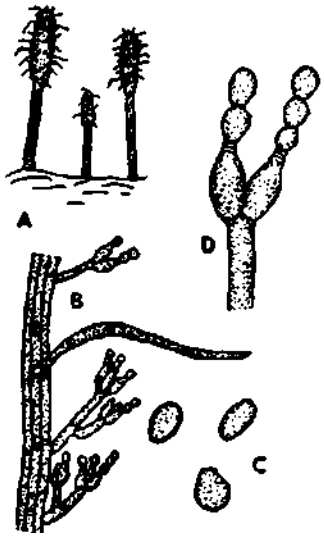
ISARIA



THAROOPAMA



HARPOGRAPHIUM



TRICHURUS

DIDYMOBOTRYUM

SCLEROGRAPHIUM Berk. Colonies covering surface of leaflets; synnemata tail, slender, black; conidiophores diverging outward, bearing near the apex small truncate denticles that bear single conidia; conidia several-celled, dictyosporous, brown, dry.

Illustration: 5". *aterrimum;* redrawn from Hughes (197). (A) synnema; (B) conidiophores and conidia. Reference (301).

ACAROCYBE Sydow emend. M.B. Ellis. Mycelium superficial, brown; conidiophores erect, brown, branched to form tall, slender synnemalike structures, each with a head; synnema forms as hyphae branch and grows downward, branches closely appressed; head composed of short, thick fertile cells on short branches; conidia 2- to 3-celled, pale brown, obclavate, straight or curved; on living leaves.

Illustration: *A. hansfordii;* redrawn from Ellis (115, 120). (A) portions of synnemata showing unusual form of development; (B) conidiogenous cells; (C) conidia. Reference (301).

SPIROPES Cifcrri. Colonies effused, hairy or velvety, pale to brown or black, often overgrowing and apparently parasitic on Meliolineae or other tropical leaf ascomycetes; conidiophores simple, single or clustered into synnemata, pale to dark brown, septate; conidiogenous area simple, sympodular, with numerous conspicuous conidial scars; conidia solitary, 2- to several-celled, variable but often obclavate, pale to dark brown.

Illustration: (A) separate conidiophores of 5". *capensis;* (B) synnema of *S. japonicus;* redrawn from Ellis (123).

AKANTHOMYCES Leb. Synnemata light colored, cylindrical or somewhat attenuated above, composed of compact hyphae; phialides produced as terminal cells of lateral branches in **a** compact layer, ellipsoid, obovoid or cylindrical, acute at the apex; conidia hyaline, 1-celled, smooth, catenulate; parasitic on insects and spiders.

Illustration: *A, acuieata;* (A) synnemata on dead moth; (B) phialides and conidia; (A) drawn from photograph; (B) redrawn from drawing; both from Mains (278). Reference (301).

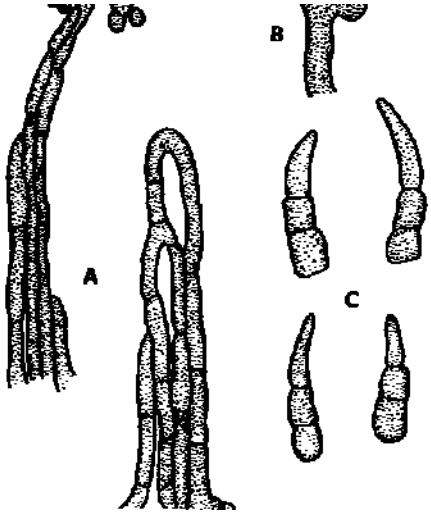
INSECTICOLA Mains. Synnemata light colored, clavate, stipitate, upper fertile portion compact composed of branching hyphae terminating in phialides that form **a** compact layer; conidia hyaline, l-cclled, smooth, catenulate; parasitic on insects.

Illustration: /. *clavate;* (A) synnemata on infected cricket; (B) phialides and conidia; (A) drawn from photograph, (B) redrawn from drawing; both from Mains (278). Reference (301).

HYMENOSTILBE Petch. Synnemata nearly cylindrical, composed of longitudinal, closely compacted hyphae; phialides in a layer covering the synnema, produced on short, lateral branches, subcylindric to clavate, obtuse or narrowed on short sterigmata; conidia hyaline, 1-celled, smooth, borne singly; parasitic on insects or spiders.

Illustration: //. *verrucosa;* (A) synnemata of fungus on spider; (B) conidiophore branch, phialides, and conidia; (A) drawn from photograph; (B) redrawn from drawing; both from Mains (278). Reference (301).

SCLEROGRAPHIUM



ACAROCYBE

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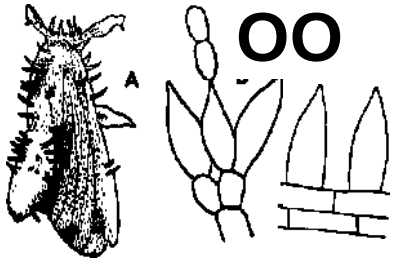
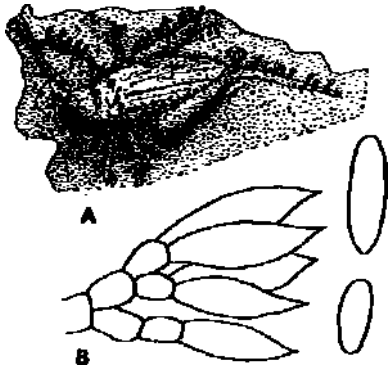
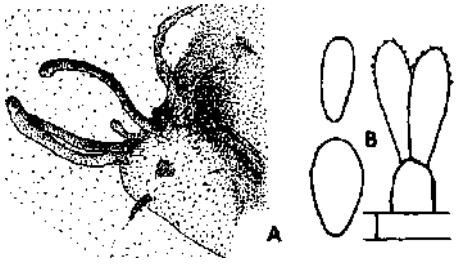


AKANTHOMYCES

SPIROPES



INSECTICOLA



HYMENOSTILBE

GIBELLULA Cav. Synnemata light to brown, cylindrical, composed of loose, longitudinal hyphae; conidiophores brownish, terminal cell or cells hyaline, apex enlarged, bearing prophialides and phialides that compose a globose or broadly wedge-shaped head; conidia fusoid to ellipsoid, produced successively, single or in short chains; parasitic on spiders; conidial states of *Torrubiella.*

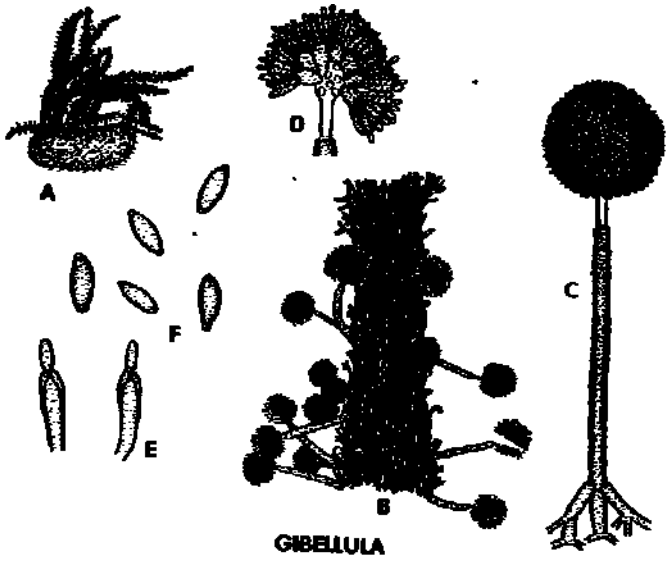
Illustration: *G. suffulta;* (A) synnemata on mummified spider; (B) portion of synnema showing conidiophores and comdial heads; (C) single conidiophore and conidial head; (D) portion of conidial head; (E) phialides; (F) conidia; redrawn from Speare (381). References (277, 301).

HIRSUTELLA Pat. Synnemata, simple or with numerous branches arising nearly at right angles (some species lack synnemata); phialides arising laterally on synnema or from mycelium on host, hyaline, inflated below, abruptly or gradually narrowing to long slender sterigmata; conidia hyaline, 1-celled, oblong to cylindrical, covered with slime; parasitic on insects.

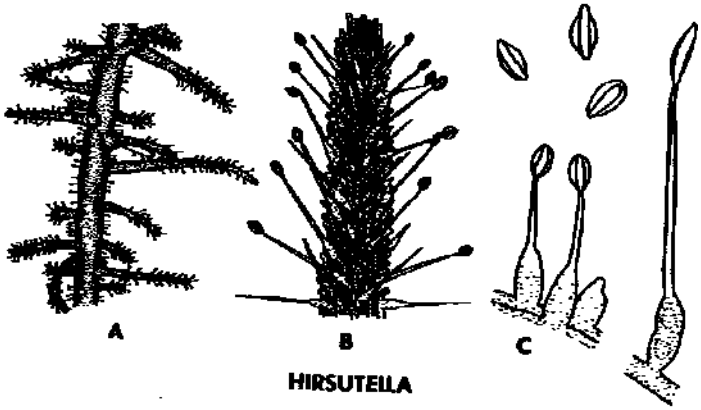
Illustration: *H. saussurei.* (A, B) portions of synnemata; (C) phialides and conidia; redrawn from Speare (382). References (135, 279, 286, 301).

SYNNEMATIUM Speare. Synnemata simple or branched, brown when mature; phialides mostly at ends of branches, slender, tapering to a pointed tip; conidia hyaline to pale brown, covered with slime, several spores held together in clusters; sclerotia spherical, becoming brown with thick-walled cells; parasitic on insects.

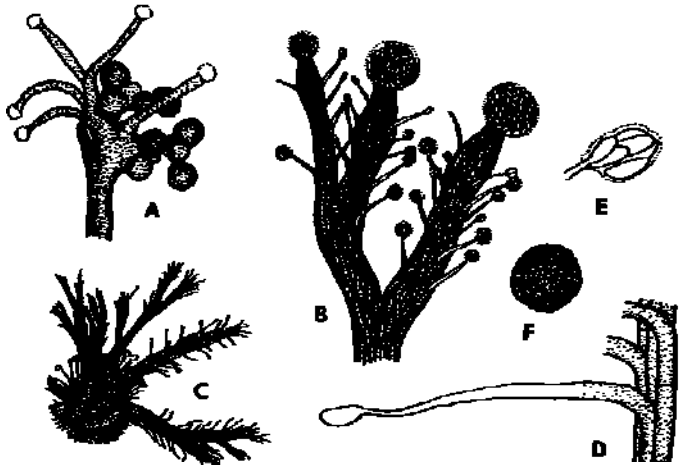
Illustration: *S- jonesii;* (A) synnema producing sclerotia; (B) synnema producing conidia; (C) sclerotium germinating and producing synnemata; (D) phialide and conidium; (E) cluster of conidia in mucus; (F) sclerotium; redrawn from Speare (382). Reference (279).



GIBELLULA



HIRSUTELLA



SYNNEMATIUM

PHYLLOSTICTA Pers. Pycnidia dark, ostiolate, lenticular to globose, immersed in host tissue, erumpent or with a short beak piercing the epidermis; conidiophores short; conidia small, 1-celled, hyaline, ovoid to elongate; parasitic, producing spots, principally on leaves. Compare with *Phoma.*

Illustration: *P. minima;* original, from dried material; (A) leaf spot and pycnidia on leaf of maple; (B) section of leaf and pycnidium; (C) conidiophores; (D) conidia. Reference (52).

PHOMA Desm. Like *Phyllosticta;* parasitic, on various plant parts. Both generic names, *Phoma* and *Phyllosticta,* occur commonly in the literature but morphologically they are alike.

Illustration: (A-C) *P. hetae,* from culture; (D) *P. lingam,* from section of host; original; (A) side view of pycnidium; (B) top view of pycnidium; (C) conidia; (D) pycnidium and conidia. Reference (417).

PLENODOMUS Preuss. Pycnidia dark, immersed, irregular in shape, opening irregularly at the apex; conidia hyaline, 1-celled, oblong; parasitic.

Illustration: *P. destruens;* original. (A) surface view of erumpent pycnidia on sweet potato stem; (B) section through pycnidium; (C) pycnidia produced in culture; (D) conidia.

SELENOPHOMA Marie. Pycnidia brown, globose, immersed, erumpent, ostiolate; conidia hyaline, 1-celled, bent or curved, typically lunate or less often boomerang-shaped; parasitic, causing spots on grasses and some other hosts.

Illustration: *S. linicola.* (A, B) pycnidia on flax stem, drawn from photographs; (C) conidia; all redrawn from Vanterpool (457). Reference (386).

PYRENOCHAETA de Not. Pycnidia dark, ostiolate, nearly globose, erumpent with a few simple bristles, especially near the ostiole; conidiophores simple or rarely branched; conidia small, 1-celled, hyaline, ovoid to elongate; parasitic or saprophytic.

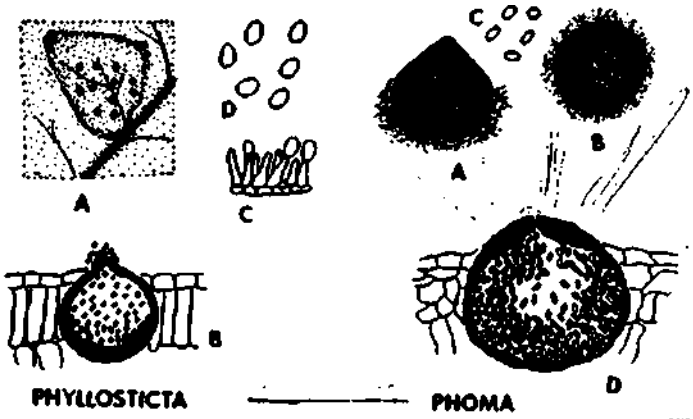
Illustration: *Pyrenochaeta* sp.; original, from culture. (A) group of pycnidia; (B) pycnidium; (C) conidiophores and conidia.

DENDROPHOMA Sacc. Like *Phoma* and *Phyllosticta* but conidiophores are branched.

Illustration: *D. obscurans;* original, from culture. (A, B) pycnidia and exuded masses of conidia; (C) conidiophores; (D) conidia.

APOSPHAERIA Sacc. Pycnidia dark, rounded, with a short papillate ostiole; conidiophores short, 1-celled, conidia hyaline, 1-celled, elongate to globose; saprophytic on wood.

Illustration: *P. pezizoides* original, from herbarium material on *Fraxinus* wood. (A) habit of pycnidia; (B) section through pycnidia; (C) conidiophores; (D) conidia.


A
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C
A
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B
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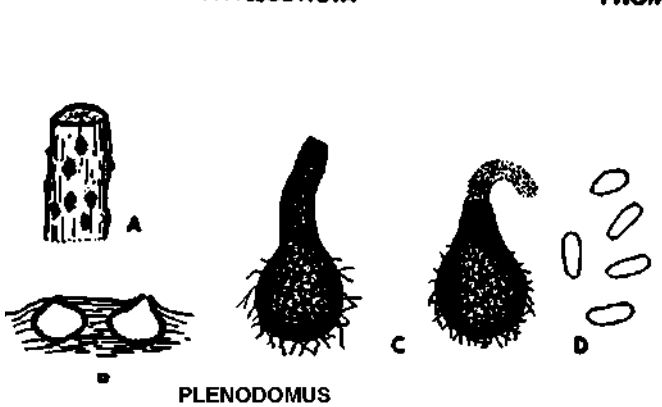
PHYLLOSTICTA
PHOMA


A
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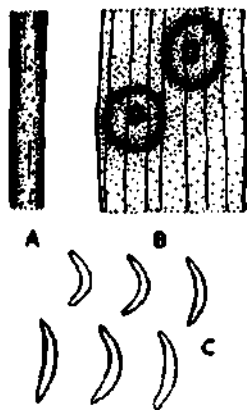
PLENODOMUS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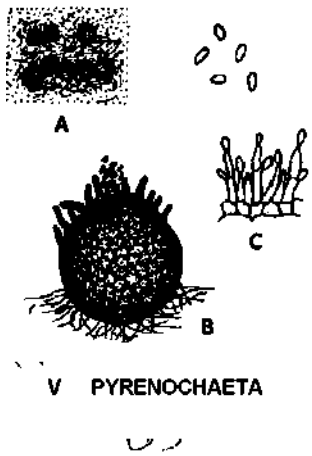
SELENOPHOMA


A
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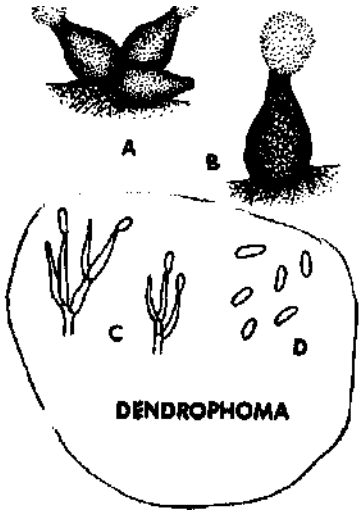
V PYRENOCHAETA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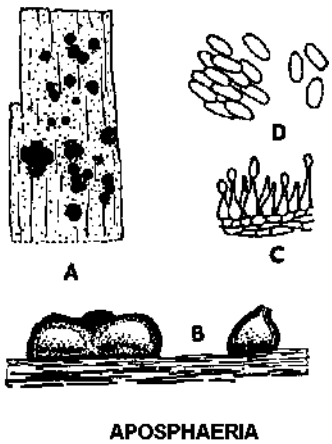
DENDROPHOMA


D
C
A
B
APOSPHAERIA

PEYRONELLAEA Goidanich. Pycnidia brown to black, superficial to partly immersed, rounded, with conspicuous ostiole, single to crowded; conidia 1-celled, hyaline or later becoming subhyaline to dark, ovoid to ellipsoid; chlamydospores many-ceiled, dark, apical or intercalary, with irregular septations; saprophytic or parasitic.

Illustration: *Peyronellaea* sp.; original, from culture. (A) habit of pycnidia in culture; (B) pycnidia; (C) conidia; (D) chlamydospores. References (150, 443).

RHIZOSPHAERA Mang. and Har. Pycnidia superficial, somewhat globose, dark, of cellular texture, with ostiole at apex, tapering below to a stalk; conidiophores short, simple; conidia 1-cellcd, hyaline, ovoid, smooth.

Illustration: *R. pini;* original, from herbarium material on leaves *of Abies balsamea.* (A, B, C) habit *of* pycnidia on leaf; (D) pyenidium; (E) conidiophores and conidia.

^**PHOMOPSIS** Sacc. Pycnidia dark, ostiolate, immersed, erumpent, nearly globose; conidiophores simple; conidia hyaline, 1-celled, of two types, ovoid to fusoid (alpha) conidia, and filiform, curved or bent (beta conidia); parasitic, causing spots on various plant parts. Imperfect state of *Diaporthe.*

Illustration: *P. (Diaporthe) vexans;* original, from egg plant fruit. (A) fruit spot showing pycnidia; (B) pycnidia; (C) alpha conidia; (D) beta conidia; (E) conidiophores. References (340, 342).

ASTEROMELLA Pass, and Thum. Pycnidia dark, small, globose, ostiolate, located in a mass of radiating dark hyphac (subiculum); conidia hyaline; l-cellcd, ovoid to cylindrical; parasitic on leaves.

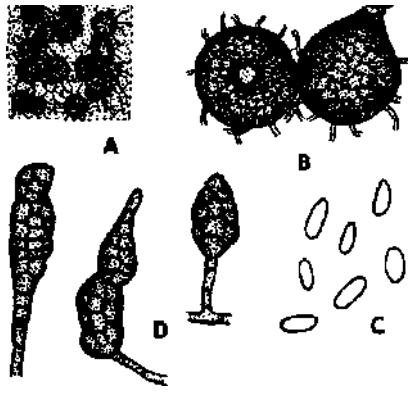
Illustration: *A. andrewsii;* original, from herbarium material on leaves of *Gentiana puberula.* (A) leaf spots and habit of fungus; (B) lop view of pycnidia and radiating hyphae; (C) section of pyenidium; (D) conidia.

CHAETOPHOMA Cooke. Pycnidia dark, small, globose to irregular, without ostiole, in dense or loose clusters, seated on an olive-colored subiculum; conidia hyaline, I-celled, very small, ovoid; saprophytic *on* plant material.

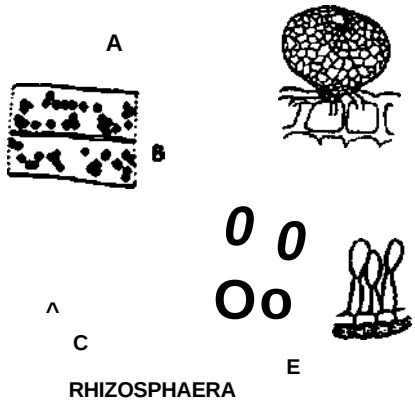
Illustration: *C. confluens;* original, from herbarium material on dead stems of *Spartina.* (A) habit, showing clusters of pycnidia on stem; (B) group of pycnidia, enlarged; (C) conidia.

- **MACROPHOMA** Berl. and Vogl. Pycnidia dark, ostiolate, globose, erumpent; conidiophores simple, short or elongate; conidia hyaline, 1-celled, over 15 microns long, ovoid to broadly ellipsoid; parasitic; may be a stage in the development of *Botryodiplodia* or *DothiorellaAncludcd* here because the name commonly occurs in the literature.

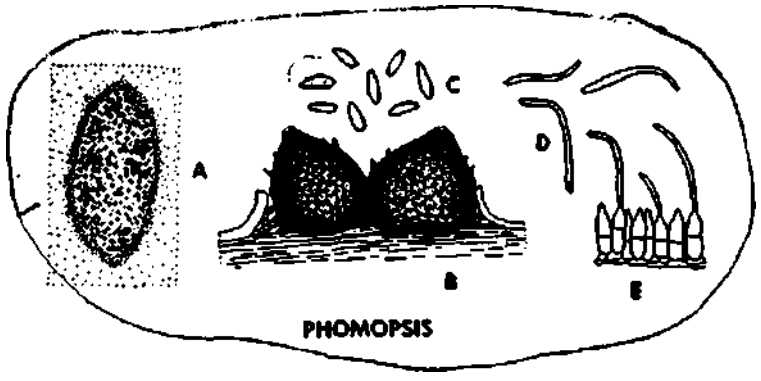
Illustration: *Macrophoma* sp.; original, from dried oak leaves. (A) leaf spot and pycnidia; (B) section through pyenidium; (C) conidiophores and immature conidia; (D) mature conidia.

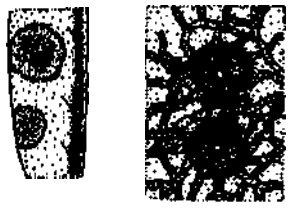


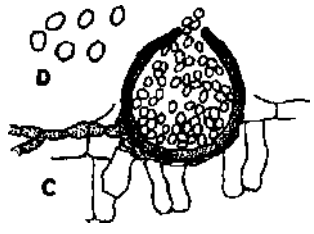
PEYRONELLAEA



RHIZOSPHAERA

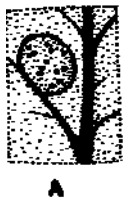






ASTEROMEUA

CHAETOPHOMA



MACRO PHOMA

NEOTTIOSPORA Desm. Pycnidia separate, globose, membranous; dark, innate, ostiolate; conidiophores short, simple, hyaline; conidia 1-celled, hyaline, each with a single appendage; appendage mucoid, evanescent, in the form of an inverted, hollow cone with thin, hyaline walls, formed by the rupture of the outer wall, which later becomes everted and funnellike; saprophytic.

Illustration: *N. caricina;* redrawn from Cunnell (67). (A) section of pycnidium; (B) conidiophores showing developing conidia; (C) conidia with appendages. Reference (413).

CYTOSPORINA Sacc. Stroma black, cushion-shaped or tubercular; pycnidia distinct, sunken, arranged more or less in a circle in the stroma, with ostiole; conidia 1-celled, hyaline, filiform, curved or bent; saprophytic on bark.

Illustration: *C. ludibunda;* original, from herbarium material on bark of *Prunus serrulata.* (A) habit of pycnidia in bark; (B) section through stroma and pycnidia; (C) conidia.

SCEEROTIOPSIS Sperg. Pycnidia large, separate, smooth, without a pore, fleshy or membranous; conidiophores erect, simple, filiform; conidia 1-cclled, hyaline, ellipsoid, angular at both ends.

Illustration: *S. concava;* original, from herbarium material on *Galas aphylla* leaf. (A) habit of pycnidia on leaf; (B) section of pycnidium; (C) conidiophores; (D) conidia.

AMPELOMYCES Ces. *(Cicinnoholus* Ehrenb.) Pycnidia dark, rounded, clavate or fusoid, developing inside conidiophores of powdery mildew fungi (Erysiphaceae), without ostiole; conidia hyaline or subhyaline to dark, 1-celled, ovoid to oblong; parasitic on Erysiphaceae.

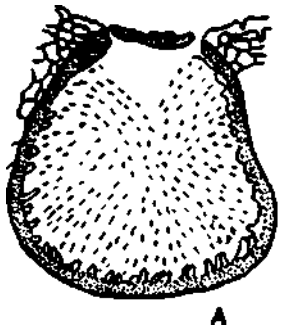
Illustration: *A. quisqualis;* original, from herbarium material on *Erysiphe* on leaf of *Grindelia.* (A) hyphae and conidiophores of *Erysiphe,* some bearing pycnidia of the parasite; (B, C) pycnidia enlarged; (D) conidia. References (270, 356).

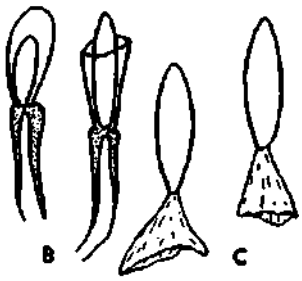
DILOPHOSPORA Desm. Pycnidia dark, globose, ostiolate, usually stromatic, within plant tissue; conidia 1-celled, hyaline, cylindrical, with short, branched slender appendages at both ends.

Illustration: *D. alepecuri;* original, from herbarium material on *Andropogon trachycaulum.* (A) habit of pycnidia in leaf; (B) pycnidia in stroma; (C) conidia with appendages.

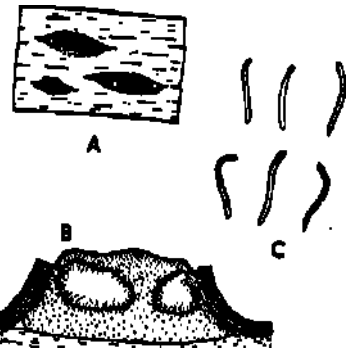
— **DOTHIORELLA** Sacc. Pycnidia dark, globose, grouped in a well-developed stroma; stroma subcortical, breaking out; conidiophores simple, short; conidia hyaline, 1-celled, ovoid to broadly ellipsoid; parasitic or saprophytic on wood.

Illustration: *Dothiorella* sp.; original, from dried material on oak twigs. (A) habit of pycnidia and stromata; (B) section through stroma; (C) conidiophores; (D) conidia.





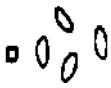
NEOTTIOSPORA



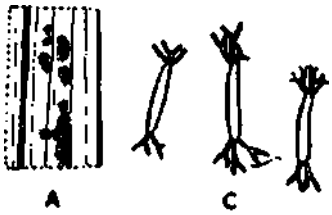
CYTOSPORINA

B C

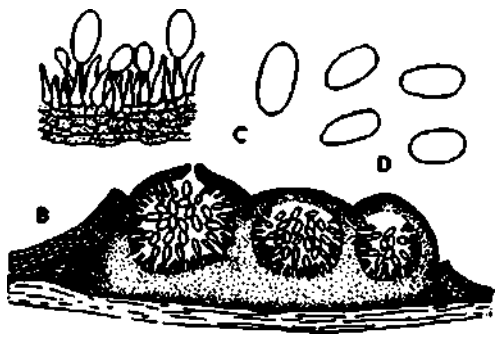
SCLEROTIOPSIS



AMPELOMYCES



DILOPHOSPORA



DOTHIORELLA

ELEUTHEKOMYCELLA Hohn. Pycnidia single, black, smooth, soft-leathery, with ostiole; conidiophores simple or branched, septate; conidia 1-celled, hyaline, cylindrical-ellipsoid, with a filiform pedicel and a slender, apical appendage; on other fungi.

Illustration: *E. mycophila;* redrawn from Seeler (367). (A) pycnidium embedded in host fungus; (B) cells of pyenidial wall, (C) conidiophores and conidia.

SPHAERONAEMA Fr. Pycnidia dark, superficial or crumpent, base spherical, with a long beak; conidiophores simple; conidia hyaline, 1-celled, ovoid to elongate; chiefly saprophytic.

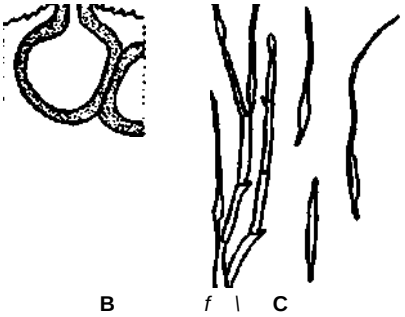
Illustration: *S. acerinum;* original, from herbarium material on dead braches of *Acer.* (A) habit of pycnidia; (B) section showing single pycnidium enlarged; (C) conidiophores, conidia, and sterile hyphae; (D) conidia.

HYALOPYCNIS Hohn. Pycnidia superficial, light-colored (shiny white) membranous, with a globose base and a long, subcylindrical neck, fimbriate at the apex; wall of pycnidium and neck composed of parallel hyphae fused laterally; conidiophores long, simple or branched; conidia 1-celled, hyaline, cylindrical or ovoid; on other fungi.

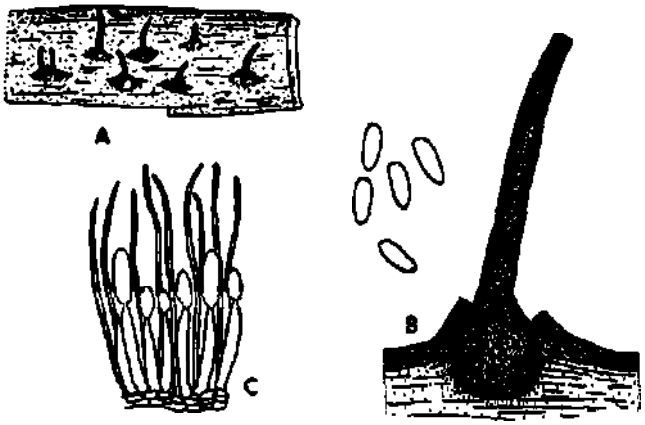
Illustration: *Hyalopycnis* sp.; original, from culture. (A) habit of pycnidia in culture; (B) pycnidium showing parallel hyphae; (C) conidiophore; (D) conidia from pycnidium; (E) conidia borne directly on mycelium. Reference (326).

EEEUTHEROMYCES Fuckel em. Seeler. Pycnidia single, superficial, light-colored, soft leathery or gelatinous and translucent when wet, walls and neck composed of small irregular cells; conidiophores hyaline, lining neck as well as base of pycnidium, septate, bearing conidia apically and laterally; eonidium 1-celled, hyaline, ellipsoid, attenuated at apex and at base; on basidiomycetes.

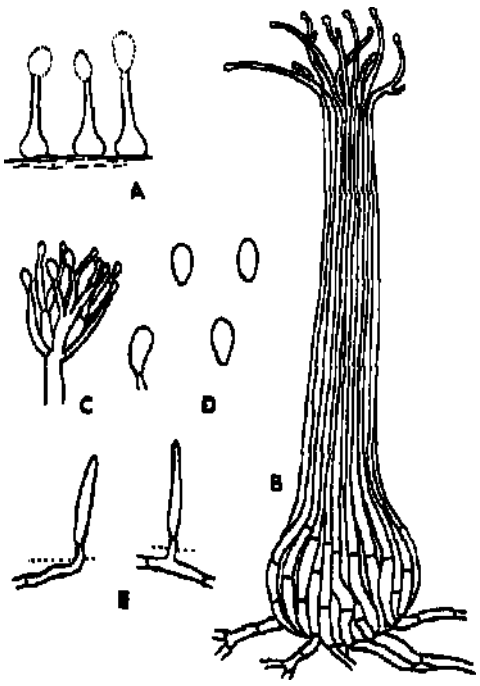
Illustration: *E. subulatus;* redrawn from Seller (367). (A, B) pycnidia; (C) cells of pyenidial wall; (D) conidiophores; (E) conidia.



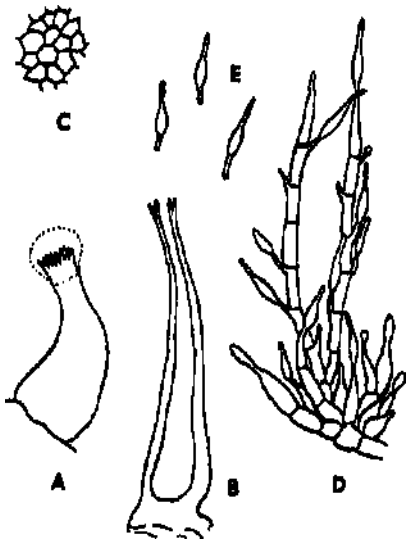
ELEUTHEROMYCELLA



SPHAERONAEMA



HYALOPYCNIS



ELEUTHEROMYCES

PEEUROSTROMELIA Petr. Pycnidia tufted thickly or hairy, on stroma, with or without ostioles; conidiophores long, simple or branched, septate; conidia 1-celled, hyaline, borne at the apex and on sides at the septa of the conidiophore.

Illustration: *P. deiitiscens;* original, from herbarium material on bark of *Primus.* (A) habit of pycnidia in bark; (B, C) sections of stroma and pycnidia; (D) conidiophores; (E) conidia.

FUSICOCCUM Corda. Pycnidia in spherical or flattened, subepidermal, erumpent, dark stroma, one to several per stroma; opening separately or with a common pore; conidiophores simple, short; conidia hyaline. I-celled, fusoid; parasitic or saprophytic on wood.

Illustration: *E Uicinum;* original, from herbarium material on dead branch of *flex opaca.* (A) habit of pycnidia; (BJ section through stroma and pyenidium; (CJ conidiophores and conidia; (D) conidia.

RABENHORSTIA Fr. Pycnidia borne in black, erumpent, subcortical stroma; stroma nearly globose, wider at base, upper part truncate, often circularly split at the top, divided into several cavities; conidiophores filiform, simple, septate; conidia hyaline, 1-celled, ovoid to oblong; saprophytic on branches.

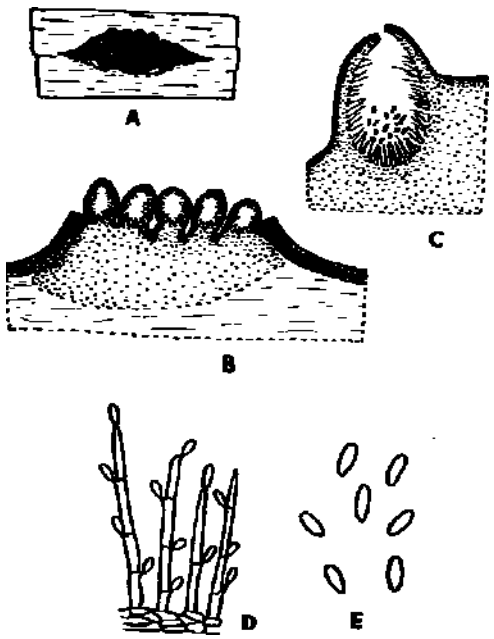
Illustration: *R. tiliae;* original, from herbarium material on dead branch of *Tilia.* (AJ habit of pycnidia; (B) section through stroma; (C) conidiophores; (D) conidia.

vtCYTOSPORA Ehrenb. Pycnidia within a superficial or erumpent, tuberculate, globose, stroma; cavities ^ irregular, incompletely separate; conidiophores slender; conidia hyaline, 1-celled, elongate-curved (allantoid); parasitic, *or* saprophytic on wood. Mostly imperfect states of *Vaha.*

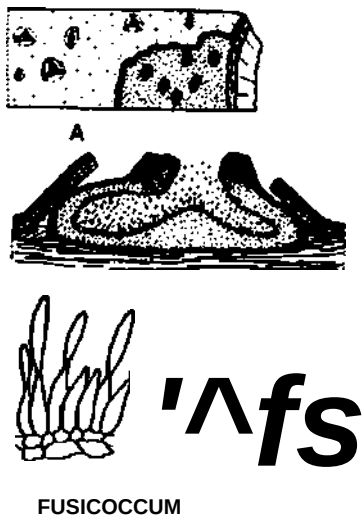
Illustration: *C. (Vaha) leucosioma;* original, from herbarium material on twigs of *Prunus domestica.* (A) habit of stromata; (B) section through stroma; (C) conidiophores; (D) conidia.

CYTOSPORELEA Sacc. Pycnidia forming irregular cavities within erumpent, tuberculate stroma; conidiophores slender, simple or branched; conidia hyaline, 1-celled, ovoid to oblong; parasitic or saprophytic on wood; similar to *Cytospora* except for shape of conidia.

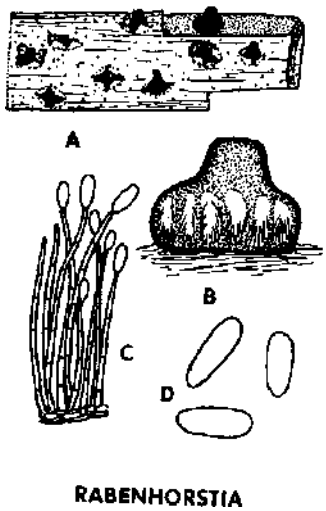
Illustration: *C. carnea;* original, from herbarium material on dead twigs of *Castanet* deniata.* (A) habit of stromata; (B) section through stroma; (C) conidiophores and conidia.



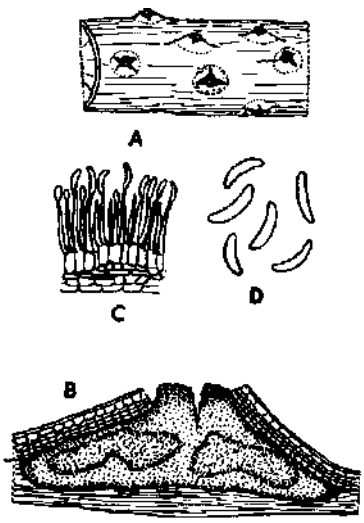
PLEUROSTROMELLA



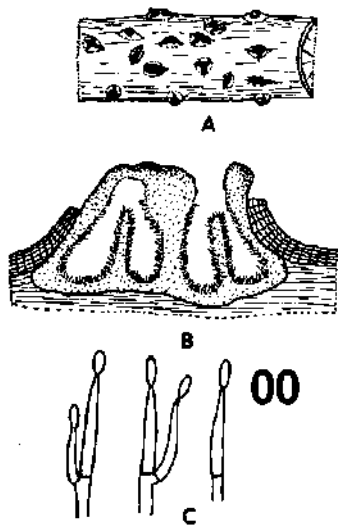
FUSICOCCUM



RABENHORSTIA



CYTOSPORA



CYTOSPORELLA

SPORONEMA Desm. Pycnidia subepidermal, slightly membranous, at first closed, later dehiscing radiately, gaping, dark; conidiophores slender, typically branched; conidia 1-celled, hyaline, ovoid to oblong; on leaves.

Illustration: *S. phacidioides;* redrawn from Jones (241). Reference (262).

CATINULA Lev. Pycnidia mostly globose-ovoid, dark, superficial, membranous-leathery, rather firm and solid, or somewhat fleshy when wet, nearly smooth, gaping at the top with a large mouthy often brightly colored when fresh; conidiophores simple or branched; conidia 1-celled, subhyaline, globose to oblong.

Illustration: *C. thujae;* original, from herbarium material on *Thuja plicata.* (A) habit of pycnidia on leaves; (B) pycnidium; (C) conidiophores; (D) conidia.

AMEROSPORIUM Speg. Pycnidia superficial, subcupulate, opening wide at apex, black, surrounded by long, pointed, black setae; conidiophores crowded, branched; conidia 1-celled, hyaline to subhyaline, without bristles, cylindrical to ellipsoid; saprophytic.

Illustration: *A. caricum;* original, from herbarium material on *Carex* leaves. (A) habit of pycnidium on leaf; (B) pycnidium; (C) seta; (D) conidiophore; (E) conidia.

SHANORIA Subram. and Ramakr. Stromata black, carbonaceous, with one or more locules, lined with conidiophores, at maturity dehiscing by an irregular longitudinal rupture; conidiophores simple, cylindrical or clavate; conidia 1-celled, hyaline, with a filiform subapical appendage at each end-
Illustration: *S. bamhusarum;* redrawn from Shanor (368). (A) habit of stromata in leaf; (B) section through stroma and pycnidia; (C) conidiophores and conidia. References (412).

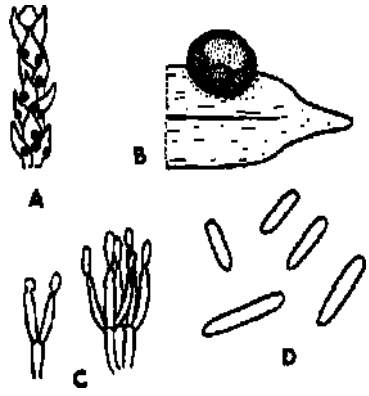
DOTHICHIZA Lib. Pycnidia subglobose, smooth, dark, erumpent from bark, somewhat disc-shaped, irregularly dehiscent; conidiophores simple, slender; conidia 1-celled, hyaline, ovoid to cylindrical.

Illustration: *D. populae;* original, from herbarium material on *Populus* sp. (A) habit of pycnidia on wood; (B) section of pycnidium; (C) conidiophores; (D) conidia.

DINEMASPORIUM Lev. Pycnidia black, cup-shaped, superficial, with long dark setae; conidiophores rod-shaped, mostly simple; conidia hyaline, I-celled, elongate or allantoid, with a slender appendage at each end; saprophytic.

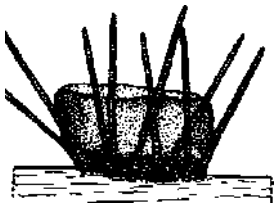
Illustration: *Dinemasporium* sp.; original, from fresh material on dead grass stem. (A) habit of pycnidia; (B) side view of pycnidium; (C) top view of pycnidium, enlarged; (D) seta; (E) conidia.

SPORONEMA



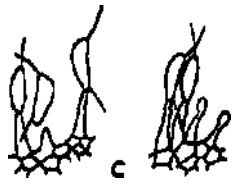
CATINULA

«"Kf.'.pva:r-:ti



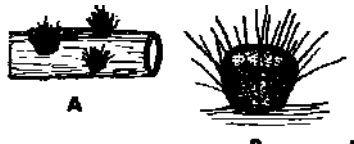
B

AMEROSPORIUM



I *Vl:4U\t*

SHANORIA



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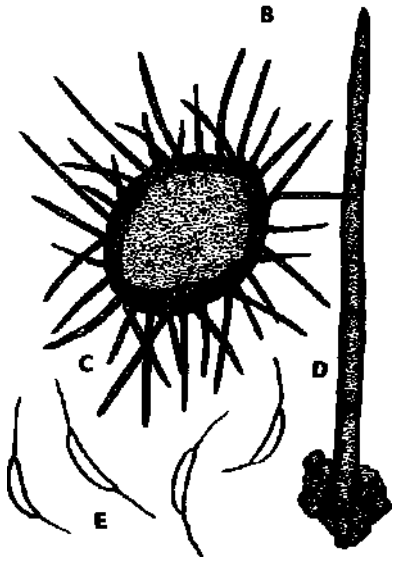
DOTHICHIZA



DINEMASPORIUM

ANTHASTHOOPA Subram. and Ramakr. Pycnidia immersed, with membranous wall, without stroma; conidiophores produced from surface of a cushion-shaped mound of tissue at base of pycnidial cavity; conidia f-celled, hyaline, concave-convex in outline, each with an apical, hyaline, mucoid appendage turned backwards and closely appressed to the concave side of the conidium; saprophytic.

Illustration: *A. simba;* redrawn from Subramanian and Ramakrishnan (410). (A) section through pycnidium; (B) conidia with appendages.

HAINESIA Ellis and Sacc. Pycnidia fleshy to gelatinous, bright-colored, globose at first, opening and becoming discoid, erumpent; conidiophores long, slender, branched; conidia hyaline; l-celled, oblong to fusoid or somewhat allantoid; saprophytic.

Illustration: ***H.*** *rubi;* original, from herbarium material on leaves of cultivated *Rubus.* (A) habit of pycnidia; (B) section through open pycnidium; (C) conidiophores and conidia.

ASCHERSONIA Mont. Pycnidia in brightly colored, hemispherical or cushion-shaped stromata, somewhat sunken, opening by wide pores or ruptures that join to form irregular cracks; conidiophores slender, branched; conidia hyaline, usually 1-ccllcd, but sometimes reported as being septate, fusoid; saprophytic or some species parasitic on insects.

Illustration: *A. aleyrodis;* original, from herbarium material on *Aleyrodes citri* on leaves of citrus. (A) habit of stromata covering insects; (B) section through stroma and pycnidia; (C) conidiophores; (D) conidia.

ACTINOPELTE Sacc. Pycnidia superficial, borne on a stalk or columella, dimidiate, shield-shaped, black, coalescing or scattered, ostiole variable; conidiophores simple; conidia hyaline, less often brownish, I-celled, ovoid, oblong or fusoid; parasitic on leaves.

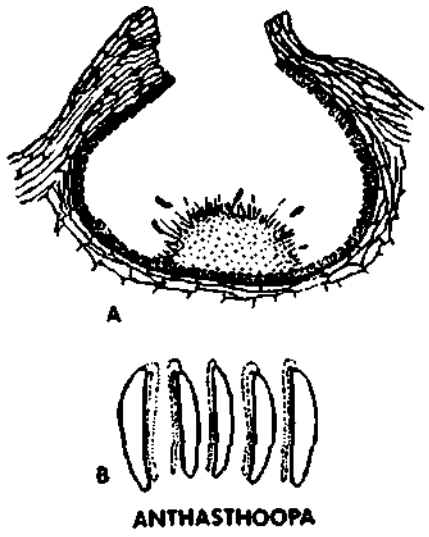
Illustration: *A. (I\eptothyrium) dryina;* original, from fresh material on leaves of *Quercus coccinea.* (A) habit of pycnidia in leaf spot; (B) pycnidium, top view; (C) pycnidium, lower surface showing conidiophores and conidia; (D) conidiophores and conidia. Reference (435).

MELASMIA Lev. Pycnidia in a broad, black, flattened stroma that is superficial or nearly so, dimidiate; conidiophores simple or branched; conidia hyaline or subhyaline, i-celled, allantoid or fusoid; parasitic on leaves; imperfect state of *Rhytisma.*

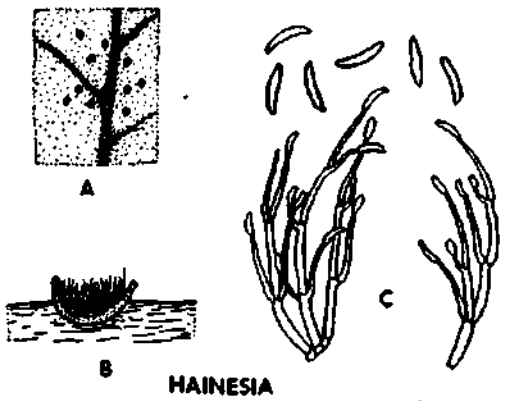
Illustration: *M. hypophylla;* original, from herbarium material **on** leaves of *Gleditsia triacanthos.* (A) habit of pycnidia; (B) section through pycnidium; (C) conidiophores; (D) conidia.

LEPTOTHYRIUM Kunze. Pycnidia superficial or erumpent, dimidiate, shield-shaped, dark, with or without ostiole; conidiophores simple; conidia hyaline, l-celled, ovoid, oblong or curved; parasitic on leaves, fruit, etc.

Illustration: *L. lonicerae;* original, from herbarium material on leaves of *Lonicera invoiucrata.* (A, B) habit of pycnidia; (C) pycnidium breaking open; (D) conidia.



ANTHASTHOOPA



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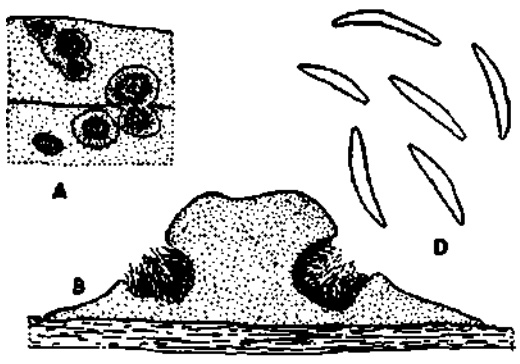

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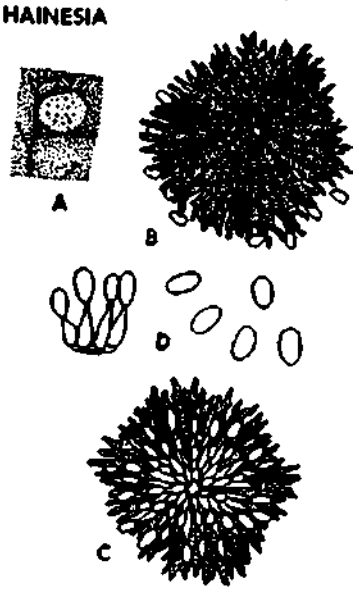
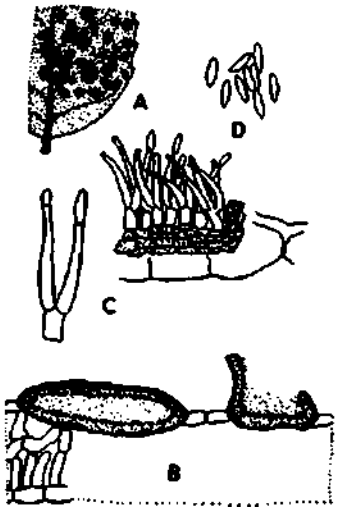
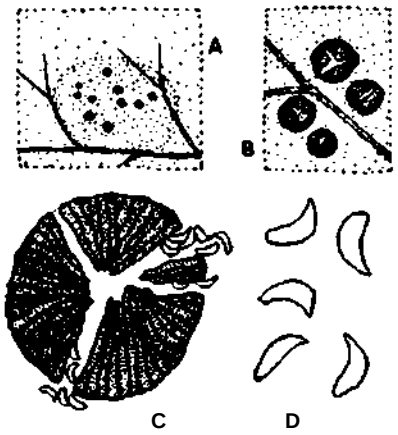


ACTINOPELTE



MELASMIA



LEPTOTHYRIUM

LEPTOSTROMA Fr. Pycnidia black, separate, dimidiate, subsuperficial, flattened to elongate, more or less cleft lengthwise; conidiophores short, simple, 1-celled; conidia hyaline, 1-celled, ovoid, elongate or allantoid; parasitic or saprophytic; probably imperfect state of Hysteriaceae.

Illustration: *L. actaea;* original, from herbarium material on *Cimicifuga racemosa.* (A) habit of pycnidia; (B, C) pycnidia enlarged; (D) section of pycnidium; (E) conidiophores and conidia.

CONIOTHYRIUM Sacc. Pycnidia black, globose, separate, erumpent, ostiolate; conidiophores short, simple; conidia small, dark, 1-celled, ovoid or ellipsoid; parasitic or saprophytic.

Illustration: *Coniothyrium* sp.; original, from fresh material on rose stems and culture obtained from rose. (A) habit, necrotic spot, and pycnidia; (B) pycnidia in culture; (C) conidiophores and conidia.

HARKNESSIA Cooke. Pycnidia globose, conical, thin, white, porous-lacerate at the apex, bursting out through the leaf tissue; conidiophores filiform; conidia dark, 1-celled, ellipsoid to ovoid, drawn out into a hyaline pedicel (conidiophore); saprophytic on leaves.

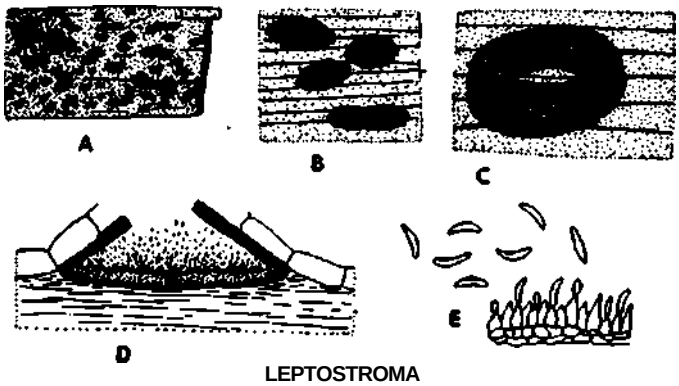
Illustration: *H. eucalypti;* original, from herbarium material on *Eucalyptus* leaves. (A) habit of pycnidia; (B) top and side views of pycnidia enlarged; (C) section through pycnidium; (D) conidiophores and conidia. Reference (422).

CHAETOMELIA Fuckel. Pycnidia black, superficial, separate, without ostiole, covered sparsely with dark bristles; conidiophores simple or branched; conidia dark to subhyaline, 1-celled, fusoid to somewhat curved; saprophytic.

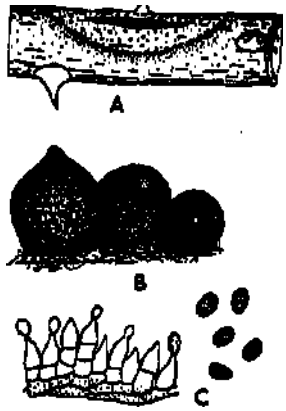
Illustration: C *aira;* original, from herbarium material on dead stalks of *Sorghum vulgare.* (A) habit of pycnidia; (B) pycnidium enlarged; (C) bristle; (D) conidiophore and conidia; (E) pycnidium of *Chaetomella* sp. from culture. Reference (358).

SPHAEROPSIS Sacc. Pycnidia black, separate or grouped, globose, erumpent, ostiolate; conidiophores short; conidia large, dark, 1-celled, ovoid, elongate or somewhat irregular; parasitic.

Illustration: *S. malorum (Physalospora obtusa);* original, from herbarium material on apple leaf, fruit, and from culture. (A) pycnidia in leaf spot; (B) section of pycnidium in fruit; (C) conidia from culture.

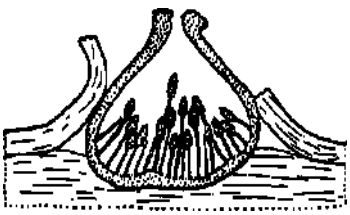


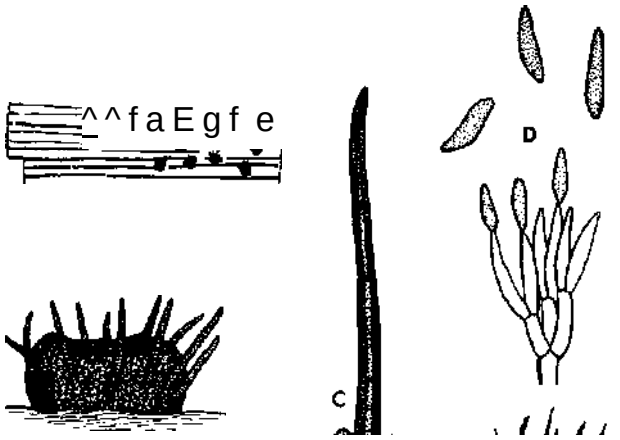
LEPTOSTROMA



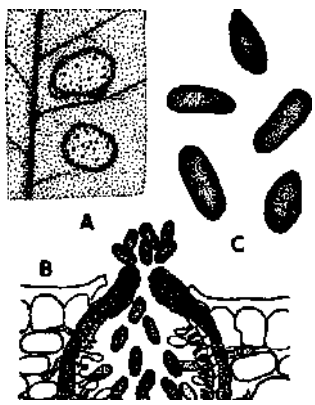
CONIOTHYRIUM

HARKNESSIA





CHAETOMELLA



SPHAEROPSIS

HAPLOSPOREIXA Spcg. Pycnidia clustered in a black, wartlike stroma that bursts out of the bark, papillate; conidiophores simple; conidia large, dark, l-celled, ovoid or oblong; parasitic or saprophytic. The genus may be synonymous with *Sphaeropsis,* but the latter is described as having no stroma.

Illustration: ***H.*** *longipes;* original, from herbarium material on dead limbs of *Morus alba.* (A) habit of pycnidia and stromata; (B) section through stroma; (C) conidiophores, conidia, and sterile hyphae; (D) conidia.

RHYNCHOPHOMA Karst. Pycnidia separate, not on leaves, somewhat globose, beaked, bursting out of substrate (usually bark) or superficial, opening by a large pore; conidiophores simple or branched; conidia 2-celled, hyaline, ovoid-oblong.

Illustration: *R. raduloides;* original, from herbarium material on stems of *Ribes hracteosum* (A) habit of pyenidium in bark; (B) section of pyenidium; (C) conidiophores; (D) conidia,

ASCOCHYTA Lib. Pycnidia dark, globose, separate, immersed in host tissue, ostiolate; conidia hyaline, 2-celled, ovoid to oblong; parasitic, principally causing leaf spots. Much like *Phyllosticta* but with 2-cclled conidia.

Illustration: *Ascochyta* sp.; original, from fresh and dried material on barly leaf. (A) habit of pycnidia in leaf spot; (B, C) top and side views of pycnidia; (D) conidia. Reference (343).

DIPLODINA Westend. Pycnidia black, separate, immersed or erumpent, globose or flattened, ostiolate; conidiophores simple, slender; conidia hyaline, 2-celled, ovoid or ellipsoid; parasitic or saprophytic; similar to *Ascochyta* but not produced in spots.

Illustration: *D. macrospora;* original, from herbarium material on dead twigs of *Cornus.* (A) habit of pycnidia; (B) section through pyenidium; (C) conidiophores; (D) conidia.

DARLUCA Cast. Pycnidia black, spherical, ostiolate, superficial, located in rust sori; conidia hyaline, 2-celled, ellipsoid or fusoid to oblong, tipped with mucous or bristlelike appendages at both ends; parasitic on rust fungi, chiefly on uredia.

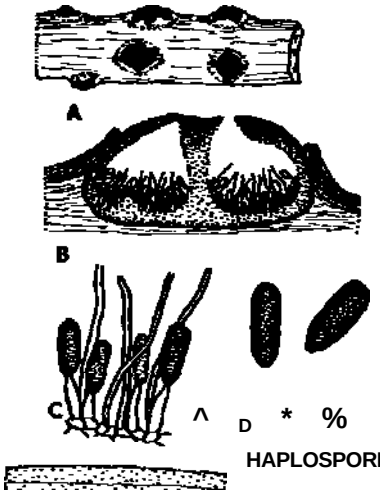
Illustration: *D.filum;* original, from dried material of *Puccinia* on grass leaf. (A, B) habit of pycnidia in uredia; (C) section through uredium of rust showing pycnidia; (D) conidia.

KELXERMANNIA Ellis and Everh. Pycnidia black, globose, separate, immersed in host tissue, ostiolate; conidiophores short, simple; conidia hyaline, mostly 2-celled, cylindrical with an awl-shaped appendage at the tip; parasitic or saprophytic.

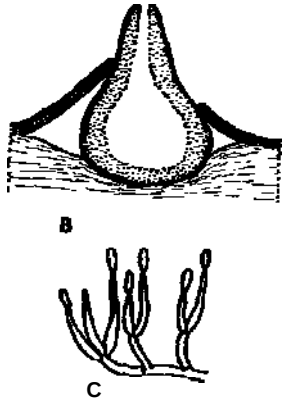
Illustration: *K. yuccaegena;* original, from herbarium material on *Yucca angustifolia.* (A) habit of pycnidia; (B) section of *Yucca* leaf showing location of pycnidia; (C) section of pyenidium; (D) conidiophores; (E) conidia.

ROBILLARDA Sacc. Pycnidia brown to pale, in spots, erumpent to subsuperficial, globose to flattened, with small ostiole; conidia hyaline, 2-celled, cylindrical, with 3 to 4 hyaline setae at one end; parasitic on grasses, causing leaf spots.

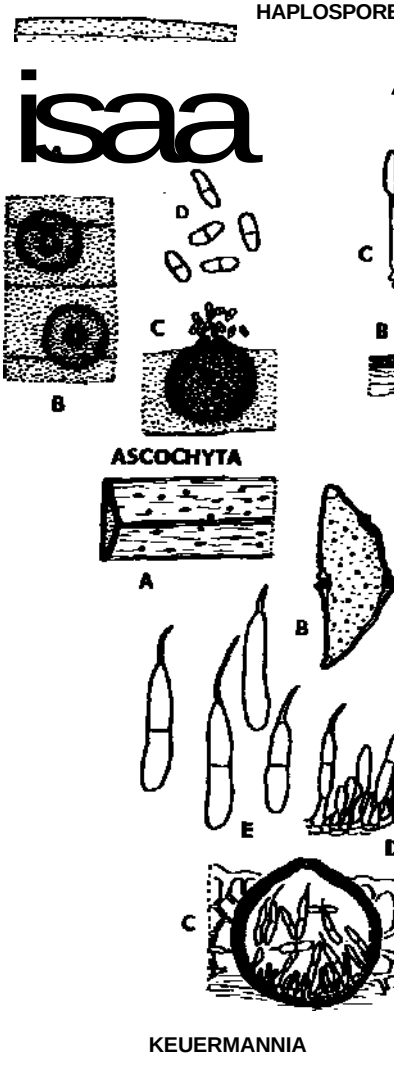
Illustration: *R. phragmites;* redrawn from Cunnel (69). (A, B) pycnidia; (C) conidia with appendages. References (305, 385, 386).



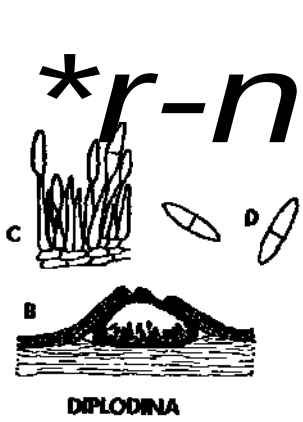
HAPLOSPORELU



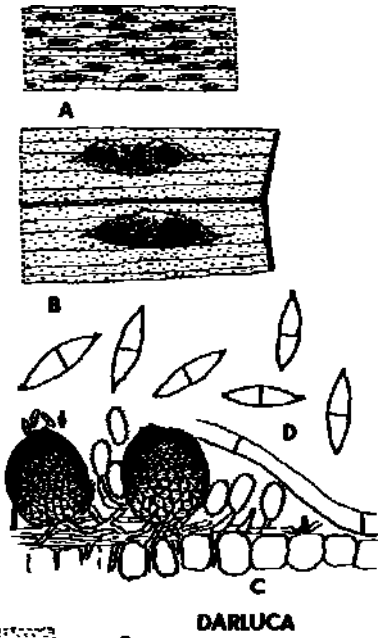
RHYNCHOPHOMA



ASCOCHYTA

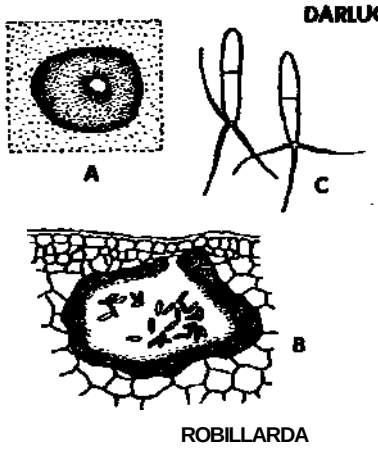


DIPLODINA



DARLUCA

KEUERMANNIA



ROBILLARDA

-DIPLODIA Fr. Pycnidia black, single, globose, immersed, erumpent, ostiolate; conidiophorcs slender, simple; conidia dark, 2-celled, ellipsoid or ovoid; parasitic or saprophytic.

Illustration: *D. zeae;* original, from herbarium material on dead corn stalk and from culture. (A, B) habit of pycnidia; (C) pyenidium from culture; (D) conidia.

BOTRYODIPLODIA Sacc. Pycnidia black, ostiolate, erumpent, stromatic, confluent; conidiophorcs simple, short; conidia dark and 2-celled at maturity, ovoid to elongate; parasitic or saprophytic on twigs. This genus is much like *Macrophoma* or *Dothiorella,* if only immature conidia are present.

Illustration: *B. acerina;* original, from herbarium material on twigs of *Acer.* (A, B) habit of pycnidia and stromata; (C) section through pyenidium; (D) conidiophorcs; (E) conidia.

HENDERSONULA Spcg. Pycnidia black, stromate, 1 to several per stroma, locules occurring at different levels in stroma; conidiophores long, flexuous; conidia often extruded in cirri; at first 1-celled, hyaline to yellowish, later becoming 3- to 4-celled and dark; parasitic or saprophytic on wood or bark.

Illustration: *Hendersonula* sp.; original, from material from pine bark. (A) stroma bearing pycnidia breaking through bark; (B) section through stroma showing pycnidia; (C) immature conidia; (D) mature conidia.

STAGONOSPORA Sacc. Pycnidia dark, separate, superficial or erumpent, globose, ostiolate; conidiophores short; conidia hyaline, typically 3- to 4-celled, cylindrical to elliptical; parasitic or saprophytic on leaves and stems.

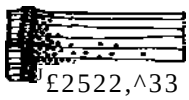
Illustration: *S. carpathica;* original, from herbarium material on leaves of *Trifolium repens.* (A, B) habit of pycnidia; (C) section through pyenidium; (DJ conidiophores; (EJ conidia. Reference (68).

ARISTATOMA Tehon. Pycnidia brown, globose, erumpent, ostiolate, separate, bearing dark brown setae near the ostiole; conidiophores short, simple; conidia hyaline, several-celled, cylindrical; parasitic, causing leaf spots.

Illustration: *A. oeconimicum;* original, from herbarium material on leaves of *Vigna sinensis.* (A, B) habit of pycnidia; (C) section through pyenidium; (D) conidia. Reference (418).

DOTHISTROMA Hulbray. Stroma dark, elongate, innate, becoming erumpent and swollen, with a stalk extending into the substratum, composed internally of dense, vertical hyphae; locules separate, one to several in the upper part of the stroma; conidiophores simple, slender; conidia several-eel led, hyaline, long-cylindrical to filiform; on pine needles.

Illustration: *D. pini;* original, from herbarium material on needles of *Pinus nigra.* (A) habit of pycnidia on pine needle; (B) section through stroma and pyenidium; (C) conidia. Reference (216).



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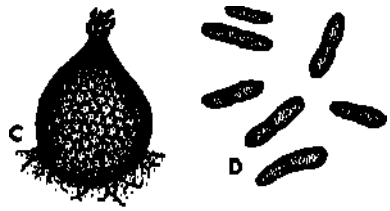
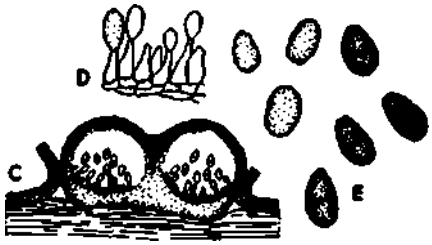


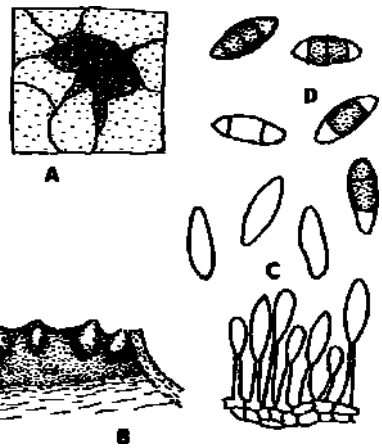
DIPLODIA

A

B

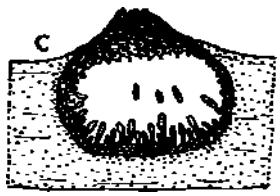


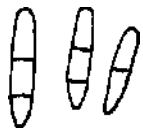
BOTRYODIPLODIA



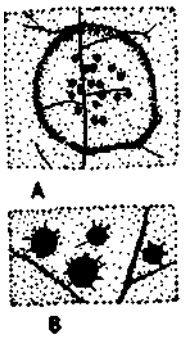
HENDERSONULA

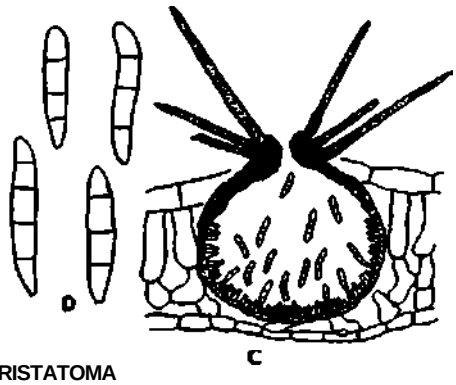
WSK&*



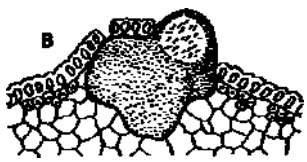


V STAGONOSPORA





ARISTATOMA



DOTHISTROMA

DISCOSIA Lib. Pycnidia black, separate, circular, flattened, between the epidermis and cuticle; conidiophores short, simple; conidia hyaline, several-celled, allantoid to fusoid, with single appendage at each end; parasitic.

Illustration: *D. maculicila;* original, from herbarium material on *Smilex* leaves. (A) habit of pycnidia; (B) single pyenidium, top view; (C) section of pyenidium; (D) conidiophores and conidia. Reference (163).

BARTILINIA Tassi. Pycnidia dark, globose, separate, ostiolate, innate or erumpent; conidiophores short; conidia hyaline, usually 4-cclled, the lower cell tapering, appendages delicate, arising from apical cell, usually 3 or 4; saprophytic.

Illustration: *B. nolinae;* (A) top view of pyenidium; (B) section through pyenidium; (C) conidia; drawn from photographs from Pollack (336).

TETRANACRIUM Hudson and Sutton. Pycnidia immersed, hysteriform; conidiophores erect, simple, hyaline, arising from inner cells of pyenidium; conidia single, apical pale brown, branched, composed of 4 divergent branches, all arising from a globose basal cell; the main upright branch often somewhat longer, the side branches equal, each branch 3- to 5-celled; saprophytic.

Illustration: *T. gramineum;* redrawn from Husdon and Sutton (181). (A) section through pyenidium; (B) conidiophore and developing conidium; (C) conidium.

MICROPERA Lev. Pycnidial cavities in yellowish to dark, waxy, erumpent stroma, opening irregularly, with one or more irregular cavities; conidiophores simple or branched; conidia hyaline, septate, elongate-filiform, pointed at the ends; frequently sickle-shaped; parasitic or saprophytic.

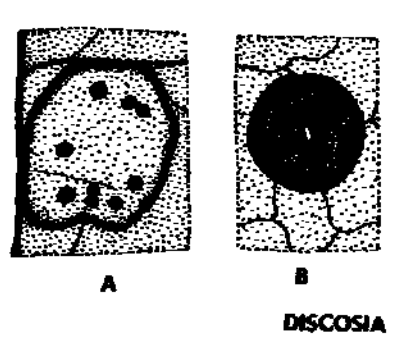
Illustration: *M. abietina (Dermea balsamea);* original, from fresh material on branches of *Tsuga canadensis.* (A) habit of stromata; (B) section through stroma showing pycnidial cavities; (C) conidiophore and conidia.

^**SEPTORIA** Sacc. Pycnidia dark, separate, globose, ostiolate, produced in spots, erumpent; conidiophores short; conidia hyaline, narrowly elongate to filiform, several-celled; parasitic, typically causing leaf spots.

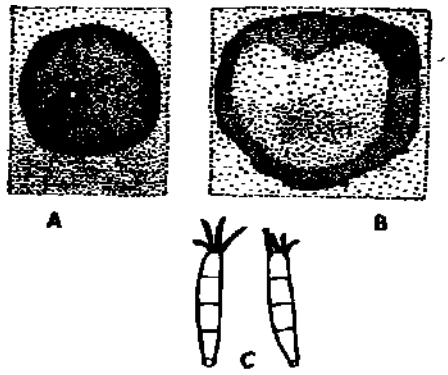
Illustration:S. *apii;* original, from dried material on leaves *of Apium.* (A) habit of pycnidia; (B) section through pyenidium; (C) conidiophores and conidia.

GELATINOSPORIUM Peck. Pycnidia stromatic, arising from a dark hypostroma, splitting open irregularly, tissue cartilaginous; conidiophores simple or branched; conidia hyaline, I- or more-celled, narrowly spindle-shaped, bowlike, both ends pointed; spraophytic on branches.

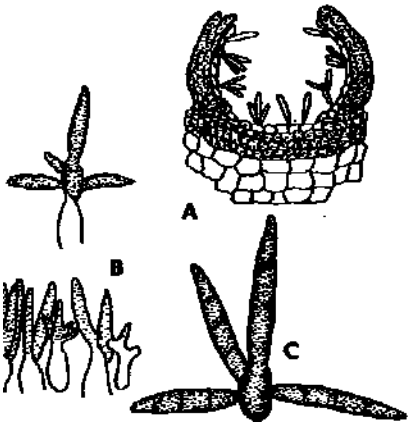
Illustration: *G. hetulinum;* original, from herbarium material on *BetuJa lenta.* (A, B) habit of pycnidial stroma; (C) section of stroma; (D) conidiophores and conidia.



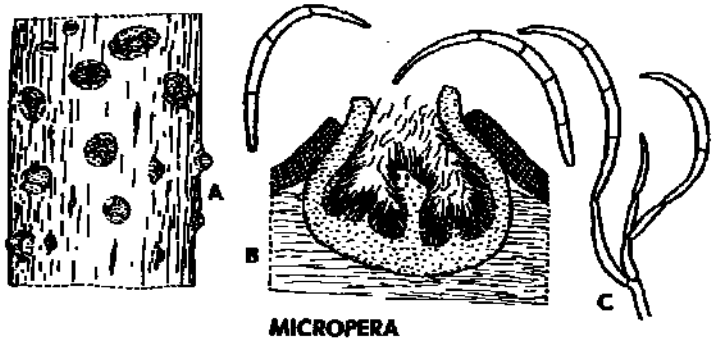
DISCOSIA



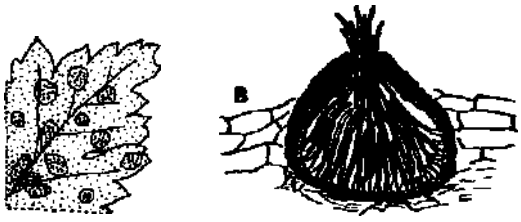
BARTILINIA

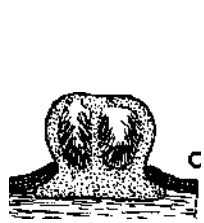


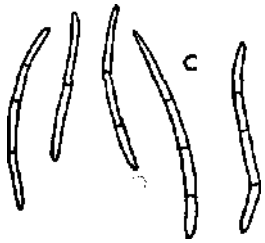
TETRANACRIUM



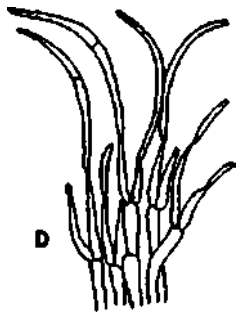
MICROPERA







SEPTORIA



GELATINOSPORIUM

EPHELIS Fr. Stroma dark, or lighter when young, resembling unopened smut galls; pycnidia erumpent, open cupulate, somewhat gelatinous; conidia hyaline, 1-celled, acicuiar; parasitic on grasses; conidial states of *Bahnsia.*

Illustration: *E. (Balansia) horealis;* original, from herbarium material on stems of grass. (A) stroma and pycnidia; (B) pycnidia enlarged; (C) conidia. Reference (94).

HENDERSONIA Sacc. Pycnidia dark, separate, globose, ostiolate, immersed, usually erumpent; conidia dark, several-celled, elongate to fusoid; saprophytic or parasitic.

Illustration: *H. celtifoUa;* original, from herbarium material on leaves of *Celtis occidentaHs.* (A) habit of pycnidia; (B) section through pycnidia; (C) conidia.

LEPTOSTROMELLA Sacc. Pycnidia black, elongate, longitudinally cleft, at first covered and at maturity appearing superficial, flattened to depressed; conidiophores simple, short; conidia hyaline, 1- to several-celled, elongate to filiform; saprophytic.

Illustration: *L. filicina;* original, from herbarium material on dead leaf stalks of *Dry op ten's spinulosa.* (A, B) habit of pycnidia; (C) section through pyenidium; (D) conidiophores and conidia.

PHAEOSEPTORIA Speg. Pycnidia dark, spherical, separate, ostiolate, subepidermal or erumpent; conidiophores simple, short; conidia yellowish to light brown, elongate to filiform, several-celled; parasitic principally on grasses.

Illustration: *P. festucae* var. *muhlenbergiae;* original, from culture obtained from *Muhlenbergia.* (A) pyenidium; (B) conidiophores and immature conidia; (C) mature conidia. Reference (384).

SPHAEROGRAPHIUM Sacc. Pycnidia black, separate, base globose, beak conical, spinelike, erumpent; conidiophores branched; conidia hyaline, I- to 2-celled, filiform-fusoid, often curved; saprophytic.

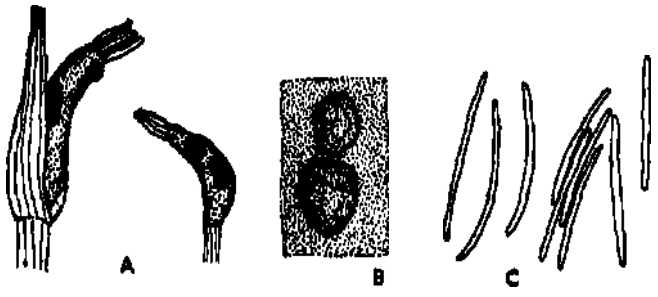
Illustration: *S. fraxini;* original, from herbarium material on twig of *Fraxinus.* (A) habit of pycnidia; (B) single pyenidium; (C) conidiophores and conidia.

RHABDOSPORA Mont. Pycnidia dark, separate, not produced in spots, erumpent, ostiolate; conidiophores short, simple; conidia hyaline, narrowly elongate to filiform, several-celled parasitic or saprophytic.

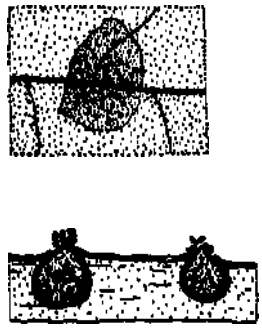
Illustration:/?, *solidaginis;* original, from herbarium material on stem of *Solidago canadensis.* (A, B) habit of pycnidia; (C) section through pyenidium; (D) conidia.

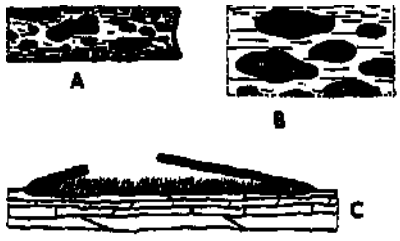
CHAETOSEPTORIA Tehon. Pycnidia complete, separate, spherical, innate, without clypeus, subicle or stroma, with ostiole, without beak, crowned with setae; conidia long, slender, several-celled, hyaline, parasitic on leaves, in spots.

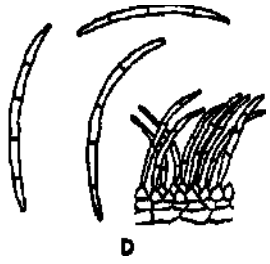
Illustration: *C. wellmanii;* redrawn from Yerkes (479). (A, B) pycnidia; (C) conidia.



EPHELIS







LEPTOSTROMEUA

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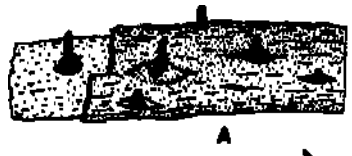
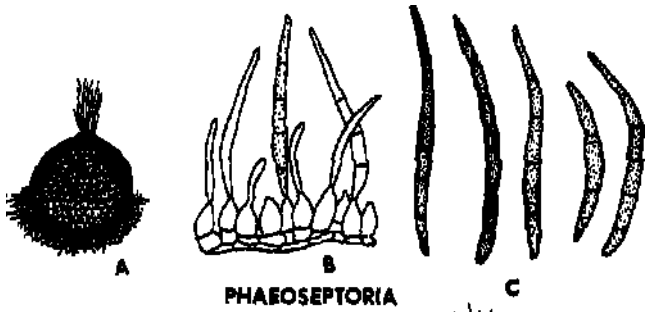
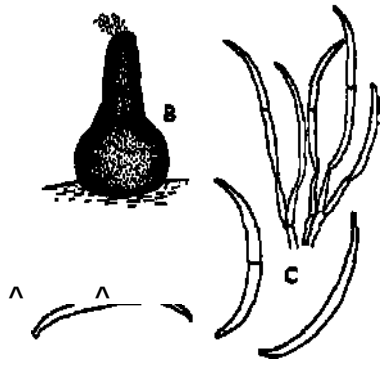
HENDERSON!*

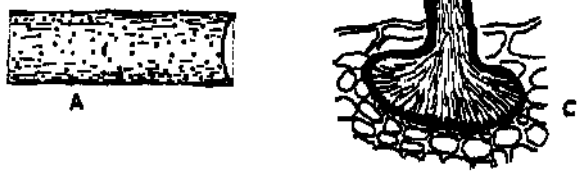


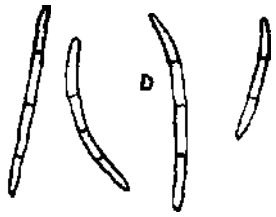


PHAEOSEPTORIA

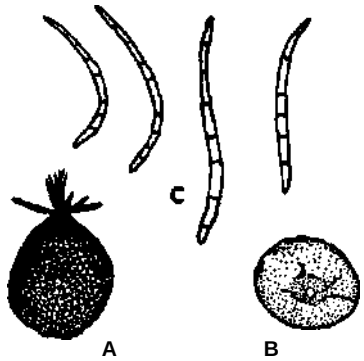


SPHAEROGRAPHIUM





RHABD05PORA



CHAETOSEPTORIA

PHLYCTAENA Mont, and Desm. Pycnidia dark, separate or sometimes confluent, developing in or under the epidermis or bark, closed or ostiolate, usually with one chamber or divided by irregular folds; conidiophores simple or forked; conidia hyaline, 1-celled, cylindrical or long, spindle-shaped, mostly bent, sickle-shaped; saprophytic.

Illustration: *P. albocincta;* original, from herbarium material on stem of *Rhus radkans.* (A) habit of pycnidia; (B) section through pyenidium; (C) conidiophores; (D) conidia.

PROSTHEMIUM Kunze. Pycnidia separate, covered, later breaking out, carbonaceous, globose-depressed, opening by a pore, dark; conidiophores filiform, hyaline, septate, conidia .several-celled, dark, cylindrical to ellipsoid, stellately joined into few-spored groups, resembling a staurospore.

Illustration: *P. hetulinum;* original, from herbarium material on bark of *Betula alba.* (A) habit of pycnidia in bark; (B) section of pyenidium; (C) conidia.

CHONDROPODIUM Hohnel. Pycnidia stromatic, stalked, columnar, externally black, hard, internally gelatinous, conidiophores simple, conidia hyaline, several-celled, crescent-shaped or sickle-shaped; weakly parasitic or saprophytic.

Illustration: *C. pseudotsugae.* (A) habit of pycnidia; (B) section through pyenidium; (C) conidiophores and conidia; (A, B) drawn from photographs; (C) from drawing. All redrawn from White (470).

PHLEOSPORA Wallr. Pycnidia dark, imperfectly formed, globose, innate in tissue, not in distinct spots; conidia hyaline or subhyaline, several-celled, elongate fusoid to filiform; parasitic or saprophytic.

Illustration: *P. robinae;* original, from herbarium material *on* leaves of *Robiniapseudoacacia.* (A) habit of pycnidia; (B) section through pyenidium; (C) conidia.

DICHOMERA Cooke. Pycnidia black, grouped on stroma, bursting out of bark, globose, ostiolate; conidiophores simple, conidia dark, globose, ovoid or ellipsoid, several-celled with oblique septa; saprophytic.

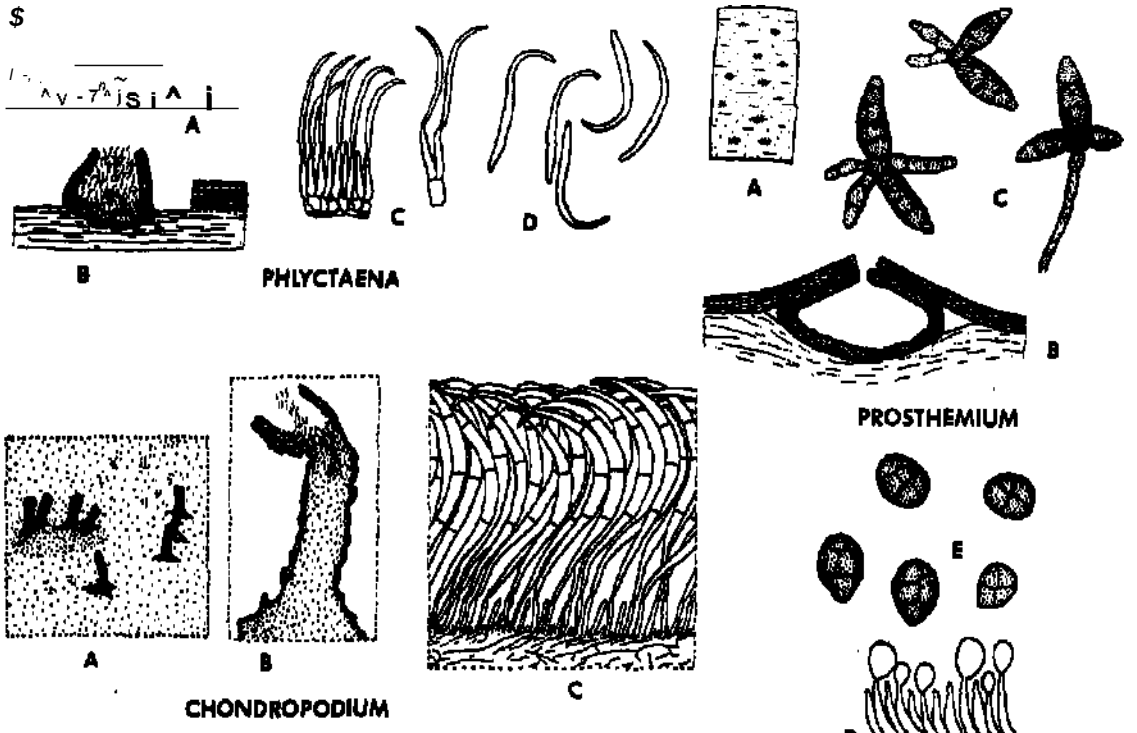
Illustration: *D. prunkola;* original, from herbarium material on twigs of *Prunus virginiana.* (A, B) habit of pycnidia; (C) section of stroma and pycnidia; (D) conidiophores and immature conidia; (E) mature conidia.

CAMAROSPORIUM Schulz. Pycnidia black, erumpent, globose, separate, ostiolate, papillate; conidiophores short, simple; conidia dark, ovoid to ellipsoid, with several cross walls and a few longitudinal or oblique walls; saprophytic on twigs.

Illustration: *C. robinae;* original, from herbarium material on dead twigs of *Robinia pseudoacacia.* (A, B) habit of pycnidia; (C) section of pyenidium; (D) conidiophores and immature conidia; (H) mature conidia.

CORNULARIA Sacc. Pycnidia dark, stalked, cylindrical, bulbous at the base, or clavatc, usually in tufts or groups; conidia hyaline to colored, several-celled, fusoid to greatly elongated; parasitic or saprophytic.

Illustration: *C. persicae;* original, from herbarium material on twig of *Prunus.* (A, B) pycnidia; (C) conidia.'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PROSTHEMIUM
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CHONDROPODIUM
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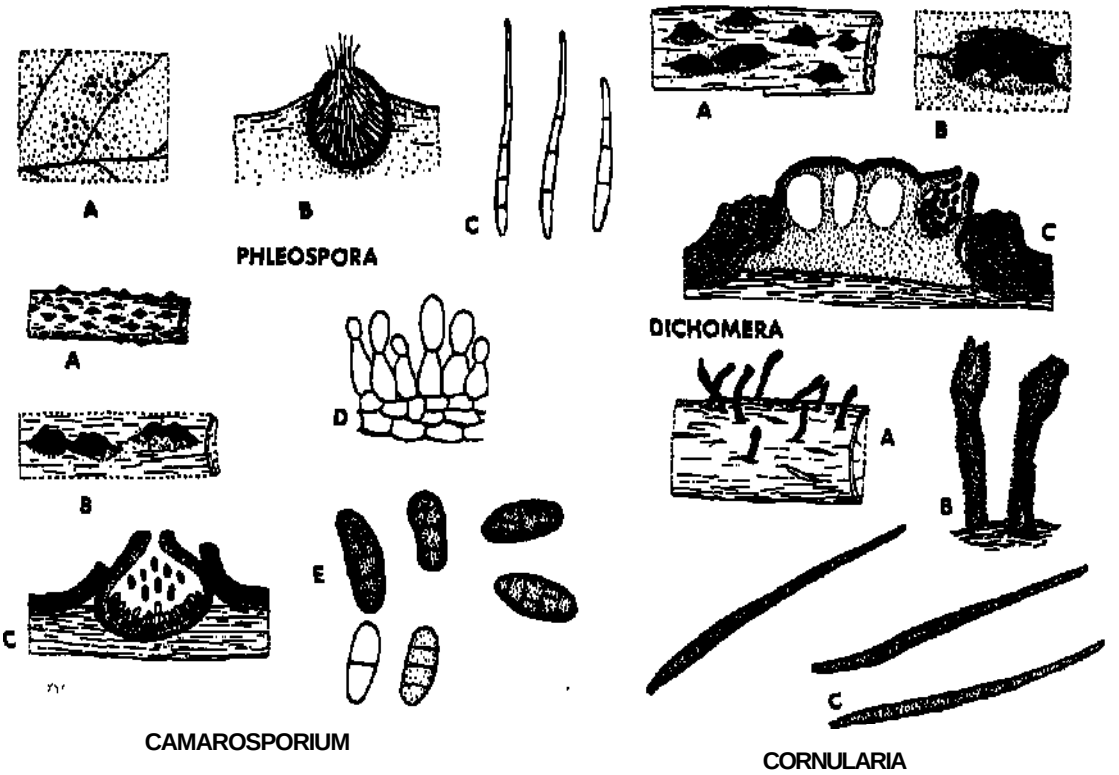
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CAMAROSPORIUM
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CORNULARIA

SPHACELOMA de Bary. Acervuli disc-shaped or cushion-shaped, waxy; conidiophores simple, closely grouped or compacted, arising from a stromalike base, sometimes almost appearing as a sporodochium; conidia hyaline, 1-celled, ovoid or oblong; parasitic; imperfect states of *Elsinoe;* similar to *Gloeosporium* and *Colletotrichum.*

Illustration: *S. ampelinmn (Elsinoe ampelina);* original, from herbarium material on grape twigs and fruit. (A) habit on twig; (B) portion of acervulus on twig; (C) portion of acervulus on fruit; (D) conidia.

GLOEOSPORIUM Desm. and Mont. Acervuli subepidermal erumpent, disc-shaped or cushion-shaped, waxy; conidiophores simple, variable in length; conidia hyaline, 1-celled, ovoid to oblong, sometimes curved; parasitic, chiefly on leaves or fruits; mostly conidial states of *Glomerella.*

Illustration: (A-C) *G. nervisequum (Gnomonia veneta);* (D-F) *G. fruiligenum (Glomerella cingulata);* original, from fresh material on *Platanus* leaves and from culture. (A) habit of fungus; (B) section through acervulus; (C) conidiophores and conidia; (D) acervuli produced in culture; (E) conidia; (F) conidiophores and conidia in culture.

COLLETOTRICHUM Corda. Acervuli disc-shaped or cushion-shaped, waxy, subepidermal, typically with dark, spines or setae at the edge or arr^ong the conidiophores; conidiophores simple, elongate; conidia hyaline, 1-celled, ovoid or cfofong, to falcate parasitic; imperfect states of *Glomerella.* This genus differs '-from *Gloeosporium* in having spines, which may be absent in some cultures.

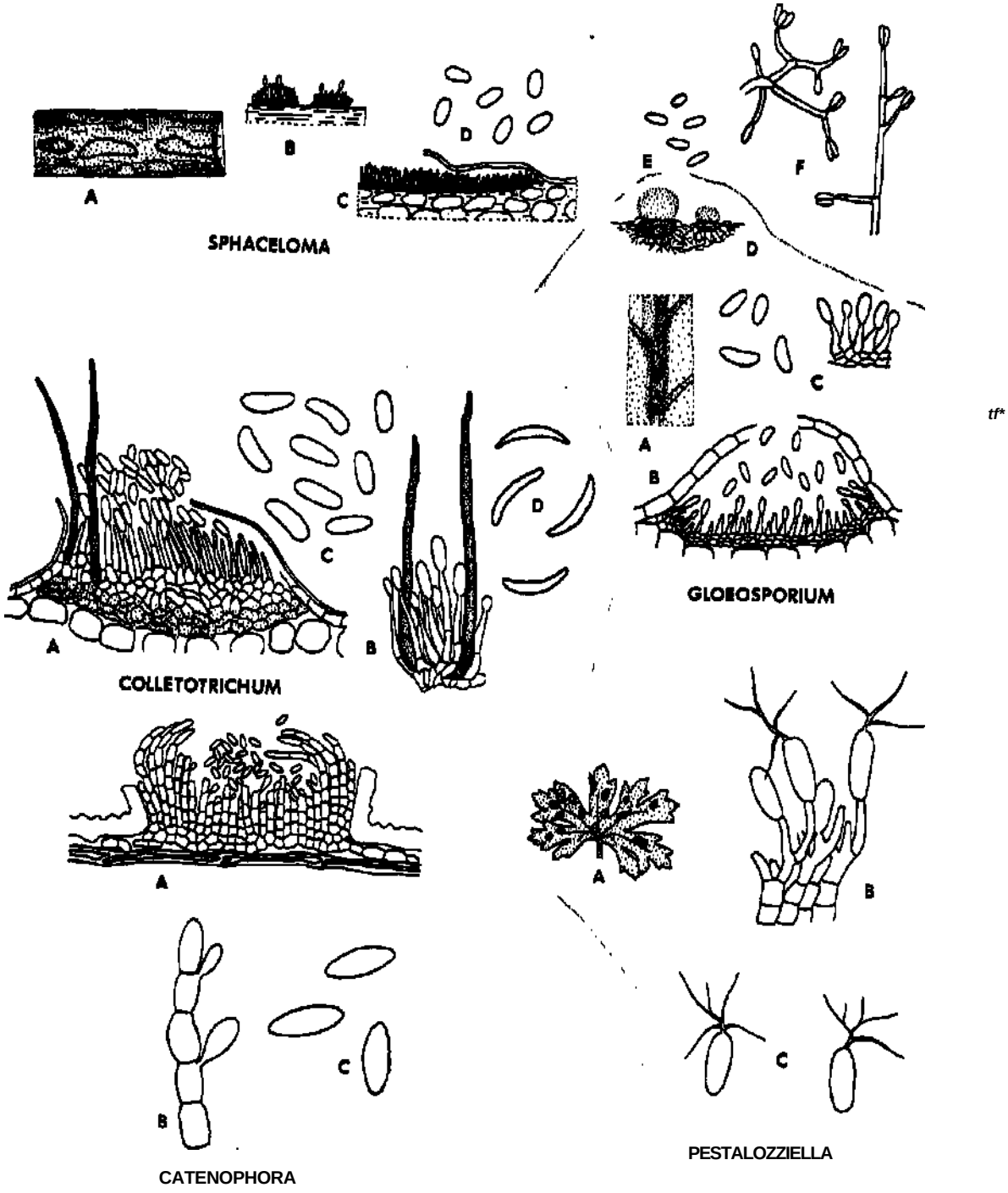
Illustration: *C. lindemutheanum;* original from prepared slide and from culture. (A) section of acervulus from prepared slide; (B) conidiophores, conidia and setae from culture; (C) conidia; (D) conidia of *C. graminicola.*

CATENOPHORA Luttrell. Acervulus cushion-shaped; conidiophores simple, septate, elongate; conidia hyaline, 1-celled, ellipsoid, produced on lateral sterigmata, one per cell of the conidiophore; parasitic.

Illustration: *C. pruni;* (A) section through acervulus; (B) conidiophore producing conidia; (C) conidia; redrawn from Luttrell (271).

PESTALOZZIELLA Sacc. and Ellis. Acervuli subcuticular; conidiophores slender, simple or branched; conidia hyaline, 1-celled, ovoid or oblong; with a hyaline branched appendage at the apex; parasitic.

Illustration: *P. subsessilis;* original, from herbarium material on leaves of *Geranium caroliniana.* (A) habit on leaf; (B) conidiophores and conidia; (C) conidia.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SPHACELOMA
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GLOEOSPORIUM
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COLLETOTRICHUM
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CATENOPHORA
PESTALOZZIELLA

MELANCONIUM Link. Acervuli subepidermal or subcortical, conic or discoid, black; conidiophores simple; conidia dark, I-celled, ovoid to ellipsoid or oblong; parasitic or saprophytic.

Illustration: *M. oblongum;* original, from herbarium material on dead twigs of *Jugulans cinerea.* (A) habit of acervuli; (B) section through acervulus; (C) conidiophores and conidia. Reference **(419).**

MYCOLEPTODISCUS Ostazeski. Sclerotia small, round, black; acervuluslike fruiting structure; shieldlike, yellow to brown; stroma a single layer of cells bearing conidia; conidiophores obsolete; conidia hyaline, 2-celled, allantoid, with a filamentous appendage at each end (absent in some isolates), parasitic on legumes.

Illustration: *M. (Leptodiscus) lerrestris;* (A) spore-bearing upper surface of acervulus; (B) section through acervulus; (C) conidia; (A) drawn from unpublished photograph furnished by J.W. Gerdemann; (B, C) drawn from photographs from Gerdemann (145). References (284, 320).

MAKSSONINA Magn. Acervuli subepidermal, discoid, pale; conidiophores short, simple; conidia hyaline, 2-celled, ovoid to elongate; parasitic, chiefly on leaves.

Illustration: *M. populi;* original, from herbarium material on leaves of *Populus.* (A) habit on leaf; (B) section through acervulus; (C) conidiophores and conidia.

SEPTOGLOEUM Sacc. Acervuli subepidermal, erumpent, pale; conidiophores short, simple; conidia hyaline, several-celled, oblong to fusoid; parasites on leaves.

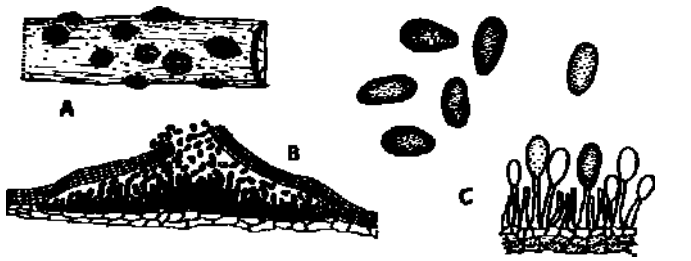
Illustration: *S. profusum;* original, from herbarium material on leaves of *Ulmus americana.* (A, B) habit of acervuli; (C) section through acervulus; (D) conidiophores and conidia.

CRYPTOSPORIUM Kunze. Acervuli erumpent, becoming cup-shaped or disc-shaped, stroma brownish; conidiophores simple or branched; conidia hyaline or subhyaline, l-celled, elongate, falcate; parasitic.

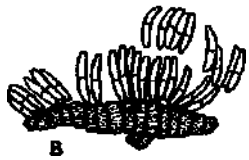
Illustration: C. *pinkoia;* (A) section through acervuli; (B) conidiophore and conidia; redrawn from Lindcr (269).

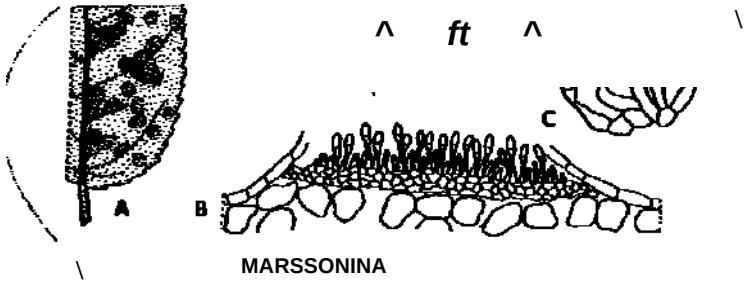
LIBERTELLA Desm. Acervulus subcortical, erumpent, yellow to red; conidiophores branched; conidia hyaline, l-celled, filiform; saprophytic.

Illustration: *L. betulina;* original, from herbarium material on bark of *Betula lutea.* (A) habit of acervuli; (B) section through acervulus; (C) conidiophores; (D) conidia held together in matrix; (E) separate conidia.

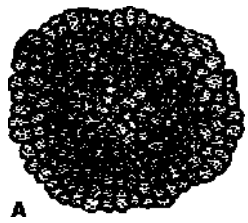


MELANCONIUM

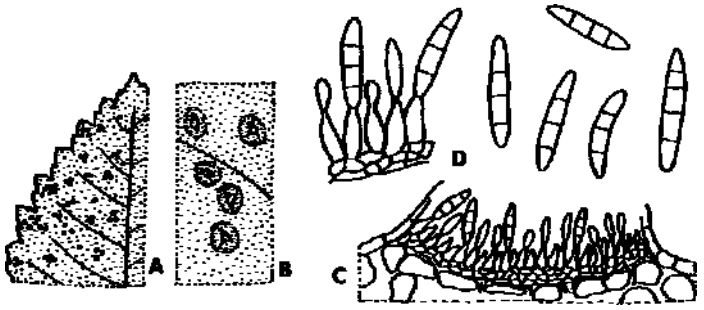




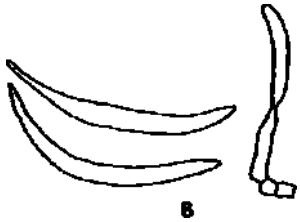
MARSSONINA

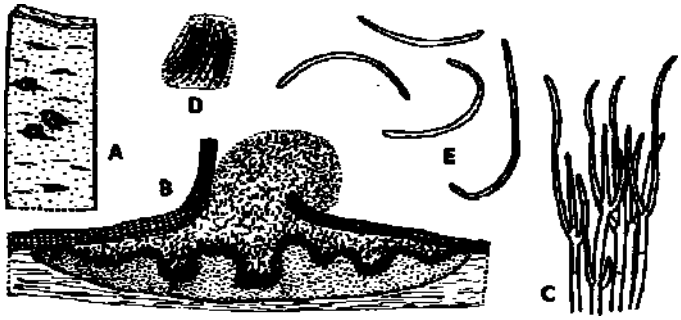


MYCOUPTODISCUS



SEPTOGLOEUM





LIBERTELLA

CRYPTOSPORIUM

CYLINDROSPORIUM Unger. Acervuli subepidermal, white or pale, discoid or spread out; conidiophores short, simple; conidia hyaline, filiform, straight or curved, l-celled or becoming septate; parasitic on leaves.

Illustration: *C. padi (Coccomyces hiemalis);* original, from dried material on cherry leaves. (A, B) habit of acervuli; (C) section through acervulum; (D) conidiophores and conidia.

MONOCHAET1A Sacc. Acervuli dark, discoid or cushion-shaped, subepidermal; conidiophores slender, simple; conidia dark, several-celled with hyaline, pointed end cells, elongate to fusoid, with a single apical appendage; parasitic.

Illustration: *M. mali;* original, from herbarium material on apple leaf. (A) habit on leaf; (B) section through acervulus; (C) conidiophores and conidia. Reference (391).

PESTALOT1A de Not. Acervuli dark, discoid or cushion-shaped, subepidermal; conidiophores short, simple; conidia dark, several-celled, with hyaline, pointed end cells, ellipsoid to fusoid, with two or more hyaline, apical appendages; parasitic; or saprophytic. References (392, 416).

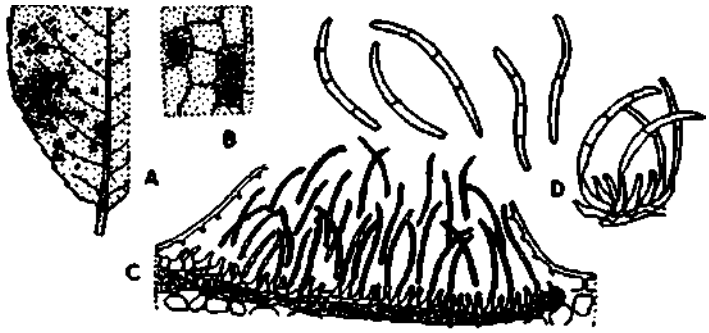
Illustration: *P. macrotricha;* original, from fresh material on leaves of *Rhododendron.* (A, B) habit of acervuli; (C) section through acervuli; (D) conidiophores and conidia; (E) conidia. References (392, 415).

POEYNEMA Lev. Mycelium immersed in substratum, hyaline; acervuli typical with little stromatic development; conidiophores arising from cells of stroma, conidia single, apical, cylindrical, obclavate, 2-to 3-celled, brown, with single simple or branched apical appendage and 1 to 3 basal appendages.

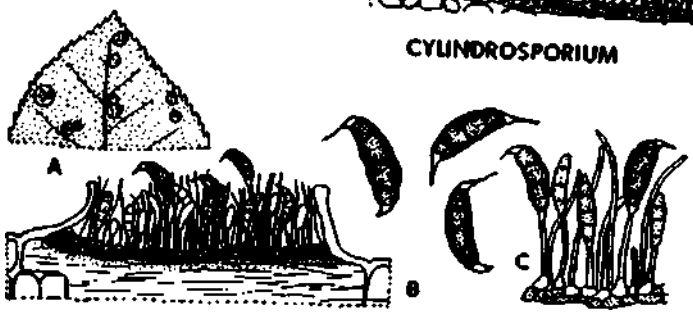
Illustration: *Polynema (Neobarclaya)* sp.; redrawn from Sutton (416). (A) section through acervulus; (B) conidia. Reference (420).

SEIMATOSPORIUM Corda. Acervuli typical, first immersed, erumpent; conidiophores cylindrical, slender, with a few apical proliferations; conidia borne single and successively on proliferating new growing points, fusiform to curved, 4- to 6-celled, 2 end cells hyaline, median cells dark, apical appendage single, simple or rarely branched, basal appendage usually simple; on leaves and twigs. Compare with *Pestahtia.*

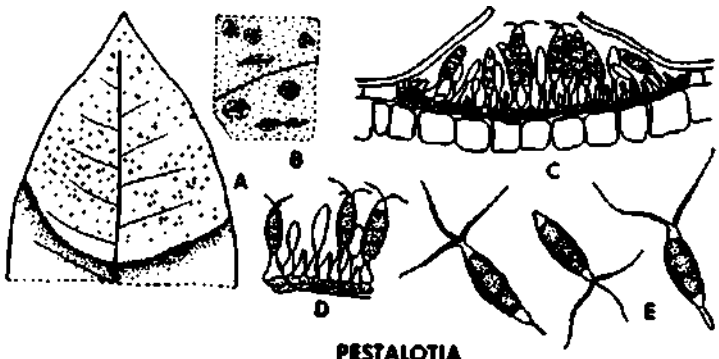
Illustration: *Seimatosporium* sp. *(Cryptostictis arbuti);* redrawn from Sutton (418). (A) portion of acervulus; (B) developing conidium; (C) conidia.



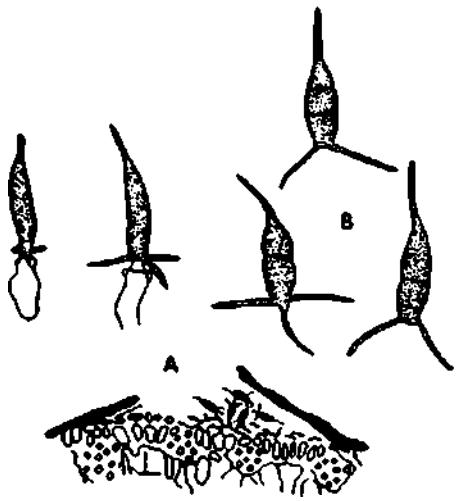
CYLINDROSPORIUM



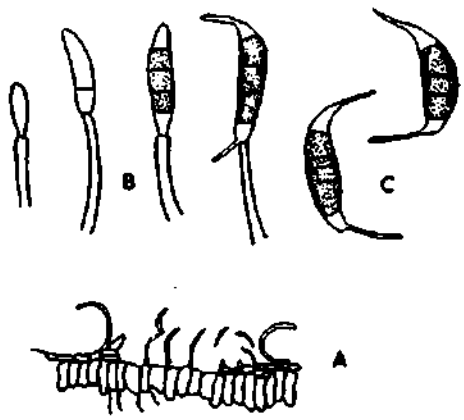
MONOCHAETIA



PESTALOTIA



POLYNEMA



SEIMATOSPORIUM

ENTOMOSPORIUM Lev. Acervulus subcuticular, discoid, dark; conidiophores short, simple; conidia hyaline, 4-celled, cross-shaped, the two lateral cells smaller, all except the basal cell equipped with a slender bristle; parasitic on leaves and fruit.

Illustration: *E. maculatum (Fabrea maculata);* original from herbarium material on leaves of *Cydonia.* (A) habit on leaf; (B) section through acervulus; (C) conidia.

CORYNEUM Nees. Acervulus subcutaneous or subcortical, black, cushion-shaped to disc-shaped; conidiophores slender, simple; conidia dark, several-celled, oblong to fusoid; parasitic or saprophytic.

Illustration: *C. kunzei;* original, from fresh material on oak twigs. (A) habit of acervuli on twig; (B) section through acervulus; (C) conidiophores and conidia. Reference (425).

ASTEROSPORIUM Kunze. Acervuli bursting through bark; conidiophores slender, simple; conidia dark, typically 4-armed, each arm septate, saprophytic.

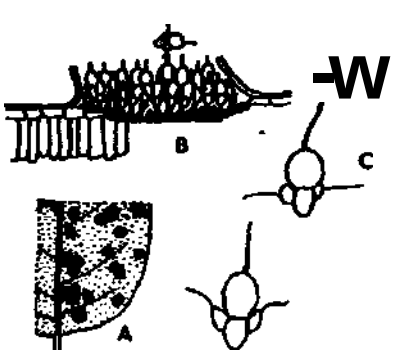
Illustration: *A. hoffmanni;* redrawn from Archer (3). (A) section through acervulus; (B) conidia.

PHRAGMOTRICHUM Kunze ex Fries. Fructifications interpreted as acervuli (sometimes pycnidium-like), stromatic; conidiophores short, upright, simple; conidia yellow or slightly darker, apical in basipetal chains, phragmosporous or dictyosporous; saprophytic on leaves or twigs.

Illustration: *P. karstenii;* redrawn from Sutton and Pirozynski (428). (A) acervuluslike fruit structure; (B) conidiophores and conidia; (C) conidia.

STEGANOSPORIUM Corda. Acei'vuU subcortical, dark, cushion-shaped; conidiophores simple; conidia dark, dictyosporous, ovoid, oblong or pear-shaped; saprophytic on wood.

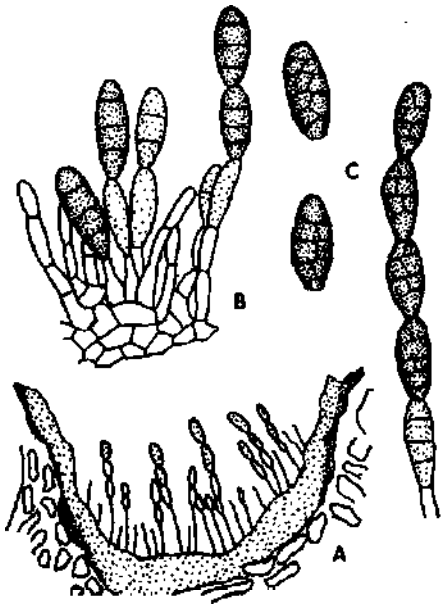
Illustration: *S. pyriforme;* original, from fresh material on bark of *Acer.* (A) habit of acervuli; (B) section through acervulus; (C) conidiophores, conidia, and sterile hyphae; (D) conidia. Reference (458).



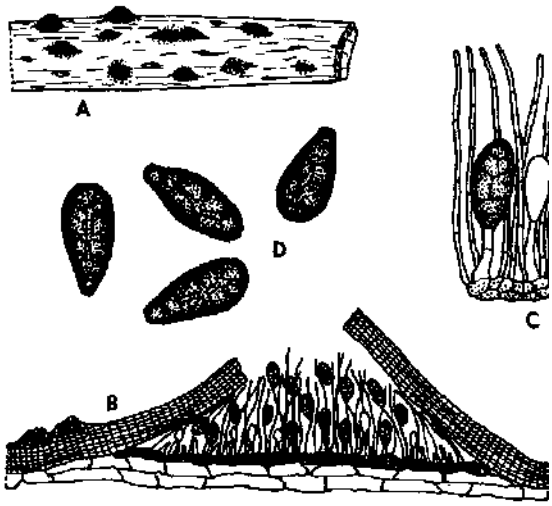
ENTOMOSPORIUM

CORYNEUM

ASTEROSPORIUM



PHRAGMOTRICHUM



STEGANOSPORIUM

& ,

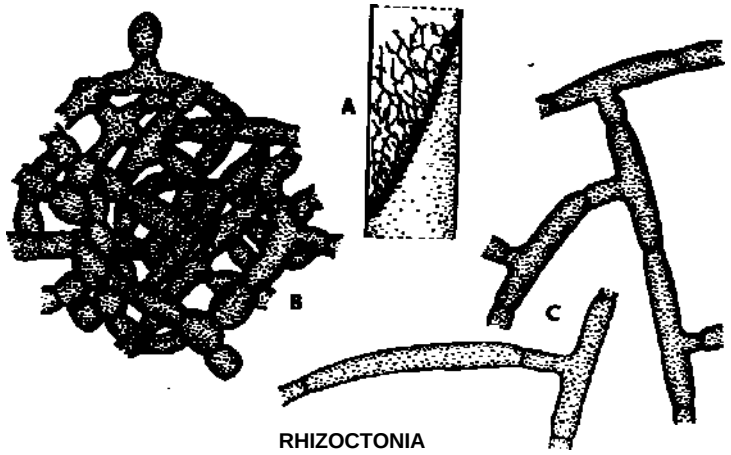
'tj?X **RHIZOCTONIA** DC. Mycelium hyaline in some species to dark in others (such as *R. solani),* the most common species; cells of mycelium usually long, septa of branches usually set off from the main hyphae; asexual fruit bodies and conidia absent; sporodochium-like bodies and chlamydospore-like cells in chains produced in some species; sclerotia light colored and poorly formed in some species or brown or black and well formed in other; parasitic, chiefly on roots or other underground parts of plants.
Illustration: *R. (Thanatephorus) solarri;* original, from culture. (A) small sclerotia and mycelium in tube culture; (B) section of loose sclerotium; (C) cells of mycelium. References (323, 361).

SCLEROTIUM Tode. Asexual fruit bodies and conidia lacking; sclerotia brown to black, globose or irregular, compact; mycelium usually light; parasitic, principally on underground parts of plants.

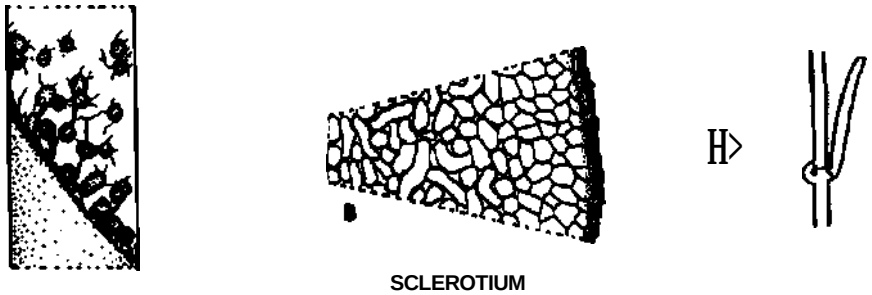
Illustration: *S. rolfsii;* original, from culture. (A) sclerotia in tube culture; (B) portion of section of sclerotium; (C) portions of mycelium showing clamp connections. " *. , (I* . \.*u.*> v. v> * *-*"

PAP15LOSPORA Preuss. Asexual spores lacking; mycelium light to dark brown, producing compact clusters of small cells or bulbils which are sclerotium-like and serve to reproduce the fungus; saprophytic, or parasitic on storage parts of some plants.

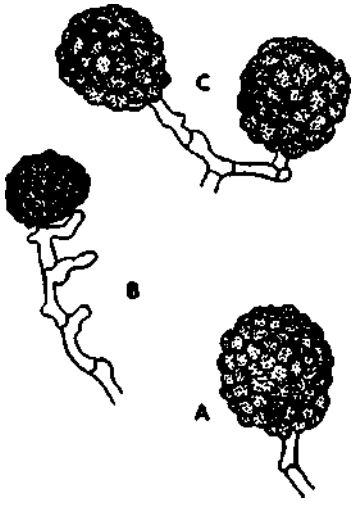
Illustration: *Papulospora* sp.; original, from decaying wood. (A-C) sclerotia produced on mycelium with clamp connections. References (17, 176, 177).



RHIZOCTONIA



SCLEROTIUM



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GLOSSARY
Definitions and Examples

Acicular: slender and pointed; needle-shaped. *Ephelis,* p. 184.

Acervulus: an erumpent, open, saucer-shaped fruit body, bearing conidiophores and conidia, characteristic of the Melanconiales.

Acropetal: chain of conidia having the youngest conidium at the apex. *Monilia,* p. 72; *Cladosporium,* p. 106.

Allantoid: conidia somewhat curved.

Aleuriospore: *see* p. 42.

Amerospore: a one-celled conidium.

Anastomosis: fusion between hyphal branches to form a network. *Rhizoctonia,* p. 196.

Anneilate: conidial scars appearing as rings at apex region of conidiophore or conidiogenous cell due to successive formation of terminal conidia. *Scopulariopsis,* p. 98; *Spilocaea,* p. 106.

Annellospore: *see* **p. 42.**

Arthrospores: *seep.4*\.

Attenuated: drawn out, narrowed, more or less to a point. *Alternaria,* p. 132; *Cercospora,* p. 128.

Ba si petal: successive chain of conidia having the youngest conidium at the base. *Oidium,* p. 68; *Aspergillus,* p. 94.

Biotrophic: a method by which some parasites obtain nutrients from living host cells. *Calcarisporium parasiticum, Gonatobotrys simplex.*

Blastospore: *see* **p. 42.**

Botr yob last ospore: *see* **p. 43.**

Bulbil: a small number of cells aggregated into a sclerotiumlike structure. *Papularia,* p. 82.

Capitate: conidia formed into a more or less rounded head. *Aspergillus,* p. 94; *Botrytis,* p. 76.

Catenulate: conidia formed in chains of two or more. *Monilia,* p. 72; *Cladosporium,* **p.** 106.

Ch lam yd ospore: a thick-walled terminal or intercalary conidium formed from a previous cell. Also see Aleuriospore. *Chalaropsis,* p. 90; *Sepedonium,* p. 82.

Circinate: recurved. *Circinotrichum,* p. 90; *Gyrothrix,* p. 90.

Clamp connection: a hyphal outgrowth connecting two adjacent cells of the mycelium, characteristic of certain basidiomycetes. *Sclerotium,* p. 196.

Clavate: club-shaped, broader toward the apex.

Coenocytic: nonseptate, with multinucleate hyphae or segments.

Collarette: a cup-shaped structure or flaring apex of a phialide. *Phialophora,* p. 88; *Chlohdium,* **p.** 88.

Conidiogenous cell: a cell or portion of a conidiophore bearing conidia (a sporogenous cell).

Cruciform: arranged in the form of a cross. *Dictyoarthrinum,* p. 134; *Entomosporium,* p. 194.

Cupulate: cup-shaped, deeper than saucer-shaped. *Hainesia,* p. 174; *Dinemasporium,* p. 172.

Deciduous: referring to conidia falling off naturally.,

Dehiscent: breaking open at maturity. *Dothichiza,* p. 172; *Sporonema,* p. 172.

Dendroid: branched, treelike. *Trichoderma,* p. 92.

Denticle: small to medium sized, sharp or blunt, toothlike projection on which conidia are borne. *Gonatobotrys,* p. 76.

Dermatomycosis: a fungus disease restricted to the surface of the skin of man and animals.

Determinate: cessation of growth of a conidiophore when a terminal conidium is formed. *Microsporum,* p. 116; *Humkola,* p. 84.

Dichotomous: forked, branched into two more or less equal arms. *Dichobotrys,* **p.** 78.

Dictyospore: conidium having both transverse and oblique septa. *Ahernaria,* p. 132; *Steganosporium,* **p.** 194.

Didymosporc: a two-celled conidium.

Dimidiate: a half structure, or having one part smaller than the other. *Actinopehe,* p. 174; *Lepiostroma,* p. 176.

Discoid: disc-shaped, flat, and circular.

Echinulate: with slight projections, usually pointed, on the surface of conidia or conidiophores. *Torula,* p. 74; *Heterosporium,* p. 122.

Ellipsoid, Elliptical: a conidium having an outline of an ellipse with rounded ends. *Pithomyces,* p. **132;** *Bactridium,* p. 148.

Endogenous: conidia produced well within a phialide. *Chalara,* p. 90.

Erumpent: breaking out through the surface of the substratum. *Coryneum,* p. 194; *Botryodipiodia,* p. I S O .

Exogenous: conidia produced on the outside of a conidiogenous cell.

Falcate: curved like the blade of a sickle.

Falx: a hook-shaped hypha or cell capable of bearing conidia. *Zygosporium,* **p. 72.**

Fascicle: tight cluster or group. *Graphium,* p. 152; *Doratomyces,* p. **154.**

Filiform: threadlike, very slender. *Septoria,* p. 182; *Cylindrosporium,* p. 192.

Flexuous: wavy. *Polythrincium,* p. 112.

Fusoid, Fusiform: spindle-shaped. *Microsporum,* p. 1 1 6 ; *Monacrosporium,* p. **1 1 8 .**

Fuscous: brownish-gray, smoky.

Geniculate: bent like a knee, often giving a zig-zag appearance. *Geniculosporium,* p. **100.**

Globose: nearly spherical.

Haustorium: a special absorbing structure formed by some parasitic fungi within cells of the host. *Piptocephalis,* p. 62.

Helicospore: a coiled or spiral-shaped conidium. *Helicomyces,* **p.** 136.

Hyaline: clear, absence of dark pigment.

Hyperparasite: a parasite on another parasitic fungus. (A term used loosely; often, parasitism has not been proved.) *See also* Mycoparasite.

Hyphopodium: a **1-** or 2-celled, branchlike structure on epiphytic mycelium of certain fungi.

Clasterosporium, p. 118.

Hysteriform: elongated, with a median cleft. *Leptostroma,* p. 176.

Indeterminate: growth of conidiophore does not cease with production of a terminal conidium or group of conidia. *Gonatobotrys,* p. 76; *Curvularia,* p. 122.

Innate: immersed in substratum. *Sphaeropsis,* p. 176; *Cytospora,* p. 170.

Intercalary: produced between other cells, not terminal.

Lenticular: in the form of a double convex lens.

Locule: a cavity, usually within a stroma. *Dothiorella,* p. 166; *Cytospora,* p. 170.

Lunate: crescent-shaped, like a half moon. *Lunulospora,* p. 138.

Macroconidia: large, often multicelled conidia, applied when fungus produces conidia of two distinct sizes. *Fusarium,* p. 130.

Meristem arthrospore: *see* p. **41.**

Microconidia: small, usually 1-celled conidia, often applied to spermatia.

Muriform: conidia with both an oblique septa and a dictyopore. *Alternaria,* p. 132; *Steganosporium,* **p.** 194.

Murogenous: originating as an expansion of the entire conidiophore tip. *Murogenella,* p. 114.

Mycoparasite: a fungus parasitic on another fungus. *Gonatobotrys,* p. 76; *Piptocephalis,* p. 62.

Necrosis: death of cells; often applied to host of a micoparasite.

Obclavate: inversely clavate, widest at base.

Oblong: about twice as long as wide, usually with blunt ends.

Obovoid: inversely ovoid, narrowest at base.

Ostiole: opening or mouth of a pyenidium. *Phoma,* p. 162.

Ovoid: egg-shaped, with narrower end at apex.

Papilla: a small rounded projection.

Pedicel: a short, slender stalk bearing a conidium. *Brachysporium,* p. 126.

Penicillus: a brush, referring to compactly branched conidiophores. *PeniciUium,* p. 94; *Gliocladium,* p. 92.

Penicillate: a brushlike cluster of sporogenous cells on a conidiophore as in *PeniciUium,* p. 94.

Percurrent: proliferation of conidiophore or conidiogenous cell in which each successive apex arises through the previous apex. *Gonatobotrys,* p. 76; *Spilocaea,* p. 106. >vr , , n >ft ^ ;

Phialide: a specialized sporogenous cell producing conidia from an open end in basipetal succession. *Chalara,* p. 90; *Phialocephala,* p. 96.

Phialospore: *see* p. 44.

Phragmospore: a several-celled conidium with transverse septa only. *Bipolaris,* p. 126; *Dendryphiopsis,* p. 120.

Pigmented: used to indicate presence of pigment in the cell waifs, not in the internal contents.

Polyphialide: a phialide with more than one open end.

Porospore: *see* **p. 43.**

Pseudoparenchyma: isodiametric or oval fungus cells organized into tissues in which the individual hyphae have lost their identity. *Sclerotium,* p. 196.

Pycnidium: a closed or nearly closed asexual fruit body bearing conidiophores and conidia internally, characteristic of the Sphaeropsidales.

Pyriform: pear-shaped, narrower at the base.

Rachis: central axis of a conidiophore on which conidia are attached alternately. *Tritirachiwn,* p. 100. ,

Reniform: kidney-shaped.

Sclerotium: a compact resistant mass of hyphae or pseudoparenchyma.

Scolecospore: a long slender conidium. *Septoria,* p. 182; *Cylindrosporium,* **p.** 192.

Sessile: without a stalk. *Tripospermum,* p. 142; *Aureobasidium,* p. 70.

Seta: a sterile hypha associated with various fruiting structures. *Colletotrichum,* p. 188; *Gyrothrix,* **p.** 90.

Sporangiole: a small sporangium producing one to few spores, characteristic of some Mucorales. (In some genera the 1-celled sporangioles may be called conidia.) *Choanephora,* p. 66.

Sporocladium: a special short branch of a sporangiophore in certain Mucorales in which conidia are borne on one side only. *Martensella,* p. 64.

Sporodochium: a cushion-shaped structure made up of closely grouped conidiophores, characteristic of the Tuberculariaceae.

Sporogenous cell: a special cell *or* branch bearing conidia.

Staurospore: a branched or star-shaped conidium. *Tridenteria,* p. 140; *Tripospermum,* p. 142.

Sterigma: a short, pointed, peglike extension of a cell that supports a conidium, usually considered larger than a denticle.

Stipirate: having a stipe or stalk. *Cornularia,* p. 186.

Stroma: a compact mass of hyphae on which or in which conidia or fruit bodies are borne. *Botryodiplodia,* p. 180; *Cytospora,* p. 170.

Stylospore: an elongated conidium produced in a pycnidium. *Phomopsis,* p. 164.

Subhyaline: conidia generally classified as hyaline, but showing slight pigmentation in mass.

Subiculum: a loose crustlike growth on which fruit bodies are produced. *Asteromella,* **p.** 164.

Sympodulospore: *see* **p. 43.**

Sympodial: growth or branching of a conidiophore or sporogenous cell arising beneath or behind the previous conidium and pushing it to one side. *Curvularia,* p. 122; *Triiirachium,* p. 100.

Synnema: a cylindrical compact group of conidiophores, characteristic of the Stilbaceae.

Torulose: cylindrical but having swellings at intervals.

Truncate: cut off at the end, flat. *Scopulariopsis,* p. 98; *Geotrichum,* p. 68.

Tube re u late: having wartlike processes. *'"

Verricose: having small rounded processes, appearing as a minutely roughened wall. *Ulocladium,* p. 132; *Periconia,* p. 74.

Verticillate: having a whorl of three or more branches or sporogenous cells arising at the same level. *VerticilHum,* p. 92,

Vesicle: an inflated cell or portion of conidiophore. *Cylindrocladium,* p. 108.

Whorl: a number of conidia or branches attached at the same level. *VerticilHum,* p. 92.

INDEX TO GENERA